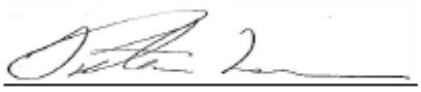
# Deerfield River & Lower Connecticut River Tactical Basin Plan

Green River, Guilford

May 2020

Tactical Basin 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.

Approved:



6/23/2020

Peter Walke, Commissioner
Department of Environmental Conservation

Date

06/23/2020

Julia S. Moore, P.E., Secretary
Agency of Natural Resources

Date

Cover Photo: Green River in Guilford – Marie L. Caduto

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**Basin 12 Towns**

Brattleboro
Dover
Dummerston*
Glastenbury
Guilford
Halifax
Marlboro
Readsboro
Searsburg
Somerset
Stamford*
Stratton
Sunderland*
Vernon
Wardsboro*
Whitingham
Wilmington
Woodford

**Towns in Major Sub-watersheds**

**Deerfield Watershed**

**Deerfield River**
Dover
Glastenbury
Readsboro
Searsburg
Somerset
Stamford
Stratton
Sunderland
Wardsboro
Whitingham
Wilmington
Woodford

**Green River**
Brattleboro
Guilford
Halifax
Marlboro
Wilmington

**North River**
Halifax
Marlboro
Whitingham
Wilmington

**Connecticut River Watershed**

**Connecticut River**
Brattleboro
Dummerston
Vernon

**Fall River**
Guilford
Vernon

**Broad Brook**
Brattleboro
Guilford
Vernon

**Whetstone Brook**
Brattleboro
Dummerston
Marlboro

* - towns with small areas in the Basin

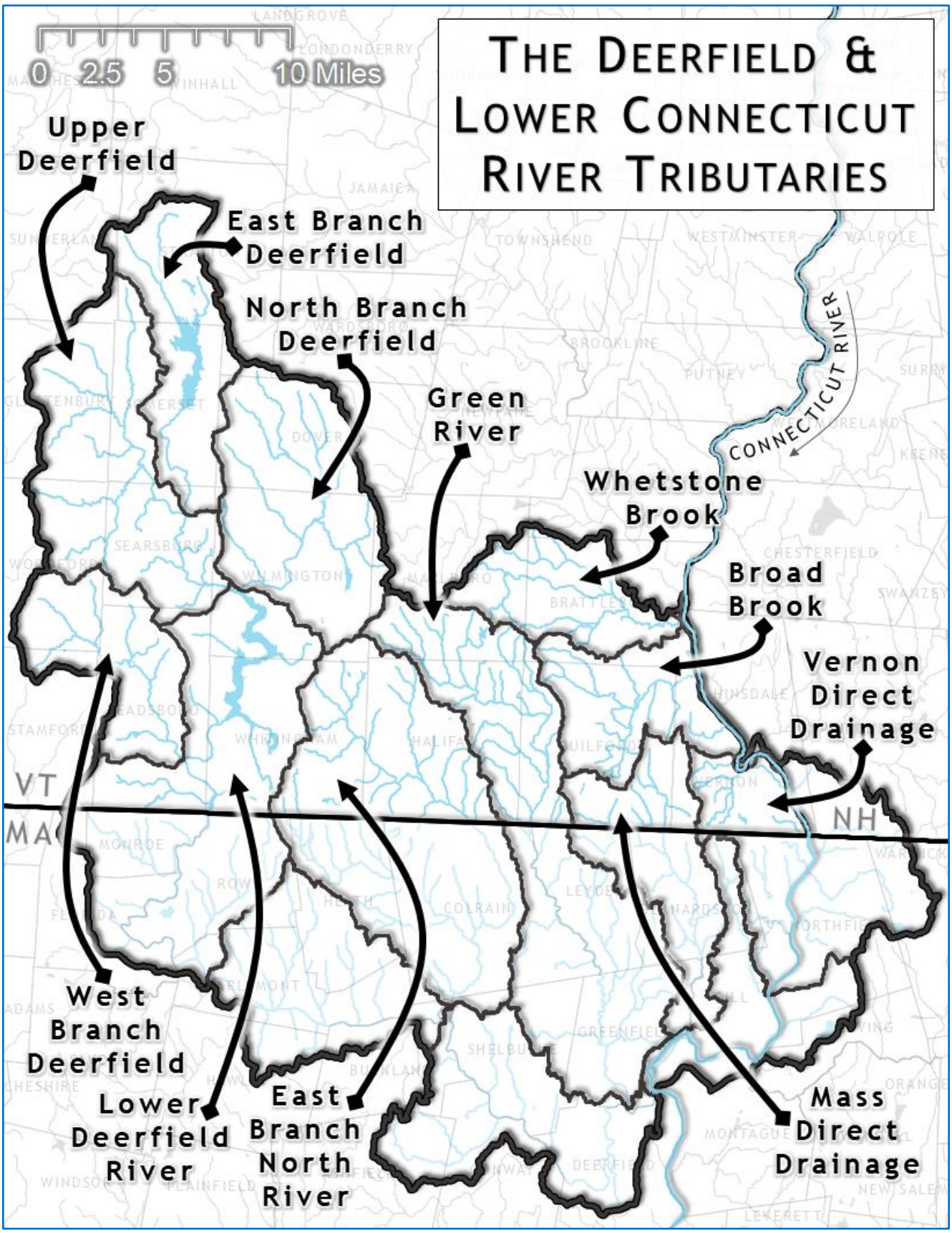
THE DEERFIELD & LOWER CONNECTICUT RIVER TRIBUTARIES
0 2.5 5 10 Miles
Upper Deerfield
East Branch Deerfield
North Branch Deerfield
Green River
Whetstone Brook
Broad Brook
Vernon Direct Drainage
CONNECTICUT RIVER
VT
NH
West Branch Deerfield
Lower Deerfield River
East Branch North River
Mass Direct Drainage

Figure 1.

## Executive Summary

The Deerfield Tactical Basin Plan (TBP) provides an assessment of watershed condition and identifies current and future strategies to protect high quality waters and restore impaired water resources based on the approaches set forward in the Vermont Surface Water Management Strategy (VSWMS).

The five chapters in this plan provide a framework for understanding Basin 12, including its unique characteristics and water quality issues, and where and how to carry out priority actions to protect, maintain, enhance, and restore water quality in the Basin.

**Chapter 1**

- Basin Description
- Condition of Waters--Lakes, Rivers, and Wetlands

**Chapter 2**

- Priority waters for surface water protection

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**Chapter 4**

- Water Quality Regulations and Strategies

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The Deerfield River descends from the towns of Glastenbury and Stratton in the southern Green Mountains of Vermont. It flows through south central Vermont and crosses the Vermont-Massachusetts border before it joins the Connecticut River. The Deerfield River in Vermont has four branches: North, South, East and West. Two more of the Deerfield's main tributaries, the East Branch of the North River and the Green River, originate in Vermont and enter the Deerfield River in Massachusetts. The Deerfield River system drains 14 towns and 318 square miles in Vermont and 347 square miles in Massachusetts.

Included in Basin 12 is a short reach of the Connecticut River mainstem, from the mouth of the West River in Brattleboro south to the Massachusetts border as well as

Whetstone, Broad and Newton Brooks and the Fall River draining directly into the Connecticut River.

The Deerfield is the second most forested, the least developed, and the least cultivated basin in the State of Vermont (Figure 4). Forested land covers 82% of the Basin. Approximately 60% of the land in the Basin is under some form of protection due to inclusion in the Green Mountain National Forest, Great River Hydro ownership, private conservation or Use Value Appraisal (Current Use).

Extensive opportunities exist in the Basin for protection and reclassification where water quality and habitat conditions show that aquatic biota and fisheries are in exceptional condition and meet the criteria of Class A(1) or B(1). Seven waters are being recommended for A(1) for Aquatic Biota and three for B(1). Vermont Fish and Wildlife Department (VFWD), Fisheries Division is recommending 13 waters for B(1). Outstanding Resource Water designation is being proposed for three lakes and two gorges. Three wetlands are being put forward for further study to determine if they meet Class 1 wetland criteria.

While river and stream conditions for aquatic life, aesthetics, swimming and boating in the Basin exceed state-wide averages (Figure 6.), many lakes and ponds are either unassessed or impacted by acid and mercury entering with precipitation (Figure 9). Increasingly, cyanobacteria blooms are impacting swimmability of waters in the state. The current status of cyanobacteria in Basin 12 is not known and would benefit from further assessment.

Stressors do impact the Basin in numerous areas. Ski resort development degrades water quality in the North Branch Deerfield River. High levels of bacteria are found in the North Branch Deerfield River and Whetstone Brook. Extensive areas have been physically altered by straightening, channel relocation and riverbed manipulation. Additionally, natural flows and water temperatures are altered by six hydroelectric dams and reservoirs and water withdrawals for snowmaking.

Six separate Total Maximum Daily Loads (TMDLs) or Water Quality Remediation Plans (WQRPs) are in place addressing five pollutants: acidity, bacteria, mercury, nitrogen and stormwater.

Only 4.6 percent of the Basin is in agricultural land use with Newton Brook in Vernon being the only agriculturally impaired water. Stormwater runoff and road runoff bring sediment and nutrients into waterways throughout the Basin.

Actions to implement projects that address these impacts and those to protect water resources are documented in the on-line Watershed Projects Database. Overarching strategies and actions are listed in Table 16.

## What is a Tactical Basin Plan

Tactical basin planning is carried out for the Agency of Natural Resources (VANR) by the Watershed Management Division's Monitoring and Assessment, Program (MAP) in coordination with watershed partners. Tactical basin plans are developed in accordance with the Vermont Surface Water Management Strategy (VSWMS) and the Vermont Water Quality Standards (VWQS) to protect, maintain, enhance, and restore the biological, chemical, and physical integrity of Vermont's water resources. The basin-specific water quality goals, objectives, strategies, and actions described in the TBPs aim to protect public health and safety and ensure public use and enjoyment of Vermont waters.

The TBP process allows for the issuance of plans for Vermont's fifteen basins every five years, as required by statute 10 V.S.A. § 1253. The plans incorporate the U.S Environmental Protection Agency's (EPA) 9-element framework for watershed plans (Environmental Protection Agency, 2008) and meet obligations of the Vermont Clean Water Act. Updating a basin plan includes: 1. monitoring water quality and summarizing existing information, 2. assessing and analyzing water quality data, 3. identifying strategies and projects to protect and restore waters, 4. seeking public comment and finalizing the plan, and 5. ongoing plan implementation and tracking throughout the planning cycle.

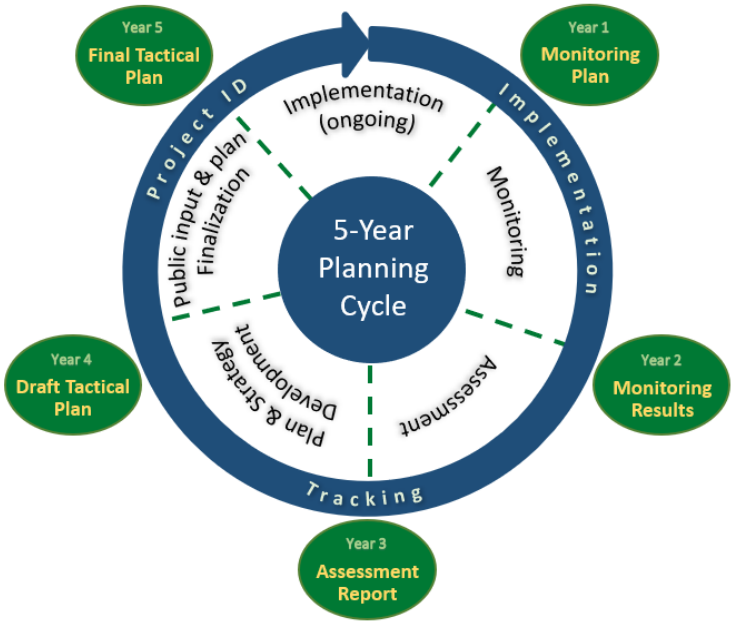


Figure 2. Steps in the Tactical Basin Planning

Tactical basin plans can be considered a strategic guidebook for protecting and restoring Vermont's surface waters for VANR and watershed partners. Plans identify causes and sources of pollution and opportunities for protecting waters through

outstanding resource water designation and reclassification. Plans also identify pollutant reductions needed to restore water quality, including those necessary to meet Total Maximum Daily Load targets. Plan implementation tables list strategies to foster education and outreach, and targeted restoration actions that are eligible for federal and state funding. The plan's strategies, described in Chapter 5's strategy table, target overarching objectives that are tracked via the online Watershed Projects Database (WPD) which lists individual projects that will meet these objectives. The WPD is continuously updated to capture project information from

- the TBP process,
- on the ground assessments and
- emerging projects due to natural and/or anthropogenic events.

The 2014 Basin 12 Water Quality Management Plan identified sixty-two action items of which half have been implemented or are in progress by VANR and its watershed partners. A report card of this progress can be viewed in Appendix A. The 2019 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 environmental modeling and on-the-ground monitoring and assessment data. This updated tactical basin plan will serve for the next five-years to address water quality concerns across land use sectors and improve aquatic habitat.

## A. Vermont's Clean Water Acts

The Vermont Clean Water Act, Act 64, addresses water quality throughout Vermont by addressing the sectors that have potential to cause pollution. These sectors are agriculture, developed lands, wastewater, roads and natural resources processes. Agricultural non-point source water quality programs and the application of the Required Agricultural Practices (RAPs) on small, medium, and large farms is managed by the Agency of Agriculture, Food and Markets (VAAFM). Stormwater discharges from new and existing development, industrial and municipal stormwater discharges, and runoff from state and municipal roads are managed through the Vermont Departments of Environmental Conservation (VDEC) and Agency of Transportation (AOT). While the Vermont Department of Forests, Parks and Recreation (VDFPR) and VDEC, in tandem, address water quality runoff from forest silvicultural activities. Regulations specific to these new requirements are covered in detail in the legislation summary.

The Act established the Clean Water Fund to assist municipalities, farmers and others implement projects that will reduce nutrient and sediment pollution from all sectors: agriculture; developed lands, including stormwater and roads; unstable streambanks and lakeshores; and wastewater.

Act 64 also establishes the requirement that all water quality improvement actions undertaken by the State be integrated by means of TBPs, and establishes partnerships with regional planning commissions, conservation districts, and other organizations to support this work. TBPs encourage communities to take protective measures that will restore, maintain and enhance water quality in all areas, but do not preclude development that is consistent with municipal bylaws, regional and municipal plans, and with applicable state and federal regulations.

The Clean Water Service Delivery Act, Act 76 of 2019, establishes a water quality project delivery framework to support Vermont's clean water goals. Act 76 secures a new long-term funding source for the Clean Water Fund. Three of the most fundamental aspects of this law are:

1. **Provides assurances to meet non-regulatory targets**: Act 76 prioritizes program delivery and funds for non-regulatory projects. Non-regulatory projects include small-scale green stormwater management practices, conservation initiatives on Vermont farms, and natural resource restoration projects such as easements, wetlands restoration, or vegetated buffer plantings. While not required, these projects are essential to achieve the water quality goals
2. **Phosphorus reduction targets**: Act 76 places a greater emphasis on achieving phosphorous reduction targets set for each watershed.
3. **Establishes Clean Water Service Providers**: new regional organizations called clean water service providers (CWSP). CWSPs will be established in each major watershed to identify, implement and maintain local water quality projects.

## B. Vermont Water Quality Standards

The Vermont Water Quality Standards (VWQS) establish the minimum or maximum limits for certain water quality parameters at specific locations for the purpose of managing waters to support their designated uses. Designated uses include aquatic biota and habitat; swimming & contact recreation; boating; fishing; public water supply and crop irrigation. In Vermont, Water Quality Standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

The VWQS define biological integrity as "the ability of a body of water to support and maintain a community of organisms that has the expected species composition, diversity, and functional organization comparable to that of the water in its natural condition." The health of a biological community reflects the level of combined human-induced stresses acting upon it. Aquatic communities that are most impacted often suffer from an accumulation of multiple stressors.

These VWQS are intended to achieve the goals of the State's water quality policy (10 V.S.A. § 1250), as well as the objective of the federal Clean Water Act (33 U.S.C. § 1251 et seq.) which is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

## C. Assessment Methodology

The Agency of Natural Resources' Watershed Management Division (WSMD) in VDEC assesses the health of a waterbody using biological, chemical and physical criteria. Most of this data can be accessed through the Vermont Integrated Watershed Information System, online data portal.

VDEC uses monitoring and assessment data[1] to assess individual surface waters in relation to VWQS as outlined in the 2016 DEC Assessment and Listing Methodology. The four categories used to assess Vermont's surface water are **full support, stressed, altered** and **impaired**. Waters that currently support designated and existing uses and meet water quality standards are placed into the full support or stressed categories. Waters that do not meet VWQS are placed in the altered or impaired categories.

**Water Quality Assessment Reports** compile and interpret water quality monitoring information from throughout the Basin, and, where possible, link that information to the causes of observed problems and the sources of pollutants. These reports also highlight waters of notable high quality.

**Water quality classifications** in Vermont are based on a designated use being supported. Waters where actual conditions fully support a designated use and conditions meet or exceed the criteria for a specific water quality classification are recommended for reclassification in the basin planning process. Waters may also be petitioned for reclassification by the public.

[1] Appendix A of the Vermont DEC Water Quality Monitoring Strategy 2011-2020

### Volunteer Monitoring Programs and Data

VDECs monitoring programs are supported and enhanced by volunteer monitoring programs statewide. In close partnership with local watershed groups and lake associations water quality data is collected throughout the state during the seasons of highest recreational use and for specific studies. The VDEC supports volunteer water quality monitoring effort through the LaRosa Partnership Program.
Volunteer monitoring groups collecting water quality data through the LaRosa Partnership Program include:

- Connecticut River Conservancy (CRC)
- Deerfield River Watershed Alliance (DRWA)
- Southeastern Vermont Watershed Alliance (SeVWA)

DRWA began monitoring the Deerfield, Green and East Branch of the North River in 2017 and SeVWA has been monitoring Whetstone Brook since 2004. CRC has coordinated three "Samplepalooza" events on the Connecticut River.

All three of these programs participate in the LaRosa Partnership Program which provides free laboratory testing of volunteer collected water samples throughout the State. Data from these programs can be found at The LaRosa Volunteer Water Quality Monitoring Analytical Services Partnership

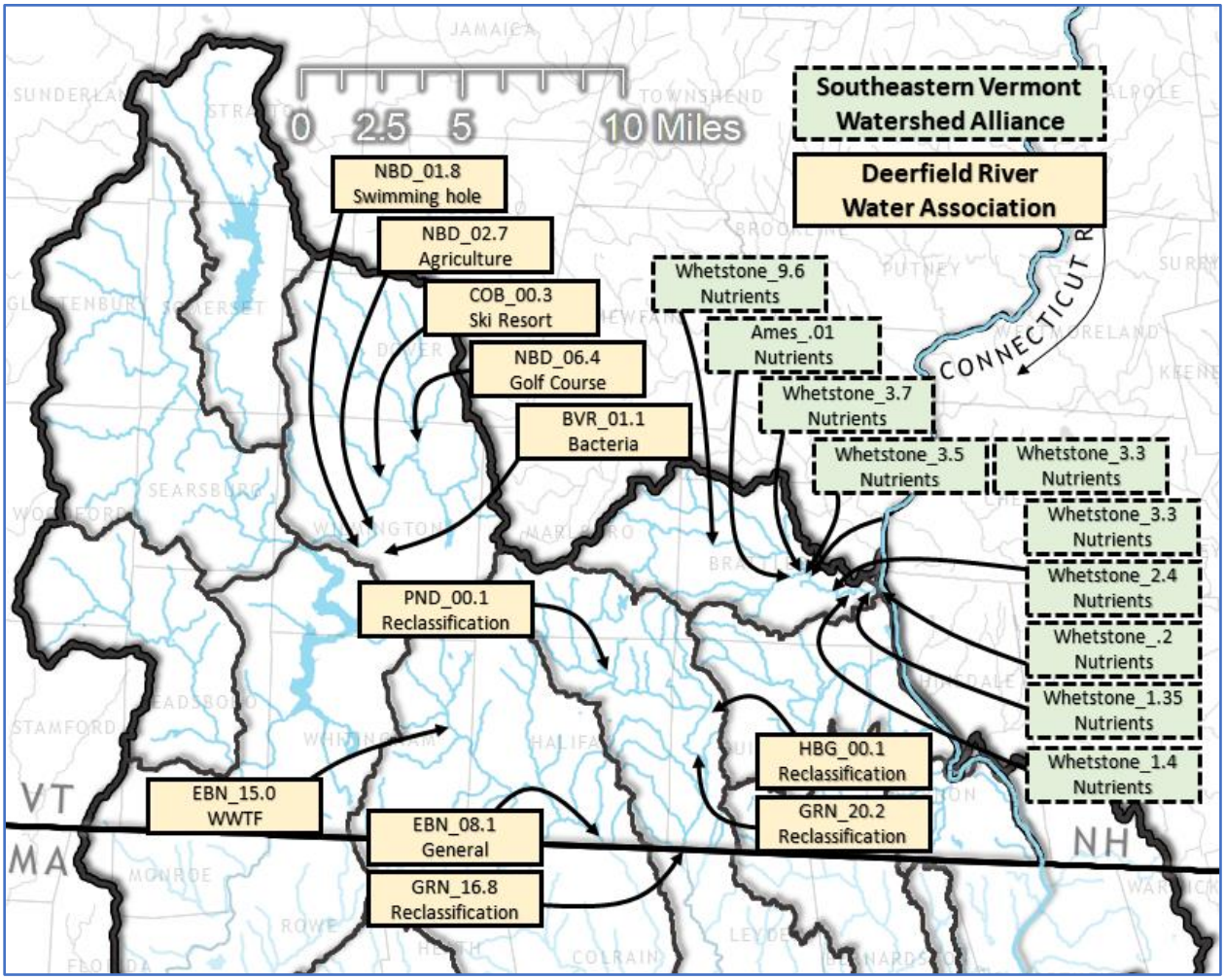


Figure 3. Volunteer Monitoring

## Climate Change in Vermont

Climate is defined by long-term weather patterns, which in turn, influence human and natural systems. The 2014 Vermont Climate Assessment established state-level, climate change information with implications for local surface waters. Since 1941, Vermont average temperatures have increased 2.7° F with warming occurring twice as fast in winter. The latter results in earlier thaw dates for rivers, lakes and ponds, and mountain snowpack. Average annual stream flows are increasing, which is expected to continue in the future. High flows now happen more frequently, leading to increased inundation flooding and fluvial erosion (stream-related erosion.) Additional information on climate change in Vermont can be found at: https://climatechange.vermont.gov.

The impact of increased runoff and streamflow in a watershed depends heavily on local land use and land cover. These impacts are exacerbated in developed areas with extensive impervious cover, the excess runoff can increase stormwater volume and velocity thereby mobilizing larger pollutant loads[2]. In addition, increased streamflow will increase bed and bank erosion and deliver more sediments downstream. In areas where non-point source pollution is a concern (e.g., agricultural lands, residential areas), more runoff can increase sediment, nutrient, and pathogen loading to surface waters[3]. Changes in climate increasingly require watershed restoration projects to incorporate stormwater and non-point source runoff controls to counteract pollutant transport as well as the potential for higher peak flows.

Aquatic habitats affected by increased runoff and streamflow could experience increases in sediments, nutrients, scouring, and water temperature. In response, local freshwater plant and animal species may shift their geographic ranges and seasonal activities and alter their abundance. Maintaining habitat connectivity, river and lake riparian buffers, and stream equilibrium conditions will help reduce the impacts of climate change on Vermont's rivers, lakes and ponds, and wetlands.

On the other end of the spectrum, higher temperatures are predicted to lead to more episodic droughts[4]. Potential impacts may include drier soils decreasing water levels in wetlands and headwater streams and higher water temperatures throughout the watershed impacting aquatic life.

[2] (Galford, et al., 2014).
[3] (Galford, et al., 2014
[4] https://climatechange.vermont.gov/our-changing-climate/what-it-means/farms-forests

# Chapter 1 Basin Description and Condition

The Deerfield River descends from the towns of Glastenbury and Stratton in the southern Green Mountains of Vermont. It flows through south central Vermont and crosses the Vermont-Massachusetts border before it joins the Connecticut River. The Deerfield River has four branches in Vermont: North, South, East and West. Two more of the Deerfield's main tributaries, the East Branch of the North River and the Green River, originate in Vermont and enter the Deerfield River in Massachusetts. The Deerfield River system drains 14 Vermont towns in two counties and is about 318 square miles in area.

A short reach of the Connecticut River mainstem is included in Basin 12. From the mouth of the West River in Brattleboro south to the Massachusetts border, the Connecticut River is controlled by two hydroelectric dams. The Vernon dam and the Turners Falls dam in Montague, MA alter flows throughout the thirteen-mile reach.

Draining directly into the Connecticut River are Whetstone, Broad and Newton Brooks and the Fall River. Whetstone Brook drains 25.5 square miles; Broad Brook 23.8 square miles; Newton Brook 4.4 square miles; and the Vermont portion of the Fall River, 10.4 square miles. These waters are also included in this plan.

## Current Land Use

Basin 12 is the second most forested, the least developed, and the least cultivated basin in the State of Vermont. Forested Land covers the greatest area at 82% (Figure 4). Due to the large areas covered by the Harriman and Somerset reservoirs created for hydroelectric water storage, Open Water covers 2%. Wetlands make up 5%, Agricultural Crop Land 4.6%, and Developed Land areas cover 4.7%.

Over 27% of the Basin is part of the Green Mountain National Forest which covers most of the western basin, including almost all of the Upper Deerfield, and most of the East and West Branches. With the addition of lands owned by Great River Hydro, almost all the Basin 12 land in Stratton, Somerset, Glastenbury, Woodford and Stamford is under some form of land protection and close to 100% forested.

Other conserved lands, either public or private, cover 10% and Use Value parcels (Current Use) encompass another 20% of the Basin, leaving only 40% of the entire Basin without some level of protection (Figure 5).

Agriculture occurs mostly along the valleys of the Deerfield and Connecticut Rivers and Whetstone Brook, producing a limited amount of row crops and large amounts of hay for both dairy and horse operations.

Developed areas are concentrated around Brattleboro and West Brattleboro and in and around the ski areas Mount Snow and the Hermitage, in Dover and Wilmington.

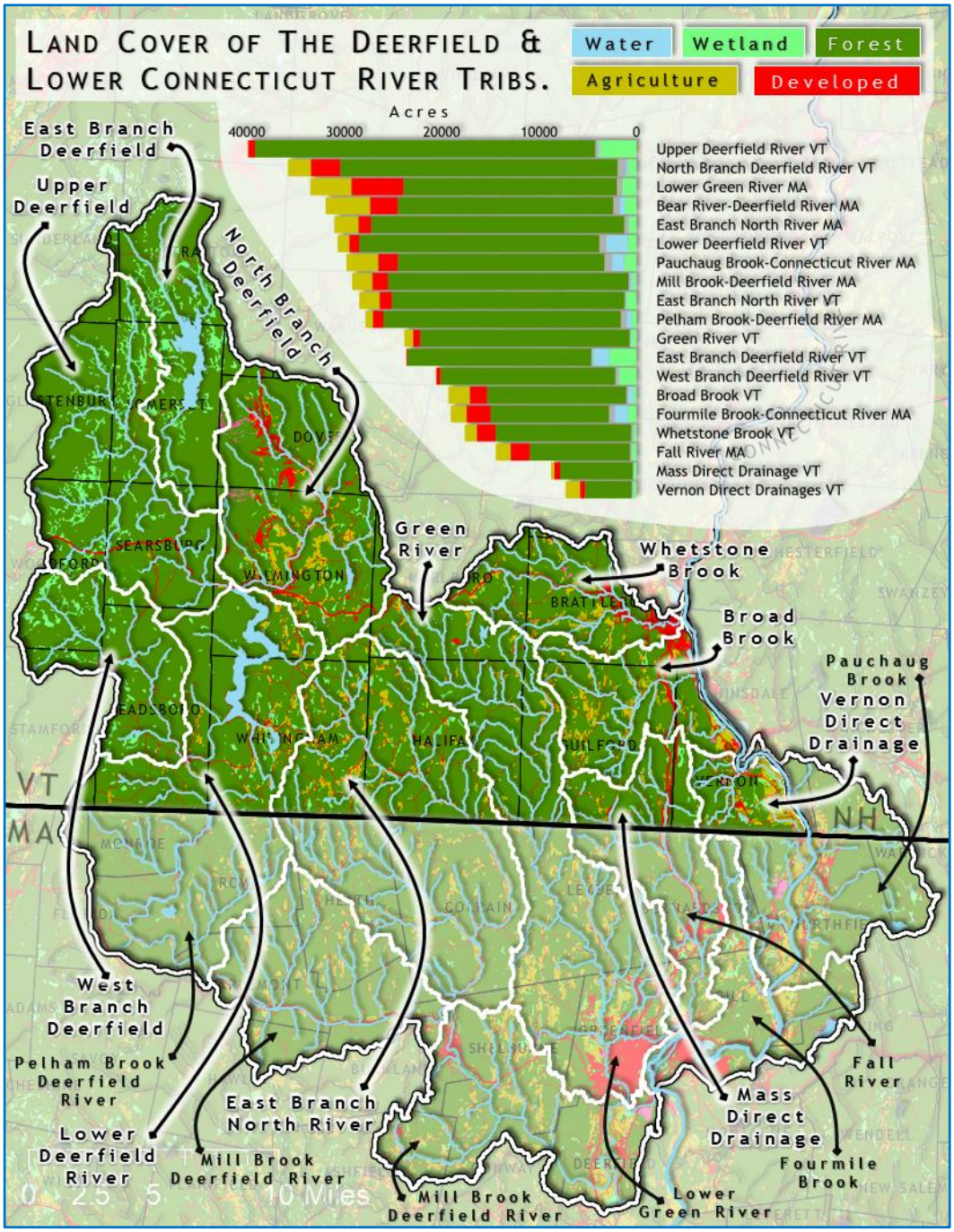


Figure 4. Land Cover

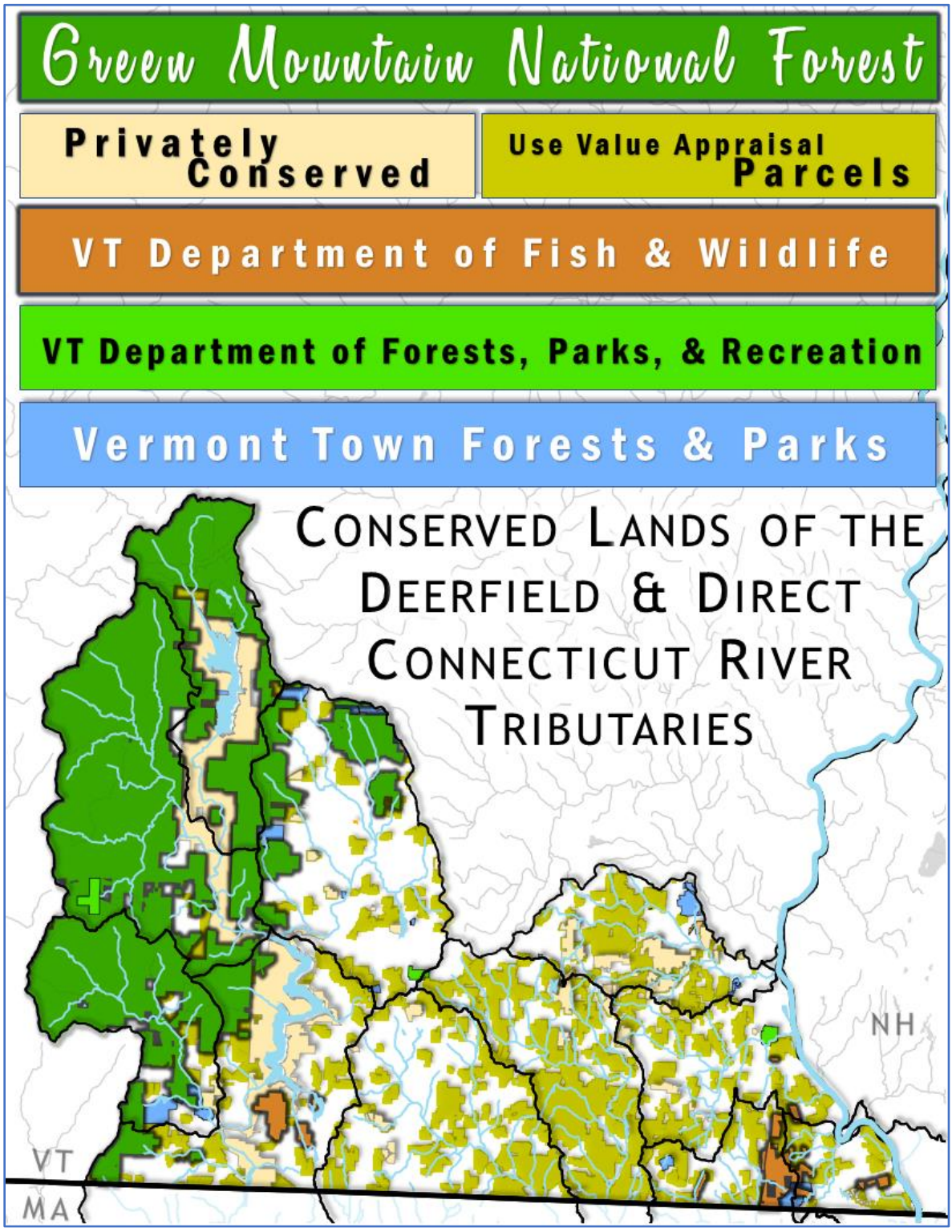

Figure 5. Conserved Lands

However, stressors do impact the Basin in numerous areas. Ski resort development degrades water quality of the North Branch Deerfield River. High levels of bacteria are found in the North Branch Deerfield River and Whetstone Brook. Extensive areas have been physically altered by straightening, channel relocation and riverbed manipulation. And natural flows and water temperatures are altered by hydroelectric dams and water withdrawals for snowmaking.

## Condition of Rivers

The majority of the Basin's waters are in good to excellent condition with regards to aquatic biota (Figure 6). The majority of the region is forested with dispersed areas of small village development. However, extensive development around two major ski areas on the North Branch Deerfield and urban development in Brattleboro increases

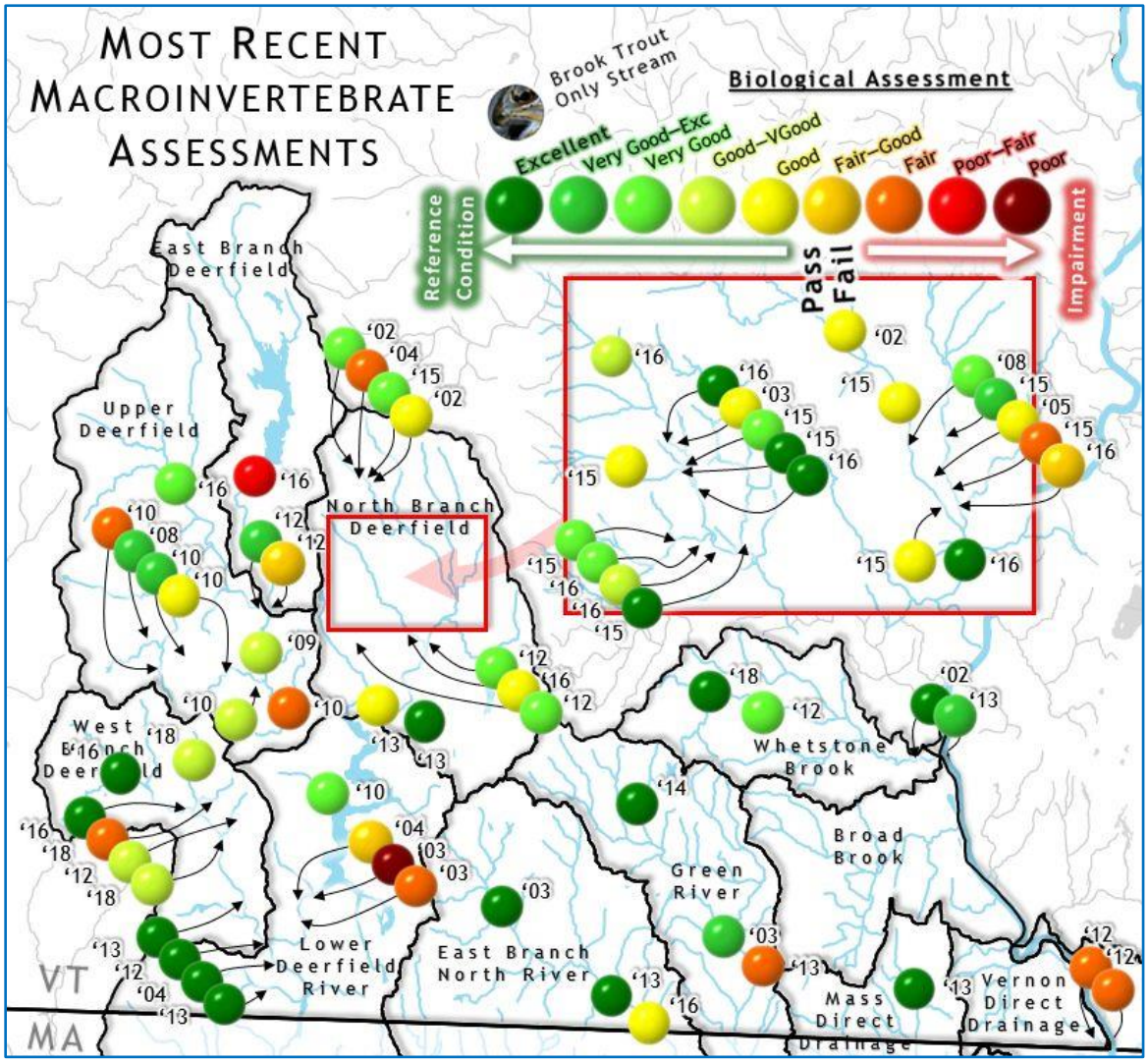


Figure 6. Macroinvertebrate Biological Conditions

stormwater runoff and chloride concentrations in these areas. There are 54 known dams in the Basin impacting flows, sediment transport and aquatic organism passage on the mainstem rivers as well as tributaries and streams.

Flow alteration is the most prevalent stressor[5] in the streams and rivers of the Basin. Leading pollutants include acid and mercury deposition, *E. coli* bacteria, excess nutrients and temperature modifications – both hot and cold.

In many Basin tributaries fish communities are impacted by low acidity and low productivity of headwater streams (Figure 7).

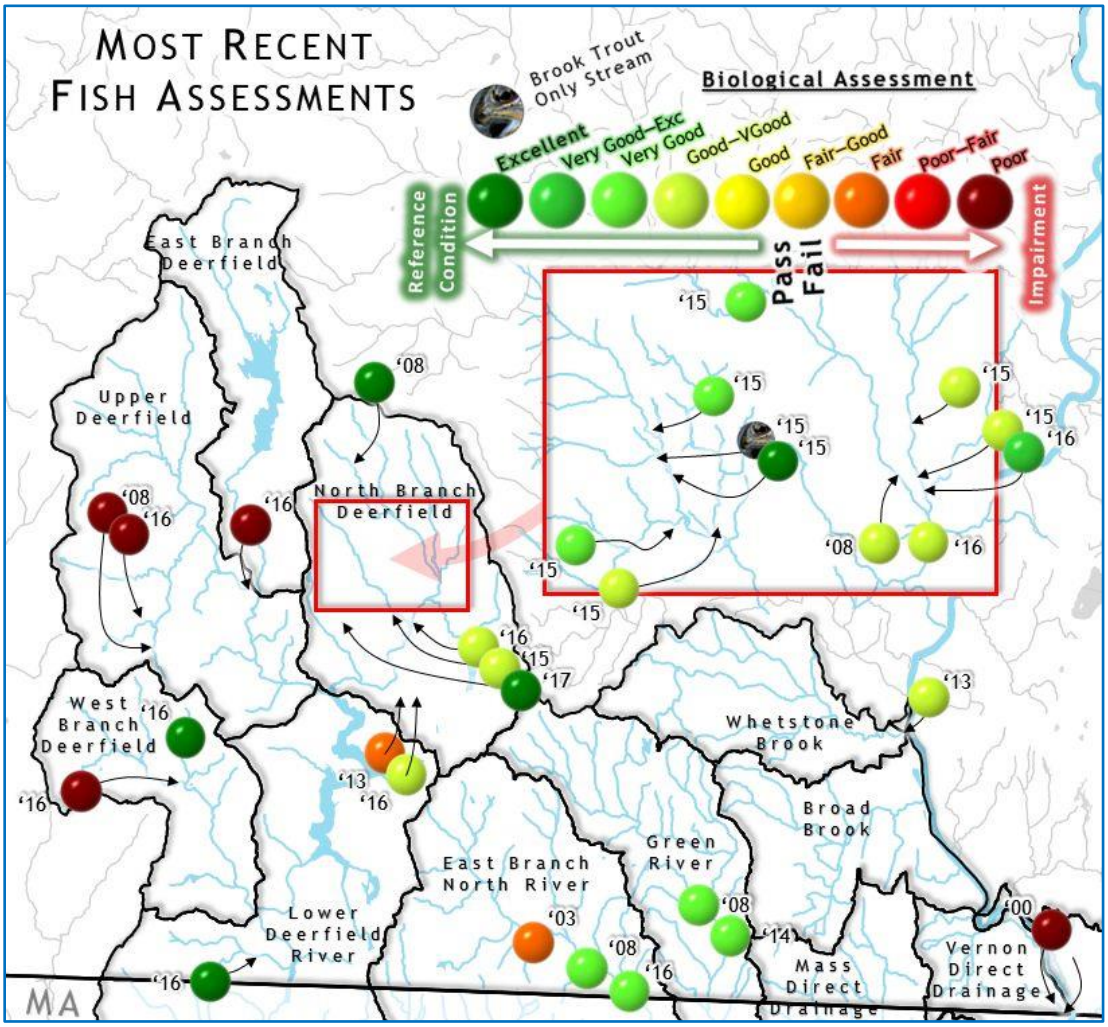


Figure 7. Fish Community Biological Conditions

[5] See VSWMS for pollutant definitions https://dec.vermont.gov/watershed/map/strategy

Excellent water quality in many of the tributaries, along with striking geologic formations create many popular swimming holes on rivers, streams and lakes. Broad Brook falls and gorge may be the best example and is being nominated as a candidate for Outstanding Resource Water based on its aesthetic value and swimming use.

Figure 8 compares the conditions of assessed rivers and streams in the Basin with assessed rivers statewide for five designated uses. For most designated uses Basin rivers exceed the state-wide average for full support of these uses.

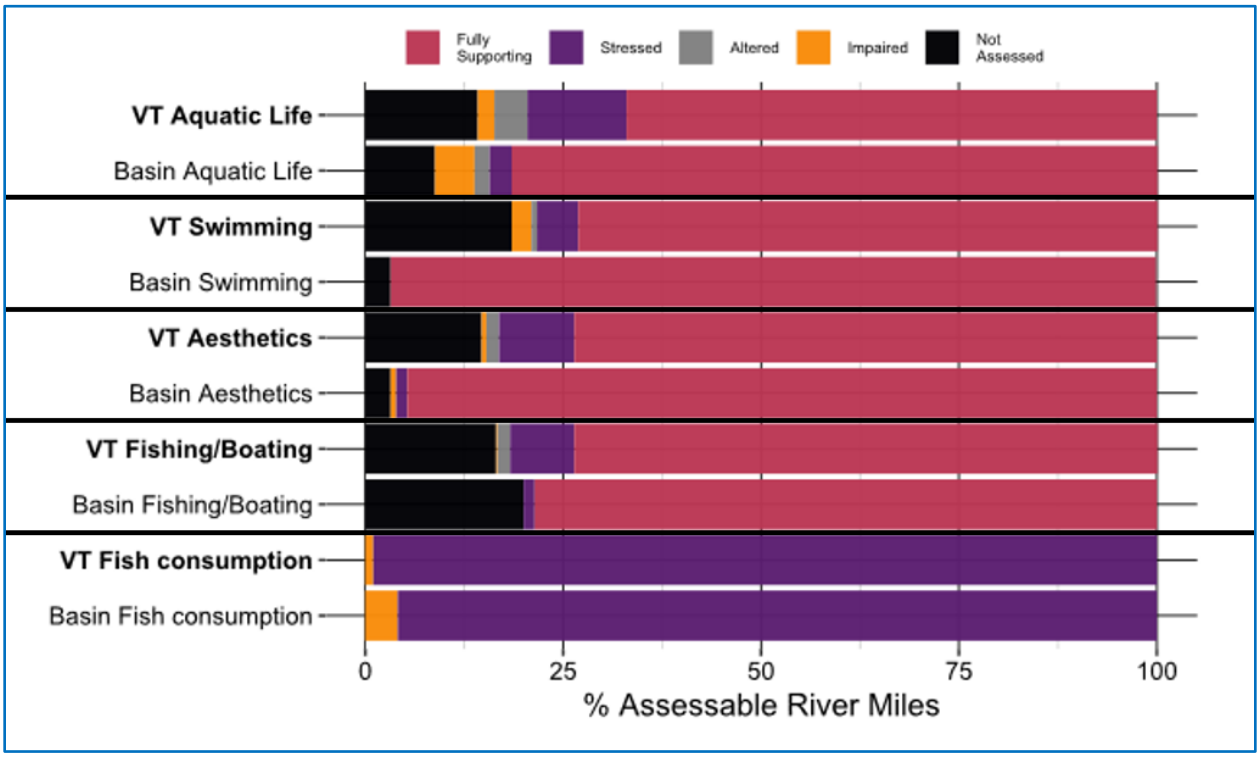


Figure 8. Use Conditions of Assessed Rivers and Streams

## Condition of Lakes and Ponds

There are 17 lakes and ponds in the Deerfield Basin that are 20 acres or greater, which total approximately 4,000 acres. The largest is Harriman Reservoir (2,040 acres), followed by Somerset Reservoir (1,568 acres), Sadawga Lake (194 acres), and Sherman Reservoir (160 acres). Harriman Reservoir is the second largest lake found entirely in Vermont. All of these lakes have dams that elevate the water levels.

Lake and pond water quality and habitat conditions are monitored through numerous programs including the Spring Phosphorus and Lake Assessment Programs and by the Lay Monitoring Program. While many lakes and ponds fully support the requirements of the VWQS, a number are impacted by acidification, and several exhibit high levels of

mercury in fish. Both acid and mercury result from atmospheric deposition from sources outside of Vermont and are exacerbated by local geological conditions and water level manipulation.

Lake-specific data is analyzed and compiled to create the Vermont Lake Score Card. The Score Card rates Vermont lakes in terms of nutrient trend, invasive species, mercury, and shoreland condition. Figure 9. provides a comparison of the conditions of lakes in this basin with lakes statewide. Individual lake assessments can be reviewed from the Vermont Lakes Scorecard.

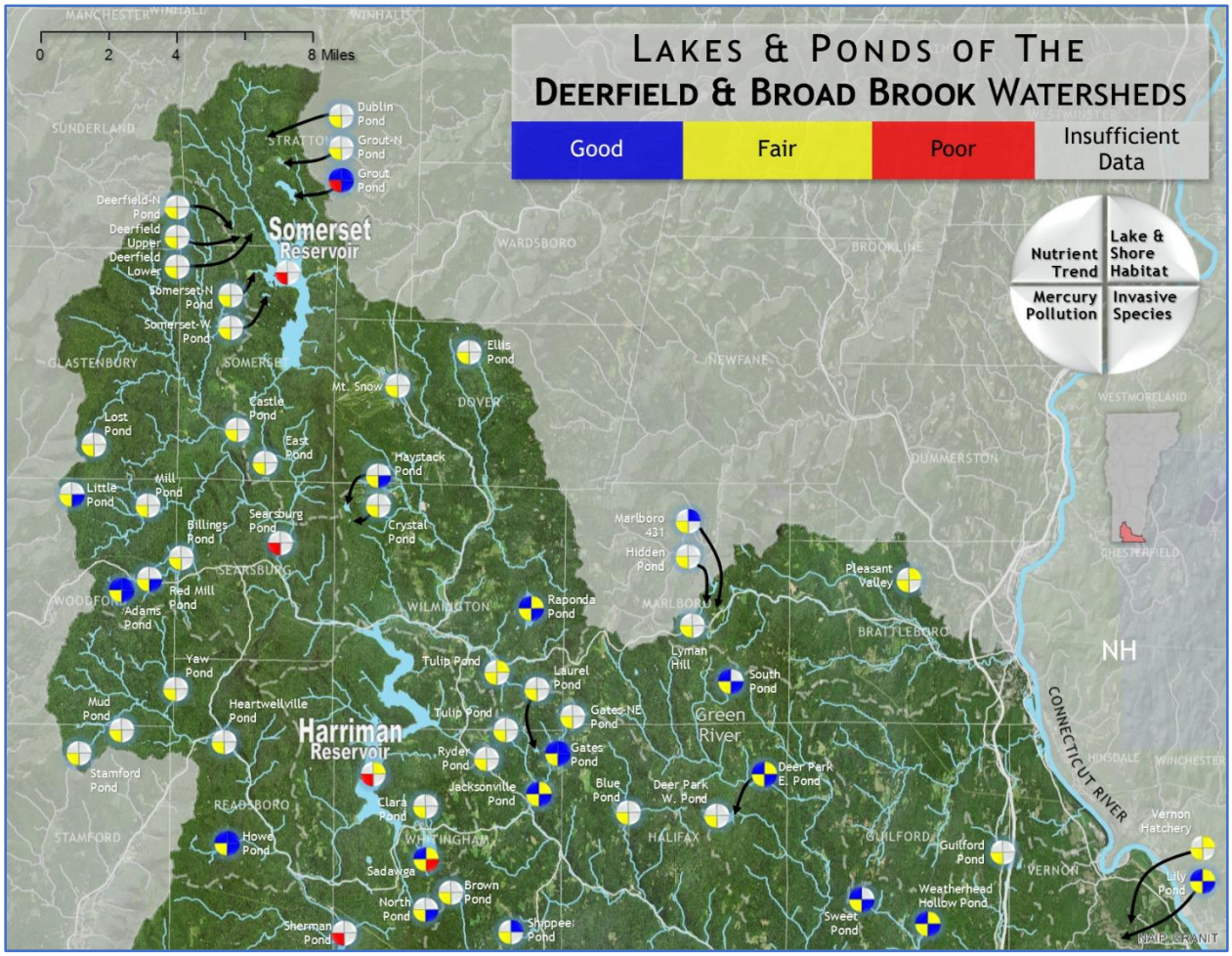

Figure 9. Lake Score Card Conditions

Figure 10 compares the conditions of assessed lakes and ponds in the Basin with those assessed statewide for five designated uses. Fewer Basin lakes and ponds have invasive species and more have good habitat conditions. However due to the extent of acid and mercury impaired lakes in the region the water quality status is below state averages.

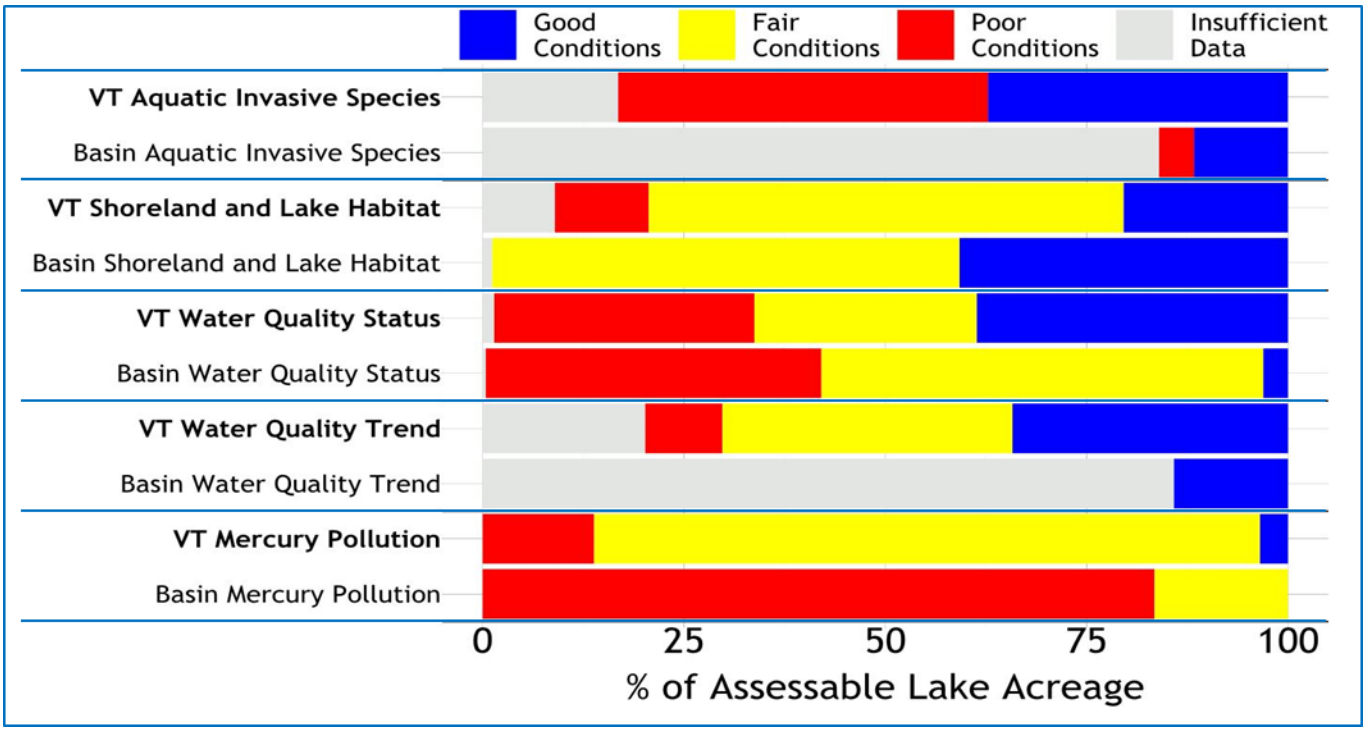


Figure 10. Use Conditions of Assessed Lakes

Table 1. Acid and Mercury Impaired Lakes

| Acid and Mercury Impaired Lakes | | |
|---|---|---|
| **Lake** | **Acid** | **Mercury** |
| Adams Reservoir | X | |
| Grout Pond | X | X |
| Harriman Reservoir (Whitingham) | X | |
| Haystack Pond | X | |
| Howe Pond | X | |
| Lily Pond (Vernon) | X | |
| Little Pond (Woodford) | X | |
| Lost Pond (Glastenbury) | X | |
| Searsburg Reservoir | | X |
| Sherman Reservoir | | X |
| Somerset Reservoir | X | X |
| South Pond (Marlboro) | X | |
| Stamford Pond | X | |

The greatest stressors to lakes in the Basin are acid and mercury deposition. Eleven lakes are impaired due to acid and four due to mercury. Basin 12 has more acid impaired lakes than any other basin in the state attributable to the prevailing weather pattern that carries mid-west air pollution through the region, proximity to those pollution sources and to the lack of buffering capacity of the bedrock geology.

## Condition of Wetlands

Many, but not all, wetlands are identified on the Vermont Wetlands Inventory Map however it is estimated that National Wetland Inventory maps, upon which Vermont Wetlands Inventory Maps are based, miss 82% of wetlands less than 3 acres in size and 68% of wetlands 3-20 acres in size.[6] Hence many wetlands in the Basin may not be mapped.[7]

Protecting and monitoring wetlands is more effective when wetlands have been located on the landscape. Accurately mapping wetlands in Basin 12 is a priority to order to properly evaluate wetland contributions to stormwater and floodwater storage, erosion control, water quality, fish and wildlife habitat and more. Towns experiencing strong development pressure or with many high value wetlands, are particularly in need of accurate mapping which can be done using modern LIDAR imaging and field verification. Wilmington, Dover and Vernon are priority towns for wetland mapping.

More than 35% of the original wetlands in Vermont have already been lost. In recent years, residential, commercial and industrial development have been the primary causes of wetland loss. Identifying wetland restoration opportunities in the Basin is needed.

Few wetlands in Basin 12 or the state have been assessed for quality. Of those that have been assessed through the Vermont Rapid Assessment Methodology (VRAM) those in Basin 12 have ranked along the upper end of the scale, indicating higher quality and little disturbance (Figure 11).

A significant portion of Basin's wetlands are within the USFS Green Mountain National Forest affording them a high level of protection against disturbance. Others are protected on lands owned and conserved by Great River Hydro's easements with Vermont Land Trust (VLT). The lower elevation lands are subjected to possible flooding in the event of highwater releases from the hydroelectric dams along the Deerfield River system.

Outside of these areas, important wetlands in the Basin include the Vernon Black Gum Swamps, the floating bog in Lake Sadawga and Atherton Meadows wetland in

[6] https://www.uvm.edu/rsenr/sal/leslie/Morrissey_Sweeney.pdf
[7] Assessment of The National Wetlands Inventory: Implications for Wetland Protection, Leslie A. Morrissey and William R. Sweeney*, 2006

Vermont's Atherton Meadows Wildlife Management Area. All three of these are recommended for assessment for consideration as Class 1.

The Vernon Black Gum Swamps, Lily Pond and other wetlands in Vernon host a very high frequency of Rare, Threatened and Endangered (RTE) species and unusual species composition due to their southerly location in state. The area also has a higher than usual development pressure/potential due to its proximity to Massachusetts, the extent of undeveloped flat land, and the recent loss of income from the decommissioning of the Vermont Yankee Nuclear Power plant leading to interest in new development plans.

Many vernal pools are critical habitat for many native amphibians. Some have been identified and many more are awaiting field verification of their locations. Most towns have not had complete, ground truthed vernal pool surveys. Identifying their locations increases the likelihood of full protection under the Vermont Wetlands Rules.

Beavers are important wetland influencers. Allowing wetlands to naturally change in size and shape due to alterations by beavers is important to maintaining natural water systems and diverse aquatic habitat. Helping towns manage beavers and wetlands is an ongoing need. Large areas of undeveloped land, such as owned by Green Mountain National Forest, could be assisted in considering ways to fully support natural beaver activity in wetlands.

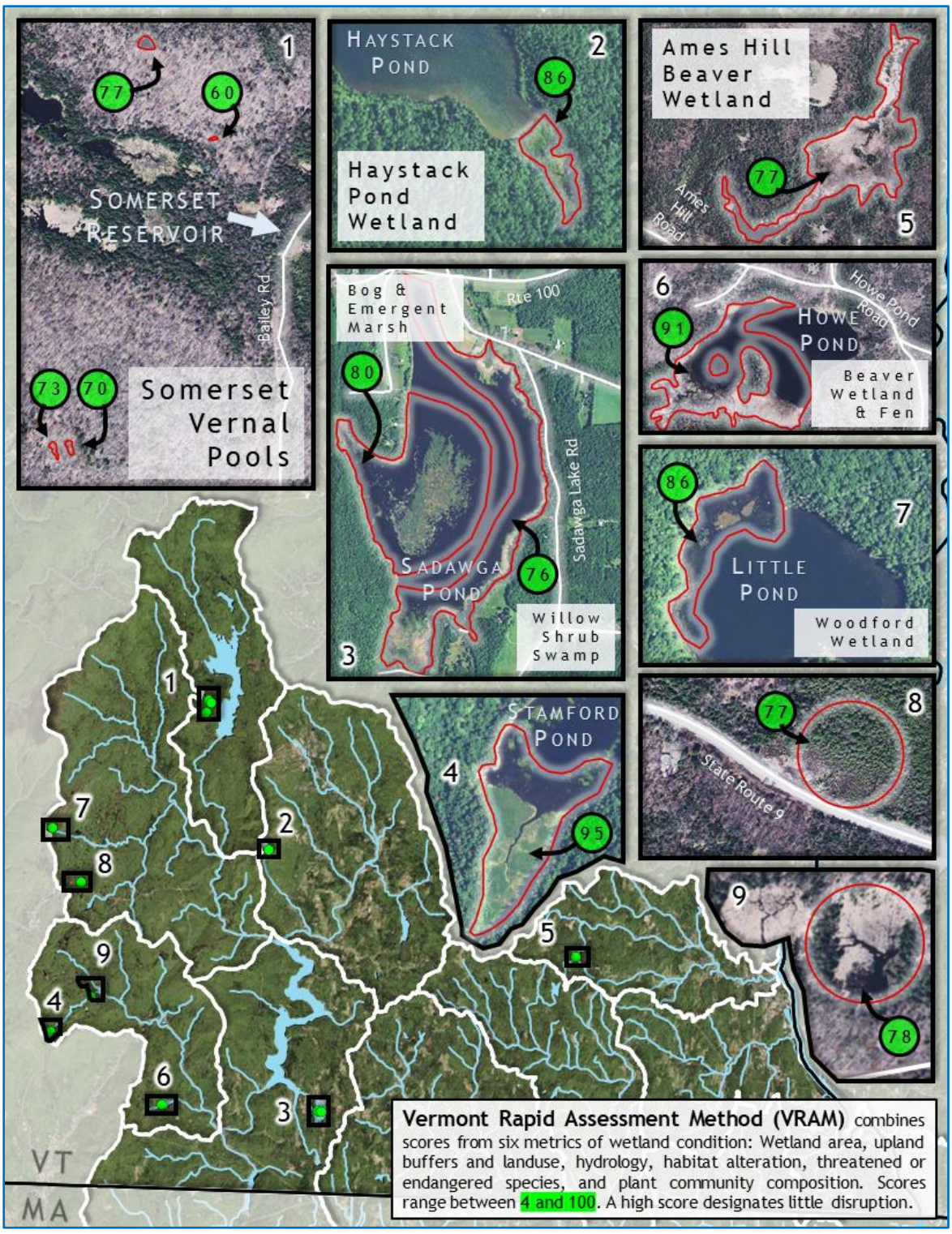


Figure 11. Condition of Assessed Wetlands

## Condition of Fisheries

The Deerfield watershed and southern tributaries to the Connecticut River provide habitat for a variety of warm and cold-water fish species. The waterbodies in the Deerfield watershed include large reservoirs for hydropower generation, lakes and ponds which provide warmwater fisheries, small headwater streams providing cold-water habitat for trout, and large tributary streams. This diversity of habitat types promotes a range of fishing opportunities throughout the Basin.

One of the more profound characteristics of the Deerfield relates to the number of impoundments operated for hydropower. Somerset, Searsburg, Harriman, and Sherman are all part of a hydro power complex within the Deerfield. While these reservoirs interrupt natural stream processes, they also provide habitat for a variety of species and are popular recreational fisheries. Harriman and Somerset are the two largest reservoirs in the Basin.

### Lakes and Ponds

The Basin also includes several other popular lakes and ponds including Lake Raponda, Lake Sadawga, South Pond, and Weatherhead Hollow where American eel, a Species of Greatest Conservation Need (SGCN) was observed in 2013.

### Small Headwater Streams

Small headwater streams that provide habitat for native Brook Trout are found throughout the Basin. Streams with relatively high abundance include Bond Brook, Broad Brook, Cold Brook, Deerfield mainstem (i.e. Harriman bypass), Haystack Brook, Lamb Brook, Oak Brook, Central Park Brook, and West Branch Deerfield. It should be noted that trout abundances are highly variable and can be influenced by several factors, with stream temperatures being the most profound.

### Large Tributary Streams

Large tributary streams include the North Branch Deerfield, East Branch Deerfield, Mainstem Deerfield, Whetstone Brook, Broad Brook and the Green River. Fish production downstream of Somerset and within the Harriman bypass, is presumed to be inhibited by the cold-water, low oxygen discharge from the dam. However, results for the region indicate that even in undeveloped watersheds, in the absence of a major dam, trout productivity is low to mid-range for the region.

Although these coldwater releases may result in sub-optimal conditions for trout growth immediately below the project, preliminary data indicate that the affected reach is relatively short. Moreover, deep water outlet structures can provide beneficial coldwater releases below hydroelectric projects which create temperature regimes suitable for year-round survival of trout[8]. Consistent coldwater releases can be particularly important in light of climate change predictions as these releases also extend and enhance coldwater habitats and fisheries further downstream. As such, broader trout fisheries benefits may be realized and outweigh localized impacts.

The North Branch Deerfield and tributaries are generally influenced by land use development including two ski resorts and agriculture. Currently the North Branch flows through a snow-making pond located at Mount Snow, which likely influences stream temperatures. Tributaries to the North Branch Deerfield such as Cold Brook are also influenced by snow-making due to two withdrawal sites, one located at the Hermitage and one located downstream of Mount Snow's snowmaking pond.

### Tropical Storm Irene

Tropical storm Irene occurred in 2011 and resulted in the deposition of over six inches of rain in the central and south-eastern portion of Vermont. Post-flood activities required stream alteration to protect life and property and rebuild critical transportation infrastructure[9]. However, much of the in-stream work resulted in the widening, deepening and straightening of stream channels. In some cases, in-stream wood was removed, stream banks were bermed, and stream bed elevations were raised. As a result, aquatic habitats including a diversity of substrate types, depths, flows, and cover, necessary to support healthy fish populations, suffered severe negative impacts.

In 2012, VFWD staff conducted roadside assessments of instream habitat degradation throughout the central and southern portion of Vermont.[10] An estimated 77 miles of streams were identified as being degraded from post-flood stream alteration activities. As such, the VFWD has been actively working to restore reaches to more natural conditions. For example, the Whetstone was recently restored to remove an over-abundance of bed armoring which resulted in subsurface flows. Efforts to continue

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[8] Walters, J.P., T.D. Fresques and S.D. Bryan. 1997. Comparison of creel returns from rainbow trout stocked at two sizes. North American Journal of Fisheries Management, 17:474-476.

[9] Lunderville, N. 2011. Irene recovery report. A stronger future. A report to the Governor of Vermont.
[10] Kirn, R. 2012. Impacts to Stream Habitat and Wild Trout Populations in Vermont . Following Tropical Storm Irene. Vermont Fish and Wildlife Department Annual Report, Project No.: F-36-R-14.

stream restoration in these reaches are paramount as it may take decades before these streams recover.

In sum, trout production can be influenced by many factors including food availability, water chemistry, temperature and available habitat. Trout production appears to be limited throughout the region due to natural causes such as water chemistry, stream temperatures, and in certain areas may be further impacted by flow alterations and post-Irene alterations within the system. Tributary streams provide greater trout abundances, and stocking supplements catchable sized trout to support a moderate recreational fishery. Efforts to improve aquatic passage, protect riparian corridors, re-evaluate the flow regime during the FERC relicensing process, and restoring Post-Irene reaches are management tools that could be applied to the Deerfield watershed, and tributaries of the Connecticut River.

All waters of Vermont are under a Vermont Department of Health Fish Consumption Advisory for exceeding the USEPA mercury limits in fish. Grout Pond, Somerset Reservoir, Harriman Reservoir, Sherman Reservoir, and Searsburg Reservoir fall under a Special Advisory with lower consumption limits of certain species due to their high acidity. Mercury is a chemical that becomes toxic to humans and other animals at high concentrations. As big fish eat smaller fish, the mercury concentrations increase in the fish tissues, and through this process of bioaccumulation, mercury levels become unsafe for human consumption of certain species of fish.

Despite these challenges, based on VFWD data, a number of streams could potentially meet the B(1) criteria for fisheries. 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. More sampling is needed but the streams that may meet these criteria are: Scooter, Negus, Cheney, Blue Brook, West Branch Deerfield, Fall, Hager, South Branch Deerfield, Cold Brook, Haystack, and Oak Brook, Broad Brook, Whetstone. Other streams may be potential candidates but have not yet been sampled.

Management Recommendations:

1. Protect riparian corridors
2. Improve flood resiliency and restore post-Irene impacts.
3. Improve aquatic habitat and connectivity, including the strategic placement of wood in streams which would benefit native trout species in certain reaches.

4. Where flows are regulated, promote the natural flow regime
5. Help stop the spread of exotic species and pathogens
6. Protect water quality
7. Identify and designate B(1) High Quality Fishing – wild salmonid streams quality

The complete *Deerfield Watershed and lower Connecticut Tribs (Basin 12) Fisheries Assessment* report provided by VFWD Fisheries Division can be found in Appendix D.

## Chapter 2 Priority Surface Waters for Protection

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 and 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's consideration at any time. Petitioners can work with their Watershed Planner to nominate waters for either reclassification or ORW designation. Alternatively, petitioners can follow the procedure in the current legislation: 10 V.S.A. § 1253 for water classification and 10 V.S.A. § 1424a for ORW.

All surface waters in Vermont are managed to support designated uses valued by the public at a level of Class B(2) or better (Table 2). These uses include swimming, boating, fishing, aquatic biota, aquatic habitat, aesthetics, drinking water source and irrigation. VDEC has established criteria for six of these classes and VFWD has established criteria for the fishing designated use. Monitoring data collected by both Departments supports the recommendations in this Plan.

Several waters in the Basin are identified as being high quality, and these, as well as other unique waterbodies, are candidates for establishing alternate management objectives or augmented protections through one of the following processes.

- Reclassification of surface waters
- Outstanding Resource Waters designation
- Class I Wetland designation
- Designation as cold-water fisheries
- Identification of existing uses

Table 2. Criteria for Water Classes

| Use | A1 | B1 | B2 |
|---|---|---|---|
| Aquatic Biota | Excellent - Natural Condition | Very Good - minor change | Good - moderate change |
| Aquatic Habitat | Natural Condition | Very Good - minor change | Good - moderate change |
| Aesthetics | Natural Condition | Very Good | Good |
| Boating | Excellent - maximum extent without degradation | Very Good - maximum extent with no more than minor degradation | Good - meets hydrological criteria |
| Fishing | Salmonid population in Natural Condition | Salmonid population in Very Good Condition | Salmonid population in Good Condition |
| Public Water Supply | (A2) Uniformly excellent character, highly suitable | --- | Suitable with treatment |
| Swimming | Excellent | --- | Good |

**Class A(1)** waters are waters in a natural condition that have significant ecological value. By Vermont statute[11] all surface waters above 2,500 feet of elevation are Class A(1). Below the 2,500-ft. elevation threshold, there are numerous surface waters which meet the biological criteria established for Class A(1), or exhibit characteristics consistent with Class A1. These waters are or can be designated as Class A(1).

**Class A(2)** waters are waters of uniformly excellent character that, with filtration and disinfection, are suitable for use as a public water source.

**Class B(1)** waters are waters of which one or more uses are documented to be higher quality than Class B(2) criteria for waters.

**Class B(2)** waters are waters that are suitable for: swimming and other primary contact recreation; irrigation and agricultural uses; aquatic biota and habitat; good aesthetic value; boating, fishing, and other recreational uses; and, with filtration and disinfection, as a public water source. Class B(2) is the base (or default) classification to which all surface water uses, excepting those already designated as Class A(1), A(2), and/or B(1) are managed.

Figure 12 presents the Basin 12 protection priorities for lakes, rivers and wetlands.

[11] 10 V.S.A. § 1253

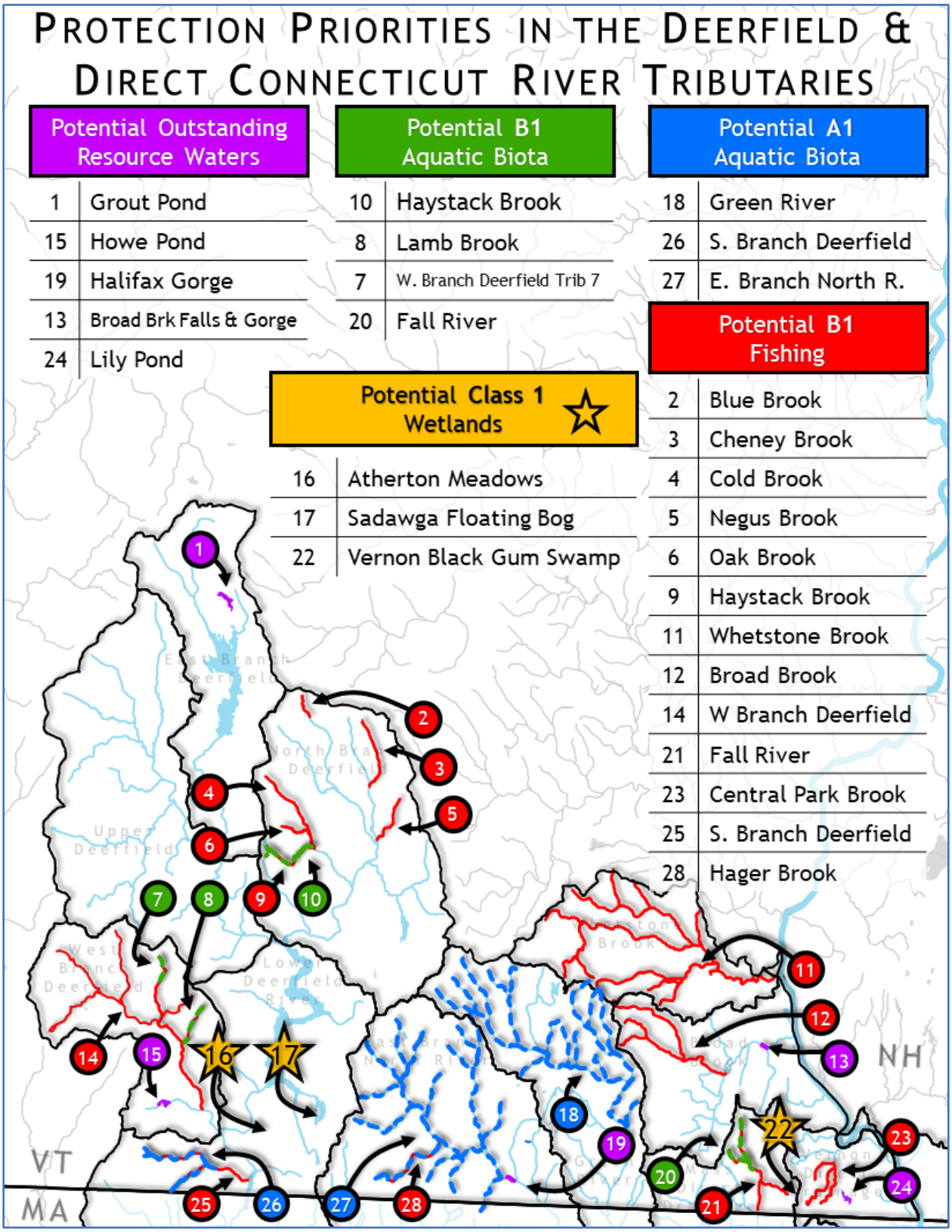



Figure 12. Protection Priorities

## Reclassification of Waters

Current water classifications can be found in the VWQS.

The waters presented in Table 3 meet or exceed the criteria for aquatic biota to the level listed.

Table 3. Reclassification Proposed for A(1) Aquatic Biota

| Sub-watershed | Class | Use |
|---|---|---|
| **Reclassification Proposed** | | |
| East Branch North River | A(1) | Aquatic Biota |
| Green River | A(1)* | Aquatic Biota |
| South Branch Deerfield River | A(1) | Aquatic Biota & Fish |

* Due to its excellent condition the Green River is being recommended for A(1) reclassification. The Green River and its tributaries from the Vermont-Massachusetts state line to the Green River water supply intake 6.4 miles downstream in Massachusetts serves as a Massachusetts Class A - Public Drinking Water Supply for the town of Greenfield. In order to protect this resource, the Vermont portion of the river should be protected to the highest level possible.

The waters presented in Table 4 meet or exceed the criteria for the listed use to the level of B(1)for Aquatic Biota &/or Fishery

Table 4. Reclassification Proposed for B(1) Aquatic Biota & Fishery

| Sub-watershed | Class | Use |
|---|---|---|
| **Reclassification Proposed** | | |
| Lamb Brook | B(1) | Aquatic Biota |
| West Branch Deerfield River - Trib 7 | B(1) | Aquatic Biota |
| Fall River | B(1) | Aquatic Biota & Fishery |
| Haystack Brook | B(1) | Aquatic Biota & Fishery |
| Blue Brook | B(1) | Fishery |
| Broad Brook | B(1) | Fishery |
| Central Park Brook | B(1) | Fishery |
| Cheney Brook | B(1) | Fishery |
| Cold Brook | B(1) | Fishery |
| Hager Brook | B(1) | Fishery |
| Negus Brook | B(1) | Fishery |
| Oak Brook | B(1) | Fishery |
| South Branch Deerfield River | B(1) | Fishery |
| West Branch Deerfield River | B(1) | Fishery |
| Whetstone Brook | B(1) | Fishery |

## Outstanding Resource Waters (ORW) Designation

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. ORWs can be designated by the Agency of Natural Resources through a public petition process. ORWs display outstanding qualities that are determined to deserve a higher level of protection. ORW designation may be based on any one or more of the following features:

1. existing water quality and current water quality classification;
2. the presence of aquifer protection areas;
3. the waters' value in providing temporary water storage for flood water and storm runoff;
4. the waters' value as fish habitat;
5. the waters' value in providing or maintaining habitat for threatened or endangered plants or animals;
6. the waters' value in providing habitat for wildlife, including stopover habitat for migratory birds;
7. the presence of gorges, rapids, waterfalls, or other significant geologic features;
8. the presence of scenic areas and sites;
9. the presence of rare and irreplaceable natural areas;
10. the presence of known archeological sites;
11. the presence of historic resources, including those designated as historic districts or structures;
12. existing usage and accessibility of the waters for recreational, educational, and research purposes and for other public uses;
13. studies, inventories and plans prepared by local, regional, statewide, national, or international groups or agencies, that indicate the waters in question merit protection as outstanding resource waters; and
14. existing alterations, diversions or impoundments by permit holders under state or federal law.

While there are presently no ORWs in Basin 12, several surface waters have been identified as prospective candidates for ORW, which are presented in Table 5. As part of the implementation of this tactical basin plan, the Agency, in cooperation with a petitioner, may evaluate the consistency of these surface waters with the features and values identified in prior ORW determinations. Surface waters that satisfy criteria for designation as ORW may be proposed for such designation through rulemaking.

Table 5. Proposed ORW Designation

| Water | Location | Supporting Data | ORW Feature |
|---|---|---|---|
| Grout Pond | Stratton | WQ, scenic, RTE, Uncommon plant & animal | 1, 5, 6, 8, 12 |
| Howe Pond | Readsboro | Class A2, state forest land | 1, 2, 5, 6, 8, |
| Lily Pond | Vernon | RTE, NC, uncommon plant & animal | 5, 6, 9, 12 |
| Broad Brook falls and gorge | Guilford | Scenic gorge and waterfalls, state lands river recreation access | 7, 8, 12 |
| Halifax Gorge | Halifax | 1,500 ft spanning gorge, East Branch North River | 7, 8, 12 |

## Class 1 Wetlands Designation

The State of Vermont identifies and protects significant wetlands such that no net loss of wetlands and their values and functions is allowed. By evaluating the extent to which a wetland provides functions and values, it is classified as:

- **Class I**: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection,
- **Class II**: Merits protection, either taken alone or in conjunction with other wetlands, or
- **Class III**: Neither a Class II nor a Class I wetland.

Impacts to Class I wetlands may only be permitted when the activity is necessary to meet a compelling public need for health or safety. The VT Wetlands Program's Class I website contains an interactive map and includes determinations for eight designated Class I wetlands in the state.

There are currently no Class I wetlands in the basin although the Vernon Black Gum Swamps have been determined to meet the criteria for Class I designation. The Wetlands Program welcomes recommendations for Class I candidates.

The following wetlands are proposed for study for consideration of possible reclassification to Class I.

Table 6.

| **Wetlands to Assess** |
|---|
| Atherton Meadows (Whitingham) |
| Lake Sadawga floating bog (Whitingham) |

## Identification of Existing Uses

Consistent with the federal Clean Water Act and the Vermont Water Quality Standards the Agency may identify existing uses of waters during the tactical basin planning process or on a case-by-case basis during application reviews for state or federal permits. An existing use is any designated 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. Once identified, the level of water quality necessary to protect existing uses shall be maintained and protected regardless of the water's classification. The public is encouraged to recommend waters for existing uses for swimming, boating, fishing, drinking water, and ecological significance given that they provide evidence of such use.

The Agency stipulates to these broader existing uses:

- all lakes and ponds in the basin have existing uses of swimming, boating and fishing,
- fishing in streams and rivers is widespread and too numerous to document individually,
- small streams provide spawning and nursery areas, which contribute to fish stocks downstream.

Existing uses identified for the Basin to date should be viewed as only a partial accounting of known existing uses based upon limited information. The list does not change protection under the Clean Water Act or Vermont Water Quality Standards for waters not listed. The existing uses in the Basin for swimming, boating, fishing, and

drinking water supply are found on the Deerfield Basin Plan webpage at: http://dec.vermont.gov/watershed/map/basin-planning/basin12 and in Appendix B.

Adams Reservoir,
Woodford State Park

# Chapter 3 Priority Areas for Surface Water Restoration

## A. Impaired Waters and Priority Surface Waters

The Vermont Surface Water Management Strategy (VSWMS) lays out the goals and objectives of VDEC's Watershed Management Division for addressing pollutants and stressors that can negatively affect the designated uses of Vermont surface waters. When waters do not fully support desired uses they are listed as **stressed, altered** or **impaired**.

Section 303(d) of the Federal Clean Water Act requires states to develop lists of impaired waters that include lakes, ponds, rivers and streams that do not meet Water Quality Standards. Five lists identify waters that do not meet water quality standards to some degree:

- Part A (303d list) – impaired waters requiring a TMDL;
- Part B – impaired waters with other required remediation measures in place;
- Part D – impaired waters with TMDLs in place;
- Part E – waters altered by aquatic invasive species;
- Part F – waters altered by flow modifications.

The sixth list

- Stressed Water – refers to waters that support uses but where water quality or habitat conditions have been disturbed and may require some attention to maintain or restore water quality.

These priority waters comprise the 303(d) List of Impaired Waters and List of Priority Surface Waters and can be viewed on the Vermont Environmental Atlas. For a more detailed description of monitoring results use the Integrated Watershed Information System (IWIS) online data portal. These lists also include preliminary information on responsible pollutants and/or physical alterations to aquatic and riparian habitat, the stressors and if known, the sources of the pollutant.

The results of monitoring and assessment data are documented in the Basin 12 Water Quality and Aquatic Habitat Updated Assessment Report and the Basin 13 - Lower Connecticut River Direct Drainage Assessment Report. The waterbodies identified on these lists are a focus for remediation efforts in this plan.

The majority of the Basin's waters fully support the desired uses as shown in Figure 13.

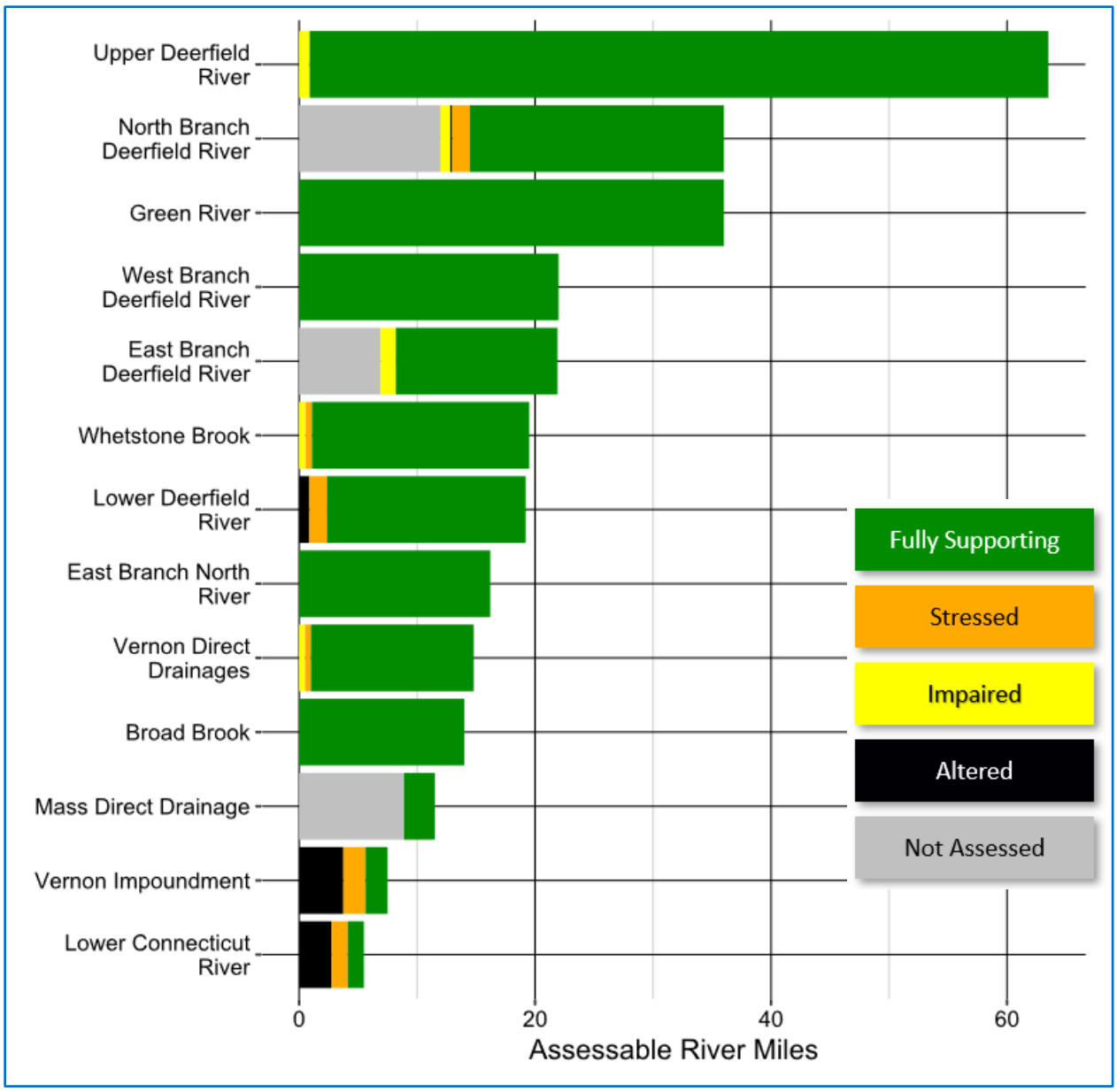


Figure 13. Use Support of Assessed Rivers

## Impaired Waters and Priority Surface Waters

Figures 14 & 15 provide the location and list of Priority Waters.

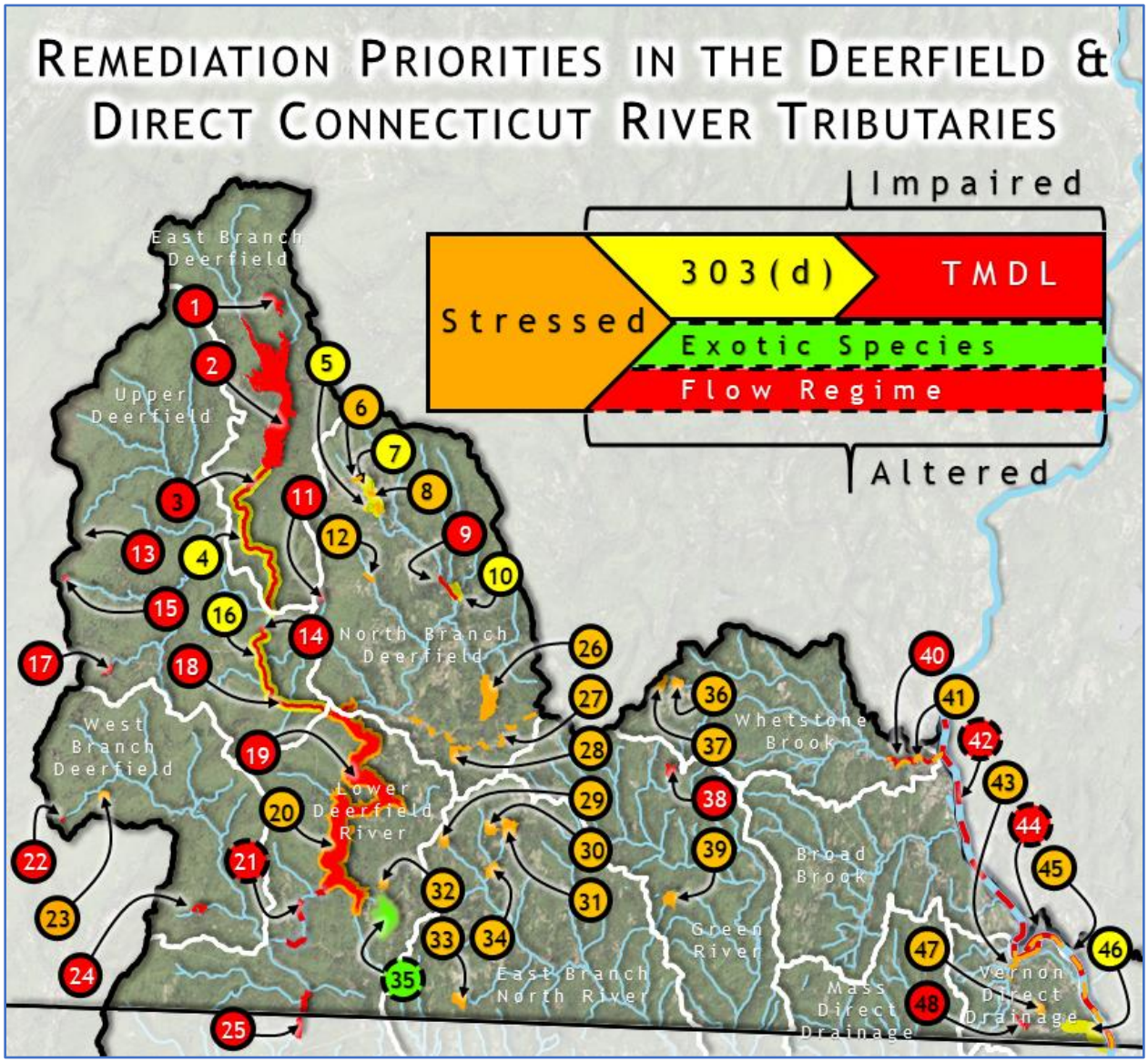
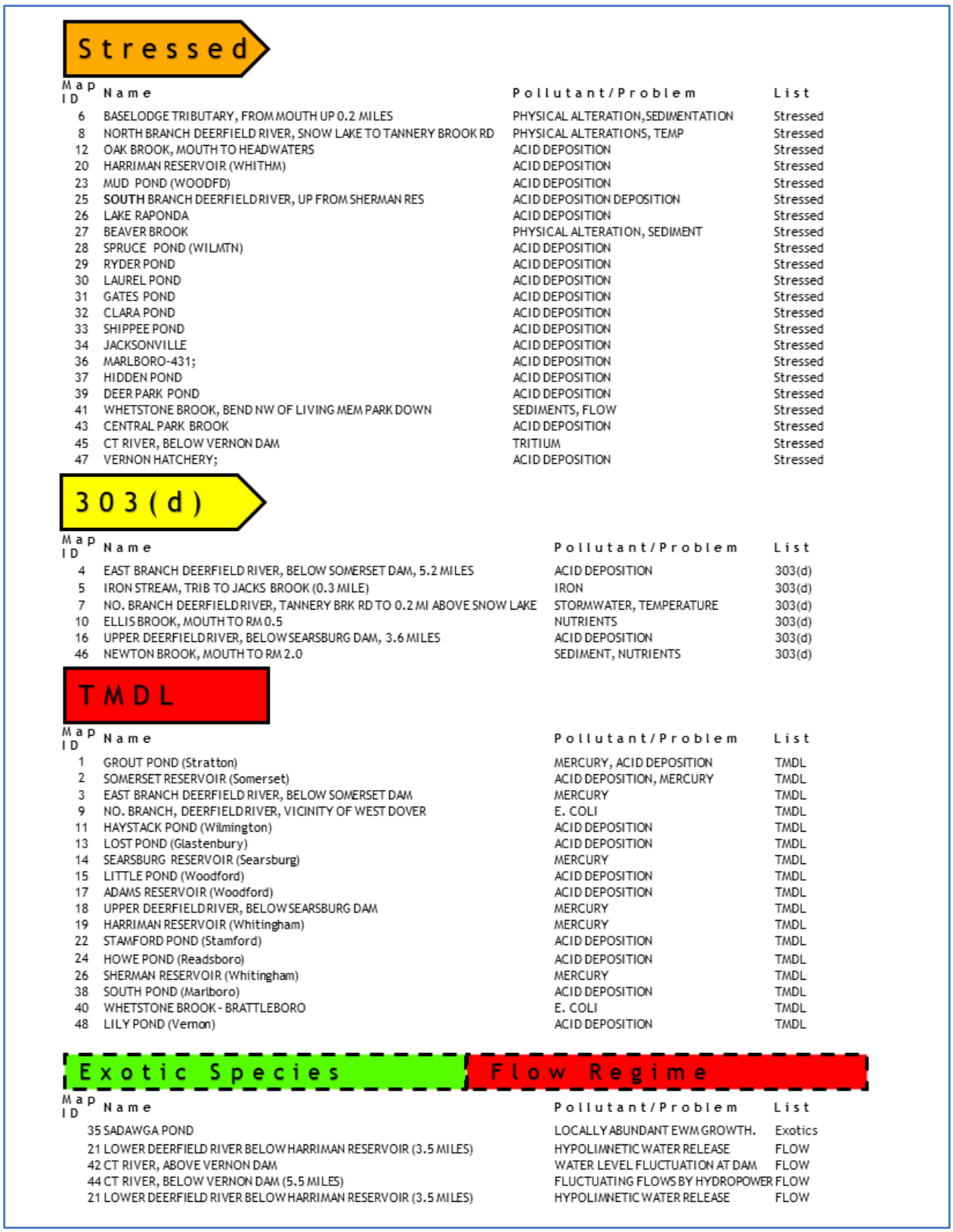


Figure 14. Remediation Priorities Map



## Stressed

| Map ID | Name | Pollutant/Problem | List |
|---|---|---|---|
| 6 | BASELODGE TRIBUTARY, FROM MOUTH UP 0.2 MILES | PHYSICAL ALTERATION,SEDIMENTATION | Stressed |
| 8 | NORTH BRANCH DEERFIELD RIVER, SNOW LAKE TO TANNERY BROOK RD | PHYSICAL ALTERATIONS, TEMP | Stressed |
| 12 | OAK BROOK, MOUTH TO HEADWATERS | ACID DEPOSITION | Stressed |
| 20 | HARRIMAN RESERVOIR (WHITHM) | ACID DEPOSITION | Stressed |
| 23 | MUD POND (WOODFD) | ACID DEPOSITION | Stressed |
| 25 | SOUTH BRANCH DEERFIELD RIVER, UP FROM SHERMAN RES | ACID DEPOSITION DEPOSITION | Stressed |
| 26 | LAKE RAPONDA | ACID DEPOSITION | Stressed |
| 27 | BEAVER BROOK | PHYSICAL ALTERATION, SEDIMENT | Stressed |
| 28 | SPRUCE POND (WILMTN) | ACID DEPOSITION | Stressed |
| 29 | RYDER POND | ACID DEPOSITION | Stressed |
| 30 | LAUREL POND | ACID DEPOSITION | Stressed |
| 31 | GATES POND | ACID DEPOSITION | Stressed |
| 32 | CLARA POND | ACID DEPOSITION | Stressed |
| 33 | SHIPPEE POND | ACID DEPOSITION | Stressed |
| 34 | JACKSONVILLE | ACID DEPOSITION | Stressed |
| 36 | MARLBORO-431; | ACID DEPOSITION | Stressed |
| 37 | HIDDEN POND | ACID DEPOSITION | Stressed |
| 39 | DEER PARK POND | ACID DEPOSITION | Stressed |
| 41 | WHETSTONE BROOK, BEND NW OF LIVING MEM PARK DOWN | SEDIMENTS, FLOW | Stressed |
| 43 | CENTRAL PARK BROOK | ACID DEPOSITION | Stressed |
| 45 | CT RIVER, BELOW VERNON DAM | TRITIUM | Stressed |
| 47 | VERNON HATCHERY; | ACID DEPOSITION | Stressed |

## 303(d)

| Map ID | Name | Pollutant/Problem | List |
|---|---|---|---|
| 4 | EAST BRANCH DEERFIELD RIVER, BELOW SOMERSET DAM, 5.2 MILES | ACID DEPOSITION | 303(d) |
| 5 | IRON STREAM, TRIB TO JACKS BROOK (0.3 MILE) | IRON | 303(d) |
| 7 | NO. BRANCH DEERFIELD RIVER, TANNERY BRK RD TO 0.2 MI ABOVE SNOW LAKE | STORMWATER, TEMPERATURE | 303(d) |
| 10 | ELLIS BROOK, MOUTH TO RM 0.5 | NUTRIENTS | 303(d) |
| 16 | UPPER DEERFIELD RIVER, BELOW SEARSBURG DAM, 3.6 MILES | ACID DEPOSITION | 303(d) |
| 46 | NEWTON BROOK, MOUTH TO RM 2.0 | SEDIMENT, NUTRIENTS | 303(d) |

## TMDL

| Map ID | Name | Pollutant/Problem | List |
|---|---|---|---|
| 1 | GROUT POND (Stratton) | MERCURY, ACID DEPOSITION | TMDL |
| 2 | SOMERSET RESERVOIR (Somerset) | ACID DEPOSITION, MERCURY | TMDL |
| 3 | EAST BRANCH DEERFIELD RIVER, BELOW SOMERSET DAM | MERCURY | TMDL |
| 9 | NO. BRANCH, DEERFIELD RIVER, VICINITY OF WEST DOVER | E. COLI | TMDL |
| 11 | HAYSTACK POND (Wilmington) | ACID DEPOSITION | TMDL |
| 13 | LOST POND (Glastenbury) | ACID DEPOSITION | TMDL |
| 14 | SEARSBURG RESERVOIR (Searsburg) | MERCURY | TMDL |
| 15 | LITTLE POND (Woodford) | ACID DEPOSITION | TMDL |
| 17 | ADAMS RESERVOIR (Woodford) | ACID DEPOSITION | TMDL |
| 18 | UPPER DEERFIELD RIVER, BELOW SEARSBURG DAM | MERCURY | TMDL |
| 19 | HARRIMAN RESERVOIR (Whitingham) | MERCURY | TMDL |
| 22 | STAMFORD POND (Stamford) | ACID DEPOSITION | TMDL |
| 24 | HOWE POND (Readsboro) | ACID DEPOSITION | TMDL |
| 26 | SHERMAN RESERVOIR (Whitingham) | MERCURY | TMDL |
| 38 | SOUTH POND (Marlboro) | ACID DEPOSITION | TMDL |
| 40 | WHETSTONE BROOK - BRATTLEBORO | E. COLI | TMDL |
| 48 | LILY POND (Vernon) | ACID DEPOSITION | TMDL |

## Exotic Species

## Flow Regime

| Map ID | Name | Pollutant/Problem | List |
|---|---|---|---|
| 35 | SADAWGA POND | LOCALLY ABUNDANT EWM GROWTH. | Exotics |
| 21 | LOWER DEERFIELD RIVER BELOW HARRIMAN RESERVOIR (3.5 MILES) | HYPOLIMNETIC WATER RELEASE | FLOW |
| 42 | CT RIVER, ABOVE VERNON DAM | WATER LEVEL FLUCTUATION AT DAM | FLOW |
| 44 | CT RIVER, BELOW VERNON DAM (5.5 MILES) | FLUCTUATING FLOWS BY HYDROPOWER | FLOW |
| 21 | LOWER DEERFIELD RIVER BELOW HARRIMAN RESERVOIR (3.5 MILES) | HYPOLIMNETIC WATER RELEASE | FLOW |

Figure 15. Remediation Priorities List

The goals of the Tactical Basin Plan include addressing the stressors or pollutants degrading the listed waters through geographically specific actions listed in the implementation table in Chapter 5 and the Watershed Projects Database. The types of actions prescribed are based on the stressor specific practices outlined in the Vermont Surface Water Management Strategy. Additional monitoring and assessment needs are outlined in Table 17 in Chapter 5.

An additional goal is to reduce nitrogen loading from the Basin contributes to elevated nitrogen levels in Long Island Sound and that results in a dissolved oxygen impairment. The types of actions prescribed are based on the stressor specific practices outlined in the Vermont Surface Water Management Strategy. See the section below on the Long Island TMDL.

While only one lake is listed in Figures 14 and 15 as being altered for aquatic invasives, there are more waters that are impacted by these but have not been officially listed in Part E of Priority Listing of Vermont Waters. The mainstem of the Connecticut River in particular has numerous invasive species present.

## B. Basin Specific Total Maximum Daily Loads (TMDLs)

A TMDL or Total Maximum Daily Load is the calculated maximum amount of a pollutant that a waterbody can receive and still meet Vermont Water Quality Standards. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and develops a means to implement those reductions. TMDLs can be calculated for reducing water pollution from specific point source discharges or for an entire watershed to determine the location and amount of needed pollution reductions.

Under Section 303(d) of the Federal Clean Water Act, all states are required to develop lists of impaired waters. The list includes impaired lakes, ponds, rivers and streams that do not meet Water Quality Standards. For Vermont, impairment is substantiated by chemical, physical or biological data collected through monitoring and these waters are noted on the state's 303(d) list of Impaired Waters. The Federal Clean Water Act requires TMDLs to be developed for waters on the list; the list provides a schedule indicative of TMDL completion priority.

Pursuant to 40 C.F.R. §130.7(b), the State may use a Water Quality Remediation Plan (WQRP) in lieu of a TMDL for an impaired water when the State determines that the pollution control requirements of the WQRP are stringent enough to meet State Water Quality Standards within a reasonable period of time.

Table 7 lists the TMDLs completed thus far in the Basin:

Table 7. TMDLs

| Sub-watershed | Date | Coverage |
|---|---|---|
| TMDLs | | |
| Vermont Statewide TMDL for Bacteria-Impaired Waters | 2011 | |
| North Branch-Deerfield | 2011 | |
| Whetstone Brook | 2011 | |
| TMDL for 30 Acid Impaired Lakes | 2003 | |
| TMDL for 7 Acid Impaired Lakes | 2004 | |
| TMDL for 2 Acid Impaired Lakes | 2012 | |
| Vermont - Mercury | 2007 | Statewide |
| Long Island Sound Dissolved Oxygen TMDL | 2000 | Multi-state |
| Vermont Enhanced Implementation Plan | 2013 | |
| Northeast Regional Mercury Total Maximum Daily Load | 2007 | Multi-state |
| Mount Snow Resort Water Quality Remediation Plan | 2011 | Mt Snow Resort |
| Mount Snow Carinthia Iron Stream Remediation Plan | 2015 | Mt Snow Resort |

### Long Island Sound Dissolved Oxygen TMDL

The Long Island Sound Dissolved Oxygen TMDL, released in 2000, is designed to address low dissolved oxygen or hypoxia in Long Island Sound bottom waters (Figure 16). It is often referred to as the Connecticut River Nitrogen TMDL because it is linked to an overabundance of nitrogen discharging into the Sound from the Connecticut River and other tributaries. While nitrogen is essential to a productive ecosystem, too much nitrogen fuels the excessive growth of algae. When the algae die, they sink to the bottom, where they are consumed by bacteria. The microbial decay of algae and the respiration of oxygen-breathing bacteria and other organisms use up the available oxygen in the lower water column and in the bottom sediments, gradually reducing the dissolved oxygen concentration to unhealthy levels.[12]

[12] A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound

In 2013 a Vermont-specific section was added to the LIS-TMDL to address four goals:

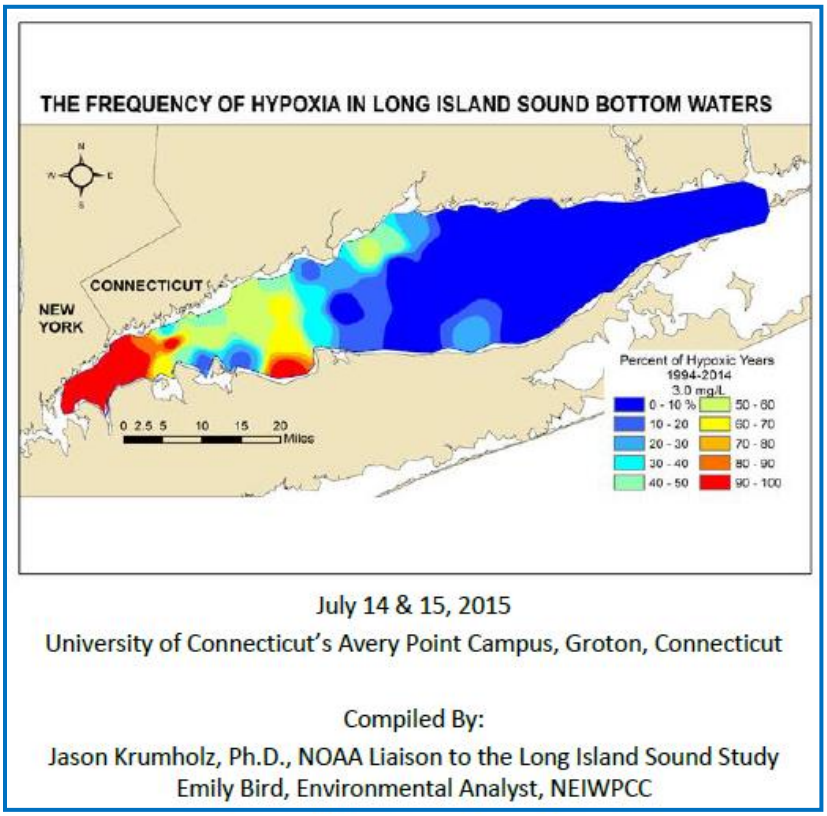



Figure 16. Frequency of Hypoxia in Long Island Sound[13]

- identify the Vermont sources of nitrogen as they are currently understood, across broad land use sectors, such as developed, agricultural and forested;
- identify the current status and trends of important drivers of nitrogen export such as the intensity of agricultural and development activities and investigate how these might have changed since the TMDL baseline time period of 1990;
- identify the management programs, operating at that time, that address these drivers of nitrogen loading that have a significant effect on reducing or preventing nitrogen export. A part of this is to identify a timeline as to when programs were initiated or enhanced; and
- using a weight-of-evidence approach, to assess the combined management programs/projects to develop a qualitative evaluation as to whether management efforts are sufficient to meet the original 2000 TMDL of a 10% NPS nitrogen reduction and if these actions are sufficient to maintain that control into the future. [14]

A 2006 USGS report found nitrogen loading of 1,750 pounds per square mile per year in the Connecticut River watershed near the confluence of the Saxtons River is coming from sources in Vermont and New Hampshire. This rate of loading is lower than that

[13] Proceedings of the 2015 Long Island Sound Water Quality Workshop
[14] Vermont Enhanced Implementation Plan for the Long Island Sound TMDL

recorded at the MA/CT state line near Thompsonville Connecticut, at 2230 pounds per square mile per year.[15]

Loading of nitrogen in the Connecticut River watershed has been modeled through the Spatially Referenced Regressions on Watershed Attributes (SPARROW) model developed by the USGS. The findings were presented in a 2019 publication[16] by Scott Ator. This modeling included estimated loading from municipal discharges, agricultural, and urban lands, as well as from atmospheric deposition along with additional calculations for watershed and in stream nitrogen loss. As shown in Figure 17, updating the model with current data, the delivered aggregated load (kg) of nitrogen to LIS from Vermont is estimated to be about 3,185 metric tons or 12% of the total load to the Sound.

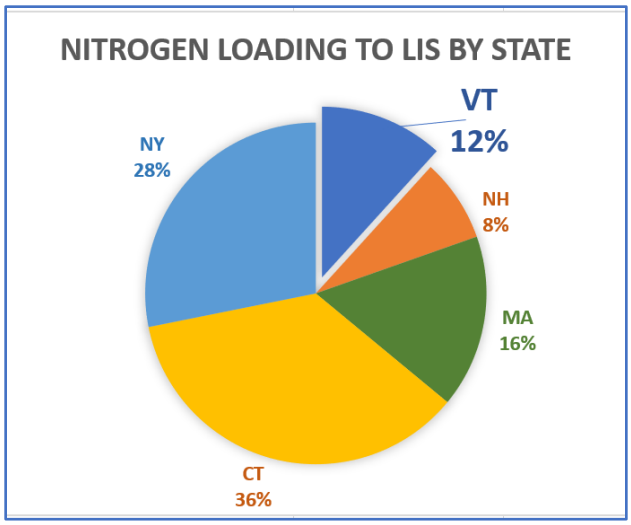



Figure 17. Nitrogen Loading to Long Island Sound by State

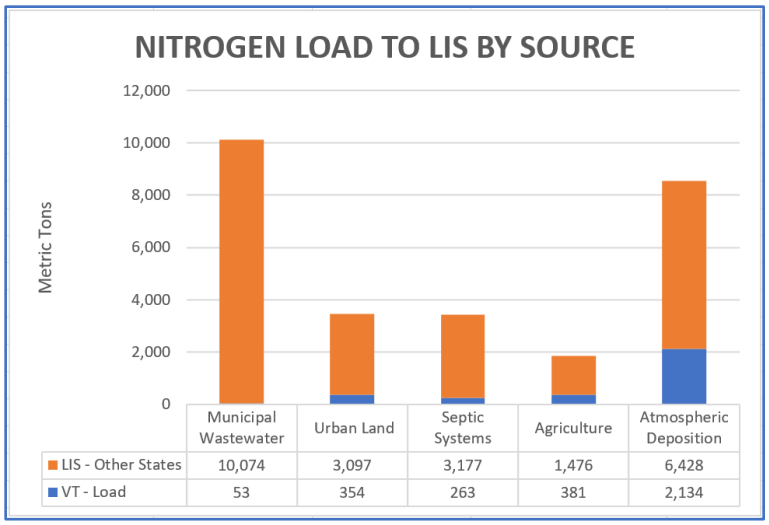



Figure 18. Nitrogen Loading to Long Island Sound by Source

As depicted in Figure 18, Vermont's contribution to loading in Long Island Sound breaks down as 0.2% being from municipal wastewater-treatment; 1.3% from urban land; 1.0% from septic system effluent; 1.4% from agricultural lands; and the remaining 8% is from atmospheric deposition.

[15] Assessment of Total Nitrogen in the Upper Connecticut River Basin in New Hampshire, Vermont, and Massachusetts, December 2002–September 2005

[16] Spatially Referenced Models of Streamflow and Nitrogen, Phosphorus, and Suspended-Sediment Loads in Streams of the Northeastern United States-2019

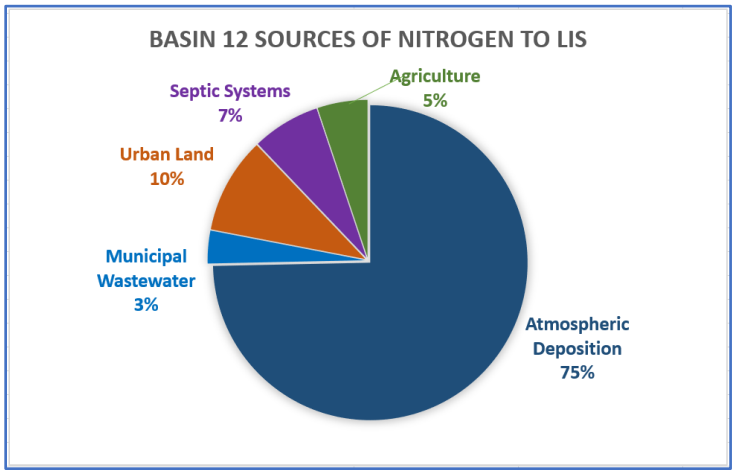



Figure 19. Nitrogen Loading to Long Island Sound from Basin 12 by Source

Of the seven Vermont basins in the Connecticut River and Long Island Sound watershed, Basin 12 contributes 10% of the nitrogen load (Figure 19) broken down into 3% from municipal wastewater-treatment; 10% from urban land; 7% from septic systems; 5% from agricultural lands; and 75% from atmospheric deposition.

In 2017, EPA embarked on its Nitrogen Reduction Strategy to investigate and better define control actions to reduce nitrogen in the Long Island Sound. Information on the most current developments and strategies can be found in EPA's Long Island Sound Study, a summary is provided below:

> *EPA is implementing a strategy to aggressively continue progress on nitrogen reductions, in parallel with the States' continued implementation of the 2000 Total Maximum Daily Load (TMDL) and achieve water quality standards throughout Long Island Sound and its embayments and near shore coastal waters. The strategy recognizes that more work must be done to reduce nitrogen levels, further improve dissolved oxygen (DO) conditions, and address other nutrient-related impacts in Long Island Sound. The nitrogen reduction strategy complements the 2000 TMDL in important ways. Foremost, while the 2000 TMDL is premised on achieving water quality standards for DO in the open waters of LIS, the EPA strategy expands the focus to include other nutrient-related adverse impacts to water quality, such as loss of eelgrass, that affect many of LIS's embayments and near shore coastal waters.*

The sources of nitrogen to be addressed in Vermont include wastewater discharges, agricultural lands, developed lands and forest practices. Overarching strategies and the steps Vermont is taking to implement these by enacting Act 64 in 2015 include:

- *Continue implementation of nitrogen reductions from wastewater treatment plants (WWTPs), including capping WWTP nitrogen loads, monitoring nitrogen discharged from WWTPs, and the completion of nitrogen removal optimization studies at WWTPs in the VT portion of the LIS watershed.* The development of targets for nitrogen

reduction is underway. Discharge permits are being reviewed and updated as part of the permit renewal process.

- *Control non-point source discharges from agricultural lands through implementation of Required Agricultural Practices (RAP) and Best Management Practices (BMP) to decrease sediment and nutrient runoff.* RAPs have been updated and implemented to include increased requirements for small farm certification, increased buffer zones, livestock exclusion, additional nutrient management, and tile drainage. Additional requirements include inspections of small certified farms; requirements for training farm owners or operators regarding prevention of discharges to waters; mitigation of stormwater runoff; land application of manure or nutrients; nutrient management planning; and certification of custom applicators land-applying manure or nutrients.
- *Continue implementation of state stormwater permits covering construction, roads, direct and indirect discharges.* Activities that require an ANR stormwater permit, have been expanded to include: construction of one acre or more of impervious surface; discharge from industrial facilities; municipal separate storm sewer systems; earth disturbance of one or more acres; expansion of existing impervious surface by more than 5,000 square feet if the resulting impervious area is more than one acre; runoff from municipal and state roads; and retrofitting of old impervious surfaces. Many of the practices addressing stormwater flow and sediment reduction also help mitigate nitrogen transport.
    - *Note:*
        - The 1-acre construction threshold will be reduced to ½-acre in 2022;
        - An additional road permit is the Statewide Transportation Separate Storm Sewer System General Permit specific to the State (AOT) highway system and non-road developed lands.
- *Decrease discharges from forestry practices through continued implementation of AMPs, outreach and the use of portable skidder bridges.* VDFPR has revised the Acceptable Management Practices for Maintaining Water Quality on Logging Jobs (AMPs).

The Long Island Sound Watershed Regional Conservation Partnership Program (LISW-RCPP) was created in 2015 across six states to coordinate the development and implementation of a comprehensive working lands program with foci on: 1) nutrient management and soil health, 2) protection of non-industrial forest habitat, biodiversity, and drinking water sources, and 3) stem erosion and improve resiliency on working lands through riparian restoration.

In partnership with the Vermont Association of Conservation Districts (VACD), UVM Extension, the Connecticut River Conservancy, The Nature Conservancy and federal, state and local organizations in NH, MA, CT, NY and RI ten million dollars is being invested in the adoption of best management practices on private working lands, providing both technical and financial assistance.[17] Additionally the Long Island Sound Futures Fund is available throughout the Connecticut River watershed for Nitrogen removal projects.[18]

## Water Quality Remediation Plans

As mentioned above, Water Quality Remediation Plans (WQRP) are used in lieu of TMDLs where the source, cause and extent of a problem is identifiable. Two WQRPs are in place to address water quality issues from Mount Snow resort development. These lay out actions to be implemented to remediate the water quality impacts.

Mount Snow WQRP actions:

- Removal of Snow Lake and restoration of the North Branch Deerfield River stream channel, thus reducing thermal loading and restoring the natural hydrologic and sediment transport regime
- Implementation of the iron seep prevention and control plans
  Remediation of undersized, improperly sited, or degraded culverts to restore the hydrologic regime
- Implementation of on-mountain BMPs for waterbars, work roads, storage areas, and other practices to help control runoff
- Expand upon prior watershed assessments to identify point sources of sediment loading and confirm existing water quality stressors identified in the 2006 Stream Geomorphic Assessment (SGA)for the purpose of identifying remediation projects
- Transfer of the existing salt and sand storage area adjacent to existing parking lots to a covered facility at the proposed maintenance building to minimize potential runoff
- Adherence to VTDEC construction stormwater permit requirements and the USFS Special Use Permit (on USFS lands) soil stabilization and revegetation

[17] LISW-RCPP website at: http://www.lisw-rcpp.com/home.html
[18] Long Island Sound Futures Fund: https://www.nfwf.org/lisff/Pages/home.aspx

requirements to minimize the effects of excessive sediment washoff associated with areas of earth disturbance

## C. Targeted Waters for Restoration

While numerous waterbodies are identified as needing remediation in Figures 14 & 15. For this Basin Plan the sub-watersheds in Table 8 are being prioritized for focused restoration based on their current conditions. These waters have on-going water quality problems, or their water quality or habitat conditions are threatened by current land use practices. Strategies for these waters are included in the Summary of Implementation Actions, (Table 16) and the Watershed Projects Database.

Table 8. Restoration Priorities

| Sub-watershed | Restoration Focus | Land Use Sector |
|---|---|---|
| North Branch Deerfield River | Address bacteria TMDL, stormwater TMDL and altered flows | Land Development, Snow Making, Agriculture, Wastewater |
| Cold Brook | Address development and stormwater runoff & altered flows | Land Development, Snow Making |
| Whetstone Brook | Address bacteria TMDL and stormwater runoff | Land Development, Roads |
| Broad Brook | Improve important wildlife connectivity to CTR & NH at the landscape scale | Natural Resources |
| Newton Brook | Address nutrients & sediment from agricultural inputs | Agriculture |
| Lake Raponda | Work with community to assess lake conditions and implement restoration projects | Land Development, Roads, Natural Resources |
| Kettle Pond | Work to address stormwater inputs degrading the pond | Land Development |

### A Word About Hydro

The generation of hydroelectric power plays a significant role in Basin 12. Great River Hydro, LLC (GRH) purchased the power infrastructure on the Deerfield River in Vermont and lower Connecticut Rivers in 2017. Public Sector Pension Fund owns the Northfield Mountain pump storage facility across the border in Massachusetts. These hydroelectric facilities are in service and have flow alteration impacts on Basin 12 rivers and lakes. One other hydroelectric facility, the Harrisville Mill dam, is located on the Green River in Halifax.

Together the GRH dams are capable of producing 103 megawatts of electricity. The dams operate on a store and peak system. Water is held back until power is needed by the electric grid at which time water is released and power generated. This practice interrupts natural flows and sediment transport throughout the river systems. As a result, the Connecticut River and the Deerfield River below Harriman Dam are listed as impaired for altered flows impacting aquatic life support. Further assessment of the reservoirs is needed to determine if they should be listed as flow altered or stressed.

Flow is regulated through the Federal Energy Regulatory Commission (FERC) and dam operations are licensed through that agency. The Deerfield dams were licensed in 1997 for 40 years. The next opportunity to address and/or consider changing flow requirements will be when this permit expires in 2037.

Table 9. Hydroelectric Facilities

| Sites | Generating Capacity (MW) | Type |
|---|---|---|
| Deerfield River at Somerset Dam - VT | 0 | Storage, no hydropower generation |
| Deerfield River at Harriman - Readsboro, VT | 41 | Peaking, seasonal storage |
| Deerfield River at Searsburg - VT | 5 | Peaking, daily storage |
| Deerfield River at #5 - Monroe Bridge - MA | 14 | Peaking, daily storage |
| Deerfield River at Sherman Dam - Rowe, MA | 6 | Peaking, weekly storage |
| Connecticut River at Vernon Dam - VT | 37 | Peaking, daily storage |
| Northfield Mountain Pumped Storage Station - MA | 1168 | Peaking, pumped storage |

Glory Hole at Harriman Dam

Vernon Dam and Fish Ladder

## Chapter 4 Strategies to Address Pollution by Land Use Sector

Tactical basin plans address water quality by land use sector as summarized in the following sections. These sectors are consistent with the VDEC CWIP Clean Water Investment Report. A source sector is a land use activity that can contribute pollutants to the environment. Sectors effecting water quality addressed in this plan are:


## A. Agriculture

About 4.6 percent of the Basin is in agricultural land use. Agriculture can both positively and adversely affect water quality. Well managed agricultural land can allow for infiltration of precipitation, improve soil health and remove nutrients through sediment attenuation on floodplains and plant uptake. However, nutrients, pathogens, and sediments can adversely affect water quality when waste storage facilities or erosion control methods fail, or when heavy rains and floods inundate fields and wash manure, fertilizer and sediment from fields and farmstead areas into waterways.

This section integrates basin specific information on agricultural water resource impairments, regulatory programs, Best Management Practice (BMP) implementation, funding sources, outreach efforts, and partnerships to inform strategies to address agricultural water resource impairments. The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate agriculture related BMPs in order to meet the state's clean water goals nutrient reductions to support the Long Island Sound Nitrogen TMDL. This section is organized around the Vermont Agency of Agriculture, Food, and Markets (VAAFM) regulatory programs including the Required Agricultural Practices (RAPs), the Large Farm Operation Program (LFO), the Medium Farm Operation Program (MFO) the Certified Small Farm Operations Program (CSFO) and the available agricultural assistance and outreach programs and local coordination efforts.

Agricultural activity in the Basin is concentrated in the valleys of the Connecticut River, the North Branch of the Deerfield, the East Branch of the North River and along the Whetstone and Broad Brooks.

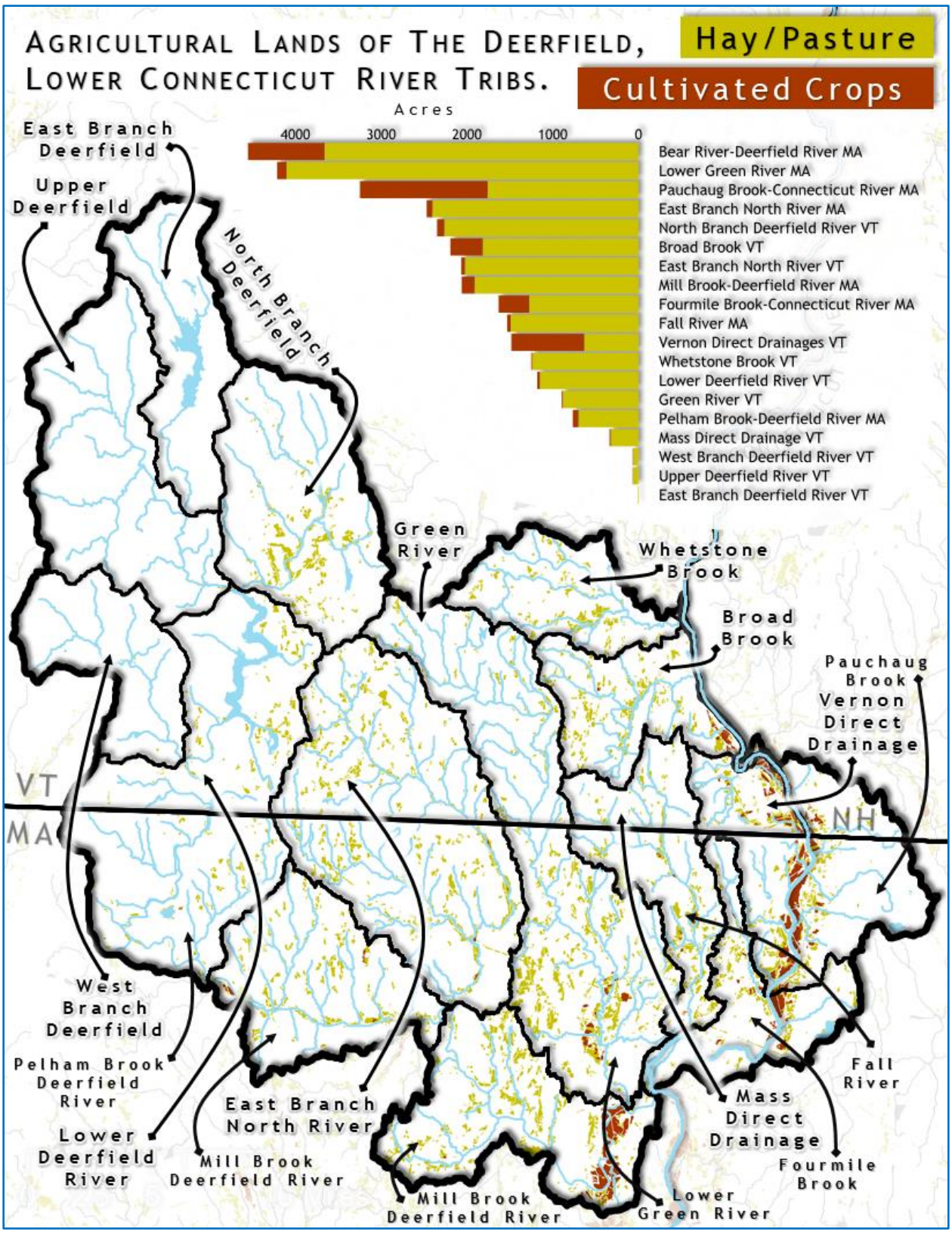



Figure 20. Agricultural Land Cover

Land cover analysis shows that between 2001 and 2016 there has been a small increase in the percent of land in the Basin used for annual crop production and a smaller decrease in the percent used for hay or pasture.

There are 17 registered farms in the Basin made up of one MFO, six CSFOs and ten SFO. There are no permitted LFOs in the Basin. VAAFM and the Natural Resources Conservation Service (NRCS) fund programs that assist farmers with implementing field and farmstead BMPs to improve water quality. Many farms in the Basin are implementing field BMPs. The most popular field BMP through state and federal assistance programs is cover cropping which has been implemented on over 870 acres of cropland in the Basin since 2012. Other field BMPs that have been implemented through state and federal cost share programs since 2012 in the Basin include conservation crop rotation (225 acres); corn-to-hay conversion (81 acres); prescribed grazing (100 acres); brush management (188 acres); early successional habitat development/management (113 acres).

Table 10. Distribution of Farm Operations by HUC12 Watershed

| HUC12Name | Total Farm Operations | MFO | CSFO | SFO* |
|---|---|---|---|---|
| East Branch Deerfield River | | | | |
| East Branch North River | 3 | | | 3 |
| Fall River | 1 | | 1 | |
| Headwaters Deerfield River | | | | |
| Lower Green River | | | | |
| North Branch Deerfield River | 2 | | | 2 |
| Pauchaug Brook-Connecticut River | 2 | 1 | 1 | |
| Pelham Brook-Deerfield River | | | | |
| Sherman Dam-Deerfield River | 1 | | 1 | |
| Taylor Brook-North River | | | | |
| Upper Green River | 1 | | | 1 |
| Vernon Dam-Connecticut River | 4 | | 3 | 1 |
| West Branch Deerfield River | | | | |
| Whetstone Brook | 3 | | | 3 |
| **Total Farm Operations** | **17** | **1** | **6** | **10** |
| **VAAFM estimates 10 small farms in the Basin will fall within RAP jurisdiction. Outreach will need to continue to help landowners understand where they fall within the RAP farm size categories and RAP requirements.* | | | | |

From 2012-2018 VAAFM invested $69,829 in farmstead BMPs which has been matched by farmers' investment of $72,703 totaling $142,532 in improvements. Implemented

farmstead BMPs were primarily related to barnyard management and heavy use are protection. USDA NRCS also works with farmers on farmstead BMP implementation and funding adding to the overall investment in the Basin's farms.

Runoff from agricultural lands has been identified as a contributor to water quality issues in two of the waters in the Basin. These are nutrient loading concerns in Newton Brook in Vernon and Ellis Brook in Dover. Agricultural runoff also contributes nitrogen from the watershed to the impairment of Long Island Sound causing critically low dissolved oxygen levels.

Priority areas for agricultural work include:

- Newton Brook
- Ellis Brook
- Whetstone Brook
- Connecticut River
- North Branch Deerfield River

The foci for all of these are buffers and farmstead improvements.

### Agricultural Regulatory Programs

The VAAFMs Accepted Agricultural Practices were established in 2006 and revised in 2016 and 2018, Required Agricultural Practices (RAPs), and existing MFO and LFO permit programs set baseline farm management practices to ensure environmental stewardship. Medium and Large Farm Operational Permits (L/M FO) have been in place for over 10 years, while the Required Agricultural Practices (RAPs) and to support the necessary nutrient load reductions to address the TMDLs in the state including the Long Island Sound TMDL. These revisions are expected to result in a significant increase in conservation practice implementation in the future by requiring Nutrient Management Plans (NMPs), increasing vegetative buffers, reducing maximum soil erosion rates by half on small farms, and the creation of a small farm certification program along with many other practices.

#### *Large (LFO) and Medium (MFO) Farm Operation Programs*

The VAAFM LFO Program requires large sized farms with more than 700 mature dairy cows (or the equivalent in other livestock types) to operate under an individual permit. The MFO Program requires farms with between 200 and 700 mature dairy cows (or equivalent) to operate under a general permit. Both permit program requirements exceed those of the technical components of the Federal Clean Water Act and aim to

reduce the amount of phosphorus and other nutrients entering Vermont's waterways. In the Basin, there are no permitted LFOs and only one permitted MFO. VAAFM inspects all MFOs every three years. Inspections include assessments of farm Nutrient Management Plans (NMPs), production area assessments of all facilities associated with the permitted operation, and cropland management assessments in accordance with Vermont's Water Quality Standards and RAP's.

### *Certified Small (CSFO) and Small Farm Operations (SFO) Programs*

VAAFM's Certified Small Farm Operations (CSFO) program supports farmers to ensure their clear understanding of the RAPs, while helping assess, plan, and implement any conservation and management practices necessary to meet water quality goals.

VAAFM estimates that there are 6 CSFO in the Basin. CSFOs are required to annually self-certify their operations and will be inspected at least once every 7 years. Inspections are just getting underway and are currently focused on increasing education and outreach about regulations and financial and technical assistance programs.

VAAFM estimates 10 small farms in the Basin will fall within RAP jurisdiction but may not need to certify. Outreach will need to continue to the remaining farms or locations to help landowners understand where they fall within the RAP farm size categories and to help them understand the RAP requirements.

Priority watersheds for inspection in this Basin include

- Newton Brook,
- Whetstone Brook
- Lower Connecticut River valley

### Agricultural Assistance and Outreach Programs

In addition to work completed to meet regulatory requirements, farm operators have begun and will continue to voluntarily adopt field and farmstead BMPs based on the increased availability of technical and financial assistance throughout the Basin. VAAFM and NRCS both fund several programs that support farmers with developing nutrient management plans, implementing practices, or purchasing equipment to

improve water quality. State funding programs are listed on the VAAFM grants website[19] and more information about NRCS programs.[20]

Many farmers implement conservation practices without financial assistance. In 2019, VAAFM launched the Multi-Partner Agricultural Conservation Practice Tracking and Planning Geospatial Database ("Partner Database") to improve planning and tracking of NRCS, VAAFM, and no cost share agricultural field and farmstead BMP implementation across the state.

Figure 19 represents field BMPs implemented each year from 2012 to 2018 through state and federal assistance programs. This graph depicts only practices funded though the AAFM and NRCS programs. Practices that are continued by the farmer outside of these programs are not included. The most popular field BMP is cover cropping at 870 acres, followed by crop rotation at 225 acres. The graph shows an increase in the acreage of cover crops over this time period.

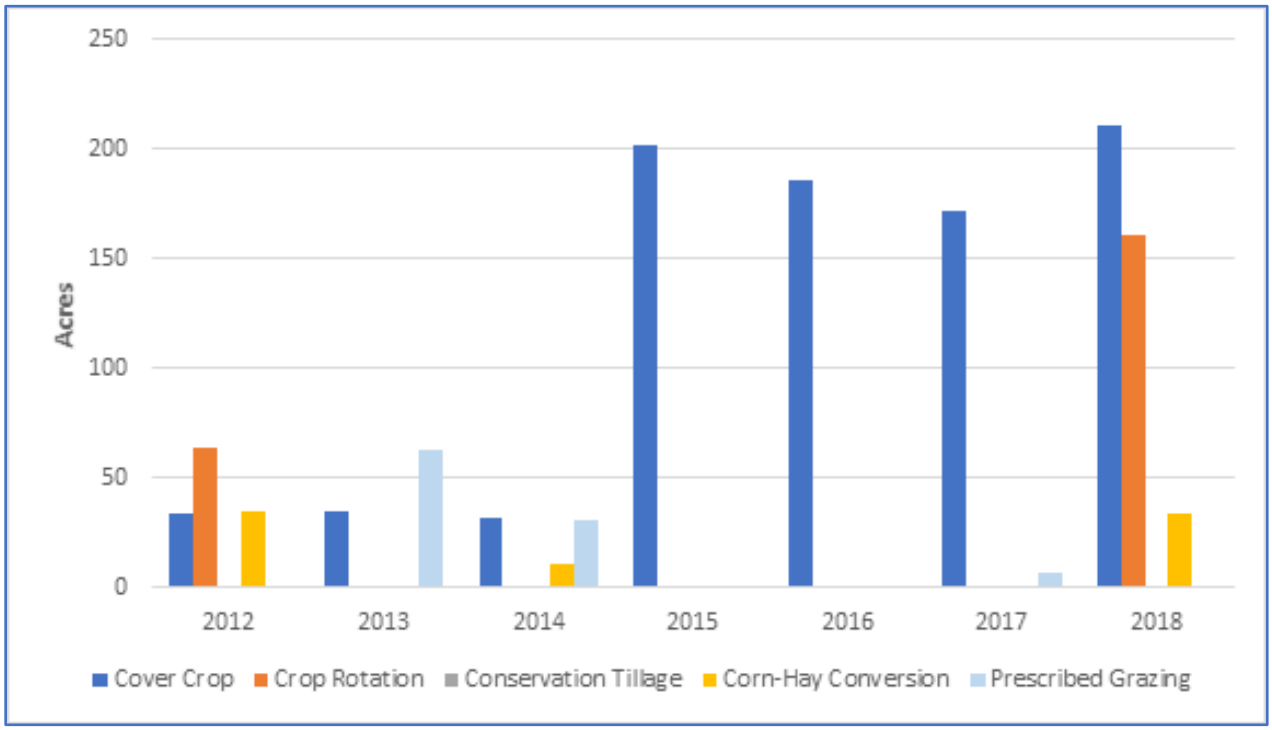



Figure 21. Acreage of NRCS and VAAFM Funded Field BMPs Implemented by Year

[19] https://agriculture.vermont.gov/grants
[20] https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/?&cid=stelprdb1048817

### Clean Water Goals for Agriculture

In order to coordinate agricultural water quality improvement efforts identified through the basin planning process, several watershed and farm-focused organizations have been actively engaging their communities for several years. These include: the BCCD, WCNRCD, the Connecticut River Watershed Farmers Alliance (CRWFA), AAFM, UVM Extension, and USDA/NRCS.

Through discussions with the agricultural community and conversations between farm-focused partners in the region, the following drivers of local water quality problems have been identified:

- Agriculture runoff
- Nutrient loading (in local waters and as per the LIS-TMDL).
- Lack of riparian buffers
- General water quality and human health issues (e.g. *E. coli*,)
- Streambank erosion

These issues were defined and ranked according to both the surface water monitoring data and the public concern expressed at forums and meetings. . Sustained coordination with these groups is an important strategy in this plan to effectively target agricultural BMP implementation and improve water quality conditions. Other areas of focus for this group are:

- Hosting annual workshops on:
  - the RAP revisions,
  - improving soil health,
  - implementing conservation field practices and
  - wetland designations
- Establishing local (municipal) goals and objectives to protect
  - water quality
  - wetlands
  - floodplains
- Educational workshops directed to horse, beef, and small animal operations.
- Outreach to promote buffer planting practices and opportunities.
- Farmer support in developing and implementing NMPs
- Regional equipment sharing programs to increase the implementation of effective cover cropping programs.
- Water quality monitoring and research effort to understand nitrogen source areas in all the Connecticut River watersheds.

- Outreach and targeted project implementation among partners.
- Work with NRCS and VAAFM to address funding distribution inequity in the Basin. (Figure 20).

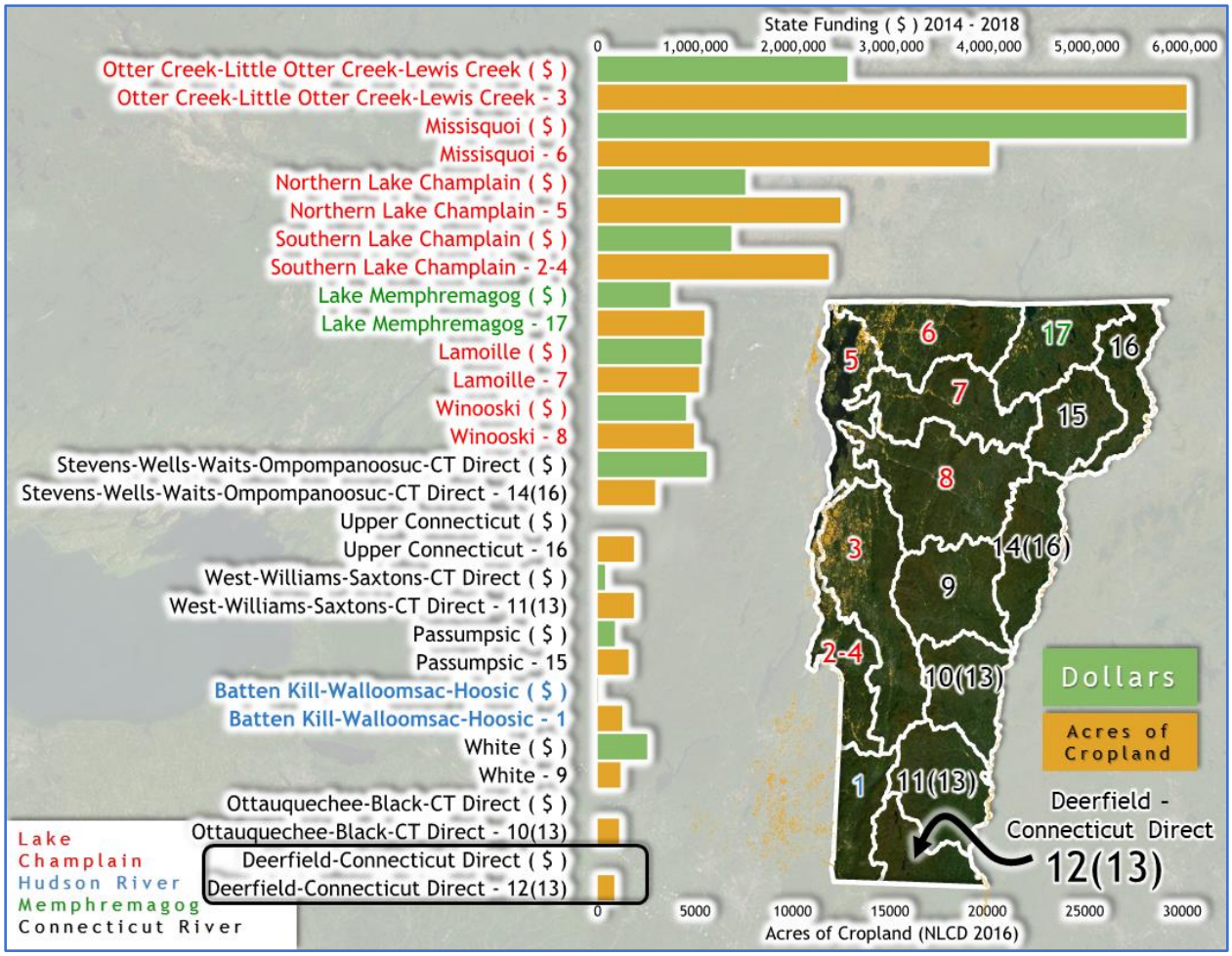



Figure 22. State and Federal Agricultural Funding Since 2004

## B. Developed Lands -- Stormwater

Stormwater runoff is a contributor to many of the water quality issues in the Basin. However, the only impairment listed due to stormwater is a segment of the North Branch Deerfield River from just above Snow Lake down to Tannery Road. The cause of this impairment is due to stormwater runoff, stream channel modifications, land development and construction related erosion. The Base lodge tributary at Mount Snow is stressed for runoff from land development which has been noted as causing erosion resulting in a high sand bedload. Stormwater is a key concern in the North Branch Deerfield River and Cold Brook in Dover and Wilmington.

Stormwater runoff across the Basin adds excess sediment and nitrogen which is a concern in relation to Long Island Sound. Approximately 11% of Vermont's nitrogen load to originates from urban land. Stormwater is also directly impacting the Whetstone Brook and the Kettle Pond watershed in Brattleboro.

This section integrates basin specific information on stormwater-related water resource impairments, regulatory programs, stormwater master plans (SWMP), Illicit Discharge Detection and Elimination (IDDE) studies, existing implementation efforts, and partnerships to inform strategies to address stormwater-related water resource impairments. The tactical basin planning approach engages the local, regional, and federal partners needed to accelerate green stormwater practice implementation in the development of these strategies to meet the state's clean water goals. Stormwater mapping work, IDDE studies and SWMP are the primary drivers for voluntary implementation efforts in the Basin.

Regulatory stormwater programs and permits are in place to ensure proper design and construction of stormwater treatment and control practices as well as construction-related erosion prevention and sediment control practices, necessary to minimize the adverse impacts of stormwater runoff to surface waters throughout Vermont.

**Stormwater Mapping and IDDE -** DEC has assisted municipalities not subject to the regulatory stormwater rules by mapping drainage systems and performing illicit discharge detection and elimination (IDDE) studies. The goal of IDDE is to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems and discharging to surface waters. This work has been completed for most major urbanized areas in the state and is underway in Basin

12. Data is compiled in Town Stormwater Mapping and Stormwater Master Planning Reports[21].

### *Operational three-acre impervious surface permit program*

The Stormwater Program will issue a general permit in 2019 for stormwater from so-called "three-acre sites" which are existing sites with three or more acres of impervious surface that lack a stormwater permit based on the 2002 Vermont Stormwater Management Manual. For the Connecticut River watershed including the Deerfield River Basin, parcels will need to apply for permit coverage by 2033. For the North Branch of the Deerfield stormwater impaired sub-watershed and other waters with stormwater impairments, this permit will be required before 2023. Since this date is well beyond the timeframe for this plan, voluntary stormwater efforts though stormwater master planning are likely to be the primary drivers for stormwater implementation efforts for this planning cycle.

### *Stormwater Master Planning and Outreach*

One stormwater master plan (SWMP) has been completed for Crosby Brook in Brattleboro. SWMPs are recommended for the remainder of Brattleboro and for the towns of Dover and Wilmington and where development around Mount Snow and Hermitage Resorts has caused increased sedimentation and stormwater runoff.

### Clean Water Goals for Stormwater

- Develop and implement SWMPs for Brattleboro, Dover, Wilmington and Hermitage Resorts
- Implement treatment recommendations in the town Stormwater Reports and WQRPs
- Decrease stormwater discharges to Kettle Pond
- Address gully erosion due to stormwater discharge points

[21] https://dec.vermont.gov/watershed/cwi/manage/idde

## C. Developed Lands -- Roads

Reducing road runoff and erosion is critical to meeting the state's clean water goals. Municipal roads runoff is a major source of sediment and nutrients in the Basin that contributes to water quality issues. Road runoff also contributes a small portion of the nitrogen loading to the Connecticut River watershed which is a concern for the Long Island Sound TMDL.

This section integrates basin specific information on transportation-related water resource impairments, road erosion inventories (REIs), road practice implementation, regulatory programs, and existing partnerships to inform strategies to address transportation-related water resource impairments. The tactical basin planning approach engages local, regional, and federal partners needed to accelerate transportation-related practice implementation in the development of these strategies in order to meet the state's clean water goals. The section is organized around the regulatory programs including the Municipal Roads General Permit (MRGP), the Transportation Separate Storm Sewer System Permit (TS4), and the Municipal Separate Storm Sewer System Permit (MS4) as these regulatory programs are the driving factor in road water quality implementation efforts in the Basin.

The Municipal Roads General Permit (MRGP) released in 2018, along with the Transportation Separate Storm Sewer System Permit (TS4), and the Municipal Separate Storm Sewer System Permit (MS4) are the driving regulatory programs in road water quality implementation efforts in the Basin. There are no MS4 towns in the Basin. The TS4 program covers all stormwater discharges from state-owned or controlled impervious surfaces and is implemented by AOT.

The MRGP is a state-wide permit, for all Vermont cities and towns. It is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The permit requires each municipality to conduct a Road Erosion Inventory (REI) of hydrologically-connected roads, those in close proximity to water resources, to determine if town roads meet MRGP road standards. Additional information regarding the MRGP and tools available to assist municipalities can be found at this link and maps of hydrologically-connected roads can be found on the ANR Atlas under the Stormwater layer. Un-organized towns and gores, such as Glastonbury and Somerset, are exempt from the MRGP.

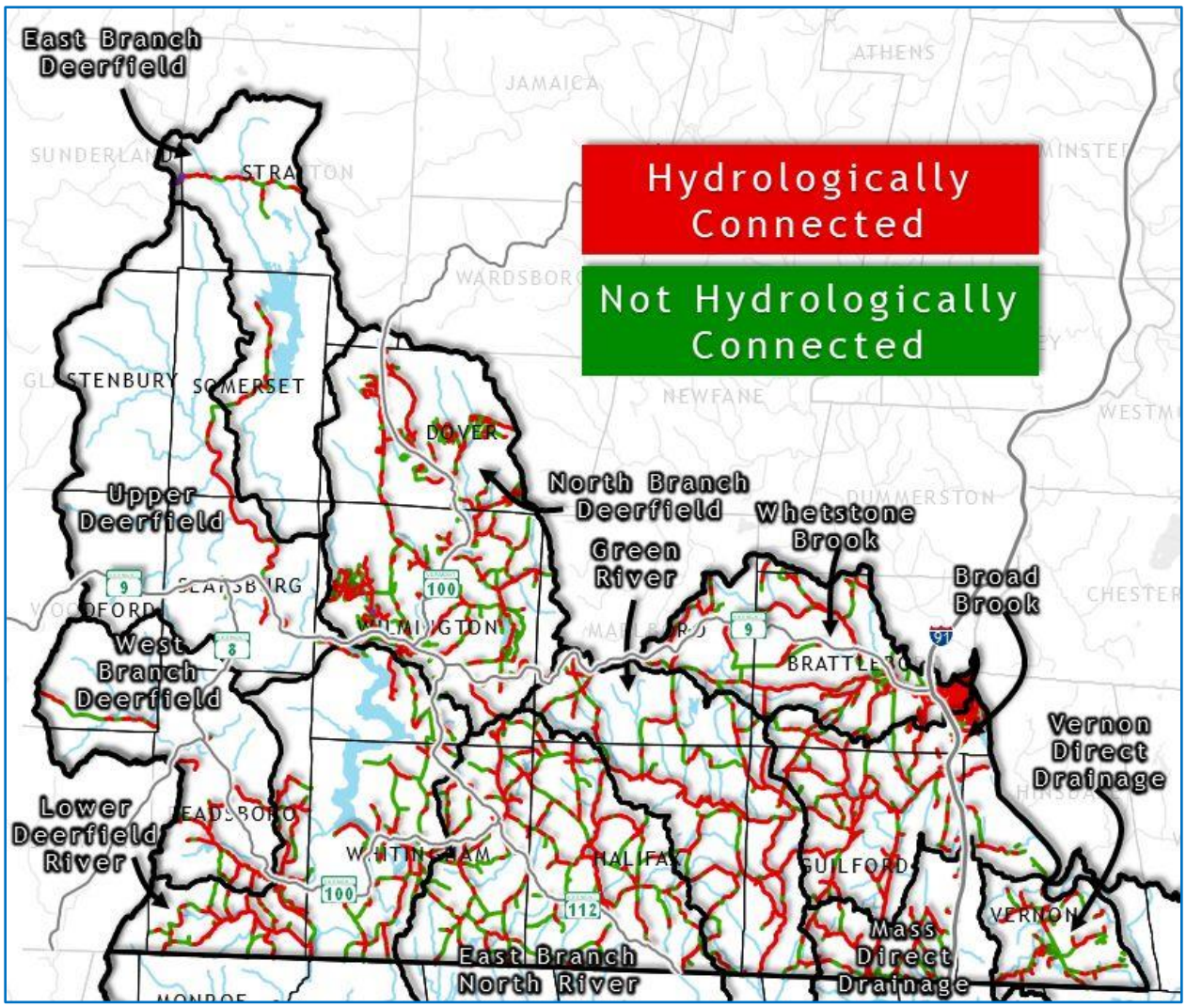



Figure 23. Hydrologically Connected Road Segments

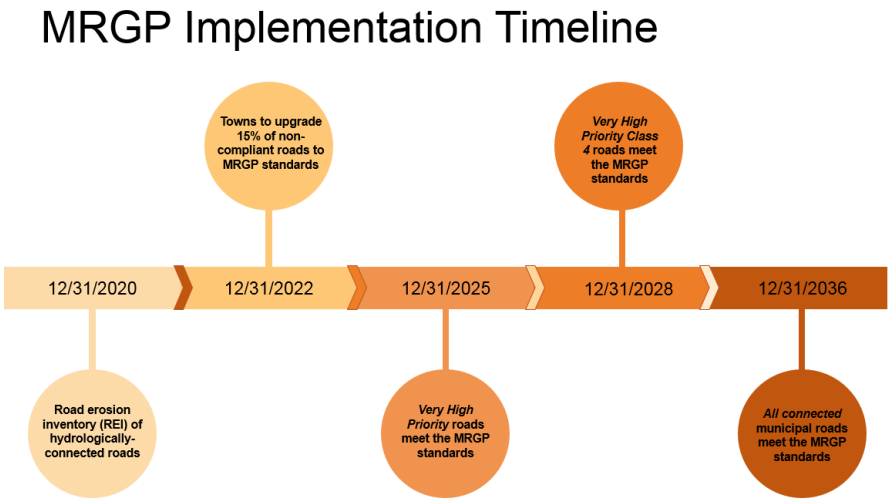


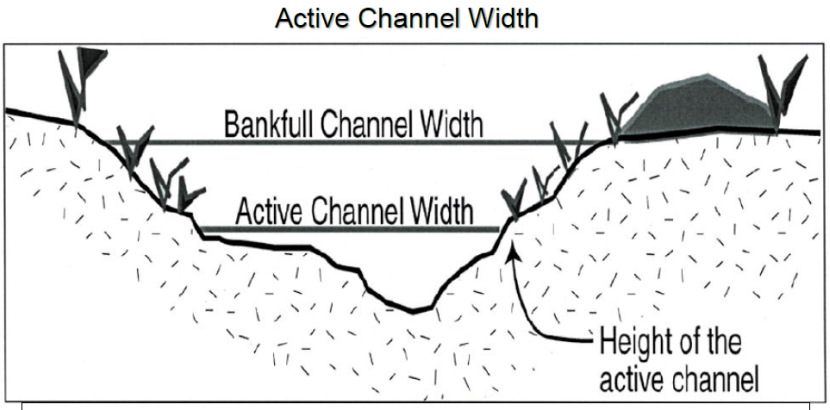

Figure 24.

REIs are due to be completed by December 31, 2020. DEC has developed a computer application to assist municipalities in undertaking REIs.

MRGP road standards include road crowning,

stabilizing drainage ditches, removing grader berms, lowering road shoulders, upgrading drainage culverts, rock lining catch basin outfalls, disconnecting drainage from waterways and other practices. The MRGP standards implemented over a period of time, will bring all hydrologically connected municipal roads up to the new standard by December 31, 2036. DEC requires towns to bring *Very High Priority* road segments[22] up to the new standards before December 31, 2025 for all road types, except Class 4 roads which are required to meet standards by December 31, 2028. *Very High Priority* road segments are those that score Does Not Meet MRGP standards and are located on slopes greater than 10%. The MRGP requires that all towns bring at least 15% of non-compliant road segments up to MRGP standards before December of 2022. REI results by town can be found in the MRGP Implementation Table.

In addition to the MRGP, **Vermont Road and Bridge Standards** are required for municipalities under Act 64. Towns can voluntarily adopt the Vermont Road and Bridge Standards. These standards are administered by AOT, and go above and beyond MRGP standards. For example, municipalities may adopt MRGP standards for non-hydrologically-connected roads. Additional standards include adopting the Active Channel Width for intermittent stream culvert replacements. The Active Channel Width (Figure 23) is described as the channel scour width and is approximately 75% of the bankfull channel width, which is generally required for perennial stream channel bridge and culvert replacements. Towns adopting the Vermont Road and Bridge




**Active Channel Width** means the limits of the streambed scour formed by prevailing stream discharges, measured perpendicular to streamflow. The active channel is narrower than the bankfull width (approximately 75%) and is defined by the break in bank slope and typically extends to the edge of permanent vegetation.

**Culvert sizing for crossings on intermittent streams:** Determine the Active Channel Width by field measurements, ***the culvert size should meet or exceed the Active Channel Width***. To obtain the measurements go to the crossing location and obtain several upstream Active Channel Width measurements in riffle (fast moving water) narrower channel locations. The selected channel width should be a representative average of the field measurements. In the absence of field measurements, the drainage areas in the table can be used.

Figure 25. Active Channel Width

[22] Hydrologically-connected paved and gravel road segments with drainage ditches scoring "Does Not Meet" on the REI, on slopes greater than 10 %, are considered Very High Priority Road Segments.

Standards, may be entitled to higher cost share rates in federally-declared flood event reimbursements.

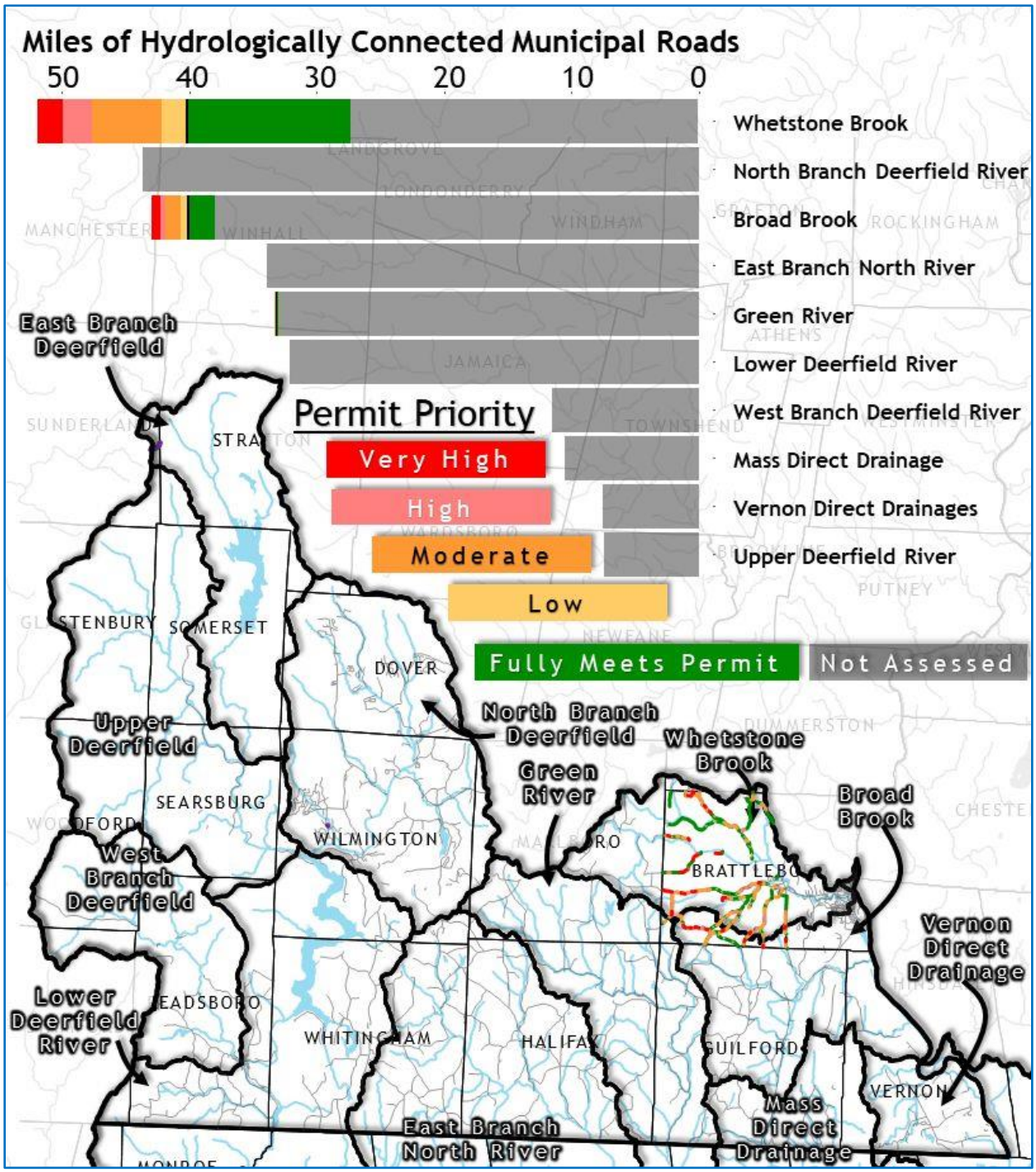



Figure 26. High Risk Road Segments

Table 11. Road Erosion Inventory Assessment

**MRGP Segment Priority Counts**

| Municipality | Total Road Miles[1] | Hydrologically Connected Segment Count[1] | Inventoried Segments | Meets Standards | | | REI Status |
|---|---|---|---|---|---|---|---|
| | | | | Fully | Partially | Does Not | |
| Brattleboro | 93 | 1076[1] | 566 | 262 | 118 | 149 | underway |
| Dover | 61 | 474 | 0 | 250 | 121 | 103 | COMPLETE |
| Dummerston | 66 | 6[1] | 1 | 1 | | | COMPLETE, Report pending |
| Glastonbury[2] | Exempt | 0 | | | | | EXEMPT |
| Guilford | 76 | 806 | 0 | | | | planned 2020 |
| Halifax | 70 | 535 | 0 | | | | COMPLETE |
| Marlboro | 56 | 197 | 0 | | | | planned 2020 |
| Readsboro | 43 | 438 | 398 | 206 | 124 | 68 | underway |
| Searsburg | 6 | 73 | 73 | 13 | 34 | 26 | underway |
| Somerset[2] | Exempt | 71 | | | | | EXEMPT |
| Stratton | 28 | 34[1] | 0 | | | | COMPLETE |
| Sunderland[1] | 31 | 6[1] | 6 | 4 | 2 | 0 | COMPLETE |
| Vernon | 25 | 164 | 162 | 112 | 35 | 15 | COMPLETE |
| Whitingham | 64 | 396 | 0 | | | | not scheduled |
| Jacksonville Village | - | 37 | 0 | | | | --- |
| Wilmington | 74 | 597 | 597 | 339 | 168 | 90 | field work compete 2018, report pending |
| Woodford | 9 | 24[1] | 0 | | | | not scheduled |

[1] portion of town in Basin 12

[2] unorganized towns are exempt from MRGP

VTrans Better Roads and the ANR's Municipal Roads Grants-in-Aid program both sponsored by the Clean Water Fund, support the development of municipal REIs and project implementation. In addition to completing a REI, numerous towns in the Basin have taken advantage of these grant programs and technical assistance to address erosion along hydrologically-connected roads. Of the 16 municipalities that are mostly or entirely located in the Basin, 9 enrolled in Grants-in-Aid (GIA) in FY 2018, and in FY 2019, 9 enrolled in this program to receive financial support for addressing hydrologically connected roads. The GIA program requires that non-MRGP compliant hydrologically-connected roads be brought up to MRGP standards, as a condition of grant completion. Road improvements funded through the Clean Water Fund are summarized in the Vermont Clean Water Initiative Annual Investment Report. The BMPs used to address water quality concerns on unpaved roads are among the most cost-effective actions to reduce nutrient and sediment pollution.

From 2014 and 2019 the Clean Water Program has provided funding of $458,738 to towns to complete REI and implement corrective projects.

Table 12. Better Roads Grant Funding

| Grants Funded | | | | |
|---|---|---|---|---|
| 2014 - 2019 | | | | |
| **Better Roads** | | | **Grant-in-Aid** | |
| **Town** | **Funding Awarded** | **# Projects** | **Funding Awarded** | **# Projects** |
| Brattleboro | 4,000 | 1 | | |
| Dover | 8,000 | 1 | | |
| Dummerston | 58,795 | 3 | | |
| Glastenbury | 0 | 0 | | |
| Guilford | 60,000 | 2 | 41,903 | 3 |
| Halifax | 37,600 | 3 | 29,466 | 2 |
| Marlboro | 24,206 | 4 | 9,570 | 2 |
| Readsboro | 18,000 | 2 | 11,989 | 1 |
| Searsburg | 0 | 0 | | |
| Somerset | 13,801 | 1 | | |
| Stamford | 17,355 | 2 | | |
| Stratton | 8,000 | 1 | 5,300 | 1 |
| Sunderland | 51,630 | 4 | | |
| Vernon | 23,040 | 2 | 6,800 | 2 |
| Wardsboro | 0 | 0 | | |
| Whitingham | 0 | 0 | | |
| Wilmington | 134,311 | 6 | 26,218 | 7 |
| Woodford | 0 | 0 | | |
| **TOTALS** | **$458,738** | **32** | **$131,246** | **18** |

### *State Managed Roads (Transportation Separate Storm Sewer System General Permit – TS4)*

The 2017 TS4 General Permit is a stormwater permit for all AOT owned or controlled infrastructure. The permit requires AOT to reduce the discharge of pollutants from the TS4 to the maximum extent practicable (MEP) through compliance with the six minimum control measure requirements. This includes state roads, garages, park and rides, welcome centers, airports, and sand and gravel operations. Clean Water Goals for Roads

- Complete REIs for all towns and uploaded to the database in the Basin to meet this MRGP requirement. Guilford, Marlboro (planned 2020), Whitingham, Woodford (not scheduled)

- Implement priority practices in target watersheds and MRGP projects across the watershed where these will result in the biggest water quality benefits
- Increase municipal participation in Better Roads & Grant-In-Aid funding
- Conduct outreach on private roads and driveway BMPs
- Provide technical assistance to towns on project development and prioritization for WQ benefit
- Implement projects to address Class 4 road & legal trail erosion addressing Very High Priority non-MRGP compliant Class 4 roads, those on slopes greater than 10%, first
- Priority watersheds for implementation:
    - Whetstone Brook, Green River, East Branch North River

## D. Wastewater

Municipal wastewater, originating from a combination of domestic, commercial, and industrial activities, is conveyed to centralized wastewater treatment facilities (WWTF) and treated to established standards before discharge into a receiving water.

An overarching consideration for the issuance of wastewater discharge permits in the Deerfield River planning basin is the Long Island Sound TMDL for nitrogen. This multi-state TMDL has been promulgated with interim waste load and nonpoint source nitrogen load allocations. At issuance of this Plan, all facilities are operating under permits developed under a nitrogen permitting strategy whereby all Vermont WWTFs ultimately discharging to the Connecticut River must, collectively, discharge no more than 1,727 lbs. TN/day. Each individual facility has a unique Total Nitrogen (TN) loading limit. In addition to the nitrogen loading limit, WWTFs are required to develop optimization plans for maximizing nitrogen removal and regularly monitor for nitrogen compounds.

In an effort to be better informed about potential nutrient impacts, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions to determine the "reasonable potential" that WWTFs have, to cause or contribute to downstream water quality impairment. Results of these investigations are recorded as part of permit issuance documentation. Municipal wastewater discharge permits in the Basin are shown in Table 13.

Table 13. Municipal Wastewater Discharge Permits

| Facility (permit ID) | Permit effective date | Planned permit re-issuance year | Permitted flow (MGD) | IWC* 7Q10 /LMM | Current Percent of Design Flow (2017) | Treatment type | # of CSOs | Receiving water |
|---|---|---|---|---|---|---|---|---|
| Brattleboro (3-1242) | 2016 | 2021 | 3 | 0.004 / 0.001 | 44% | RBC | 0 | CT River |
| Cold Brook FD 1 (3-1296) | 2017 | 2019 | .028 (direct discharge flow) | 0.047 / 0.005 | Have not reached capacity that necessitates a direct discharge. In 2018, the facility processed 4.7 MGD at the Haystack treatment system and 7.1 MGD at the Golf Course system. | Aerated lagoons and indirect spray disposal fields | 0 | Indirect - Rose and Haystack Brooks Direct – North Branch of the Deerfield |
| NorthStar Nuclear Decommissioning Company LLC (formerly Entergy Nuclear VT Yankee) (3-1199) | Original effective date: 2017 (transfer of ownership in 2019) | 2022 | 4.3 | XX | 84% | *None* | 0 | CT River |
| Long Falls Paperboard, LLC (formerly FiberMark) (3-1136) | 2012 | Expired 2017 | 2 | 0.003 / 0.001 | 62% | Primary clarification/ aerated stabilization | 0 | CT River |
| Readsboro (3-1215) | 2015 | 2020 | 0.075 | 0.004 / 0.002 | 47% | Aerated lagoons | 0 | Deerfield River |
| Whitingham (3-1229) | 2013 | 2019 | 0.012 | NA[1] | 62% | RBC | 0 | Harriman Reservoir |
| Whitingham-Jacksonville (3-1230) | 2014 | 2019 | 0.05 | 0.120 / 0.032 | 37% | RBC | 0 | East Branch North River |
| Wilmington (3-1281) | 2018 | 2023 | 0.135 | 0.166 / 0.024 | 59% | RBC and aerated lagoons | 0 | North Branch Deerfield River |

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

*[1] Facility discharges to a reservoir; dilution statistics for stream not applicable.*

Six municipal wastewater treatment facilities and two industrial facilities process more than 6.6 billion gallons of wastewater per year. All WWTF undergo periodic inspections of facility operations, effluent data collections and laboratory testing procedures to verify compliance with permit conditions.

Wastewater treatment facility improvement projects decrease nutrient pollution (e.g., phosphorus and nitrogen) from municipal wastewater systems through treatment upgrades, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure. The recent upgrade of the North Branch Fire District #1 facility in Dover was supported by a state/federal/municipal partnership investment of $4,419,902.

## Facility Specific Information

### Brattleboro

The Town of Brattleboro owns and operates the Brattleboro Wastewater Treatment Facility. Brattleboro is one of the largest direct-dischargers to the Connecticut River.

The facility recently underwent a major refurbishment which consisted of a headworks, two primary clarifiers, a moving bed bio-reactor (MBBR), four trains of rotating biological contactors (RBCs), two secondary clarifiers, and a chlorine contact chamber. Solids are processed using the 2PAD Anaerobic Digestion System, a thermophilic and mesophilic system.

Overall, the refurbishment has improved the Facility's treatment capacity. The 2PAD Digestion System has allowed the facility to accept additional septage, high-strength industrial wastewater, and dairy processing wastewater from nearby homes and businesses. In addition, in response to the Long Island Sound TMDL, the new MBBR was added to provide tertiary treatment for Total Nitrogen removal via nitrification and denitrification. In 2017, the Facility removed an annual average of 6% of the daily influent TN loading. In addition to nitrogen removal, the MBBR can be used to provide supplemental treatment of Biochemical Oxygen Demand (BOD).

### Cold Brook FD 1

The Cold Brook facility is permitted for two indirect spray disposal fields and a single direct discharge. The two spray disposal fields are in the watersheds of Rose Brook and Haystack Brook. When and if the spray fields exceed their maximum application, effluent may be discharged directly to the North Branch Deerfield River.

Wastewater treatment consists of two separate aerated lagoon WWTFs, one at the Hermitage Golf Club and one at Haystack Mountain. The facilities are interconnected, and wastewater can be diverted from Haystack to the Golf Course WWTF if indirect discharge flows at Haystack reach capacity.

### NorthStar Nuclear Decommissioning Company LLC (Entergy Nuclear VT Yankee)

In 2018 the VT Yankee Nuclear power plant was sold to the NorthStar Decommissioning Company to finalize the decommission and ultimate closure of the plant. The plant has been shut-down since 2014 and as of August 2018, all spent nuclear fuel has been removed from the facility's spent fuel pool and dry-casked,

thereby ceasing any spent-fuel-pool related thermal loading to the wastewater discharge.

Currently, as NorthStar works to finalize the plant's decommissioning, periodic intake and discharge associated with on-site equipment cooling and fire protection will continue to occur in accordance with the Discharge Permit. During this decommissioning period wastewater discharge flows are anticipated to be approximately 36 gallons per day, drastically lower than their permitted flow of 4.3 million gallons per day.

### Long Falls Paperboard (formerly FiberMark)

The wastewater treatment system consists of primary clarification followed by an 8.3 million-gallon aerated stabilization basin. The treated effluent is discharged via a diffuser into the Connecticut River. The most recent reasonable potential review for the current authorization to discharge established a more restrictive effluent limitation for turbidity, based upon a review of facility monitoring data.

### Readsboro

The Town of Readsboro owns and operates the Readsboro WWTF which consists of two aerated lagoons, chlorination for disinfection and dechlorination before being discharged to the Deerfield River. In 2017, the Facility removed an annual average of 44% of the daily influent TN loading.

### Whitingham

The Whitingham WWTF is a secondary wastewater treatment facility. The Facility's sister-plant is Whitingham-Jacksonville. The treatment system consists of three septic tanks in series followed by two aerated flow equalization tanks, an RBC unit, a secondary clarifier and two ultraviolet light disinfection units. In 2017, the Facility removed an annual average of 30% of the daily influent TN loading. The municipality is currently in the process of performing an engineering evaluation on the two WWTFs to determine the need for maintenance, refurbishment, or upgrades. Discharges go to the Deerfield River.

### Whitingham-Jacksonville

The Jacksonville WWTF is Whitingham's sister plant, which has an identical treatment train, including secondary treatment facility consisting of two parallel trains of septic tanks, followed by two parallel trains of aerated flow equalization tanks, an RBC unit, a secondary clarifier and two ultraviolet disinfection units. In 2017, the Facility removed

an annual average of 10% of the daily influent TN loading. The municipality is currently in the process of performing an engineering evaluation on the two WWTFs to determine the need for maintenance, refurbishment, or upgrades. Discharges go to the East Branch North River.

### Wilmington

The Wilmington WWTF utilizes a rotating belt filter, two parallel RBCs, and aerated lagoons to provide secondary treatment to wastewater. The rotating belt filter is an innovative treatment technology that provides screening and primary treatment to influent wastewater. Solids are composted to Class-A biosolids using an in-vessel composting process and delivered free to Town residents. Since the Discharge Permit was recently issued in 2018, there is currently not enough data to calculate a removal efficiency of TN. The Facility will be collecting influent and effluent TN data moving forward. Discharges go to the North Branch Deerfield River.

## Clean Water Goals for Wastewater

- Reduce the nitrogen load from municipal wastewater discharges which are predicted to account for 9% of Vermont's total discharge to the Connecticut River.[23]
- Conduct planning and feasibility studies for small communities without wastewater systems
- Upgrade wastewater facilities for nitrogen reduction
- Increase funding of the State Revolving Fund programs to meet statewide wastewater control needs, including Long Island Sound nitrogen control needs
- Encourage communities to invest in protection of future water supply source waters

[23] Estimation of Total Nitrogen and Phosphorus in New England Streams Using Spatially Referenced Regression Models, USGS 2004

## E. Natural Resources Restoration

Restoration of "natural infrastructure" functions helps prevent and abate nutrient and sediment pollution. Natural infrastructure includes floodplains, river channels, lakeshores, wetlands, and forest lands. Additional benefits of restoration and protection of natural infrastructure include:

- Improved flood resiliency and flood hazard mitigation for public health and safety
- Improved habitat function
- Support of outdoor recreation opportunities and economy
- Implementation of TMDL requirements

### a) River Stability and Connectivity

**Stream Geomorphic Assessments** (SGA) study the physical conditions of rivers and the interrelationships of flowing water and sediment within varying landscapes. SGAs incorporate watershed-wide information from maps, aerial photographs, existing studies, and field data into a detailed characterization of riparian and instream habitat, erosion, and flood hazards for use in watershed planning. The overall goal of the VDEC Rivers Program is "managing toward, protecting, and restoring the fluvial geomorphic equilibrium condition of Vermont rivers by resolving conflicts between human investments and river dynamics in the most economically and ecologically sustainable manner," done through

- fluvial erosion hazard mitigation;
- sediment and nutrient load reduction; and
- aquatic and riparian habitat protection and restoration. [24]

Stream Geomorphic Assessments completed in the Basin are shown in Table 14. **River Corridor Plans** (RCP) compile SGA data into a report informing the basin planning process on potential implementation projects to mitigate both natural and

[24] VANR River Corridor Planning Guide

anthropogenic geomorphic problems which are listed in the Watershed Project Database.

Table 14. Stream Geomorphic Assessments Completed

| Sub-watershed | Date | Coverage |
|---|---|---|
| Stream Geomorphic Assessments | | |
| North Branch of the Deerfield River Corridor Plan | 2013 | Phase 1, 2 & Corridor Plan |
| Green River Corridor Plan | 2014 | Phase 1, 2 & Corridor Plan |
| East Branch North River Corridor Plan | 2017 | Phase 1, 2 & Corridor Plan |
| Whetstone Brook Watershed Corridor Plan | 2008 | Phase 1, 2 Only |

Geomorphic conditions of assessed waters are shown in Figure 25.

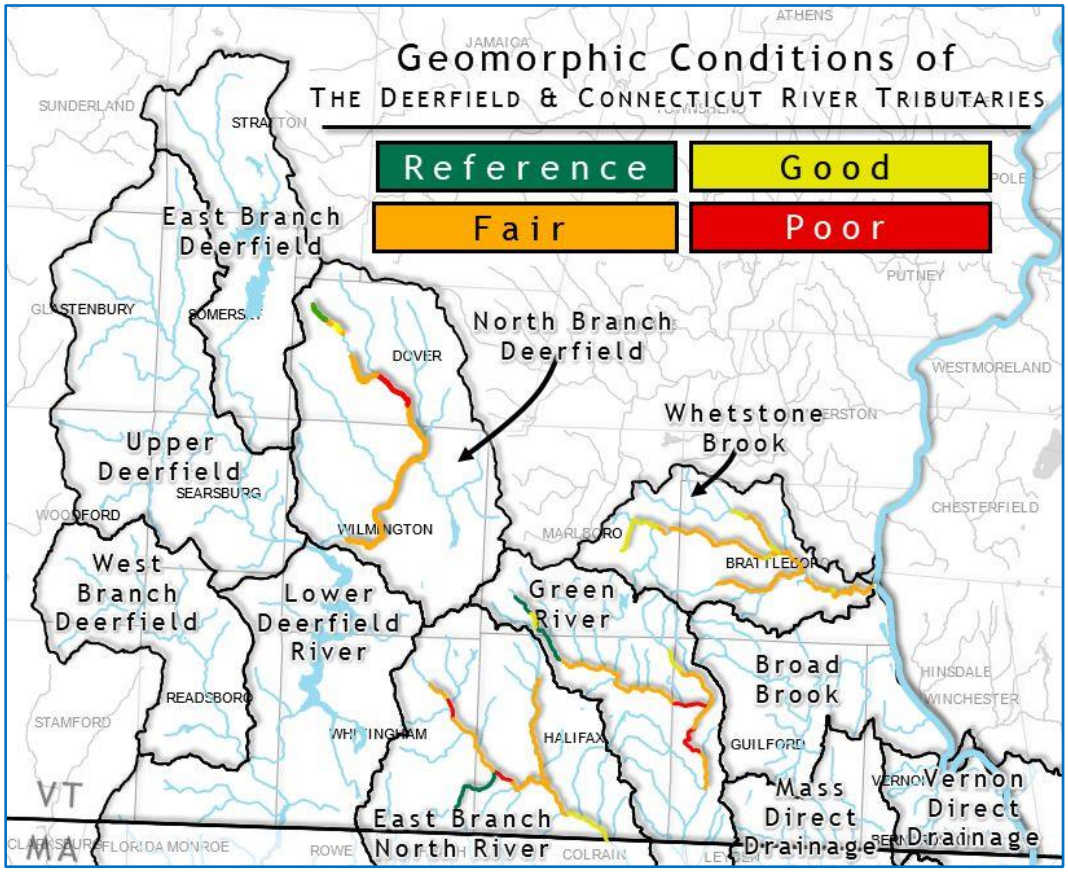



Figure 27. Geomorphic Conditions of Assessed Waters

### Dams and Dam Safety

There are 54 known dams in the Basin and likely many more that have not been documented. Each known dam is categorized by the status of its use or condition. For a complete listing of known dams see Appendix C.

Table 15. Dam Status

| Dam Status | # of Dams |
|---|---|
| Breached / Partially Breached | 7 |
| In Service | 39 |
| Not in Service | 2 |
| Removed | 4 |
| Deleted | 1 |
| Unknown | 1 |

Dams are rated by how much damage would be done downstream if the structure were to fail. These ratings are High, Significant and Low.

Of the 43 dams with ratings, 12 are High Hazard. These dams should be reviewed for possible removal and to ensure that Emergency Action Plans are in place.

All dams, even small dams for backyard ponds, are significant structures that can have major public safety and environmental implications. As a result, dams are regulated by a variety of federal, state and local laws. Beyond its regulatory authority, the state also has considerable interest in working with dam owners to see that dams are safe by being well maintained and responsibly operated. The information provided is to help dam owners and prospective dam owners to understand the implications of owning, maintaining and operating a dam.

Enacted in 2018, Act 161 - An Act Relating to the Regulation of Dams, 10 V.S.A. Chapter 43, gave VDEC jurisdiction to regulate non-federal dams that do not produce power. Jurisdiction includes dam registration, classification, inspection, application and approval to construct, re-construct, alter, repair, breach, or remove a dam, as well as related standards including design standards, operation and maintenance standards, inspection standards, and emergency action plans. It establishes dam owner liability and responsibility for the safe management and operation of their dam, and compliance with the rule.

At the time of this writing the Dam Safety Rule is under development with expected adoption in summer of 2020.

For further information on the environmental impacts of dams see ***How a dam affects a river***.

### *Clean Water Goals for Rivers*

- Work toward equilibrium
- Increase floodplain access
- Remove Snow Lake dam at Mt Snow
- Remove unneeded dams, assess need for removal of Readsboro crib dam
- Assess dam impoundments to determine if they should be listed as flow altered or stressed
- Protect floodplains and river corridors from conversion & development
- Focus on protection of alluvial fan areas
- Focus restoration work on reaches with High to Extreme Sensitivity ratings
- Restore  Birge Street parcel, Brattleboro

## b) Lakeshore Restoration

Healthy shoreland conditions help protect the functions and values of lakes, such as water quality; aquatic habitat; fishing; swimming; boating; bird-watching; property values; and many others. Recent Vermont lake science from the National Lake Assessment study shows that Vermont ranked lowest in the northeast ecoregion and in the nation for degraded shallow water habitat. Vermont's degraded conditions for aquatic habitat is directly related to shoreland clearing and conversion of natural shores to lawns.

The Vermont Legislature passed the Shoreland Protection Act for lakes and ponds, effective July 1, 2014, that regulates activities within 250 feet of the mean water level of lakes greater than 10 acres in size. The intent of the Shoreland Protection Act is to allow reasonable development along shorelands of lakes and ponds while protecting aquatic habitat, water quality, and maintaining the natural stability of shorelines. Standards for the creation of impervious surfaces (such as buildings and driveways) and cleared areas within the shoreland area are intended to preserve functioning lake ecosystems, protect water quality, bank stability, conserve aquatic and wildlife habitat, and further the economic benefits of lakes and their shorelands. Guidance on implementing the requirements of the Act is provided in A Handbook for Shoreland Development.

Shoreland Best Management Practices help achieve the healthy shoreland conditions needed to protect the lake and improve water quality and habitat conditions. The Vermont Lake Wise Program and assessments identify and work to address runoff, erosion and habitat degradation through BMP implementation. Some of the practices encouraged are shoreland vegetated buffers, infiltration steps, waterbars and rain gardens.

**Lily Pond – Vernon**
Lily Pond is a natural on-stream pond on Newton Brook. The pond is the only Outwash Plain Pondshore natural community in Vermont and hosts over a dozen species of rare aquatic plants. Downstream of the pond Newton Brook is impaired for nutrients and sediment due to agricultural impacts. The steep eastern shore has a 50-foot riparian buffer yet the levels of Total Phosphorus in the pond are high. Protection of this rare community is a priority.

**Kettle Pond – Brattleboro**
This tiny pond in the Wilson-Woods development is a true natural kettle pond created by a retreating glacier. It has no inlet or outlet stream and rises and falls with precipitation and snow melt. When it was sampled in 2015 Kettle Pond had the highest conductivity measured in a pond in Vermont, and extremely high phosphorus and chloride levels. Stormwater runoff from the neighborhood, the high school and the town garage lot flow to the pond. Stormwater treatment of these areas is needed.

**Sadawga Lake – Whitingham**
Sadawga Lake's interesting natural history make it an important lake for protection. The floating bog hosts numerous rare plants, however invasive Eurasian water milfoil and curly-leaf pondweed are pervasive, and control should be undertaken.

**Jacksonville Pond – Whitingham**
Shallow, averaging only 8 feet deep, and with extensive wetlands and agriculture upstream, Jacksonville pond has rising Total Phosphorus levels that need to be assessed.

**Lake Raponda – Wilmington**
Roads surround about 75% of Lake Raponda causing runoff and contributing large amounts of sediment to the pond and feeder streams. The town and lake association have begun addressing these issues and work will be continuing to improve conditions looking toward gaining future protections for the pond.

### *Clean Water Goals for Lakeshores*

- Conduct LakeWise Action Plan Assessments
- Establish a Lake Wise Leader to communicate with shoreland neighbors what lake-friendly practices and shoreland management looks like along the shore, and to serve as the point person for communicating with the staff of the Lake Wise Program. Establish volunteer Lay Monitoring and Volunteer Invasive Patroller Programs;
- Conduct septic systems and maintenance outreach to shoreland owners through Septic Socials;
- Restore living shorelands along lakes
- Protect Lily Pond
- Encourage landowners to form lake associations and join the Federation of Vermont Lakes and Ponds (FOVLAP)

## c) Wetland Restoration

Wetland restoration is the process of returning a degraded wetland to an approximation of its pre-disturbance condition. The United States has lost over half of its wetlands since European colonization in the early 1600s, and Vermont has lost as much as 35 percent. While conservation and protection of wetlands are critical for preventing continued loss of our remaining intact wetlands, wetland restoration is essential for rehabilitating those that have already been degraded or lost.

The large amount of active agricultural land along the Connecticut River originally hosted numerous wetlands that have over many decades, been converted to agricultural and other uses. The Connecticut River and its lower tributaries including Newton Brook in Vernon, could benefit from wetland assessment and restoration to improve water quality and habitat conditions.

### *Clean Water Goals for Wetland Restoration*

- Assess areas of prior converted wetland and hydric soils for restoration
- Implement wetland restoration as sites and opportunities are identified

### d) Forestland Restoration

Forests are the best form of land use for sustaining water quality and quantity. Studies clearly show that the amount of forestland within a watershed is an indicator of water quality and healthy aquatic ecosystems. In urban areas, trees and forests are part of what is referred to as the community's "green infrastructure" and help reduce stormwater runoff. In rural areas, forests protect municipal water supplies, mitigate the impacts of flooding, replenish groundwater aquifers, and provide recreation and critical fish and wildlife habitat, as well as a variety of wood products.[25]

Basin 12 is the second most forested, and the least developed Basin in Vermont. Forested land covers 82% of the Basin. This affords significant protection to the Basin's waters.

Forestry operations can directly impact water quality by affecting how water flows through an area. In particular, constructing roads, trails, and log landings can reduce soil permeability, increase soil erosion, and divert and concentrate water flow, leading to a channeling effect. Concentrated water flow can also erode banks and put undue pressure on bridges and culverts.[26]

The most recent Vermont Forest Resource Harvest Summary[27] from 2016 documents that Windham County, which covers most of Basin 12, had the highest volume of sawlogs and veneer trees harvested in the state at 20,412 million board feet.

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[25] VDFPR, Forest Water Quality
[26] VDFPR, Forest Water Quality
[27] Vermont Forest Resource Harvest Summary - 2016

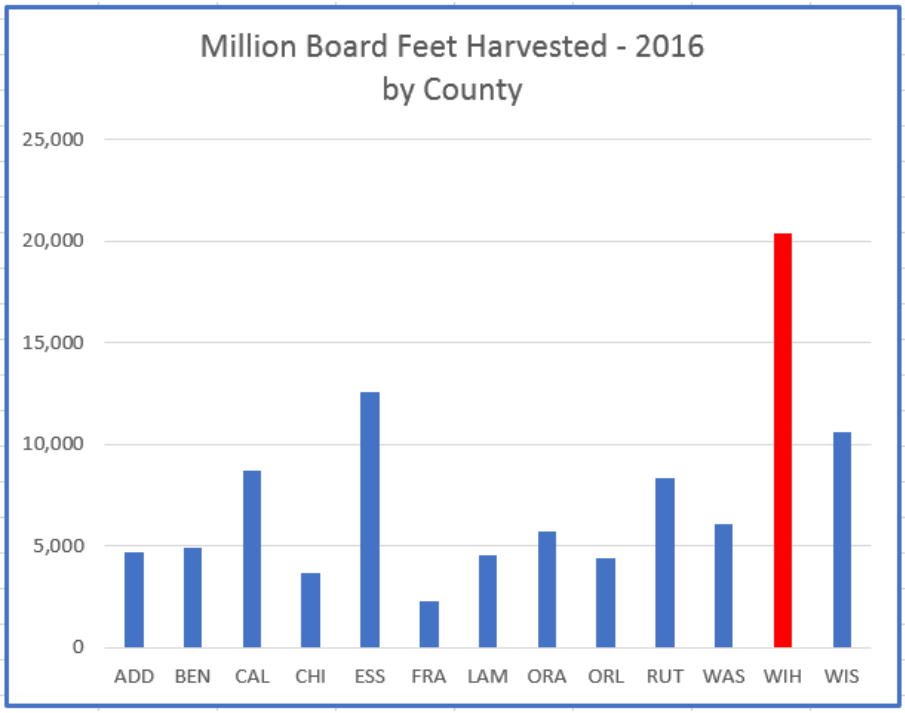


Figure 28. Windham County Harvest Summary

Proper Forestry Operations require careful adherence to the Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont. The AMP rules, which were initially adopted in 1987, and updated in 2018, are preventative measures that help control soil erosion and protect water quality. Proper implementation of the AMPs will help absorb and disperse runoff, retain soil nutrients, filter sediment and prevent fluctuations in water temperature, minimizing the effects of logging on the natural hydrologic functions of forests. In addition to updating the rules, a new version of the AMP Manual was created in 2019. This new manual has detailed information on each of the 26 practices to protect water quality, as well as a section on planning the harvest, and a section on the wetland rules and how to protect wetlands during harvesting. The new manual can be found both in print form as a field manual, or on the FPR website in pdf form[28].

As this Basin Plan is implemented, VDEC will partner with the US Forest Service on the Green Mountain National Forest Somerset Integrated Resource Project (Somerset IRP). The project area encompasses approximately 71,161 acres, around 60% of which includes National Forest System (NFS) land. Depending of funding, the project will implement management activities in the 2006 GMNF Land and Resource Management Plan (Forest Plan), including the planning, implementation and monitoring of multiple

[28] https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices

resource projects. Activities include timber harvesting, wildlife & fisheries habitat improvement, recreation & forest access opportunities, and restoration work.

Watershed treatments are expected to improve the watershed condition for aquatic habitat indicators by increasing the amount of instream large woody debris to desired levels and improving aquatic habitat connectivity.

### *Clean Water Goals for Forest Restoration*

- Decrease discharges from forestry operations through continued implementation of AMPs, outreach and training, and the use of portable skidder bridges
- Prevent stream erosion and improve resiliency on working lands through riparian restoration; logging road restoration; and stream crossing improvements which include installing properly sized structures or structure removal.
- Protect forest habitat, biodiversity, and drinking water sources

## e) Climate Change Adaptation for Wildlife

A number of species occur only in the southern Connecticut River valley. Some reach the northern limit of their range here making the Connecticut River an important corridor for the northern migration species responding to climate change pressures which include increasing temperatures, increasing drought , food web disturbances, habitat degradation and others. Habitat protection for these species will be critical to their long-term survival. Forested riparian buffers provide corridors for wildlife to access otherwise fragmented habitats as they adjust to climate pressures.

The number one goal of the Vermont Wildlife Action Plan is to:

- *Conserve, restore, and enhance habitats, natural plant and animal communities, and ecosystem integrity to maintain suitability for SGCN and ecological function and to improve resiliency to climate change.*

And the Vermont Habitat Blocks and Habitat Connectivity: An Analysis using Geographic Information Systems[29] states:

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[29] https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Conserve/Vermont_Habitat_Blocks_and_Habitat_Connectivity.pdf

- *The more intensive population growth found in the northern Champlain Valley, and the population growth, less conserved land, and greater road density found in portions of central Vermont and the southern Connecticut River valley result in higher potential block fragmentation threats in these areas.*

Another priority in Wildlife Action Plan is:

- *A priority conservation strategy identified in the Wildlife Action Plan was to "Identify and prioritize, for conservation, existing contiguous forest blocks and associated linkages that allow for upward and northward movement (of species) in response to climate change."*

The Wildlife Action Plan includes these aquatic and riparian dependent species as priorities for conservation:

**Fowlers Toad** (*Bufo fowleri*) was listed as Endangered in 2015. It is a Species of Greatest Conservation Need in Fluvial Habitat. The Fowler's Toad is very rare and has been found only in the southern Connecticut River Valley. It prefers naturally disturbed shorelines.[30]

**Spotted Turtle** (*Clemmys guttata*) found in limited locations in Windham, Bennington and Addison counties has a state natural heritage rank of S1[31] (very rare). The Spotted Turtle has been designated a Species of Greatest Conservation Need (high priority).[32]

**North American Racer** (*Coluber constrictor*) currently found only along the southern Connecticut River, has a state natural heritage rank of S1 (rare). The North American Racer is threatened in Vermont and has been designated a Species of Greatest Conservation Need (high priority).[33]

**Eastern Box Turtle** (*Terrapene carolina*) in Vermont are generally assumed to be released pets, however a cluster of reports from the southern Connecticut River Valley suggest the possibility of a native population.[34]

**American Shad** (*Alosa sapidissima*) in Vermont, is restricted to the Connecticut River from the Massachusetts line upstream to at least Bellows Falls dam. In 2019 over 314,000

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[30] The Vermont Reptile and Amphibian Atlas
[31] A system that ranks how common or rare a species is in Vermont. Species are ranked on a scale of S1 through S5 in which S1 and S2 are considered rare, S3 is considered uncommon, and S4 and S5 are common.
[32] Ibid.
[33] Ibid.
[34] 2015 Wildlife Action Plan

shad migrated past the Holyoke Dam in Massachusetts and over 11,000 passed the Vernon Dam into Vermont.

**American Eel** (*Anguilla rostrata*) – Connecticut River population – Eel management in the Connecticut River is currently focused on construction of eelpasses (to enable upstream juvenile eel movement around dams) and enumeration of immigrating eels.[35]

### *Clean Water Goals for Climate Change Adaptation*[36]

- Support efforts, such as state, federal, regional and international Climate Change Action Plans to reduce greenhouse gas emissions in the Northeast and climate change risks to SGCN
- Monitor habitat conditions & effects of stressors on habitats; restore critical habitats or ameliorate threats when/where opportunities arise to secure/restore numbers of SGCN populations & targeted abundance levels
- Conserve known habitat through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management
- Continue to document and monitor species distribution and relative abundance in Connecticut River Valley with targeted searches of potential sites, and sites where previously reported
- Map species habitat including connectivity of patches
- Work to maintain connectivity with populations to the south in Massachusetts.
- Consider reintroduction or augmentation from the closest healthy sources
- Maintaining and enhancing extant populations is always a priority and should be continued
- Identify wetlands most able to provide carbon sequestration function, including agricultural marginalized wetlands that may be restored.

## f) Hazard Mitigation and Flood Resiliency

Precipitation trend analysis indicates that the state of Vermont will receive increased rainfall in the future, primarily in the form of intense, local storms that drop high volumes of rainfall in short durations. Due to the surrounding terrain, consisting of steep slopes and narrow river valleys, the mainstems of the Deerfield, the Green Rivers and the East Branch North River are especially vulnerable to flooding, which occurs

[35] Ibid
[36] Ibid

when the rivers receive more water from precipitation and/or snowmelt than they typically experience. As a result, waters fill the channels of rivers, overflow their banks, and inundate floodplain areas that normally do not have water. Fluvial erosion also occurs during flooding events, as well as during natural hydrologic function, as water that passes through stream channels and exerts energy upon its streambanks.

Much of the watershed consists of small, mountainous streams that parallel transportation infrastructure. These smaller streams are flashier in nature and are vulnerable to flooding and severe erosion.

The Vermont Legislature passed Act 16 in 2014. The Act requires municipal and regional plans to incorporate a "flood resilience" component into all future plans. 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 and minimize long term economic, social, and natural resource impacts. The effort has led to the creation of maps to identify local flood hazard areas, identifying specific areas that should be protected for their values of slowing down or attenuating 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. VANR is providing resources and assistance to make flood resiliency an integral part of town planning including river corridor maps and model language for town plans. Numerous Tactical Basin Plan actions will assist communities in becoming more flood resilient.

Financial incentives for municipalities have been established in accordance with the requirements of 10 V.S.A. §§ 1425 and 1427 for the adoption and implementation of municipal zoning bylaws that protect and preserve river corridors, shorelands and buffers. Communities become eligible for financial incentives for river corridor and floodplain protection based on a rating system that considers a suite of mitigation activities, including implementation of Standard River Management Practices. Emergency Relief and Assistance (ERAF) rules now recognize towns that have increased river corridor and floodplain protection and provide an increased state cost share for emergency relief funding.

The Emergency Relief and Assistance Fund provides State funding to match Federal Public Assistance after federally-declared disasters. Eligible public costs are reimbursed by federal taxpayers at 75%. For disasters after 2014, the State of Vermont will contribute an additional 7.5% toward the costs leaving the municipal share of 17.5%. For communities that take specific steps to reduce flood damage the State's contribution will increase to 12.5% or 17.5% of the total cost.

The four mitigation measures towns must have in place to receive 12.5%:

1. National Flood Insurance Program (participate in or have applied to);

2. Town Road and Bridge Standards – (annually certify adopted standards that meet or
   exceed the standards in the most current: VTrans Orange Book: Handbook for Local Officials);
3. Local Emergency Operations Plan (adopted annually after town meeting);
4. Local Hazard Mitigation Plan - adopt a FEMA- approved local plan (valid for five years).

To receive 17.5% - eligible communities also must:

5. Protect River Corridors from new encroachment; or, protect their flood hazard areas from new encroachments and participate in the FEMA Community Rating System. After a declared disaster, the damage to public infrastructure including roads and culverts can exceed a million dollars. Adoption of these resiliency measures can mean significant savings for municipal taxpayers. As Figure 14. demonstrates, in the event of $1,000,000 in damages to infrastructure, the municipal share of recovery costs will decrease by up to $100,000 when ERAF protections are in place.

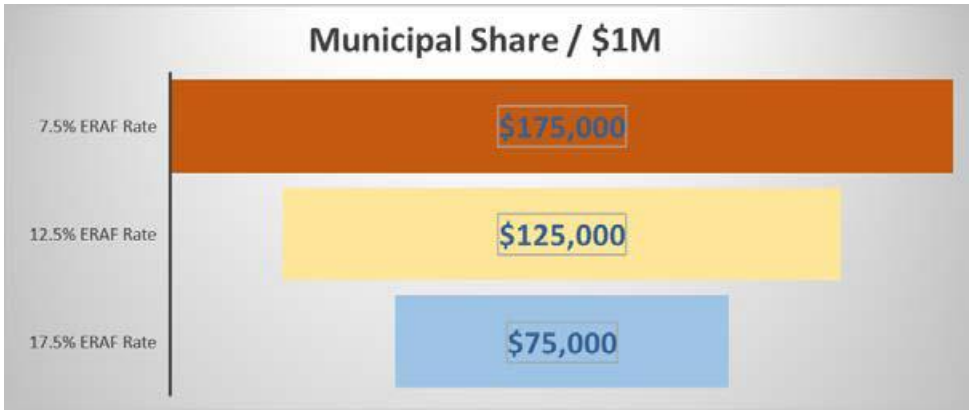


Figure 29. Emergency Relief and Assistance Fund Cost Share
From: http://floodready.vermont.gov/find_funding/emergency_relief_assistance

Three towns in the Basin have completed this process and will receive the maximum 17.5% State match for future damages. These are Brattleboro, Stamford and Vernon. Seven towns have reached the 12.5% match rate and seven towns remain at the 7.5% rate. An updated list can be found in Appendix E.

Another resiliency effort undertaken is the Vermont Economic Resiliency Initiative (VERI). With funding from the US Economic Development Administration (EDA), the Vermont Department of Housing and Community Development, working with the Agencies of Natural Resources and Transportation and the Regional Planning Commissions, VERI was launched to help ensure Vermont remains open for business when disaster strikes.

VERI assisted the state and local communities by evaluating local flood risk to business and infrastructure and identify the steps communities and the state can take to minimize rebuilding and recovery costs and ensure businesses stay open -- saving jobs and maintaining our economy. The Town of Brattleboro was selected for a more detailed analysis of the local flood risks to the community and businesses. The Brattleboro Community Report provides the foundation for the team to develop community-tailored action plans to reduce the loss of jobs, inventory and revenue, as well as the cost to repair roads, bridges and other key infrastructure.

### *Clean Water Goals for Flood Hazard Mitigation*

- Work toward stream equilibrium in all restoration efforts
- Implement VERI projects in Brattleboro
- Decrease stormwater inputs that add to the volume of flows
- Work with municipalities to adopt floodplain and river corridor protections to achieve greater ERAF funding levels
- Implement road and floodplain projects in the village of Jacksonville

**Summary of Implementation Actions**

| Strategies | Priority Areas | Town | Partners | Funding |
|---|---|---|---|---|
| **AGRICULTURAL LANDS** | | | | |
| Increase outreach and technical assistance through workshops and trainings for farmers, ag contractors and technical service providers on the new RAPs, improving soil health, implementing conservation field practices | | | UVM Ext., NRCDs, AAFM, NRCS | |
| Implement livestock exclusion practices | Newton Brook | Vernon | NRCDs, AAFM, NRCS | |
| Increase farm buffer establishment along surface waterways and upland wetlands | North Branch Deerfield, Newton Brook, Whetstone Brook, Connecticut River | Wilmington, Vernon, Brattleboro | NRCDs, AAFM, NRCS | |
| Support small farm NMP development and implementation through courses and trainings for farmers, manure applicators and technical service providers | | | UVM Ext., NRCDs, AAFM, NRCS | |
| Establish long-term funding for agricultural buffer projects | | | VDEC, NRCDs, AAFM, NRCS | |
| Increase the use of cover crops | | | UVM Ext., NRCDs, AAFM, NRCS | |
| Develop and host educational workshops directed to horse, beef, and small animal operations | | | UVM Ext., NRCDs, AAFM, NRCS | |
| Identify areas where water quality will most benefit from farm inspections and assistance | North Branch Deerfield, Newton Brook, Whetstone Brook | | NRCDs, AAFM, NRCS | |
| Increase regional equity of State and Federal agricultural funding distribution | | | AAFM, NRCS | |
| Acquire RCE on lands located in floodplain and alluvial fans | | | VLT, VRC, UVLT | |

| Strategies | Priority Areas | Town | Partners | Funding |
|---|---|---|---|---|
| **DEVELOPED LANDS / STORMWATER** | | | | |
| Conduct stormwater master planning to identify and prioritize actions | North Branch Deerfield, Cold Brook, Whetstone Brook | Brattleboro, Dover, Mount Snow, Hermitage | RPCs, NRCDs, municipalities, ski resorts | CWIP |
| Implement priority project identified in these plans | | Brattleboro, Dover, Mount Snow, Hermitage | North Branch Deerfield ski resorts | CWIP, ERP, CWSRF, WISPr |
| Identify and mitigate sources of bacteria causing impairment | North Branch Deerfield, Whetstone Brook | Dover, Wilmington, Brattleboro | VDEC, municipalities | ERP, CWSRF, WISPr |
| Address stormwater runoff entering Kettle Pond | | Brattleboro | WCNRCD, municipality | CWIP, ERP, CWSRF, WISPr |
| Address stormwater runoff entering Whetstone Brook | Whetstone Brook | Brattleboro | WCNRCD, municipality | CWIP, ERP, CWSRF, WISPr |
| Address stormwater runoff discharges from ski area development impairing water quality | North Branch Deerfield, Cold Brook | Dover, Wilmington | Municipalities, ski resorts | |
| Implement required actions to mitigate impairments addessed in the Mt Snow WQRPs | North Branch Deerfield, Baselodge trib,utary | Mt Snow Resort | Mt Snow Resort | |
| Conduct outreach to the real estate industry on the economic benefits of clean water and on applicable wetland and stomwater rules. | | | VDEC, NRCDs, RPCs | WG |
| Conduct outreach to landowners scheduled to fall under the 3-acre stomwater rule | | | RPCs, NRCDs, VDEC | WG |
| **DEVELOPED LANDS / ROADS** | | | | |
| Assist municipalities to control runoff from gravel and paved roads: implement road assessment protocol to assist with prioritization; provide technical and financial resources to assist with implementation; implement Municipal Roads General Permit (MRGP) | | | RPCs, NRCDs, municipalities | BR, GIA |
| Complete REIs in remaining towns | | Dover, Guilford, Marlboro, Whitingham Woodford | RPCs, municipalities | BR |
| Assist towns with support and training on data collection methods and uploading data into MRGP database | | | RPCs, VDEC | WG |
| Increase municipal participation in BR & GIA funding: assist in project prioritization and project proposal development | | | RPCs, NRCDs, municipalities, VDEC | WQ Planning |
| Implement projects to address Class 4 road & legal trail erosion | | | NRCDs, municipalities | CWIP |
| Conduct outreach on BMPs for private roads and driveways | | | RPCs, NRCDs | WG |
| Replace geomorphologically incompatible culverts and bridges | | | VTrans, municipalities | Structures |

| Strategies | Priority Areas | Town | Partners | Funding |
|---|---|---|---|---|
| **WASTEWATER** | | | | |
| Reduce the nitrogen load from municipal wastewater discharges to address the LIS-TMDL | | | Municipalities | CWSRF |
| Conduct wastewater planning and feasibility studies for small communities without municipal systems | | | VDEC | CWSRF |
| **NATURAL RESOURCE RESTORATION: Rivers, Lakes, Wetlands & Forests** | | | | |
| Increase education and outreach on natural resource restoration and protection needs and opportunities | | | ALL | CWIP, WG |
| **RIVERS: Work toward stream equilibrium and flood resilience** | | | | |
| Increase the number of river and floodplain restoration projects to re-establish connections to floodplains | Reaches with High to Extreme Sensitivity ratings | | NRCDs, RPCs | CWIP, WISPr |
| Increase River Corridor Easements which incorporate channel management, riparian buffer provisions and flood resiliency and protection from conversion & development | Green River, East Branch North River | | VRC, VLT, TNC | CWIP, VHCB, WISPr |
| Increase buffer plantings | Newton Brook, Whetstone Brook | | NRCDs, watershed assoc's | CWIP, WISPr, WG |
| Remove dams, esp. High Hazard dams | | | CRC, RPCs, dam owners | ERP, WISPr |
| Restore floodplain of Birge Street parcel | Whetstone Brook | Brattleboro | NRCDs, watershed assoc's | CWIP, ERP, WISPr |
| **SHORELANDS: protect and restore** | | | | |
| Promote & Implement the Lake Wise Program to encourage lake-friendly shoreline property maintenance | All Lakes & ponds | | lakeshore owners, lake assoc's, VDEC-Lakes | CWIP, ERP, WISPr |
| Establish Lay Lake Monitoring on appropriate lakes and ponds | Sadawga, Grout, Howe, Lily | | lakeshore owners, lake assoc's, VDEC-Lakes | WG |
| Work to control riparian and aquatic invasive plants | All Lakes & ponds | | lakeshore owners, lake assoc's | AIS GIA |
| Work to protect Lily Pond | | | lakeshore owners, VANR, municipality | CWIP, VHCB, WISPr |

| Strategies | Priority Areas | Town | Partners | Funding |
|---|---|---|---|---|
| **WETLANDS: protect and restore** | | | | |
| Restore degraded wetlands for habitat and water quality improvement | | Vernon | AAFM, VDEC, NRCDs, watershed assocs | CWIP, DU, WISPr |
| Assess areas of prior converted wetland and hydric soils for restoration | | | AAFM, VDEC, NRCDs, watershed assocs | WG, DU, WISPr |
| Implement wetland restoration as sites and opportunities are identified | | | AAFM, VDEC, NRCDs, watershed assocs | CWIP, DU, WISPr |
| Assess wetlands for potential reclassification | see Table 6 | Towns experiencing strong development pressure | VDEC - Wetlands | |
| Map unmapped wetlands | | Wilmington, Dover and Vernon | VDEC - Wetlands, RPCs | |
| **FISHERY: protect and restore** | | | | |
| Implement strategic wood addition projects on: | | | TU, VDFW, USFS | TU, WG, EBTJV |
| • East Branch Deerfield below Somerset Dam | | | | |
| • Deerfield mainstem above & including Rake Branch | | | | |
| • Black Brook | | | | |
| • Deer Cabin, Deer Lick, Blind and Glastonbury | | | | |
| • Heather Brook and within Vose Brook | | | | |
| Repair and maintain fish ladder at Green River Crib Dam | | | Community org | TU, WG, EBTJV |
| **FOREST MANAGEMENT: abate soil erosion** | | | | |
| Protect headwater streams and sensitive upland surface waters | | | DFPR, USFS, VLT | USFS, WISPr, CWIP |
| Conduct outreach on AMPs and forest BMPs | | | DFPR, NRCDs | WQ Planning |
| Better manage forest road runoff through adherence to AMPs and site restoration | | | DFPR, landowners | CWIP, WG, WISPr |
| Continue and expand the Portable Skidder Bridge Program | | | NRCDs | WG |
| **CLIMATE CHANGE ADAPTATION: mitigate potential impacts of climate change on species survival** | | | | |
| Support efforts, such as state, federal, regional and international Climate Change Action Plans to reduce greenhouse gas emissions in the Northeast and climate change risks to SGCN | Connecticut River valley | | ANR, RPCs, NRCDs, USFWS | |
| Conserve known habitat of SGCN through fee simple purchase, development rights or easements, management agreements, and education of private landowners and managers regarding appropriate management | Connecticut River valley | | ANR, RPCs, NRCDs, USFWS | SWG, CWIP, WISPr, VHCB |
| Work to maintain connectivity with populations to the south in Massachusetts | Connecticut River valley | | ANR, RPCs, NRCDs, USFWS | SWG, CWIP, WISPr, VHCB |

| Strategies | Priority Areas | Town | Partners | Funding |
|---|---|---|---|---|
| **HAZARD MITIGATION & FLOOD RESILIENCY** | | | | |
| Increase outreach and training for municipalities on ERAF and river corridor protections | | | VDEC-Rivers, RPCs | WQ Planning |
| Increase funding for technical assistance and incentives for municipalities to enhance flood resiliency | | | VEM, VDEC-Rivers | FEMA |
| Remove sewer lines from hazardous locations including streambeds | Whetstone Brook | Brattleboro | Municipalities, VDEC - FED | CWSRF |
| Buy-out properties that are highly vulnerable to flooding from willing sellers | Green River, East Branch North River, Whetstone Brook | | VEM, FEMA, RPCs | FEMA, HMP, PDHMP |
| Assess dams for structural integrity: prioritize High and Significant Hazard dams for removal or repair | | | VDEC - FED | FEMA, HMP, PDHMP |
| Create & implement Emergency Action Plans for all High and Significant Hazard dams | | | RPCs, VDEC - FED | |
| Implement infrastructure project at Jacksonville Municipal Center | East Branch North River | Jacksonville village | RPCs, VDEC, municipality | FEMA, HMP, PDHMP |
| **FLOW ALTERATION: Restore natural flows** | | | | |
| Work with dam operators to mitigate flow variations and work toward run-of-river management | Connecticut River, Deerfield River | | Great River Hydro | |
| **SURFACE WATER PROTECTION: Restoration and Reclassification** | | | | |
| Monitor and assess waters with no or outdated data | see Table 17 | | VDEC | |
| Work with partners to submit applications for reclassification | see Tables 3 & 4 | | RPCs, NRCDs, municipalities | WQ Planning |
| Evaluate waters for ORW designation | see Table 5 | | VDEC | |
| Evaluate waters for Class 1 Wetland designation | see Table 6 | | VDEC - Wetlands | |
| **See Acronyms for Partners and Funding codes** | | | | |

## Monitoring Priorities Table

Table 17.  identifies monitoring priorities for the Basin across several monitoring programs to achieve State monitoring goals. As described in the "What is a Tactical Basin Plan" section – the planning process is broken down into a 5-year planning cycle and the Deerfield River Basin is up for targeted monitoring in 2021. However, several monitoring programs monitor water quality in the Basin on an ongoing basis. Monitoring programs include:

- Monitoring and Assessment Program (BASS):
    - biological monitoring of macroinvertebrate and fish communities,
    - targeted chemistry sampling around WWTF or other pollution concerns,
    - LaRosa volunteer water quality monitoring program
    - Acid Lakes Long Term Monitoring program
- River Management Program (RMP):
    - geomorphic assessments that evaluate geomorphic and habitat conditions
- Lakes and Ponds Management and Protection Program:
    - spring phosphorus monitoring lake monitoring
    - lay lake monitoring programs which evaluate nutrient conditions and trends
    - shoreland condition
    - depth/bathymetric lake assessments
    - surveys for aquatic invasive species
- Wetlands Program:
    - wetlands assessments
- Vermont Department of Fish and Wildlife (VFWD):
    - fish assessments which are used to understand fish populations
    - temperature monitoring

Monitoring goals across all programs are aimed to:

1) identify and confirm water quality conditions that support reclassification of surface waters to a higher level;

2) understand water quality conditions where these are unknown such as streams or lakes that have not been sampled or assessed or where assessments may be out of date;

3) understand water quality conditions where there is a known water quality problem – to evaluate if the problem has gotten worse or to evaluate the effectiveness of restoration efforts;

4) understand pollution source areas that may be contributing to water quality issues such as nitrogen loading regarding LIS;

5) evaluate water quality changes over time – as supported by sentinel monitoring network on rivers and streams or targeted studies to evaluate water quality improvements with the implementation of best management practices.

Table 17 is an initial list of water quality monitoring priorities to guide monitoring over the next 5 years. This list has more sites than there is capacity to sample so will need to be further prioritized based on information needed to answer the most pressing questions in the Basin.

Table 17. Basin Priorities for Monitoring and Assessment

- see Acronyms list on page 102

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| **Rivers & Streams** | | | | | |
| **Deerfield River** | Old data | Moderate | 44.4 | BASS* | Data update |
| | Old data | Low | 51.3 | BASS | Data update |
| | Old data | Low | 51.8 | BASS | Data update |
| | Old data | Low | 52.4 | BASS | Data update |
| | Old data | Moderate | 65.6 | BASS | Data update |
| | Old data | Low | 66.3 | BASS | Data update |
| | Support A(1) | High | 67.5 | BASS / USFS / GRH | Potential A(1) |
| | Old data | Low | 73.1 | BASS / USFS / GRH | Maintain A(1) |
| | Old data | Low | 74.9 | BASS / USFS / GRH | Maintain A(1) |
| | No data, need headwater data | Low | above 74.9 | BASS / USFS / GRH | Maintain A(1) |
| **Bond Brook** | Wind station | Moderate | 1.7 | BASS / USFS / GRH | Permit tracking |
| **Boyd Brook** | no data | Low | | BASS / USFS / GRH | Establish Baseline |
| **Castle Brook** | pH only | Low | 0.2 | BASS / USFS | Maintain A(1) |
| South Pond Brook | no data | Low | | BASS / USFS | Maintain A(1) |
| Rake Branch | pH only | Moderate | | BASS / USFS | Data update |
| **Redfield Brook** | no data | Low | 0.7 | BASS / USFS | Establish Baseline |
| Mill Pond Brook | no data | Low | | BASS / USFS | Establish Baseline |
| Little Pond Brook | chem only | Low | | BASS / USFS | Data update |
| **Red Mill Brook** | Reclassification | Moderate | | BASS / USFS | Establish Baseline |
| **Dunbar Brook (VT/MA)** | no data | Low | | BASS | Establish Baseline |
| **Graves Brook** | no data | Low | | BASS / GRH | Establish Baseline |
| **Heather Brook** | no data | Low | | BASS / USFS | Establish Baseline |
| **Medbury Brook** | Wind station | Low | 0.4 | BASS / USFS / GRH | Monitor acid stress |
| **Number Nine Brook** | no data | Low | | BASS / GRH | Establish Baseline |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| **Pine Brook** | no data | Low | | BASS / USFS / GRH | Establish Baseline |
| **Tobey Brook** | no data | Low | | BASS / GRH | Establish Baseline |
| **Vose Brook** | no data | Low | | BASS / USFS / GRH | Establish Baseline |
| **Wheeler Brook (MA)** | no data | Low | | BASS | Establish Baseline |
| **Wilder Brook** | single sample | Low | 0.8 | BASS / USFS / GRH | Data update |
| **Glastenbury River** | | | | | |
| | old fish data | Low | 0.4 | BASS / USFS | Maintain A(1) |
| **Blind Brook** | pH only | Low | 0.3 | BASS / USFS | Maintain A(1) |
| **Deer Lick Brook** | pH only | Low | 0.1 | BASS / USFS | Maintain A(1) |
| **Deer Cabin Brook** | old data | Low | 0.1 | BASS / USFS | Maintain A(1) |
| **East Branch Deerfield River** | | | | | |
| | Reclassification | High | 0.1 | BASS / USFS / GRH | Potential A(1) |
| | Reclassification | High | 5.3 | BASS / USFS / GRH | Potential A(1) |
| **Black Brook** | pH only | Low | 2.2 | BASS / USFS / GRH | Data update |
| **West Branch Deerfield River** | | | | | |
| | Reclassification | High | 0.1 | BASS / USFS | Potential A(1) |
| | Reclassification | High | 1.8 | | Potential A(1) |
| | Reclassification | High | 5.9 | | Potential A(1) |
| | Reclassification | High | 8.5 | | Potential A(1) |
| **Reservoir Brook** | no data | Low | | BASS / USFS | Maintain A(1) |
| **Yaw Pond Brook** | pH only | Low | 0.4 | BASS / USFS | Data update |
| **Howe Pond Brook** | chem only | Low | | BASS / USFS | Data update |
| **Lamb Brook** | Reclassification | Low | 0.1 | BASS / USFS / permittee | Data update |
| **Lamb Brook** | Reclassification | Low | 0.7 | | Potential A(1) |
| **South Branch Deerfield River** | | | | | |
| | Reclassification | High | 1.3 | BASS / USFS / GRH | Potential A(1) |
| **Beaver Brook** | no data | Low | | BASS | Establish Baseline |
| **Windsor Pond trib** | no data | Low | | BASS | Establish Baseline |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| **North Branch Deerfield River** | | | | | |
| | Evaluate WQ issue | High | 5.8 | BASS | Determine source |
| | Evaluate WQ issue | High | 6.5 | BASS | Determine source |
| | Old data | High | 7 | BASS | Data update |
| | Evaluate WQ issue | High | 11 | BASS / Mt Snow | Permit tracking |
| | Evaluate WQ issue | High | 12.1 | BASS / USFS / Mt Snow | Permit tracking |
| | Reclassification | High | 12.6 | BASS / USFS / Mt Snow | Potential A(1) / Permit tracking |
| **Baselodge Trib** | old data | High | 0.1 | BASS / Mt Snow | Permit tracking |
| **Beaver Brook** | E. coli tracking | High | 1 | BASS / GRH | Locate source |
| **Bill Brook** | no data | Low | | BASS | Establish Baseline |
| Hall Brook | no data | Low | | BASS | Establish Baseline |
| Meadow Brook | no data | Low | | BASS | Establish Baseline |
| **Binney Brook** | Evaluate WQ issue | Moderate | 0.1 | BASS / USFS | Determine source |
| Rose Brook | Evaluate WQ issue | Moderate | 0.9 | BASS / USFS / GRH | Determine source |
| **Blue Brook** | Reclassification | Moderate | 0.7 | BASS | Potential future B(1) |
| **Cold Brook** | Reclassification | High | | BASS / USFS | Potential B(1) / Permit tracking |
| Oak Brook | | High | | BASS / Hermitage | Permit tracking |
| Haystack Brook | Reclassification | High | | BASS / USFS / Hermitage | Potential B(1) / Permit tracking |
| **Ellis Brook** | Evaluate WQ issue | Moderate | | BASS / USFS | Determine source |
| Negus Brook | old data | Low | | BASS / USFS | Data update |
| Cheney Brook | old data | Low | | BASS / USFS | Data update |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| **Tannery Brook** (named by DEC) | no data | Low | | BASS | Establish Baseline |
| Iron Stream | old data | High | 0.3 | BASS / Mt Snow | Evaluate iron / data update |
| **Jacks Brook** | old data | Low | | BASS / Mt Snow | Data update |
| **Green River** | | | | | |
| | Reclassification / Sentinel Stream | High | 16.6 | BASS | Potential A(1) |
| | Reclassification | High | 19.9 | BASS | Potential A(1) |
| **Borden Brook (VT/MA)** | no data | Low | | BASS | Establish Baseline |
| **Deer Park Pond Brook** (unnamed) | no data | Low | | BASS | Establish Baseline |
| **Harrisville Brook** | no data | Low | | BASS | Establish Baseline |
| **Hinesburg Brook** | no data | Low | | BASS | Establish Baseline |
| **Pond Brook** | Reclassification | Moderate | | BASS | Potential A(1), need fish |
| **Roaring Brook** | no data | Low | | BASS | Establish Baseline |
| **Thorne Brook (VT/MA)** | no data | Low | | BASS | Establish Baseline |
| **Trib. #6** | old data / Reclassification | Moderate | 1.7 | BASS | Potential A(1) / data update |
| **North River (MA)** | | | | | |
| **East Branch North River** | Reclassification | High | 11.7 | BASS | Potential A(1) |
| Branch Brook | no data | Low | | BASS | Establish Baseline |
| **Sperry Brook** | no data | Low | | BASS | Establish Baseline |
| Butler Brook – unnamed trib (Gates Pond outlet) | no data | Low | | BASS | Establish Baseline |
| Fowler Brook | no data | Low | | BASS | Establish Baseline |
| Hager Brook | no data | Low | | BASS | Establish Baseline |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| Pearsons Road Brook – unnamed trib | no data | Low | | BASS | Establish Baseline |
| Pease Brook | no data | Low | | BASS | Establish Baseline |
| Randall Brook | no data | Low | | BASS | Establish Baseline |
| Ryder Pond Brook – unnamed trib | no data | Low | | BASS | Establish Baseline |
| Sprague Brook | no data | Low | | BASS | Establish Baseline |
| **West Branch Brook (MA)** | no data | Low | | BASS | Establish Baseline |
| Brown Brook | no data | Low | | BASS | Establish Baseline |
| Burton Brook | no data | Low | | BASS | Establish Baseline |
| Cyrus Brook | no data | Low | | BASS | Establish Baseline |
| **Connecticut River & Direct Streams** | | | | | |
| **Connecticut River** | no data | Moderate | | BASS | Establish Baseline |
| Reach 04 – West River confluence to Vernon Dam | EPA NRSA site | Moderate | | BASS | TMDL tracking |
| Reach 05 – Vernon Dam to MA line | no data | Moderate | | BASS | Establish Baseline |
| **Broad Brook** | | | | | |
| | old data | High | 0.9 | BASS | Data update |
| Guilford Ctr Road - unnamed trib | no data | Low | | BASS | Establish Baseline |
| Lee Road - unnamed trib | no data | Low | | BASS | Establish Baseline |
| South Branch - unnamed trib (Rte 5) | no data | Low | | BASS | Establish Baseline |
| Weatherhead Hollow Road - unnamed trib | no data | Low | | BASS | Establish Baseline |
| **Fall River** | Reclassification | Moderate | 15.2 | BASS | Potential A(1) |
| West Brook | no data | Low | | BASS | Establish Baseline |
| Roaring Brook | no data | Low | | BASS | Establish Baseline |
| Keets Brook | no data | Low | | BASS | Establish Baseline |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| | Packer Corners Rd - unnamed trib | no data | Low | | BASS |
| **Newton Brook** | | | | | |
| | Evaluate nutrient trend | High | 0.6 | BASS | Track impairment |
| | Evaluate nutrient trend | High | 0.2 | BASS | Track impairment |
| **Whetstone Brook** | | | | | |
| | Evaluate bacteria | High | 1.1 | BASS | Track impairment |
| | Evaluate bacteria | High | 2.4 | BASS | Track impairment |
| | Reclassification | High | 10.7 | BASS | Potential A(1) |
| Ames Hill Brook | no data | Moderate | | BASS | Establish Baseline |
| Halladay Brook | no data | Low | | BASS | Establish Baseline |
| Pleasant Valley Reservoir trib | no data | Low | | BASS | Establish Baseline |
| **Lakes & Ponds** | | | | | |
| **Deerfield River** | | | | | |
| Adams Reservoir – Woodford | Evaluate nutrient trend | Moderate | | Lakes Program, BASS/LTM | Track impairment |
| Grout Pond – Stratton | Evaluate nutrient trend | High | | Lakes Program, BASS/LTM | Establish LMP, Track impairment |
| Harriman Reservoir – Wilmington, Whitingham | Shoreland assessment / water level fluctuation | High | | Lakes Program | Establish LMP |
| Haystack Pond – Wilmington | Shoreland assessment | High | | Lakes Program, BASS/LTM | Establish LMP |
| North Pond – Whitingham | Establish data to determine nutrient trend | Moderate | | Lakes Program | Establish LMP |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| Howe Pond – Readsboro | establish LMP | Moderate | A2-water supply | Lakes Program, BASS/LTM | Establish LMP, Track impairment |
| Little Pond – Woodford | Establish data to determine nutrient trend | Low | | Lakes Program, BASS/LTM | Establish LMP, Track impairment |
| Mud Pond – Stamford, Woodford | Evaluate nutrient trend / shoreland assessment | Low | | Lakes Program | Track trends |
| Lake Raponda – Wilmington | Monitor nutrient trend | High | | Lakes Program | Track trends |
| Sadawga Lake – Whitingham | Establish LMP to track trends | High | | Lakes Program | Establish LMP |
| Searsburg Reservoir - Searsburg | Establish data to determine nutrient trend / water level fluctuation | Low | | Lakes Program | Establish LMP |
| Sherman Reservoir – Whitingham | Establish data to determine nutrient trend | Low | | Lakes Program | Establish LMP |
| Snow Lake – Dover | Monitor discharges during removal | Low | | Lakes Program | Remove pond |
| Somerset Reservoir – Stratton, Somerset | Shoreland assessment / water level fluctuation | Low | | Lakes Program | Establish LMP |
| Spruce Lake - Wilmington | Establish data to determine nutrient trend | Low | | Lakes Program | Establish LMP |
| Stamford Pond – Stamford | Evaluate nutrient trend | Low | | Lakes Program, BASS/LTM | Establish LMP, Track impairment |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| Yaw Pond – Woodford, Readsboro | no data | Low | | Lakes Program | Establish Baseline |
| **Green River** | | | | | |
| Deer Park Pond – Halifax | Monitor nutrient trend | High | | Lakes Program | Establish LMP |
| South Pond – Marlboro | Monitor nutrient trend | High | | Lakes Program | Track impairment |
| **East Branch North River** | | | | | |
| Gates Pond – Whitingham | no LMP | Moderate | | Lakes Program | Establish LMP |
| Jacksonville Pond – Whitingham | Evaluate nutrient trend | High | | Lakes Program | Establish LMP |
| Laurel Pond – Whitingham | Establish data to determine nutrient trend | Low | | Lakes Program | Establish LMP |
| Ryder Pond – Whitingham | Establish data to determine nutrient trend | Low | | Lakes Program | Establish LMP |
| Shippee Pond – Whitingham | Establish data to determine nutrient trend | High | | Lakes Program | Establish LMP |
| **Connecticut River Direct** | | | | | |
| **Keets Brook** | | | | | |
| Sweet Pond – Guilford | Monitor refill / shoreland assessment | High | | Lakes Program | Monitor refilling of pond for sediment movement |
| Weatherhead Hollow Pond – Guilford | Evaluate nutrient trend | High | | Lakes Program | Track trends |
| **Newton Brook** | | | | | |
| Lily Pond – Vernon | Protection | High | | Lakes Program | Track impairment |

| Waterbody | Assessment Need | Priority | Location (River Mile) | Partner(s) | Monitoring Action |
|---|---|---|---|---|---|
| Vernon Hatchery Pond – Vernon | Establish data to determine nutrient trend | Low | | Lakes Program | Track trends |
| **Whetstone Brook** | | | | | |
| Hidden Lake – Marlboro | Monitor nutrient trend | Moderate | | Lakes Program | Track trends |
| Kettle Pond – Brattleboro | Evaluate nutrient trend / hi conductivity | High | | Lakes Program | address stormwater inputs |
| Pleasant Valley Reservoir – Brattleboro | Evaluate nutrient trend / shoreland assessment | Low | | Lakes Program | Track trends |

| **Wetlands** | | | | | |
|---|---|---|---|---|---|
| Atherton Meadow – Whitingham | Reclassification | High | | Wetlands Program | Potential Class 1 |
| Beaver Meadow – Readsboro | Reclassification | Low | | Wetlands Program | Establish Baseline |
| Shep Meadow Pond – Somerset | Reclassification | Low | | Wetlands Program | Establish Baseline |
| Lake Sadawga floating bog – Whitingham | Reclassification | Low | | Wetlands Program | Establish Baseline |
| Lily Pond – Vernon | Reclassification | High | | Wetlands Program | Establish Baseline |

## Acronyms

2PAD - 2-phase anaerobic digestion

7Q10 - proportion of river flow at lowest base

AAFM – Agency of Agriculture, Food & Markets

AIS GIA – Aquatic Invasive Species Grant-in-Aid

ANR – Vermont Agency of Natural Resources

BASS = Biomonitoring and Assessment Program

BCCD – Bennington County Conservation District

BCRC – Bennington County Regional Commission

BG – Block Grant

BR – Better Roads Grant

CRC – Connecticut River Conservancy

CRVTU – Connecticut River Valley Chapter of Trout Unlimited

CSFO – Certified Small Farm Operations

CSO – combined sewer overflow

CWIP – Clean Water Initiative Program

CWSRF – Clean Water State Revolving Fund

DU – Ducks Unlimited

EBTJV – Eastern Brook Trout Joint Venture

ERP – Ecosystem Restoration Program

FED – Vermont Facilities Engineering Division

FEMA - Federal Emergency Management Agency

GIA – Road Grant-in-Aid

GRH - Great River Hydro, LLC

HMP – Hazard Mitigation Program

HMP – Hazard Mitigation Program

PDHMP – Pre-Disaster Hazard Mitigation Program

IWC - Instream Waste Concentration

LFO – Large Farm Operation

LMM - low median monthly

LMP – Lay Monitoring Program

LTM – Long-term Monitoring Program

MBBR - moving bed bio-reactor

MFO – Medium Farm Operation

MGD – million gallons per day

MRGP - Municipal Roads General Permit

MS4 – Municipal Separate Storm Sewer System

NRCD – Natural Resources Conservation District

NRCS – USDA Natural Resources Conservation Service

RAP – Required Agricultural Practices

RBC – rotating biological contactors

RPC – Regional Planning Commission

SGCN – Species of Greatest Conservation Need

Structures – VTrans Structures Grant

SWG – State Wildlife Grant

TNC – The Nature Conservancy

TU – Trout Unlimited

USFS – US Forest Service

UVLT – Upper Valley Land Trust

UVM Ext. – UVM Extension Service

VACCD – VT Agency of Commence and Community Development

VFWD – Vermont Fish & Wildlife Department

VFPR - Vermont Department of Forests, Parks & Recreation

VDEC - Vermont Department of Environmental Conservation

- Lakes – Lakes and Ponds Program
- Rivers – Rivers Program
- Wetlands – Wetlands Program

VEM – Vermont Emergency Management

VHCB – Vermont Housing & Conservation Board

VLT – Vermont Land Trust

VRAM – VT Rapid Assessment Methodology

VRC – Vermont River Conservancy

TU – Trout Unlimited

WCNRCD – Windham County NRCD

WID - Watershed Investment Program of VDEC

WISPr – Water Infrastructure Sponsorship Program

WMA – Wildlife Management Area

WQRP - Water Quality Remediation Plan

WRC – Windham Regional Commission

## Glossary

**This glossary contains terms used in the Plan that are not defined in the Glossary included in the Vermont Surface Water Management Strategy.**

**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.

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

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

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

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

**Biological integrity** - the ability of a body of water to support and maintain a community of organisms that has the expected species composition, diversity, and functional organization comparable to that of the water in its natural condition.

**Certified Small Farm Operations** (CSFO) – a farm housing 50-199 Dairy Cows or 75-299 Cattle or 750-2,999 Sheep or Goats or 50+ Acres Annual Crops

**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.

**Dissolved Oxygen** - the concentration of free molecular oxygen dissolved in water

**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 landforms

**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.

**Large Farm Operation** (LFO) – a farm housing 700+ Dairy Cows

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

**Medium Farm Operation** (MFO) – a farm housing 200-699 Dairy Cows or 300-999 Youngstock/Heifers/Veal/Cattle

**Natural Community** - An interacting assemblage of organisms, their physical environment, and the natural processes that affect them.

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

**Nonpoint source pollution** - pollution 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.

**Production Area** - means those areas of a farm where animals, agricultural inputs, or raw agricultural products are confined, housed, stored, or prepared whether within or without structures, including barnyards, raw materials storage areas, heavy use areas, fertilizer and pesticide storage areas, and waste storage and containment areas. Production areas include egg washing or egg processing facilities, milkhouses, raw agricultural commodity preparation or storage, or any area used in the storage, handling, treatment, or disposal of mortalities.

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

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

**River Corridor** - the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the VANR River Corridor Protection Guide.

**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 Nephelometric Turbidity Unit (NTU). 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. 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).

**Wetlands** - are places where land and water meet which may be inundated or saturated by water for a few weeks of the year to shallow water year-round. Vermont's wetlands are defined as those areas of the state that are inundated by surface or ground water with a frequency sufficient to support plants and animals that depend on saturated or seasonally saturated soil conditions for growth and reproduction. These areas are commonly known as ponds, bogs, fens, marshes, wet meadows, shrub swamps, and wooded swamps.

**Water quality remediation plan** means a plan, other than a TMDL, designed to bring an impaired water body into compliance with applicable water quality standards in accordance with 40 C.F.R. § 130.7(b)(1)(ii) and (iii).

## Appendices

## Appendix A. 2014 Report Card

The 2014 Tactical Basin Plan laid out 63 Objectives each containing between one and seven Action items to be addressed. Of the 63 Objectives, 36 have been fully or partially implemented.

The implementation status of 2014 Actions are documented as:

- Completed – the Action has been implemented
- Deleted – the Action has been withdrawn from consideration
- In progress – the Action underway
- Not Started – the Action has not begun
- On-going – the Action is taking place and will continue to be carried out

Additional projects and actions that were identified after the publication of the 2014 plan have also been undertaken and many have been completed. These are listed at the end of the Report Card table below.

In developing the implementation projects for the 2019 Plan some of the 2014 projects will be carried forward for future implementation while others are no longer relevant to the current clean water priorities of the Agency of Natural Resources.

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 1: Complete on-the-ground shoreline assessments of the lakes and ponds in the Basin. | | | | |
| 1) Reference WRC shoreline maps | Lakes & Ponds | ANR | All un-assessed lakes | In Progress |
| 2) Assess and ground-truth | N/A | | | |
| Objective 2: Monitor and assess the temperature issues created by the cold water discharges from Somerset, Searsburg and Harriman dams and warm lake water in the reservoirs. | | | | |
| 1) Monitor above and below each discharge & reservoir | USFS | USFS, ANR | Deerfield River & East Branch Deerfield | In Progress |
| 2) Assess fisheries above and below each discharge & reservoir | USFS | USFS, ANR/VDEC & VFWD | Deerfield River & East Branch Deerfield | On-going |
| Objective 3: Monitor waterbodies with no or little data. | | | | |
| 1) Monitor | VDEC – Lakes & Ponds | ANR | Binney Brook | Completed |
| | VDEC - WSMD | | Beaver Brook | Completed |
| | | | Black Brook | Completed |
| | | | Blue Brook | Completed |
| | | | So. Branch Deerfield | Completed |
| | | | Ellis Brook | Completed |
| | | | Fall River | Completed |
| | | | Keets Brook | Not Started |
| | | | Connecticut River | Not Started |
| Objective 4: Monitor and assess Ellis Brook to determine cause of degradation to ALS and fisheries as listed in 303(d) Part C – Waters in Need of Further Assessment. | | | | |
| Biomonitoring & chemical assessment | VDEC – BASS lab | ANR | Ellis Brook Stations 0.5 – > 2.6 | Completed |
| Objective 5: Monitor, assess and implement clean-up of tritium contamination in the Connecticut River as Listed in Part C. | | | | |
| 1) Monitor tritium levels in groundwater discharges to the CT River and in the river itself | Entergy-VT Yankee, VDOH, VDEC | private | CT River, Vernon | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Remove and mitigate tritium contamination | Entergy-VT Yankee | private | | Not Started |
| Objective 6: Monitor the impacts of the Deerfield Wind Projects on the surrounding Class A waters to ensure there is no future degradation of water quality. | | | | |
| Biomonitoring & chemical assessment | VDEC – BASS lab | Deerfield Wind, LLC, ANR | All surrounding Class A brooks | On-going |
| Objective 7: Survey, assess and document biodiversity in areas of the Basin with insufficient data to reference in BioFinder. | | | | |
| Conduct surveys | VFWD, conservation commissions | ANR | Wilmington, Whitingham, Halifax, Brattleboro, Guilford | In Progress |
| Objective 8: Conduct geomorphic assessment & corridor planning on the East Branch of the North River. | | | | |
| 1) Conduct SGA | WCNRCD, WRC, DRWA | ERP, DREF | Mainstem, Branch Brook, Gates Pond Brook | Completed |
| 2) Compile corridor plan | | | | Completed |
| Objective 9: Expand volunteer monitoring on the major lakes in the Basin. | | | | |
| 1) Lay lake monitoring program | VDEC – Lakes & Ponds, watershed associations | ANR, WG | Gates, Grout, Harriman, Howe, Jacksonville, Lily, Sadawga, Searsburg, Sherman, Shippee, Somerset, Weatherhead Hollow | On-going |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) VIP monitoring program | | ANR, WG, ANS Grant-in Aid | Gates, Grout, Harriman, Howe, Jacksonville, Lily, Raponda, Sadawga, Searsburg, Sherman, Shippee, Somerset, Weatherhead Hollow | On-going |
| Objective 10: Locate, field-verify and document vernal pools in the Basin to fully protect wetlands. | | | | |
| 1) Continue project funding for & mapping of vernal pools | conservation commissions, watershed associations VCE, Arrowwood Env. | Legislature, ANR, WG | Full basin | Not Started |
| 2) Identify groups of vernal pools that are particularly significant or likely to maintain hydrology and habitat connectivity and thus species presence in the face of climate change | VDEC – Wetlands | ANR | Full basin | Not Started |
| 3) Identify areas to prioritize vernal pool protection and possible consideration for Class One wetland complex | VDEC – Wetlands | ANR | Full basin | Not Started |
| Objective 11: Assess high elevation wetlands in northern Deerfield watershed in relation to spring feeding by bears and use as wildlife travel corridors and provide data for BioFinder and RTE. | | | | |
| Conduct wetland assessments | VDEC – Wetlands, | ANR | Dover, Wilmington, Searsburg, Somerset | In Progress |
| Conduct bear surveys | VFWD | ANR | Same | In Progress |
| Objective 12: Survey the Deerfield watershed and document waterfalls, cascades and gorges.* | | | | |
| Conduct survey and map sites | DRWA, WRC | WG, 604(b), DREF | Deerfield watershed | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 13: Assess wetland complexes upstream of Wilmington for improved flood storage capacity. | | | | |
| Map and model current and potential storage capacity | VDEC- Rivers Program & Wetlands | ANR | Wilmington | Not Started |
| Objective 14: Conduct AEM assessments on the North Branch Deerfield upstream of Wilmington. | | | | |
| Assess agricultural operations for environmental BMPs | WCNRCD, VACD, AAFM | VWG, ERP, AAFM | North Branch Deerfield | ???? |
| Objective 15: Incorporate river corridors and flood resiliency strategies into local and regional development plans and zoning. | | | | |
| Focus on areas of highest risk identified in River Corridor plans | RPC's, Town Planning and Conservation Commissions, VLCT | MPG | Basin-wide | In Progress |
| | | | Focus Towns: Brattleboro, Wilmington, Dover, Vernon | |
| Objective 16: Remove dams that are no longer serving a useful purpose. | | | | |
| 1) The Coop dam on Whetstone Brook | VFWD, VT Dam Task Force, USFWS | AR/NOAA, ERP, USFWS-EBTJV | 42.850948, -72.557962 | Not Started |
| 2) Cold Brook dam in Dover | VFWD, VT Dam Task Force, USFWS | AR/NOAA, ERP, USFWS-EBTJV | | Completed |
| 3) Prioritize dams in *Poor* condition for removal potential | VFWD, VT Dam Task Force, USFWS | AR/NOAA, ERP, USFWS-EBTJV | | In Progress |
| Objective 17: Identify, document and protect the natural communities (NC) and RTE species in significant wetlands, including Ryder Pond, prior to dam removals. | | | | |
| 1) Survey and document NC and RTE in the Ryder Pond wetlands | VDEC – Wetlands, VFWD – NHP | | Ryder Pond | Deleted |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Survey and document NC and RTE in wetlands above dam any proposed removal project | VDEC – Wetlands, VFWD – NHP | | | |
| Objective 18: Complete a wetland restoration following a dam removal. | | | | |
| 1) Conduct training for staff and partners on dam removal and wetland restoration | Institute for Wetland & Environmental Education & Research, NRCS, VDEC - Wetlands | ERP, PFW, WRP/DU, USFWS, WG | | In Progress |
| 2) Complete the removal of the Ryder Pond dam | Ryder Pond Landowners Association | Ryder Pond Landowners Association | Ryder Pond<br>42.812828,-72.843178 | Deleted |
| 3) Restore the functions of the remaining wetland | WRP/DU | | | |
| Objective 19: Use the WRC *Undeveloped Shorelands Maps*, to prioritize areas for protection on lakes, ponds, river and streams. | | | | |
| 1) Prioritize most threatened sites | WRC, Watershed Assoc. | ANR, 604(b) | Basin-wide | Not Started |
| 2) Seek funding for purchase and easements | WRC, Municipalities, VRC | ERP, | Basin-wide | Not Started |
| Objective 20: Implement stormwater control projects to reduce flows and sediment wherever possible. Focus area priority: outfalls to the North Branch Deerfield and its tributaries. | | | | |
| 1) Conduct stormwater survey and IDDE investigations | VDEC - Stormwater | ERP | Dover, Wilmington, Whitingham, Readsboro | In Progress |
| 2) Develop and implement stormwater control projects | VDEC, Municipalities, Ski Resorts | ERP, private | Dover, Wilmington | On-going |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 21: Encourage and implement green infrastructure practices. | | | | |
| 1) Encourage use of green stormwater infrastructure. | VDEC | VDEC | Basin-wide | On-going |
| 2) Promote local regulatory approaches to encourage GSI and LID | VDEC | ERP, VAPDA | Basin-wide | On-going |
| 3) Promote local incentives to support GIS and LID. | VDEC | ERP, VAPDA | | Not Started |
| Objective 22: Monitor and document impacts of TS Irene. | | | | |
| 1) Document erosion damage & mass failures | VGS, WRC, BCRC, SGA Consultants | 604(b) | Basin-wide | Completed |
| 2) Document infrastructure problems and concerns | WRC, BCRC, VTrans, SGA Consultants | 604(b) | Basin-wide | On-going |
| 3) Develop remediation projects where appropriate | WRC, BCRC, SGA Consultants | 604(b), BBR | Basin-wide | In Progress |
| 4) Update delineated SGA and FEH corridors where river has migrated outside of boundary | VDEC – Rivers Program | ANR | Where applicable | Not Started |
| Objective 23: Better manage lakeshore and water quality issues on lakes and ponds in the Basin. | | | | |
| 1) Promote and initiate the Lake Wise program | VDEC – Lakes & Ponds, Lake Assoc. | | Lake Raponda, Sadawga Lake, Lily Pond, Hidden Lake | On-going |
| 2) Coordinate with LID staff on lakeshores and retrofitting systems | VDEC – Lakes & Ponds & Stormwater, Lake Assoc. | ERP, BBR | | In Progress |
| 3) Establish conservation programs for lakeshores | VDEC – Lakes & Ponds, WRC, BCRC, VRC | VRC, VHCB, ERP | Lake Raponda, Sadawga Lake, Shippee Pond, Lily Pond, Hidden Lake | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 4) Conduct invasives evaluation and protection programs on the lakes | VDEC – Lakes & Ponds, Lake Assoc. | | Lake Raponda, Sadawga Lake, Shippee Pond, Lily Pond, Hidden Lake, Grout Pond, Jacksonville Pond, Weatherhead Hollow Pond, South Pond | On-going |
| 5) Expand Lay Monitoring program to more Basin lakes | VDEC – Lakes & Ponds, Lake Assoc. | | All but Lake Raponda | In Progress |
| 6) Establish a monitoring and control program on Sadawga Lake to reduce the levels of Eurasian watermilfoil. | LSA | ANS Grant-in Aid | Sadawga Lake | Not Started |
| 7) Work with lakes subject to annual drawdown to eliminate these impacts | VDEC – Lakes & Ponds, Lake Assoc. | | Where applicable | On-going |
| Objective 24: Encourage and support smart growth development and compact village centers and downtowns to slow forest fragmentation. | | | | |
| 1) Promote ACCD programs. | VDEC | VDEC | Basin-wide, focus areas: resort development, Brattleboro, Wilmington, Dover | On-going |
| 2) Identify high-priority landscapes for conservation efforts. | ANR | | | On-going |
| Objective 25: Dovetail continued post-closure monitoring programs of landfills with working on fixes for known water quality impacts following the end of the required monitoring in 2013. | | | | |
| 1) Maintain water monitoring programs | VDEC - WMD | SWAG - CPP | Municipal landfills in Brattleboro, Dover, Halifax, Searsburg, Wilmington | Not Started |
| 2) Develop and implement clean-up projects at impacted locations | VDEC - WMD | SWAG - CPP | | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 26: Reduce sand and sediment inputs from gravel roads throughout the Basin. | | | | |
| 1) Provide more training and education for road agents on preventing erosion | Local Roads, Municipal DPW's, RPCs | Local Roads | Basin-wide | On-going |
| 2) Conduct BBR capital budget inventories for road-related erosion, AOP impediments, and river-road conflicts with an emphasis on flood resiliency | Focus towns, Better Backroads technician, VDEC | BBR, ERP | Brattleboro, Dover, Guilford, Halifax, Whitingham, Wilmington | In Progress |
| 3) Seek funding for regionally shared equipment for sand sweeping, catch basin sump cleaning and reduced use of sand & salt with possible conversion to brine | Focus towns, Better Backroads technician, VDEC | BBR, 319, VTrans | Brattleboro, Dover, Guilford, Halifax, Whitingham, Wilmington | Not Started |
| 3) Relocate or cover town sand pile storage area | VDEC, Guilford DPW | 319 | Guilford, Broad Brook | In Progress |
| 4) Conduct an assessment of water quality impairments associated with Class IV town roads using the model developed for the White River Basin. | VDEC, Towns, WRC, VDFPR, Better Backroads | ERP, BBR | Basin-wide | In Progress |
| 5) Reduce the amount of sediment and other pollutants associated with Class IV town roads. | Towns, WRC , Better Backroads, VDEC, VDFPR , VYCC | ERP, DREF, VYCC, Hazard Mitigation Grant Program | Basin-wide | On-going |
| Objective 27: Work to improve fisheries and fish habitat throughout the Basin. | | | | |
| 1) Implement habitat improvement projects on Whetstone, Broad, Newton and Crosby Brooks | VFWD, TU, CRWC | WG, ERP | Whetstone, Broad, Newton, Crosby Brooks | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 28: Reduce non-point source pollutants from farming operations by implementing BMPs on farms. | | | | |
| 1) Conduct AEM assessments and AOI visits to all livestock farms in focus area | WCNRCD, AAFM | AAFM, WG, ERP | Deerfield watershed: North Branch, lower Deerfield & North River, Hinesburg Brook | ????? |
| | | | CTR watershed: CTR mainstem, Newton, Whetstone, Broad, Crosby Brooks | |
| 2) Coordinate referrals of potential program staff | WCNRCD, BCCD, VACD, AAFM, NRCS | | | Not Started |
| 3) Implement BMP's on prioritized critical source areas | WCNRCD, BCCD, VACD, AAFM, NRCS | EQIP, CREP, AAFM, PFW, WHIP, WRP/DU, 319 | | Not Started |
| Objective 29: Reduce non-point source pollutants from farming operations by sharing machinery regionally. | | | | |
| 1) Survey interest of area farmers | WCNRCD | WG | Basin-wide | Not Started |
| 2) Seek funding for regionally shared equipment for manure incorporation, pasture inter-seeding & ag plastic recycling | WCNRCD, BCCD, VACD, AAFM, NRCS | AAFM, ERP, EQIP, FSA, NRCS, 319 | | Not Started |
| 3) Coordinate rental / reservation program for sharing equipment | WCNRCD, BCCD | | | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 30: Reduce non-point source pollution associated with logging operations by implementing AMPs and by promoting the use of portable skidder bridges. | | | | |
| 1) Continue the AMP Monitoring Program administered by DFPR | VDFPR, DEC Compliance and Enforcement Division, Vermont Forest Products Association | State General Funds | Basin-wide | On-going |
| 2) Support the Portable Skidder Bridge Rental Program | Windham & Bennington County NRCD, VDFPR | ERP | Basin-wide | On-going |
| Objective 31: Monitor for invasive tree pests (i.e. hemlock wooly adelgid and emerald ash borer) that could impact forest health and sustainability, and support community preparedness planning. | | | | |
| 1) Support the Forest Pest First Detector Program. | VDFPR, UVM Extension | State General Funds | Basin-wide | On-going |
| 2) Support municipalities to prepare for invasive tree pests. | VDFPR, UVM Extension | | Basin-wide | On-going |
| Objective 32: Improve planning and management of the urban tree canopy. | | | | |
| 1) Promote the planning and management of urban tree canopy to municipalities. | VDFP, UVM Extension | VDFPR, USFS | Urban areas: Focus: Brattleboro | On-going |
| 2) Promote the benefits of trees and forests for water quality. | VDFPR, UVM Extension | VDFPR, USFS | Basin-wide | On-going |
| 3) Encourage participation in the Stewardship of the Urban Landscape - Tree Stewards course | VDFPR, UVM Extension | VDFPR, USFS | Basin-wide | On-going |
| Objective 33: Protect the current high quality waters in the Deerfield watershed through reclassification and ORW designations. | | | | |
| 1) Submit Class A reclassification proposals for all waters identified in Table 3 | VDEC – MAPP | | | Completed & On-going |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Submit ORW designation proposals for all waters identified in Table 5 | VDEC – MAPP | | | Not Started |
| 4) Submit Class 1 reclassification proposals for the wetland if it meets the standards | VDEC – Wetlands, watershed groups, MAPP, VFWD, VDFPR | | | In Progress |
| Objective 34: Work with the TransCanada to address river impacts related to temperature on the Deerfield River listed in Part F. | | | | |
| 1) Summarize and present data | VDEC, USFS, TransCanada | TransCanada | Below the Harriman Reservoir | Not Started |
| 2) Develop & implement mitigation strategies | VDEC, TransCanada, USFS | TransCanada | Below the Somerset Reservoir (from fisheries) | In Progress |
| Objective 35: Work with VDFPR, VFWD, the Town of Vernon and local partners to evaluate Atherton Meadows pond and wetland and Vernon's black gum wetlands for potential Class 1. reclassification. | | | | |
| 1) Conduct evaluations | DEC Wetlands, VDFPR, VFWD, the Town of Vernon, local partners | | | Not Started |
| 2) Develop and implement management goals | VDEC – MAPP, DEC Wetlands, VDFPR, VFWD, the Town of Vernon, local partners | | | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 3) Seek reclassification if criteria are met | DEC Wetlands, VDFPR, VFWD, the Town of Vernon, local partners | | | Not Started |
| Objective 36: Develop and implement the WQRP for Mount Snow resort to address stormwater impairment and altered flows as listed in Parts A & F. | | | | |
| 1) Review Master Plan and Framework and develop remediation plan & projects | Mt Snow Resort, Act250, VDEC | Private | | ??????? |
| 2) Work with resort to implement projects | Mt Snow Resort, Act250, VDEC | Private | North Branch Deerfield & tribs | |
| 3) Disconnect Snow Lake from the North Branch Deerfield and restore stream channel | Mt Snow Resort | private | Snow Lake | Not Started |
| 4) North Branch | Mt Snow Resort, Dover | Private, BBR | North Branch | |
| 5) Iron Stream trib. | Mt Snow Resort | Private | Iron Stream trib. | |
| Objective 37: Work with the Mount Snow resort, the towns of Dover & Wilmington and the community to address high *E. coli* levels causing impairments to the North Branch of the Deerfield River. | | | | |
| Implement bacteria mitigation practices identified in the TMDL | Mt Snow Resort, Towns of Dover & Wilmington | SWAG – CPP, CWSRF | Impaired reach of No. Branch | Not Started |
| Objective 38: Implement recommendations of the LIS-TMDL to reduce point source nitrogen (N) loads by 25%. | | | | |
| 1) Identify sources and implement reduction practices | Municipal WWTFs, industrial N dischargers | CWSRF | See Section 2.6 | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 39: Implement recommendations of the LIS-TMDL to reduce non-point source nitrogen loads by 10%. | | | | |
| 1) Educate ag producers on N reduction practices | AAFM, NRCS, NRCDs, ag producers | | Basin-wide | On-going |
| 2) Implement appropriate practices including: | AAFM, NRCS, NRCDs, ag producers | EQIP, AAFM, VACD, CREP | Basin-wide | On-going |
| • Increased soil testing & | | | | |
| Nutrient Management Planning | | | | |
| • Timed fertilizer application | | | | |
| • Needs based N application rates | | | | |
| • Use of cover crops & perennial grasses | | | | |
| • Extended rotation periods | | | | |
| • Install wood chip filter beds/trenches to treat drainage water | | | | |
| • Increased riparian buffers | | | | |
| Objective 40: Work with the TransCanada, through the FERC relicensing process, to address river impairments related to flow issues on the Connecticut River listed in Part F -Waters Altered by Flow Regulation. | | | | |
| 1) Above and below the Vernon Dam | TransCanada, FERC, USFWS, NHFG, TNC, CRWC, others | TransCanada | CT River, above and below the Vernon Dam | On-going thru FERC relicensing process |
| 2) Below the Bellows Falls Dam | Same | TransCanada | CT River, below the Bellows Falls Dam | |
| Objective 41: Preserve existing and create more floodplain along the Connecticut River. | | | | |
| 1) Assess current floodplain quantity & capacity | TNC | WG | | Not Started |
| 2) Seek RCE opportunities | CRWC, CRJC | ERP | | |
| 3) Seek floodplain reconnection and restoration opportunities | TNC, CRWC, CRJC | ERP | | |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| Objective 42: Protect the land and habitat along the Connecticut River to enhance survival of the high concentration of RTE species. | | | | |
| 1) Focus efforts in Vernon & Brattleboro | USFWS – Conte Refuge, VRC | USFWS, PFW, CREP, WHIP | Vernon & Brattleboro | Not Started |
| 2) Control the spread of invasive species that degrade native floodplain and riparian habitat | USFWS – Conte Refuge, VRC | USFWS, PFW, CREP, WHIP | | On-going |
| Objective 43: Control aquatic invasive species in the Connecticut River. | | | | |
| 1) Water chestnut in Vernon Dam impoundment | SeVWA, CRJC-LRS, USFWS – Conte Refuge | ANS Grant-in Aid | Vernon<br>42.779779,-72.508396 | On-going |
| 2) Focus species: Eurasian watermilfoil, curly leaf pondweed, Japanese knotweed, European Naiad | | ANS Grant-in Aid | all boat access points | On-going |
| Objective 44: Conduct a Stream Geomorphic Assessment of the East Branch North River. | | | | |
| 1) Include Branch and Hager Brooks | WCNRCD, WRC | ERP | | Complete |
| 2) Partner with Massachusetts to assess the lower river | DRWA, RPCs | ERP, DREF | | Complete |
| Objective 45: Protect the Halifax Gorge. | | | | |
| 1) Pursue ORW designation | | | 42.743262, -72.735191 | Not Started |
| 2) Consider a public access easement | VRC | ERP | | Not Started |
| Objective 46: Complete the Stream Geomorphic Assessment of the Green River. | | | | |
| 1) Implement priority projects in the Corridor Plan | WCNRCD, WRC | ERP, DREF | TBD | Complete |
| 2) Partner with Massachusetts to assess the lower river | DRWA, RPCs | ERP, DREF | | Not Started |
| Objective 47: Work to prevent the further spread of Japanese knotweed in the watershed. | | | | |
| 1) Continue pulling workshops and outreach. | Conservation Commissions, WCNRCD | ANS Grant-in Aid, WG, WHIP | | On-going |
| Objective 48: Investigate if the Green River could be considered for “Wild & Scenic” status. | | | | |
| 1) Review resources & requirements for W&S | FGR, DRWA | WG, DREF | | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Pursue if appropriate | FGR, DRWA | WG, DREF | | |
| Objective 49: Formalize public access sites in appropriate areas. | | | | |
| Locate & pursue current access points without formal agreements | VRC, DRWA, VDFPR, VFWD | ERP, DREF, | | On-going |
| Objective 50: Consider removing the dam on Pond Brook off Jelly Mill Rd, Guilford north of Gallup Pitch Rd. | | | | |
| 1) Contact landowner | VDTF | | | In progress |
| 2) Pursue removal if appropriate | VDTF | AR/NOAA | approx. 42.764859, -72.669357 | |
| Objective 51: Protect and enhance wildlife crossing access across I-91. | | | | |
| 1) Assess AOP and terrestrial crossing opportunities in this very important RTE corridor | VTrans, VFWD, Conservation Commissions | WG, Enhancement, Structures, USFWS AOP | | Not Started |
| 2) Implement crossing improvement opportunities | VTrans, VFWD, Conservation Commissions | Enhancement, Structures, USFWS AOP | | |
| Objective 52: Work with DFPR on the water quality and habitat aspects of the re-filling or wetland restoration of Sweet Pond. | | | | |
| Coordinate with VDFPR | VDEC – MAPP & Wetlands, VFWD | ANR | Sweet Pond | |
| Objective 53: Reduce sediment impacts to Crosby Brook. | | | | |
| 1) Enlarge the capacity of the C&S stormwater pond | C&S, VDEC-Stormwater | private | 42.892878, -72.550964 | Not Started |
| 2) Address the mass failure on Black Mountain Rd. | WCNRCD, VDEC-Rivers | ERP | 42.885587, -72.565995 | Not Started |
| 3) Address erosion on Black Mountain Rd. | Town of Brattleboro | BBR | | Complete |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 4) Implement priority projects from the Corridor Plan | WCNRCD, WRC, Towns of Brattleboro & Dummerston | ERP, WG | | On-going |
| 5) Implement priority projects from Putney Road Restoration Study Project | AOT, Town of Brattleboro | Enhancement, ERP, WG, Windham Fdn | Ryan Road to Landmark Hill Driver | On-going |
| 6) Address erosion on gravel roads | Towns of Brattleboro & Dummerston | BBR, ERP | | On-going |
| Objective 55: Replace or retrofit structures prioritized in the Crosby Brook Corridor Plan. | | | | |
| 1) Ryan Road | Town of Dummerston | BBR, ERP | 42.899759, -72.551597 | Not Started |
| 2) Middle Road (upper) | Town of Dummerston | BBR, ERP | | |
| 3) Black Mountain Road | Town of Brattleboro | BBR, ERP | 42.88317, -72.563421 | |
| 4) Dickinson Road | Town of Brattleboro | BBR, ERP | 42.888716, -72.569686 | |
| Objective 56: Encourage Low Impact Development (LID) by offering development density incentives for those projects which result in reduced footprints of impervious cover. | | | | |
| Implement zoning bylaws allowing greater residential densities with the implementation of LID techniques. | RPCs, Towns, WSMD – Stormwater, VLCT | 604(b) | | Not Started |
| Objective 57: Implement recommendations of the Whetstone Brook Bacteria TMDL to control high levels of bacteria. | | | | |
| 1) Pursue and address failing or malfunctioning onsite septic systems | Town DPW, SeVWA, property owners | WG, ERP, CWSRF | Watershed-wide | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Pursue and address leaking sanitary sewer pipes | Town DPW | CWSRF | Brattleboro | Not Started |
| a) Begin testing for sanitary sewer leaks in the downtown area | | | | |
| 3) Pursue and address stormwater runoff from developed areas | Town DPW, SeVWA, property owners | ERP, WG | Brattleboro, West Brattleboro | On-going |
| 4) Pursue and address illicit discharges | Town DPW | CWSRF, ERP | Brattleboro, West Brattleboro | On-going |
| 5) Expand citizen education about the negative impacts of stormwater, with a focus on the importance of picking up after one's pet. | SeVWA, WCNRCD | WG | Watershed-wide | On-going |
| 6) Support programs that assist with the replacement or upgrading of failed onsite septic systems or expansion of the municipal wastewater system to reach more residences. | Town DPW | CWSRF | Watershed-wide | Not Started |
| Objective 58: Protect remaining floodplain and flood capacity in the Whetstone Brook watershed. | | | | |
| 1) Develop appropriate regulations to protect lands within the identified floodplain. | RPC's, Town Conservation and Planning Commissions | 604(b), MPG | Brattleboro, esp. West Brattleboro, Marlboro | On-going |
| 2) Encourage landowners to install buffers, and other tools that protect shoreland and/or riparian areas. | WCNRCD, NRCS, AAFM | T4S, CREP, WHIP, AAFM, ERP | Watershed-wide | On-going |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 3) Seek to enhance buffers through a combination of buffer plantings, land conservation, and incentive programs. | WCNRCD, NRCS, AAFM | T4S, CREP, WHIP, AAFM, ERP | Watershed-wide | On-going |
| Objective 59: Remove Tri-Park trailers in Mountain Home Park that are under agreement to be removed from the floodway. | | | | |
| 1) Coordinate development of Tri-Park Master Plan to relocate homes | VDEC – RMP, Town Planning Services Dept., Tri-Park Cooperative, ACCD | CDBG, MPG | Mountain Home Park | On-going |
| a) Priority sites: Winding Hill Rd., Brookwood Dr., and Village Dr. | | | | |
| b) include relocation schedule & funding sources | | | | |
| 2) Obtain planning grants to fund Master Plan development | Town Planning Services Dept., ACCD | CDBG, MPG | | In progress |
| 3) Remove 51 trailers from the floodplain | | HMGP | | Not Started |
| 4) Remove the berm and other structure that limit floodplain access | | ERP | | Not Started |
| Objective 60: Implement Better Backroads projects along the brook. | | | | |
| 1) Focus areas include: Hamilton Rd., Bonnyvale Rd., Guilford Rd. & Sunset Lake Rd. | Town DPWs | BBR | | On-going |
| Objective 61: Reduce sand and sediment inputs to Broad Brook. | | | | |
| 1) Work with Town to improve sand pile storage | Town DPW | Enhancement | Guilford | Not Started |
| 2) Work with Town to reduce gravel road runoff | Town DPW | BBR | | On-going |
| 3) Complete a Road Inventory and Capital Budget Plan | Town DPW | BBR | | On-going |
| Objective 62: Develop an implementation plan to address the sediment impairment in Newton Brook. | | | | |
| 1) Coordinate plan development | VDEC, AAFM, NRCDs | ANR, AAFM, WG, ERP | | Not Started |

| Action | Partners | Funding | Implementation Location | Status |
|---|---|---|---|---|
| 2) Implement plan strategies | VDEC, AAFM, NRCDs, NRCS | 319, EQIP, CREP, ERP | | |
| 3) Seek to enhance buffers through a combination of buffer plantings, land conservation, and incentive programs | WCNRCD, NRCS, AAFM | T4S, EQIP, CREP, WHIP, AAFM, ERP | | |
| 4) Implement Better Backroads projects | Municipalities | BBR | | |

Projects identified and completed after the publication of the 2014 plan:

- Reclassification to Class A(1)
    - Deerfield River and tributaries above confluence with East Branch
    - West Branch Deerfield and tributaries
    - All waters in GMNF Wilderness Areas below 2500 feet
- Deerfield Resilient Communities bi-state group formed and meeting
- RiverSmart – Deerfield River resiliency report and recommendations published by UMass - Amherst
- Deerfield Headwater Stream Management multi-agency project organized and focused on restoration of the North River
- 2015 Deerfield River Enhancement Fund awarded to the Southern Vermont Nature Museum for creation of a Deerfield River watershed museum display
- Long Island Sound -Regional Conservation Partnership Program created by 5 states providing funding for the Connecticut River watershed
- CEI Crosby Brook stormwater master plan completed
- Kettle Pond in Brattleboro monitored for the first time
- EPA Design for Resilience in Brattleboro's Whetstone Brook Corridor
- Making a Visible Difference initiative in Brattleboro focusing on flood resiliency
- Green River clean-up and restoration project (Guilford) involving removal of storm damaged/abandoned house and out-buildings, site clean-up, River Corridor Easement (RCE), site and river restoration, buffer planting
- FEMA buy-out, site restoration & RCE on property on Whetstone Brook (Brattleboro)

- Birge Street parcel (Brattleboro), purchase of floodplain parcel, completion of EPA Phase 1 ESA
- CT River Farmers Watershed Alliance created
- Green River Watershed Alliance:
    - organization created
    - outreach and education project – watershed identity workshops and walks, watershed bus tour, Rivers and Roads forums
- VTrans Methods and Tools for Transportation Resilience Planning project to develop and apply new methods that integrate river science with transportation planning, engineering and decision making in order to improve the resilience of the transportation network to damage and disruptions caused by flooding. Pilot tested in the Whetstone Brook and North Branch of the Deerfield watersheds.
- Lake Raponda: Shoreland restoration of 200 feet with bank stabilization and riparian plantings
- Johnson Dam Removal Implementation - Crosby Brook (Dummerston)
- LaRosa volunteer water quality monitoring programs:
    - Deerfield River Watershed Alliance – annually
    - Southeastern Vermont Watershed Alliance – on Whetstone Brook – annually
    - Southeastern Vermont Watershed Alliance – on Whetstone Brook temperature study & report

# Appendix B. Existing Uses in Basin 12

## Swimming

Much of the swimming in the basin takes places on the many lakes and ponds which have a presumed existing use of contact recreation.

| Waterbody | Site | Location of Use | Lat. | Long. | Town | Ownership |
|---|---|---|---|---|---|---|
| ***Deerfield River Watershed*** | | | | | | |
| Green River | Crib Dam | Timber Crib Dam below covered bridge | 42.77547 | -72.66765 | Guilford | private |
| East Branch North River | Halifax Gorge | | 42.7463 | -72.7436 | Halifax | private |
| ***Connecticut River Watershed*** | | | | | | |
| Whetstone Brook | Living Memorial Park/ Farmer's Market | Below LMP tennis BB court and behind Farmer's Market site | 42.84885 | -72.58683 | Brattleboro | Town of Brattleboro |
| Broad Brook | Fort Dummer State Park | small parking area and trail used to access a swimming hole on Broad Brook | 42.813618 | -72.563209 | Guilford | VDFRPR |

## Recreational Boating

It is the Agency's long-standing stipulation that all lakes and ponds in the basin have existing uses of boating and so only boating locations on rivers are listed below. Several locations are good whitewater or flatwater boating stretches in the basin; some highly rated by the Vermont Paddlers Association, listed in the AMC or Vermont White Water Rivers.

| Waterbody | Reach | Public Access / Put In | Lat. | Long. | Take Out | Lat. | Long. |
|---|---|---|---|---|---|---|---|
| ***Deerfield River Watershed*** | | | | | | | |
| Deerfield River | Searsburg Dam to Harriman Reservoir Class III, 4.5 miles | Below Searsburg Dam | 42.90132 | -72.95037 | Woods Rd., Wilmington | 42.865095 | -72.90313 |
| Deerfield River | Somerset Rd. bridge to Searsburg Reservoir, Class II, 5.0 miles | Somerset Rd. bridge & Castle Brook Rd. | 42.950574 | -72.98661 | Searsburg Reservoir | 42.902203 | -72.95029 |
| East Branch Deerfield River | Somerset Reservoir to Searsburg Reservoir Class I-II, 6 miles | Below Somerset Dam | 42.972011 | -72.949259 | Searsburg Reservoir | 42.902203 | -72.95029 |
| West Branch Deerfield River | Heartwellville to Readsboro Village Class V, 3.0 miles to confluence/ 5.4 miles to Tunnel St. | Howe Pond Rd. end, Readsboro | 42.802883 | -72.974512 | Tunnel St., Readsboro | 42.745236 | -72.92647 |
| North Branch Deerfield River | West Dover to Harriman Reservoir, Class I-II, 7.0 miles | Rte. 100 ROW | 42.922603 | -72.843376 | Rte. 100 | 42.868486 | -72.90413 |
| Green River | Stage Rd. to West Leyden, MA , Class II - III, 6.8 miles | Green River crib dam, Stage Rd. | 42.775614 | -72.667072 | W. Leyden Rd., West Leyden, MA | 42.698389 | -72.66512 |
| North River | Halifax Gorge: Route 112 to Route 112 Class IV(V) 3 mi | Rte. 112, 3/4 mi. north of Stowe Mountain Rd. | 42.7463 | -72.7436 | Jacksonville Rd., Colrain, MA | 42.719467 | -72.70807 |
| ***Connecticut River Watershed*** | | | | | | | |
| Connecticut River | Old Ferry Rd. to Vernon Dam Class I - II, 8 mi. | Old Ferry Road | 42.89323 | -72.53608 | Vernon Dam Portage | 42.78935 | -72.52602 |
| Connecticut River | Vernon Dam to Turners Falls Class I - II, 21.5 mi. | Gov. Hunt Recreation Area | 42.770916 | -72.515304 | Pauchaug Brook Access, MA F&W | 42.715516 | -72.45259 |

## Public Water Supply Sources

Several surface waters in the Basin serve as public drinking water supplies and are managed and protected for this use.

| Waterbody | Reach | | Supply for: | Acres |
|---|---|---|---|---|
| ***Deerfield River Watershed*** | | | | |
| Haystack Pond | Haystack Pond and all waters within its watershed in the Town of Wilmington | | Village of Wilmington water supply | 36 acres |
| Howe Pond and Howe Pond Brook | Howe Pond and all waters within its watershed. Howe Pond Brook and all waters within its watershed above the water intake, which | | Village of Readsboro water supply | 62 acres |
| ***Connecticut River Watershed*** | | | | |
| Pleasant Valley Reservoir | Pleasant Valley Reservoir and all waters in its watershed in the Town of Brattleboro. | | Village of Brattleboro water supply | 25 acres |

## Appendix C. Dams in Basin 12

| State ID # | Dam Name | Stream | Town | Surface Acres | Dam Status | Purpose | Hazard Class |
|---|---|---|---|---|---|---|---|
| 182.02 | Billings Pond | Rake Branch | Searsburg | | Breached | | Low |
| 246.02 | Binney Brook | Binney Brook | Wilmington | | Breached | | |
| 90.05 | Gates Mill | Green River | Guilford | | Breached | | |
| 164.02 | Howe Pond Upper | Howe Pond Brook | Readsboro | | Breached | | |
| 122.04 | South Pond | Pond Brook | Marlboro | | Breached | | Low |
| 243.05 | Gates Pond | East Branch North River-TR | Whitingham | 30 | Breached (Partial) | | Low |
| 164.06 | Howe Pond Lower | Howe Pond Brook | Readsboro | 56 | Breached (Partial) | Recreation | Low |
| 90.07 | Guilford-7 | Thorne Brook | Guilford | | Deleted | | |
| 201.02 | East Branch | East Branch Deerfield River | Stratton | | Removed | | |
| 191.01 | Heartwellville | West Branch Deerfield River | Readsboro | | Removed | | |
| 27.03 | Holden And Martin | Whetstone Brook | Brattleboro | | Removed | | |
| - | Ruhl | Cold Brook | Wilmington | <1 | Removed | | Low |
| 246.05 | Wilmington Reservoir | Deerfield River-OS | Wilmington | | Removed | | |
| 253.03 | Adams Reservoir | Red Mill Pond Brook | Woodford | 24 | In Service | Recreation | Significant |
| - | Beaver Brook | Beaver Brook | Wilmington | 2.9 | In Service | | |
| 122.09 | Camp Neringa | Whetstone Brook-TR | Marlboro | 1.6 | In Service | Recreation | Low |
| 61.04 | Carinthia Snow Pond | North Branch Deerfield River | Dover | 1.5 | In Service | Recreation | Low |
| 27.08 | Chestnut Hill Reservoir | Whetstone Brook | Brattleboro | 1.1 | In Service | Recreation | High |
| 91.01 | Deer Park Pond | Green River-TR | Halifax | 22 | In Service | Recreation | Low |
| 90.03 | Franklin Site No. 1 | Falls River-TR | Guilford | 4 | In Service | | Low |
| 90.08 | Guilford-8 | Broad Brook | Guilford | 0.5 | In Service | | Low |

| State ID # | Dam Name | Stream | Town | Surface Acres | Dam Status | Purpose | Hazard Class |
|---|---|---|---|---|---|---|---|
| 243.01 | Harriman | Deerfield River | Whitingham | 2157 | In Service | Hydroelectric | High |
| 122.03 | Hidden Lake | Marlboro Branch-TR | Marlboro | 19 | In Service | Recreation | Low |
| 122.08 | Hidden Lake Dike | Whetstone Brook | Marlboro | 19 | In Service | Recreation | Low |
| 243.06 | Jacksonville Pond | East Branch North River-TR | Whitingham | 17 | In Service | Other | High |
| 243.02 | Lake Clara | Lake Sadawga-TR | Whitingham | 15 | In Service | Recreation | High |
| 246.01 | Lake Raponda | Bill Brook | Wilmington | 116 | In Service | Recreation | Low |
| 243.03 | Lake Sadawga | Harriman Reservoir-TR | Whitingham | 194 | In Service | Recreation | High |
| 243.11 | Lake Sadawga West Dike | Harriman Reservoir-TR | Whitingham | 202 | In Service | Recreation | High |
| 243.09 | Laurel Lake | East Branch North River-TR | Whitingham | 18 | In Service | | Low |
| 253.01 | Little Pond | Little Pond Brook | Woodford | | In Service | | Low |
| 214.02 | Mill Pond | Connecticut River - TR | Vernon | 0.25 | In Service | | Low |
| 122.05 | Mill Pond | Whetstone Brook | Marlboro | 8 | In Service | Recreation | Significant |
| 246.04 | Mirror Lake | Cold Brook-TR | Wilmington | 3 | In Service | Recreation | Low |
| 246.07 | Mirror Lake Diversion Structure | Cold Brook | Wilmington | 0 | In Service | | |
| 243.07 | North | No. 9 Brook-TR | Whitingham | 26 | In Service | Recreation | Low |
| 61.03 | North Branch Fire District No. 1 | Ellis Brook-TR-OS | Dover | 7 | In Service | Other | Significant |
| 27.01 | Pleasant Valley Reservoir | Whetstone Brook-TR | Brattleboro | 25 | In Service | Water Supply | High |
| 243.12 | Purjes | No. 9 Brook-TR | Whitingham | 2.6 | In Service | | Low |
| 164.07 | Readsboro Reservoir | Howe Pond Brook | Readsboro | 0.06 | In Service | Water Supply | Low |
| 253.02 | Red Mill Pond | Red Mill Pond Brook | Woodford | 5 | In Service | | Low |
| 253.10 | Red Mill Pond Dike | Red Mill Pond Brook | Woodford | 5 | In Service | | Low |
| 243.04 | Ryder Pond | East Branch North River | Whitingham | 14 | In Service | Recreation | Significant |

| State ID # | Dam Name | Stream | Town | Surface Acres | Dam Status | Purpose | Hazard Class |
|---|---|---|---|---|---|---|---|
| 182.01 | Searsburg | Deerfield River | Searsburg | 25 | In Service | Hydroelectric | High |
| 243.08 | Shippee Pond | Hager Brook | Whitingham | 24 | In Service | Recreation | Significant |
| 90.04 | Sibley | Green River | Guilford | 0.9 | In Service | | Low |
| 61.01 | Snow Lake | North Branch Deerfield River | Dover | 8 | In Service | Recreation | High |
| 191.01 | Somerset | East Branch Deerfield River | Somerset | 1597 | In Service | Hydroelectric | High |
| 246.03 | Spruce Lake | Beaver Brook-TR | Wilmington | 15 | In Service | Recreation | Low |
| 195.02 | Stamford Pond | Reservoir Brook | Stamford | 10.6 | In Service | | Low |
| 90.01 | Sweet Pond | Keets Brook | Guilford | 18 | In Service | Recreation | High |
| 214.03 | Vernon | Connecticut River | Vernon | | In Service | Hydroelectric | |
| 214.01 | Vernon Fish Hatchery Pond | Newton Brook | Vernon | 8 | In Service | Recreation | Low |
| 90.02 | Weatherhead Hollow Pond | Shattuck Brook | Guilford | 33 | In Service | Recreation | Significant |
| 246.06 | West Lake | Cold Brook-TR | Wilmington | 11.6 | In Service | Snowmaking | High |
| 91.02 | Harrisville Mill | Green River | Halifax | 2 | In Service | Hydroelectric | |
| 80.01 | Ricker | Glastenbury River | Glastenbury | | Unknown | | |

## Appendix D. Fisheries Assessment of Basin 12

NOTE: Data for this report was collected and analyzed by the Vermont Fish and Wildlife Department. A very limited amount od USFS fisheries data is included at the sole discretion of VFWD staff.

VERMONT

**State of Vermont** *Agency of Natural Resources*
**Fish & Wildlife Department**
100 Mineral Street, Suite 302 [cell] 802-777-0827
Springfield, VT 05156-3168 [fax] 802-885-8890
www.vtfishandwildlife.com [email] lael.will@vermont.gov

# Memorandum

TO: Marie Caduto, Watershed Coordinator

FROM: Lael Will, Fisheries Biologist

DATE: 02/07/2019

SUBJECT: Deerfield Watershed and lower Connecticut Tribs (Basin 12) Fisheries Assessment

***Deerfield Watershed Fisheries:***

The Deerfield watershed and southern tributaries to the Connecticut River provide habitat for a variety of warm and cold-water species (Table 1). The waterbodies in the Deerfield watershed include large reservoirs serving for hydropower operation, lakes and ponds which provide warmwater fisheries, small headwater streams providing cold-water habitat for trout, and large tributary streams. This diversity in habitat types promotes a range of fishing opportunities throughout the basin.

- ***Large Reservoirs***

One of the more profound characteristics of the Deerfield relates to the number of impoundments operated for hydropower. Somerset, Searsburg, Harriman, and Sherman are all part of a hydro power complex within the Deerfield. While these reservoirs interrupt natural stream processes, they also provide habitat for a variety of species and are popular recreational fisheries. Harriman and Somerset are the two largest reservoirs in the Basin (Figure 1). Somerset Reservoir is a 1568-acre impoundment which serves to store water for hydropower production. Much of the land surrounding the reservoir is owned by the US Forest Service and the hydro company (currently Great River Hydro). The reservoir provides habitat for a variety of species including smallmouth bass, yellow perch, rock bass, pumpkinseed and stocked brook trout (Table 2). In 2015, the reservoir was sampled to monitor the smallmouth bass population using standardized boat electrofishing methods. These surveys

indicated that catch rates were 23 fish/hour. Compared to other waterbodies in the southern portion of the state, these catch rates are below the average of 40 fish/hour for smallmouth bass for District 1 (Table 3). Water quality at the time of sampling indicated low pH (5.62) and low conductivity (17.2 Ms/cm) which can indicators productivity.

During the spring of 2018 an angler survey was conducted at Somerset to examine fishing pressure (angler hours) and catch/harvest rates (fish/hour) of targeted fish such as smallmouth bass and stocked brook trout. Mean catch rates (during the survey period) of smallmouth and stocked brook trout were 0.96 and 1.46 fish/hour respectively. These data indicate that overall catch rates for these species are good, and Somerset provides a popular recreational fishery.

Harriman reservoir is a 1700-acre reservoir that also serves to provide hydropower and is subject to seasonal drawdowns. Harriman provides diverse year-round fishing opportunities and is a popular ice fishing location. The reservoir has self-sustaining populations of rainbow smelt, smallmouth bass, pumpkinseed, rock bass and chain pickerel, as well as other native species (Table 2). The reservoir is also stocked annually with brook trout, brown trout, rainbow trout, Atlantic salmon, and lake trout. Brown trout have also been reported to reproduce naturally in the tributary waters entering Harriman. Similar to Somerset, smallmouth bass catch rates from 2018 sampling indicated below average catch rates of 35 fish/hour (Table 3).

- ***Lakes and Ponds***

The basin also includes several other popular lakes and ponds including Sherman Reservoir, Lake Raponda, Lake Sadawga, South Pond, and Weatherhead Holllow. Sherman Reservoir straddles Vermont and Massachusetts and is known for producing large brown trout, which are stocked annually. Similarly, South pond is primarily sustained by stocked trout (Table 2). Lake Raponda provides habitat for self-sustaining largemouth and smallmouth bass populations. Bass electrofishing surveys conducted in 2018 indicated that smallmouth bass catch rates are above average in Lake Raponda when compared to other waterbodies in the southern portion of the state (Table 3). Other largemouth bass fisheries in the Basin include Lake Sadawga, and Weatherhead Hollow (Tables 2 and 4). Of note is that American eel a Species of Greatest Conservation Need (SGCN) was observed in Weatherhead Hollow during electrofishing surveys conducted in 2013.

- ***Small headwater streams***

Small headwater streams that provide habitat for native brook trout are found throughout the basin (Figures 2-3). Many of these streams are sampled routinely to monitor trout populations throughout the District (Figure 4). A subset of these sites are monitored annually for stream temperatures and trout populations (Figure 5). Trout population data in Basin 12 from 2000-2018 was analyzed to characterize abundances of trout throughout the Basin. A total of 37 sites from 21 streams were included in the analysis. Population metrics included an estimated total (all size classed combined) number of trout per mile based on standardized electrofishing surveys. For sites that included multiple sampling events during this period, a mean was taken. Overall total fish per mile (all size classes combined) ranged from 0 to 3114 for brook trout and 0 to 796 for brown trout (Table 5). Median abundances were 351, and 0 (trout/mile) for brook and brown trout respectively. Estimated mean abundances were 648 and 91 for brook and brown trout respectively (Table 5). Overall, these abundances were similar than the mean abundance of 622 and 164 brook and brown (trout/mile) when compared to 223 sites located throughout the District (Table 6). Streams that had relatively high (~1000 fish/mile) trout abundances (based on data from 2000-2018) included Bond Brook, Broad Brook, Cold Brook, Deerfield mainstem ~~(i.e. Harriman bypass),~~ Haystack Brook, Lamb Brook, Oak Brook, and Scooter Brook, and West Branch Deerfield (Table 5). It should be noted that trout abundances are highly variable and can be influenced by several factors, with stream temperatures being the most profound.

- ***Large Tributary Streams***

Large tributary streams include the North Branch Deerfield, East Branch Deerfield, Mainstem Deerfield, Whetstone Brook, Broad Brook and the Green River. The operations of Somerset, Searsburg, Harriman and Sherman, which are under FERC licenses, govern the flow regime in the receiving waters including the East Branch, and mainstem Deerfield. The flow regime within the East Branch is relatively flat, governed by seasonal minimum flows (9-12 cfs May-Sept; 30-48 Oct-Apr) and strict up/down ramping rates during periods of drawdown. Thus, the East Branch Deerfield below Somerset is a hydrologically altered system, primarily due to its lack of natural floods, which may be augmented by tributaries. It is not subject to daily peaking cycles or major low-flow extremes, and in many respects presents a benign flow condition. However, it is unclear how the loss of floods and/or the presence of the dam has affected river morphology below Somerset Reservoir, and whether this exacerbates the

system's naturally low productivity. Similarly, Searsburg releases a minimum flow of 35 (June 1-September 30), 55 (October 1-May 31) or 175 cfs (April 20-May 15) or inflow if less, and Harriman releases a minimum flow of 70 cfs (October 1-June 30) and 57 cfs (July 1-September 30) or inflow if less. There will be an opportunity to re-visit the current flow regime and potentially modify it to mimic more natural conditions during the FERC relicensing process, which is expected to commence in 2032.

Fish production downstream of Somerset and within the Harriman bypass, is presumed to be inhibited by the cold-water discharge from the dam (VANR 2014). Trout sampling below Somerset Reservoir took place in 1990 and in 2017 at two sites (Table 7). Based on these data, trout populations were low in both years, and 2017 had lower trout abundances than 1990. Only 67 trout/mile were estimated at the upper reach and 135 trout/mile estimated in the lower reach in 2017. In 2017, the Forest Service also conducted trout sampling within the Deerfield watershed near Somerset (Table 8). Total trout population estimates in these streams ranged from 11 to 530 trout/mile. These results indicate that even in undeveloped watersheds, in the absence of a major dam, trout productivity is on the low to mid-range for the region.

To examine longitudinal temperature gradients in these reaches, we collected basic water quality parameters (temperature, dissolved oxygen, pH and conductivity) above and below Somerset, Searsburg, and Harriman Reservoirs (Table 9; Figures 6-7). Replicate samples were collected in July and September (Table 9). Downstream of Somerset, stream temperatures were below the optimal range (13-18 °C) for brook trout for approximately ½ mile downstream of the dam (Figure 7). Stream temperatures, however, were within the optimal range for the remainder of the reach, as well as below Searsburg (Figure 7). Dissolved oxygen, and pH readings appeared to be within adequate ranges for brook trout at all sample locations (Table 9). It should be noted that these were point measurements and should be interpreted as such. To further evaluate the issues, full season (June 1 – Oct 1) temperature monitoring would provide a more robust dataset from which to draw conclusions.

Although these coldwater releases may result in sub-optimal conditions for trout growth immediately below the project, these preliminary data indicate that the affected reach is relatively short. Moreover, deep water outlet structures can provide beneficial coldwater releases below hydroelectric projects which create temperature regimes suitable for year-round survival of trout (Walters et al. 1997). Consistent coldwater releases can be

particularly important in light of climate change predictions as these releases also extend and enhance coldwater habitats and fisheries further downstream. As such, broader trout fisheries benefits may be realized and outweigh localized impacts.

The North Branch Deerfield and tributaries are generally influenced by land use development including two ski resorts and agriculture. Ski resorts, while economically and recreationally important, result in intense development along mountainsides and within headwater areas including clearing for ski trails and construction of associated infrastructure. Excessive culverting, unnatural snowpack, flow alterations, reduced riparian areas, and sediment runoff can degrade water quality, impact natural stream processes, and threaten aquatic populations. As such, many of the waters associated with ski resorts have been listed as impaired or stressed; thus requiring remediation plans (https://dec.vermont.gov/watershed/map/assessment).

Currently the North Branch flows through a snow-making pond located at Mount Snow (Snow Lake, which likely influences stream temperatures, and blocks access to upstream habitats. Trout population sampling indicate low trout abundances in the North Branch Deerfield where sampling occurred at the resort (Table 5). However, these data are dated, and sampling did not occur in the upper reaches, outside the influence of the resort.

Tributaries to the North Branch Deerfield such as Cold Brook are also influenced by snow-making due to two intakes, one located at the Hermitage and one located downstream for Mount Snow. While streamflow protection oversees conservation flows to protect aquatic resources, the structures themselves can influence movement during certain times of the year. For example, the structure located at the Hermitage is a complete barrier, while the structure located downstream is likely a partial barrier. Despite these perturbations, Cold Brook has relatively good trout abundances, and stream temperatures appear to be suitable for brook trout (Figure 8).

Tributaries to the Connecticut River include the Green River, Broad Brook and the Whetstone. All three of these streams are sampled annually to monitor trout populations concurrently with stream temperatures (Figures 9-11; Table 10). All three streams can be generally characterized as being relatively warm with low to moderate abundances of

trout. Brown trout are typically more abundant in the Whetstone. In the year 2016, stream temperatures were relatively high and trout abundances responded as such.

In sum, trout production can be influenced by many factors including food availability, water chemistry, temperature and available habitat. Trout production appears to be limited throughout the region due to natural causes such as water chemistry, stream temperatures, and in certain areas may be further impacted by flow alterations and post-Irene alterations within the system. Tributary streams provide greater trout abundances and stocking supplements catchable sized trout to support a moderate recreational fishery. Efforts to improve aquatic passage, protect riparian corridors, and re-evaluate the flow regime during the FERC relicensing process, and restoring Post-Irene reaches are management tools that could be applied to the Deerfield watershed, and tributaries to the Connecticut River.

***Fish Stocking***

The Department stocks trout where fishing opportunities exist but cannot be maintained by natural reproduction alone. Currently, the mainstem of the Deerfield is stocked with yearling brook trout along Somerset Road, and with yearling rainbow trout along Rte 9. The West Branch Deerfield is also stocked with yearling brook trout. Fishing opportunities via stocked fish are also provided at Somerset, Searsburg, Adams Reservoir, Red Mill Pond, Harriman, Sherman Reservoir, South Pond, Lake Raponda, and Stratton Pond.

***Tropical storm Irene***

Tropical storm Irene occurred in August of 2011and resulted in the deposition of over six inches of rain in the central and south-eastern portion of Vermont. As a result, hundreds of bridges, road segments, culverts, homes and other infrastructure suffered severe damage, and were in need of immediate repair. Post-flood activities required stream alteration to protect life and property and rebuild critical transportation infrastructure (Lunderville 2011). However, much of the in-stream work resulted in the widening, deepening and straightening of stream channels. In some cases, in-stream wood was removed, stream banks were bermed, and stream bed elevations were raised. As a result, aquatic habitats including a diversity of substrate types, depths, flows, and cover, necessary to support healthy fish populations, suffered severe negative impacts. In 2012, staff conducted roadside assessment of instream habitat degradation throughout the central and southern portion of Vermont (Kirn 2012). An estimated 77

miles of streams were identified as being degraded from post-flood stream alteration activities. As such, the Department has been actively working to restore reaches to more natural conditions. For example, the Whetstone was recently restored to remove an over-abundance of bed armoring which resulted in subsurface flows. Efforts to continue stream restoration in these reaches are paramount as it may take decades before these streams recover.

**Management Recommendations:**

1. **Protect riparian corridors:** Undisturbed, naturally vegetated buffer strips are extremely important in maintaining cool water temperatures and stable streambanks, filtering pollutants and providing food and shelter for fish and other aquatic organisms. These benefits are realized not only within the protected stream reach, but also in its downstream receiving waters. Providing outreach and education to private landowners on the benefits of riparian corridors would also benefit streams and should be promoted. Considering the amount of conserved lands within the upper portion of the watershed efforts should continue to protect these lands and associated riparian corridors.

2. **Improve aquatic habitat connectivity:** Maintaining a connected system allows fish to seek the best available habitat for reproductive needs, food resources, thermal refuge and cover. Aquatic connectivity also allows for the recolonization of upstream habitats after catastrophic events, such as floods or toxic discharges. Furthermore, free movement within a river system helps to maintain genetic diversity of aquatic populations. During periods of stressful environmental conditions, fish will often migrate to cold-water refuges such as the mouths of tributary streams or to areas of groundwater inflow during warm periods. Providing aquatic connectivity by evaluating and replacing culverts which impede access to the cooler tributaries would benefit native trout species that have the propensity to seek thermal refuge in the warm summer months.

3. **Improve flood resiliency and restore post-Irene impacts.** Post-Tropical Storm Irene impacts, including berming, instream channelization, and removal of instream cover including boulders and wood inevitably impacted aquatic biota within the Deerfield watershed. Restoring instream complexity and access to floodplains would improve the overall quality of the system, leading to positive

impacts on fish populations (Kirn 2012). Efforts should be made to identify sites and restore these reaches back to natural conditions.

4. **Where flows are regulated, promote the natural flow regime:** Maintaining or improving flow management at hydroelectric, storage, and existing flood control facilities would benefit downstream species. Rapid fluctuations in flows can strand fish or displace them downstream. Fluctuations may also expose or destroy spawning areas containing eggs or newly hatched fish. Conversely, reduced peak discharges and generally stable flows produced by regulated water releases from flood control or storage reservoirs inevitably impact natural stream processes including channel morphology and substrate composition.

5. **Help stop the spread of exotic species and pathogens:** A variety of non-native fish species and harmful pathogens are present in Vermont or surrounding states. Preventing future introductions of these exotic species and pathogens will allow healthy fisheries to continue.

6. **Protect water quality.** Maintaining clear, cold, and well-oxygenated water is an important habitat requirement for trout. Activities that can have negatives impacts to water quality (i.e. sediment discharges), should be avoided and/or minimized through evaluation of proposed projects. Considering VTFWD biologists provide input into several state-issued permits including stream alteration, and water quality certifications efforts to protect water quality are accomplished through several avenues. Additional efforts by interested partners to work with private landowners on riparian land stewardship will compliment state and federal regulatory efforts.

7. **Identify and designate B1 High Quality Fishing – Wild Salmonid Streams** 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. Streams designated as B1 are provided with better protections. Based on VTFWD data, streams that could potentially meet (more sampling needed) the B1 criteria are: Scooter, Negus, Cheney, Blue Brook, West Branch Deerfield, Fall, Hager, South Branch Deerfield, Cold Brook, Haystack, and Oak Brook, Broad Brook,

Whetstone[37]. Other streams may be potential candidates but have not been sampled.

[1] Some of the sites listed are not included in Table 5 because they were sampled prior to 2000 and would therefore need to be sampled again per B1 criteria. Data from outside sources are not included at this time.

**Literature Cited**

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Table 1. Fish species reported to occur in Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | Deerfield River | Green River | North River | Fall River | Broad Brook | Crosby Brook | Whetstone \ Brook | Newton Brook |
|---|---|---|---|---|---|---|---|---|---|
| American eel | *Anguilla rostrata* | X | X | | X | | | | |
| Atlantic salmon* | *Salmo salar* | X | X | X | | | | | |
| Banded killifish | *Fundulus diaphinus* | | X | | | | | | |
| Blacknose dace | *Rhinichthys atratulus* | X | X | X | X | X | X | X | X |
| Bluegill | *Lepomis macrochirus* | X | | X | X | | | | |
| Brook trout | *Salvelinus fontinalis* | X | X | X | X | X | X | X | X |
| Brown bullhead | *Ameiurus nebulosus* | X | X | X | X | X | | | |
| Brown trout | *Salmo trutta* | X | X | X | | X | | X | X |
| Chain pickerel | *Esox niger* | X | | X | | | | | |
| Common shiner | *Luxilus cornutus* | X | X | X | | X | | | |
| Creek chub | *Semotilus atromaculatus* | X | X | X | X | X | X | X | |

Table 1. Fish species reported to occur in Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | Deerfield River | Green River | North River | Fall River | Broad Brook | Crosby Brook | Whetstone \Brook | Newton Brook |
|---|---|---|---|---|---|---|---|---|---|
| Fallfish | *Semotilus corporalis* | X | X | X | | | | | |
| Fathead Minnow | *Pimephales promelas* | | | | | | | | X |
| Golden shiner | *Notemigonus crysoleucas* | X | X | | | | X | | |
| Lake trout* | *Salvelinus namaycush* | X | | | | | | | |
| Largemouth bass | *Micropterus salmoides* | X | X | | X | | | X | |
| Longnose dace | *Rhinichthys cataractae* | X | X | X | X | X | X | X | |
| Longnose sucker | *Catostomus* | X | | | | X | | X | |
| Mimic shiner | *Notropis volucellus* | X | X | | | | | | |
| Pumpkinseed | *Lepomis gibbosus* | X | | X | X | | | | |
| Rainbow smelt | *Osmerus mordax* | X | X | | | | | | |
| Rainbow trout* | *Oncorynchus mykiss* | X | X | X | | X | X | | |

Table 1. Fish species reported to occur in Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | Deerfield River | Green River | North River | Fall River | Broad Brook | Crosby Brook | Whetstone \Brook | Newton Brook |
|---|---|---|---|---|---|---|---|---|---|
| Rock bass | *Ambloplites rupestris* | X | | | | | | | |
| Slimy sculpin | *Cottus cognatus* | X | X | | X | X | X | X | |
| Smallmouth bass | *Micropterus dolomieui* | X | | | | | | | |
| Tessellated darter | *Etheostoma olmstedi* | | | X | | | | | |
| White sucker | *Catostomus commersoni* | X | X | X | | X | | X | |
| Yellow perch | *Perca flavescens* | X | | X | X | | | | |

Table 2. Fish species reported to occur in ponds within Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | DEERFIELD RIVER | | | | | | | | | | GREEN RIVER | FALL RIVER |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Mainstem | | | | | Middle Mainstem | | | Lower Mainstem | | Mainstem | Mainstem |
| | | Grout Pond | Somerset Reservoir | Adams | Red Mill Pond | Searsburg Reservoir | Lake Raponda | Lake Sadawga | Harriman Reservoir | Howe Pond | Sherman Reservoir | South Pond | Weatherhead Hollow Pond |
| American eel | *Anguilla rostrata* | | | | | | | | | | | | X |
| Atlantic salmon* | *Salmo salar* | | | | | | | | X | | | | |
| Banded [illegible] | *Fundulus diaphinus* | | | | | | | | | | | X | |
| Blacknose [illegible] | *Rhinichthys atratulus* | | | | | | | | | | | X | X |
| Bluegill | *Lepomis macrochirus* | | | | | | X | | | | | | X |
| Brook trout* | *Salvelinus fontinalis* | | X | X | X | X | | | X | | | X | X |
| Brown [illegible] | *Ameiurus nebulosus* | X | X | X | X | X | X | X | X | X | X | X | X |
| Brown trout | *Salmo trutta* | | | | | | | | X | | X | X | |

Table 2. Fish species reported to occur in ponds within Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | DEERFIELD RIVER | | | | | | | | | | GREEN RIVER | FALL RIVER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Mainstem | | | | | Middle Mainstem | | | Lower Mainstem | | Mainstem | Mainstem | |
| | | Grout Pond | Somerset Reservoir | Adams | Red Mill Pond | Searsburg Reservoir | Lake Raponda | Lake Sadawga | Harriman Reservoir | Howe Pond | Sherman Reservoir | South Pond | Weatherhead Hollow Pond | |
| Chain | *Esox niger* | X | X | | | | X | X | X | X | X | | X | |
| Common | *Luxilus cornutus* | | | X | | | | | | | | | | |
| Creek chub | *Semotilus atromaculatus* | | | | X | | | | | | | | | |
| Fallfish | *Semotilus corporalis* | | X | | | | | | X | | X | | | |
| Golden shiner | *Notemigonus crysoleucas* | X | X | X | X | | X | | X | | X | X | | |
| Lake trout * | *Salvelinus namaycush* | | | | | | | | X | | | | | |

Table 2. Fish species reported to occur in ponds within Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | DEERFIELD RIVER | | | | | | | | | | GREEN RIVER | FALL RIVER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Mainstem | | | | | Middle Mainstem | | | Lower Mainstem | | Mainstem | Mainstem | |
| | | Grout Pond | Somerset Reservoir | Adams | Red Mill Pond | Searsburg Reservoir | Lake Raponda | Lake Sadawga | Harriman Reservoir | Howe Pond | Sherman Reservoir | South Pond | Weatherhead Hollow Pond | |
| Largemouth bass | *Micropterus salmoides* | | | | | | X | X | | | | | X | |
| Longnose | *Rhinichthys cataractae* | | | | | | | | | | | | | |
| Longnose sucker | *Catostomus* | | | X | | X | | | X | | X | X | | |
| Mimic shiner | *Notropis volucellus* | | | | | | | | X | | | X | | |
| Northern Pike | *Esox lucius* | | | | | | | | | X | | | | |
| Pumpkinseed | *Lepomis gibbosus* | X | X | | | | | X | X | X | | | X | |
| Rainbow | *Osmerus mordax* | | | | | | | | X | | X | X | | |

Table 2. Fish species reported to occur in ponds within Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | DEERFIELD RIVER | | | | | | | | | | GREEN RIVER | FALL RIVER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Mainstem | | | | | Middle Mainstem | | | Lower Mainstem | | Mainstem | Mainstem | |
| | | Grout Pond | Somerset Reservoir | Adams | Red Mill Pond | Searsburg Reservoir | Lake Raponda | Lake Sadawga | Harriman Reservoir | Howe Pond | Sherman Reservoir | South Pond | Weatherhead Hollow Pond | |
| Rainbow | *Oncorynchus mykiss* | | X | | | | X | | X | | X | X | | |
| Rock bass | *Ambloplites rupestris* | X | X | | | | X | X | X | | X | | | |
| Slimy sculpin | *Cottus cognatus* | | | | | | | | | | | | | |
| Smallmouth bass | *Micropterus dolomieui* | X | X | | | | X | | X | | X | | X | |
| Tessellated darter | *Etheostoma olmstedi* | | | | | | | | | | | | | |
| White sucker | *Catostomus commersoni* | X | X | | X | X | | | X | X | X | X | X | |

Table 2. Fish species reported to occur in ponds within Basin 12. Species followed by an asterisk indicate populations are dependent upon stocking hatchery produced fish.

| Common name | Scientific name | DEERFIELD RIVER | | | | | | | | | | GREEN RIVER | FALL RIVER | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Upper Mainstem | | | | | Middle Mainstem | | | Lower Mainstem | | Mainstem | Mainstem | |
| | | Grout Pond | Somerset Reservoir | Adams | Red Mill Pond | Searsburg Reservoir | Lake Raponda | Lake Sadawga | Harriman Reservoir | Howe Pond | Sherman Reservoir | South Pond | Weatherhead Hollow Pond | |
| Yellow perch | *Perca flavescens* | X | X | | | X | X | X | X | X | X | X | X | |

Table 3. Total Smallmouth Bass CPUE (fish/hr) collected in District 1 during standard electrofishing surveys mid-90's to present. For multiple years an average was taken.

| Lake | Total CPUE (fish/hr) |
|---|---|
| Amherst Lake | 51 |
| Echo Lake | 23 |
| Harriman | 35 |
| Lake Raponda | 88 |
| Rescue Lake | 17 |
| Retreat Meadows | 8 |
| Townshend | 77 |
| Somerset | 23 |
| MEAN | 40 |

Table 4. Total Largemouth Bass CPUE (fish/hr) collected in District 1 during standard electrofishing surveys mid-90's to present.

| Lake | Total CPUE (fish/hr) |
|---|---|
| Bullhead | 53 |
| Echo | 5 |
| Gale Meadows | 20 |
| Lowell | 25 |
| Mill (Windsor) | 50 |
| Raponda | 7 |
| Retreat Meadows | 48 |
| Rescue | 11 |
| Sadawga | 36 |
| Shaftsbury | 30 |
| Stoughton | 93 |
| Weatherhead Hollow | 105 |

Table 5. Basin 12 trout population data, presented as total trout per mile, collected 2000-2018. For multi-year sampling a mean was taken. Asterix indicates data not collected by VTFWD. Highlight indicates potential B1 stream.

| Stream | Site | Year sampled | Latitude | Longitude | Brook Trout | Brown Trout | Total |
|---|---|---|---|---|---|---|---|
| Blue brook | Blue2119 | 2016 & 2018 | 42.983638 | -72.885518 | 928 | 0 | 928 |
| Bond Brook* | Bond1870 | 2017 | 42.883199 | -72.956156 | 1945 | 0 | 1945 |
| Broad Brook | Broad459 | 2007, 2013-2018 | 42.801231 | -72.598923 | 778 | 386 | 1164 |
| | Broad535 | 2007 | 42.809086 | -72.610405 | 464 | 39 | 503 |
| Cheney Brook | Cheney1791 | 2018 | 42.948994 | -72.843483 | 212 | 505 | 717 |
| Cold Brook | Cold1837 | 2003 | 42.928383 | -72.888802 | 351 | 0 | 351 |
| | Cold 3.4 | 2015-2016 | 42.92286 | -72.88507 | 1310 | 0 | 1310 |
| | Cold2.2 | 2016 | 42.915499 | -72.882112 | 706 | 0 | 706 |
| | Cold3.0 | 2016 | 42.922844 | -72.885166 | 635 | 0 | 635 |
| East Branch North River | EastBranchNorth1236 | 2003 | 42.784576 | -72.812508 | 21 | 0 | 21 |

Table 5. Basin 12 trout population data, presented as total trout per mile, collected 2000-2018. For multi-year sampling a mean was taken. Asterix indicates data not collected by VTFWD. Highlight indicates potential B1 stream.

| Stream | Site | Year sampled | Latitude | Longitude | Brook Trout | Brown Trout | Total |
|---|---|---|---|---|---|---|---|
| | EastBranchNorth1340 | 2010, '13, '14, '16 | 42.795578 | -72.82119 | 271 | 0 | 271 |
| | EastBranchNorth859 | 2008 | 42.746941 | -72.747223 | 172 | 0 | 172 |
| Ellis Brook | Ellis1595 | 2008 | 42.924465 | -72.840759 | 47 | 31 | 78 |
| Green River | Green560 | 2003 | 42.741741 | -72.672935 | 44 | 0 | 44 |
| | Green757 | 2013-2018 | 42.78883 | -72.667953 | 183 | 0 | 183 |
| GreenTrib Brook | GreenTrib890 | 2003 | 42.774506 | -72.68277 | 372 | 0 | 372 |
| Halladay Brook | Halladay522 | 2008 | 42.868744 | -72.619949 | 248 | 109 | 357 |
| Deerfield River[38] | HarrimanBypass1316 | 2000-2003 | 42.790096 | -72.919594 | 1784 | 8 | 1792 |
| Haystack Brook | Haystack0.1 | 2015-2016 | 42.91695 | -72.88335 | 1490 | 0 | 1490 |

[38] While sampling in the Harriman bypass indicated potential B1 designation, sampling occurred just after flows were restored and transplantation efforts of brook trout occurred. Therefore, these estimates may not be representative of current conditions within that reach.

Table 5. Basin 12 trout population data, presented as total trout per mile, collected 2000-2018. For multi-year sampling a mean was taken. Asterix indicates data not collected by VTFWD. Highlight indicates potential B1 stream.

| Stream | Site | Year sampled | Latitude | Longitude | Brook Trout | Brown Trout | Total |
|---|---|---|---|---|---|---|---|
| Lamb Brook* | Lamb1750 | 2017 | 42.815324 | -72.972733 | 2805 | 0 | 2805 |
| | Lamb1970 | 2005 | 42.823231 | -72.967926 | 88 | 0 | 88 |
| Medbury Brook* | Medbury1630 | 2017 | 42.868554 | -72.933952 | 656 | 0 | 656 |
| North Branch Deerfield | NorthBranchDeerfield1600 | 2008 | 42.923759 | -72.844688 | 11 | 0 | 11 |
| | NorthBranchDeerfield1745 | 2008 | 42.947548 | -72.86834 | 13 | 7 | 20 |
| | NorthBranchDeerfield1837 | 2003 | 42.954277 | -72.882729 | 77 | 0 | 77 |
| | NorthBranchDeerfield1928 | 2003 | 42.968857 | -72.892426 | 598 | 0 | 598 |
| Oak Brook | Oak0.1 | 2015 | 42.92532 | -72.88763 | 1753 | 0 | 1753 |
| Rake Brook* | Rake2150 | 2017 | 42.884891 | -73.009135 | 111 | 0 | 111 |
| Scooter Brook | Scooter295 | 2000 | 42.754749 | -72.517929 | 1427 | | 1427 |

Table 5. Basin 12 trout population data, presented as total trout per mile, collected 2000-2018. For multi-year sampling a mean was taken. Asterix indicates data not collected by VTFWD. Highlight indicates potential B1 stream.

| Stream | Site | Year sampled | Latitude | Longitude | Brook Trout | Brown Trout | Total |
|---|---|---|---|---|---|---|---|
| Unnamed Brook | Unnamed1920 | 2017 | 42.830345 | -72.980388 | 427 | 0 | 427 |
| West Branch Deerfield | WestBranchDeerfield1520 | 2013 | 42.789501 | -72.96093 | 226 | 211 | 437 |
| | WestBranchDeerfield1815 | 2016 | 42.84606 | -72.98991 | 3114 | 163 | 3277 |
| | WestBranchDeerfield1575 | 2014-2017 | 42.794342 | -72.966064 | 358 | 735 | 1093 |
| Whetstone Brook | Whetstone241 | 2003 | 42.851017 | -72.558662 | 0 | 171 | 171 |
| | Whetstone328 | 2013-2018 | 42.848763 | -72.578423 | 127 | 796 | 923 |
| | Whetstone500 | 2008 | 42.86702 | -72.615074 | 117 | 0 | 117 |
| | Whetstone525 | 2008 | 42.866055 | -72.621201 | 89 | 20 | 109 |
| | | | | | | | 0 |
| | | | | **Mean** | **648** | **91** | **733** |
| | | | | **Max** | **3114** | **796** | **3277** |

Table 5. Basin 12 trout population data, presented as total trout per mile, collected 2000-2018. For multi-year sampling a mean was taken. Asterix indicates data not collected by VTFWD. Highlight indicates potential B1 stream.

| Stream | Site | Year sampled | Latitude | Longitude | Brook Trout | Brown Trout | Total |
|---|---|---|---|---|---|---|---|
| | | | | **Median** | **351** | **0** | **437** |

Table 6. Summary statistics of total trout per mile from 223 sites throughout the District including data from 2000-2018. Data provided as a comparison of trout populations in the Deerfield basin versus 233 representative sites throughout southeastern Vermont.

| Total | | BKT | | BNT | |
|---|---|---|---|---|---|
| Mean | 793 | Mean | 622 | Mean | 164 |
| Standard Error | 61 | Standard Error | 54 | Standard Error | 32 |
| Median | 516 | Median | 348 | Median | 0 |
| Mode | 0 | Mode | 0 | Mode | 0 |
| Standard Deviation | 910 | Standard Deviation | 806 | Standard Deviation | 477 |
| Sample Variance | 827259 | Sample Variance | 649136 | Sample Variance | 227641 |
| Kurtosis | 13 | Kurtosis | 22 | Kurtosis | 50 |
| Skewness | 3.0 | Skewness | 4 | Skewness | 6 |
| Range | 7260 | Range | 7260 | Range | 4933 |
| Minimum | 0 | Minimum | 0 | Minimum | 0 |
| Maximum | 7260 | Maximum | 7260 | Maximum | 4933 |
| Sum | 176944 | Sum | 138644 | Sum | 36693 |
| Count | 223 | Count | 223 | Count | 223 |

Table 7. Comparison of brook trout population estimates 1990 and 2017.

| East Branch Deerfield2020- Somerset 8/2/1990 | | | East Branch Deerfield2020- Somerset 9/22/2017 | |
|---|---|---|---|---|
| Brook Trout Size Class | EST (N) | Pop/mi | EST (N) | Pop/mi |
| YOY | 3 | 91 | 1 | 17 |
| <6 | 9 | 272 | 3 | 50 |
| 6-10 | 4 | 121 | 0 | 0 |
| 10-12 | 0 | 0 | 0 | 0 |
| 12+ | 0 | 0 | 0 | 0 |
| Total | 16 | 483 | 4 | 67 |

| East Branch Deerfield 1775- Somerset 1990 | | | East Branch Deerfield 1775- Somerset 9/22/2017 | |
|---|---|---|---|---|
| Brook Trout Size Class | EST (N) | Pop/mi | EST (N) | Pop/mi |
| YOY | 7 | 162 | 2 | 54 |
| <6 | 4 | 93 | 3 | 81 |
| 6-10 | 2 | 46 | 0 | 0 |
| 10-12 | 0 | 0 | 0 | 0 |

| | | | | |
|---|---|---|---|---|
| 12+ | 0 | 0 | 0 | 0 |
| Total | 13 | 301 | 5 | 135 |

Table 8. US. Forest Service trout population estimates in select tributaries to the Deerfield near Somerset Reservoir.

| Blind Brook | BKT Size Class | Est(N) | Pop/mi | Lbs/acre |
|---|---|---|---|---|
| | YOY | 24.0 | 386.2 | 2.4 |
| | <6 | 7.0 | 112.7 | 1.7 |
| | 6-10 | 2.0 | 32.2 | 1.1 |
| | 10-12 | 0.0 | 0.0 | 0.0 |
| | 12+ | 0.0 | 0.0 | 0.0 |
| | Total | 33.0 | 531.1 | 5.2 |

| Castle Brook | BKT Size Class | Est(N) | Pop/mi | Lbs/acre |
|---|---|---|---|---|
| | YOY | 2 | 32.2 | 0.1 |
| | <6 | 4 | 64.4 | 1.2 |
| | 6-10 | 4 | 64.4 | 3.8 |
| | 10-12 | 0 | 0.0 | 0 |
| | 12+ | 0 | 0.0 | 0 |
| | Total | 10.0 | 161.1 | 5.0 |

Table 8. US. Forest Service trout population estimates in select tributaries to the Deerfield near Somerset Reservoir.

| Deer Cabin Brook | BKT Size Class | Est(N) | Pop/mi | Lbs/acre |
|---|---|---|---|---|
| | YOY | 6 | 97 | 0 |
| | <6 | 3 | 48 | 1 |
| | 6-10 | 2 | 32 | 1 |
| | 10-12 | 0 | 0 | 0 |
| | 12+ | 0 | 0 | 0 |
| | Total | 11 | 177 | 2 |

| Deer Lick Brook | BKT Size Class | Est(N) | Pop/mi | Lbs/acre |
|---|---|---|---|---|
| | YOY | 8 | 129 | 0 |
| | <6 | 12 | 193 | 2 |
| | 6-10 | 2 | 32 | 2 |
| | 10-12 | 0 | 0 | 0 |
| | 12+ | 0 | 0 | 0 |

Table 8. US. Forest Service trout population estimates in select tributaries to the Deerfield near Somerset Reservoir.

| | | | | |
|---|---|---|---|---|
| | Total | 22 | 354 | 4 |
| Glastenbury River | BKT Size Class | Est(N) | Pop/mi | Lbs/acre |
| | YOY | 1 | 18 | 0 |
| | <6 | 12 | 211 | 2 |
| | 6-10 | 1 | 18 | 1 |
| | 10-12 | 0 | 0 | 0 |
| | 12+ | 0 | 0 | 0 |
| | Total | 14 | 246 | 3 |
| Rake Branch | BNT Size Class | Est(N) | Pop/mi | Lbs/acre |
| | YOY | 0 | 0 | 0 |
| | <6 | 0 | 0 | 0 |
| | 6-10 | 1 | 11 | 0 |
| | 10-12 | 0 | 0 | 0 |

Table 8. US. Forest Service trout population estimates in select tributaries to the Deerfield near Somerset Reservoir.

| | | | | |
|---|---|---|---|---|
| | 12+ | 0 | 0 | 0 |
| | Total | 1 | 11 | 0 |

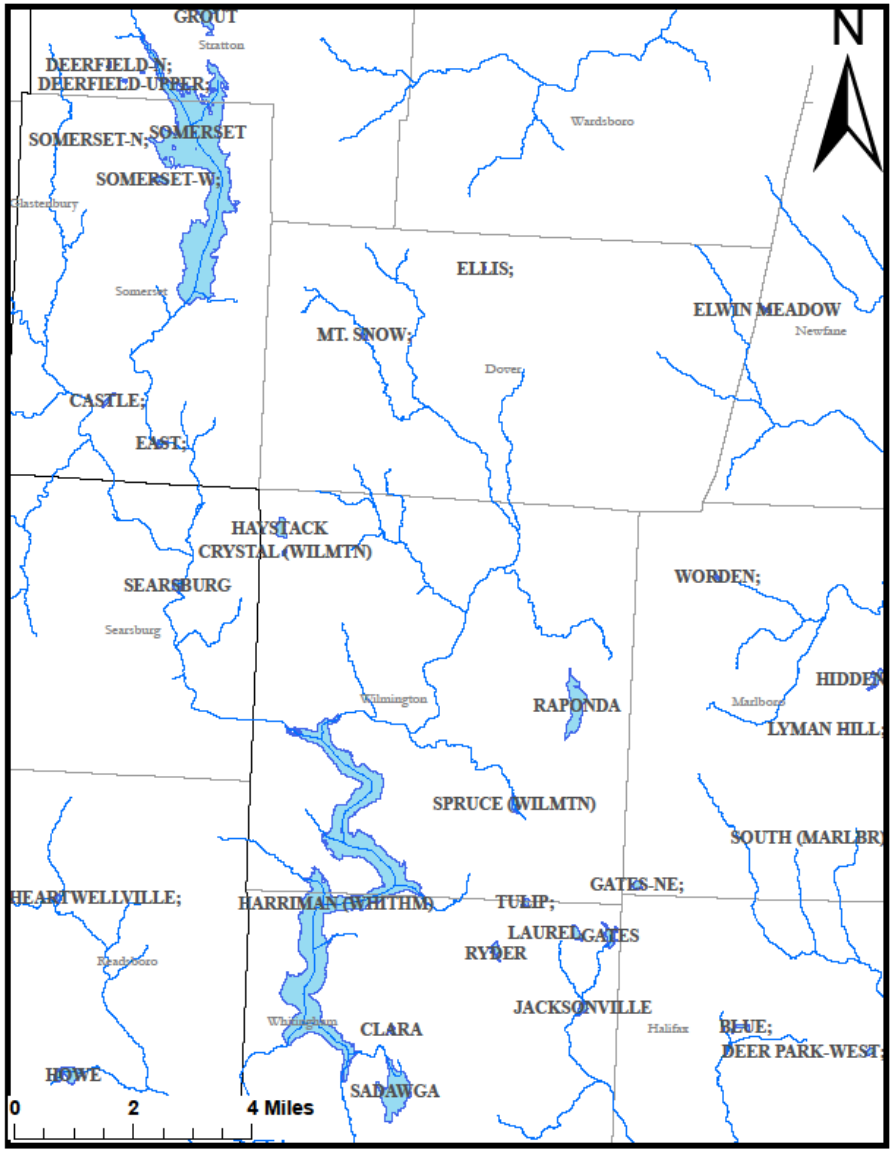
| Table 9. Water Quality measurements conducted in 2017 by VTFWD. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | SOMMERSET RESERVOIR | | | | | | | | | |
| **Site ID** | **Description** | **U/S OR D/S?** | **N** | **W** | **Elevation** | **Date** | **Temp (C°)** | **COND(µs/cm)** | **D.O. (mg/L)** | **pH** |
| Som1 | Kelly Stand Road bridge | U/S | 43.061162 | -72.968426 | 2236 | 7/5/2017 | 12.9 | 10.3 | 10.98 | NA |
| | | | | | | 9/5/2017 | 13.3 | 18.6 | 11.11 | 7.7 |
| Som2 | off Grout Pond West loop trail | U/S | 43.03986 | -72.968537 | 2220 | 7/5/2017 | 15 | 10.7 | 9.88 | NA |
| | | | | | | 9/5/2017 | 14.6 | 15.6 | 8.87 | 6.9 |
| Som3 | below reservoir outflow | D/S | 42.971716 | -72.949801 | 2200 | 7/5/2017 | 7.8 | 9.9 | 12.43 | NA |
| | | | | | | 8/29/2017 | 9.3 | 10.4 | 11.9 | 7.6 |
| Som4 | north of E. Branch mainstem confluence | D/S | 42.92898 | -72.94369 | 1826 | 7/5/2017 | 15.6 | 12 | 9.88 | NA |
| | | | | | | 8/29/2017 | 14.4 | 12.2 | 8.96 | 6.7 |
| Som5 | at E. Branch trail bridge crossing | D/S | 42.912918 | -72.946227 | 1790 | 7/5/2017 | 14.8 | 20 | 10.4 | NA |
| | | | | | | 8/29/2017 | 15.1 | 13.1 | 8.8 | 7.2 |
| Sam1 | East Branch Deerfield | D/S | 42.96966 | -72.95207 | 2037 | 8/29/2017 | 11.3 | 10.7 | 10.45 | 6.9 |
| Sam2 | East Branch Deerfield | D/S | 42.96739 | -72.95488 | 2029 | 8/29/2017 | 12.7 | 10.9 | 9.94 | 6.9 |
| Sam3 | East Branch Deerfield | D/S | 42.96567 | -72.95748 | 2011 | 8/29/2017 | 13.6 | 11.2 | 10.32 | 6.7 |
| Sam4 | East Branch Deerfield | D/S | 42.96294 | -72.96184 | 2030 | 8/29/2017 | 14.4 | 12.2 | 8.96 | 6.7 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sam5 | East Branch Deerfield | D/S | 42.95921 | -72.96657 | 1982 | 8/29/2017 | 15.1 | 13.1 | 8.8 | 7.2 |
| Sam6 | East Branch Deerfield | D/S | 42.95275 | -72.9598 | 1956 | 8/29/2017 | 13.3 | 18.6 | 11.11 | 7.7 |
| Sam7 | East Branch Deerfield | D/S | 42.9455 | -72.96144 | 1823 | 8/29/2017 | 14.6 | 15.6 | 8.87 | 6.9 |
| | **SEARSBURG RESERVOIR** | | | | | | | | | |
| **Site ID** | **Description** | **U/S OR D/S?** | **N** | **W** | **Elevation** | **Date** | **Temp (C°)** | **COND(µs/cm)** | **D.O. (mg/L)** | **pH** |
| Sears1 | Searsburg inlet, current present | U/S | 42.90978 | -72.94603 | 1763 | 6/29/2017 | 18.8 | 14.9 | 8.8 | NA |
| | | | | | | 9/5/2017 | 14.7 | 18.2 | 9.63 | 7.1 |
| Sears2 | Searsburg Outlet | D/S | 42.901506 | -72.949091 | 1722 | 6/29/2017 | 13.4 | 14.5 | 11.8 | NA |
| | | | | | | 9/5/2017 | 14.1 | 17.3 | 9.61 | 6.5 |
| Sears3 | Rt. 9. Bridge next to Lind Rd. cul-de-sac | D/S | 42.878567 | -72.945312 | 1609 | 6/29/2017 | 16.2 | 26.9 | 10.68 | NA |
| | | | | | | 9/5/2017 | 15.7 | 37.4 | 8.71 | 6.9 |
| Sears4 | Medburyville Rd. Bridge | D/S | 42.870893 | -72.919558 | 1506 | 6/29/2017 | 15 | 19.7 | 10.18 | NA |
| | | | | | | 9/5/2017 | 14.8 | 30.6 | 9.65 | 6.8 |
| | **HARRIMAN RESERVOIR** | | | | | | | | | |
| **Site ID** | **Description** | **U/S OR D/S?** | **N** | **W** | **Elevation** | **Date** | **Temp (C°)** | **COND(µs/cm)** | **D.O. (mg/L)** | **pH** |
| Harr1 | N. Br. DF. Behind dirt lot in Wilmington | U/S | 42.868375 | -72.873472 | 1507 | 6/29/2017 | 16.2 | 118.8 | 9.87 | NA |
| | | | | | | 9/5/2017 | 16.3 | 109.6 | 9.81 | 7.1 |
| Harr2 | | U/S | 42.874302 | -72.863832 | 1515 | 6/29/2017 | 16.2 | 108.4 | 10.73 | NA |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N. Br. DF. Behind Blue Mt. Produce | | | | | 9/5/2017 | 16.4 | 104.8 | 9 | 7.6 |
| Harr3 | Below Harr. Dam outflow | D/S | 42.791681 | -72.916455 | 1314 | 6/29/2017 | 13.4 | 34.5 | 11.54 | NA |
| | | | | | | 9/5/2017 | 7.7 | 28.2 | 12.6 | 6.8 |
| Harr4 | Trail, East of School on Phelps Ln. | D/S | 42.770836 | -72.938879 | 1185 | 6/29/2017 | 14.1 | 35.7 | 11.27 | NA |
| | | | | | | 9/5/2017 | 9.4 | 34.6 | 12.52 | 6.8 |
| Harr5 | Just above W. Br. Confluence | D/S | 42.770293 | -72.946935 | 1164 | 6/29/2017 | 14 | 36.3 | 11.75 | NA |
| | | | | | | 9/5/2017 | 10.4 | 32.8 | 12.04 | 7 |

Table 10. Number of Days greater than 65, 68, 72, 75, 80 °F from the period of May 15 to November 1, 2015-2017.

| Site | Days >65°F | | | Days >68°F | | | Days >72°F | | | Days >75°F | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2015 | 2016 | 2017 | 2015 | 2016 | 2017 | 2015 | 2016 | 2017 |
| Broad459 | 63 | 90 | 18 | 21 | 58 | 1 | 2 | 17 | 0 | 0 | 5 | 0 |
| Green757 | 13 | 97 | 68 | 5 | 87 | 33 | 2 | 64 | 3 | 1 | 29 | 0 |
| Whetstone328 | 84 | 100 | 51 | 47 | 76 | 14 | 7 | 24 | 0 | 0 | 0 | 0 |


GROUT
Stratton
DEERFIELD-N;
DEERFIELD-UPPER;
SOMERSET
SOMERSET-N;
SOMERSET-W;
Glastenbury
Somerset
Wardsboro
ELLIS;
ELWIN MEADOW
Newfane
MT. SNOW;
Dover
CASTLE;
EAST;
HAYSTACK
CRYSTAL (WILMTN)
SEARSBURG
Searsburg
WORDEN;
HIDDEN
Wilmington
RAPONDA
Marlboro
LYMAN HILL;
SPRUCE (WILMTN)
SOUTH (MARLBR)
GATES-NE;
HEARTWELLVILLE;
HARRIMAN (WHITHM)
TULIP;
LAUREL GATES
RYDER
Readsboro
JACKSONVILLE
Halifax
Whitingham
CLARA
BLUE;
DEER PARK-WEST;
HOWE
SADAWGA
0
2
4 Miles
N

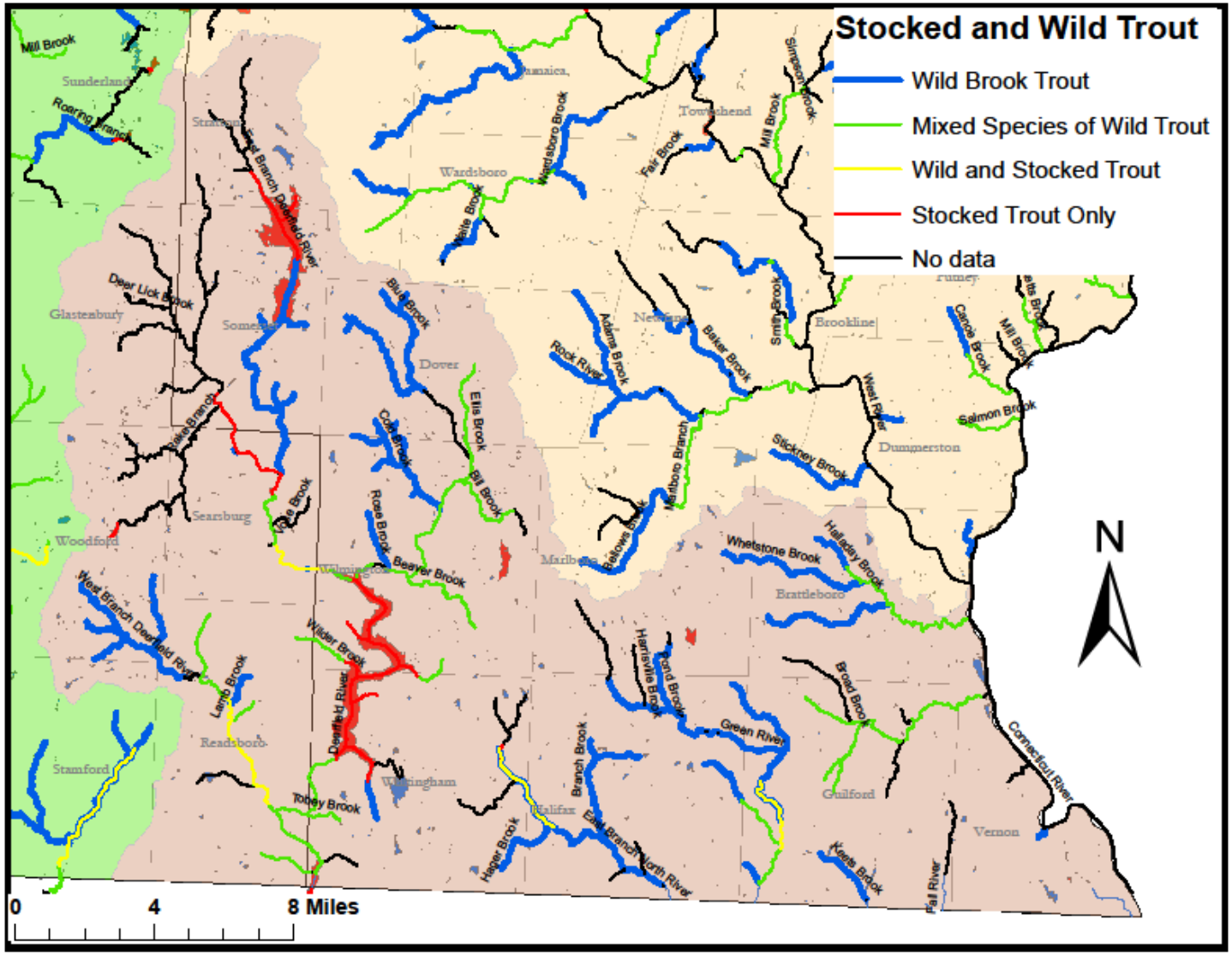



Figure 2. Streams providing habitat for trout within the Deerfield watershed.

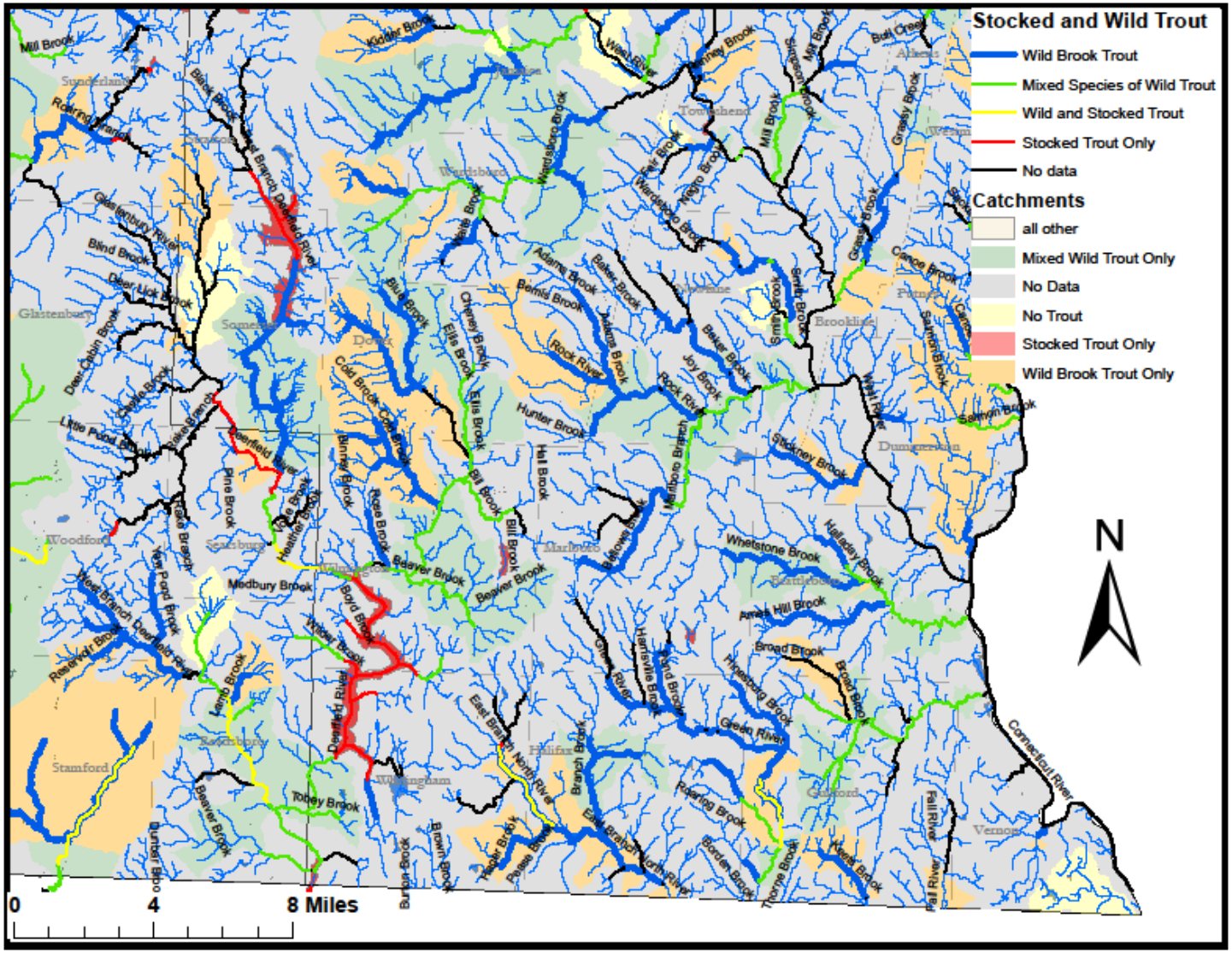



Figure 3. Catchments providing habitat for wild trout.

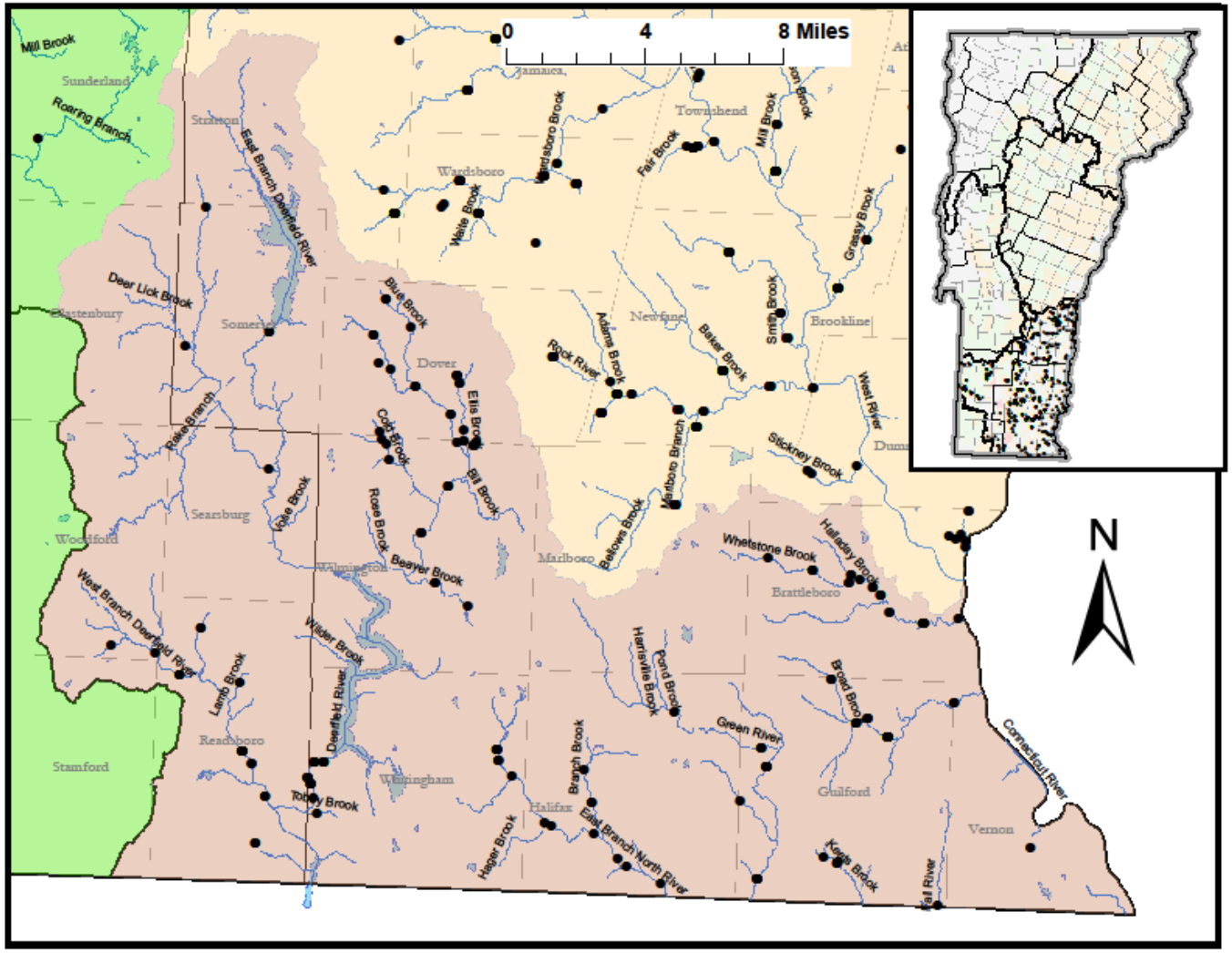



Figure 4. Trout population sampling sites throughout the basin.

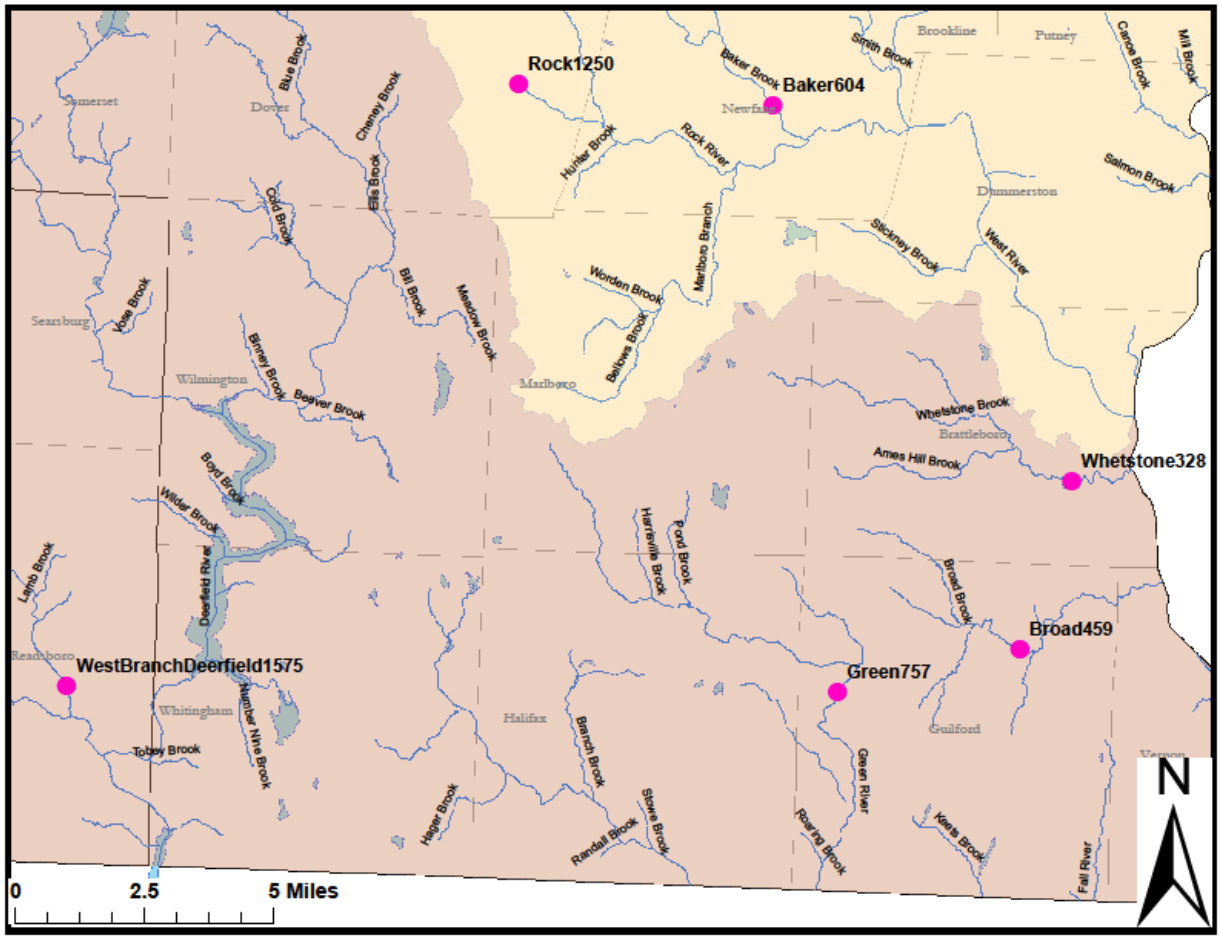



Figure 5. Sites monitored annually by VFWD for stream temperatures and trout populations.

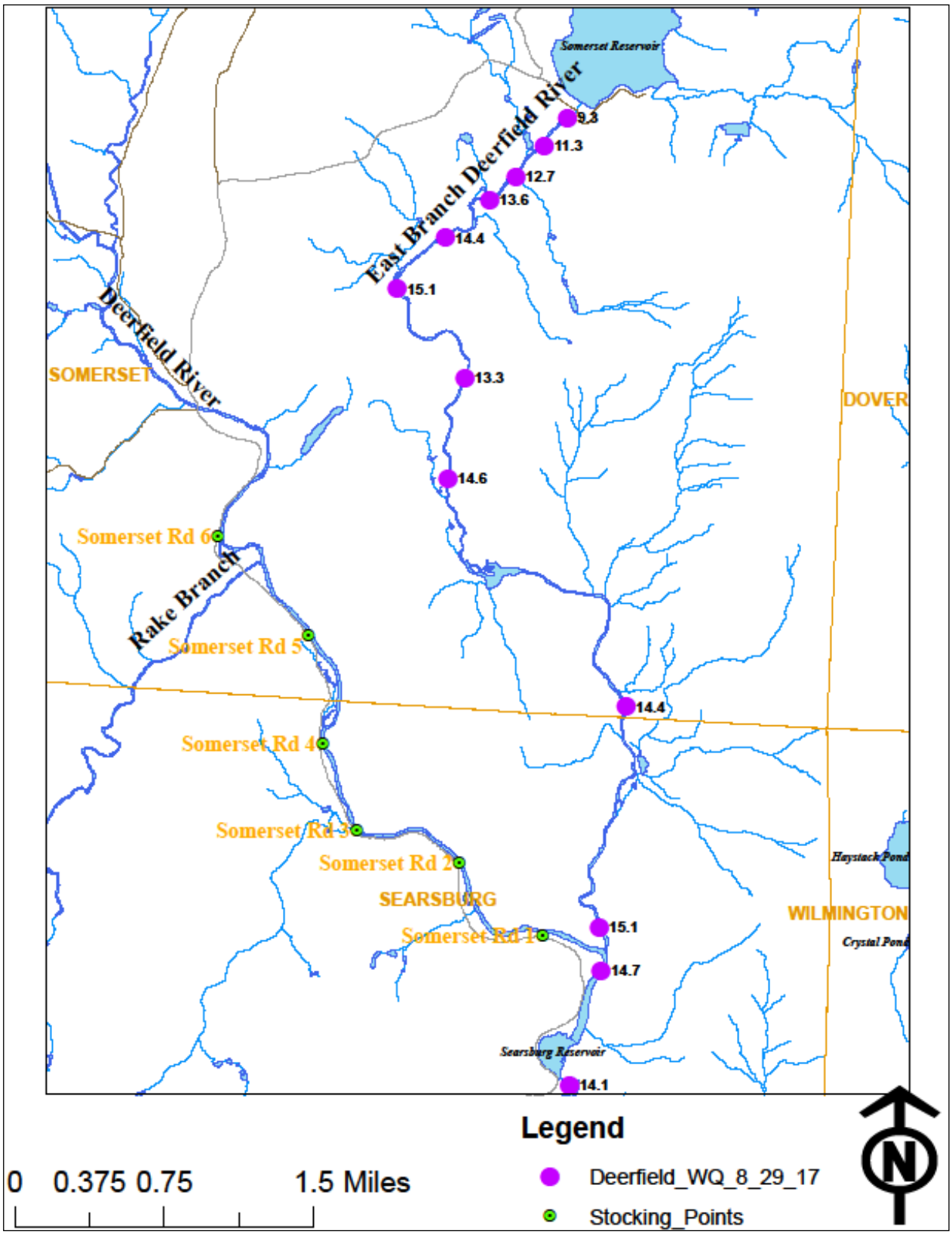


Figure 6. Stream temperatures in Celsius collected in September 2017.

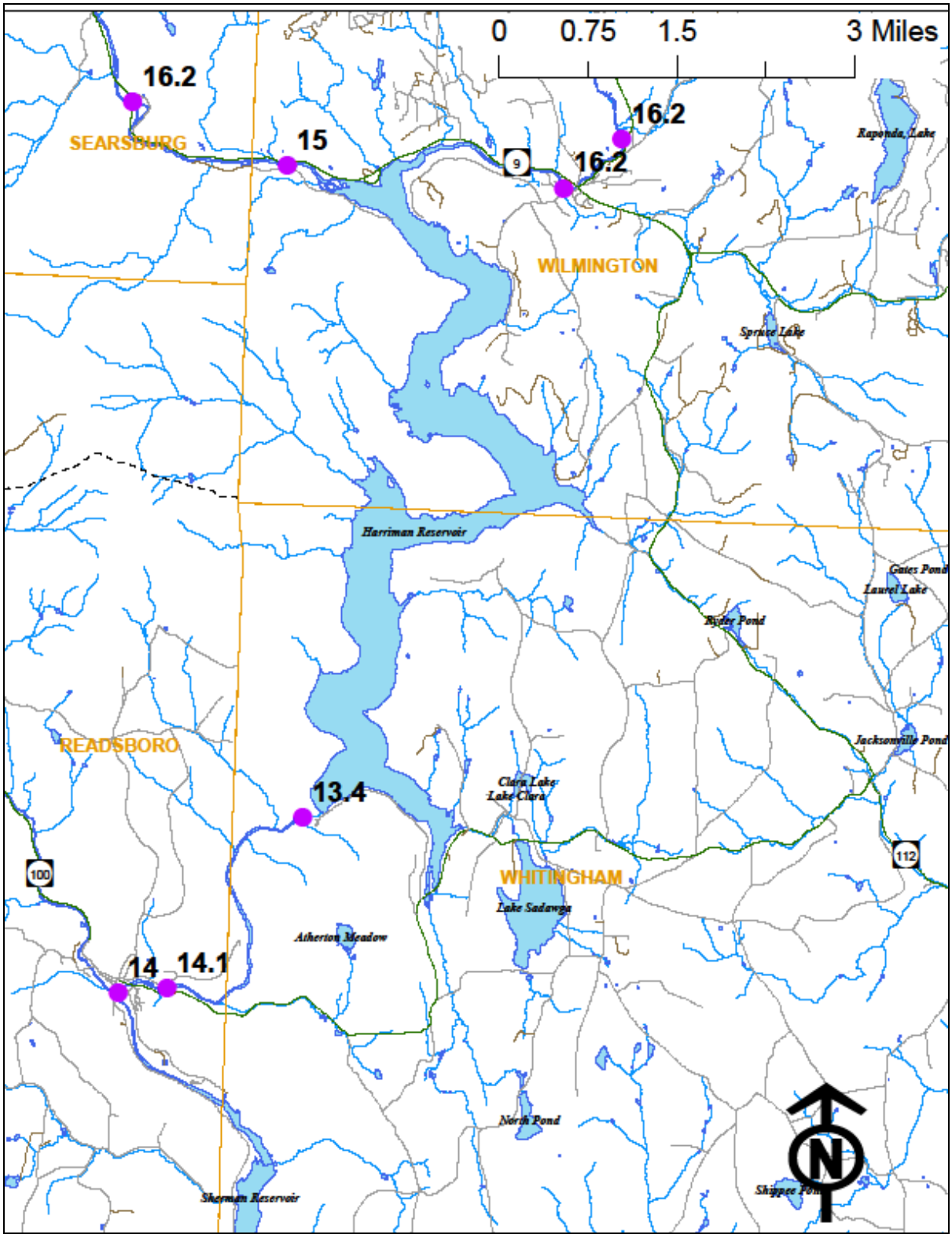



Figure 7. Stream temperatures in Celsius collected in September 2017.

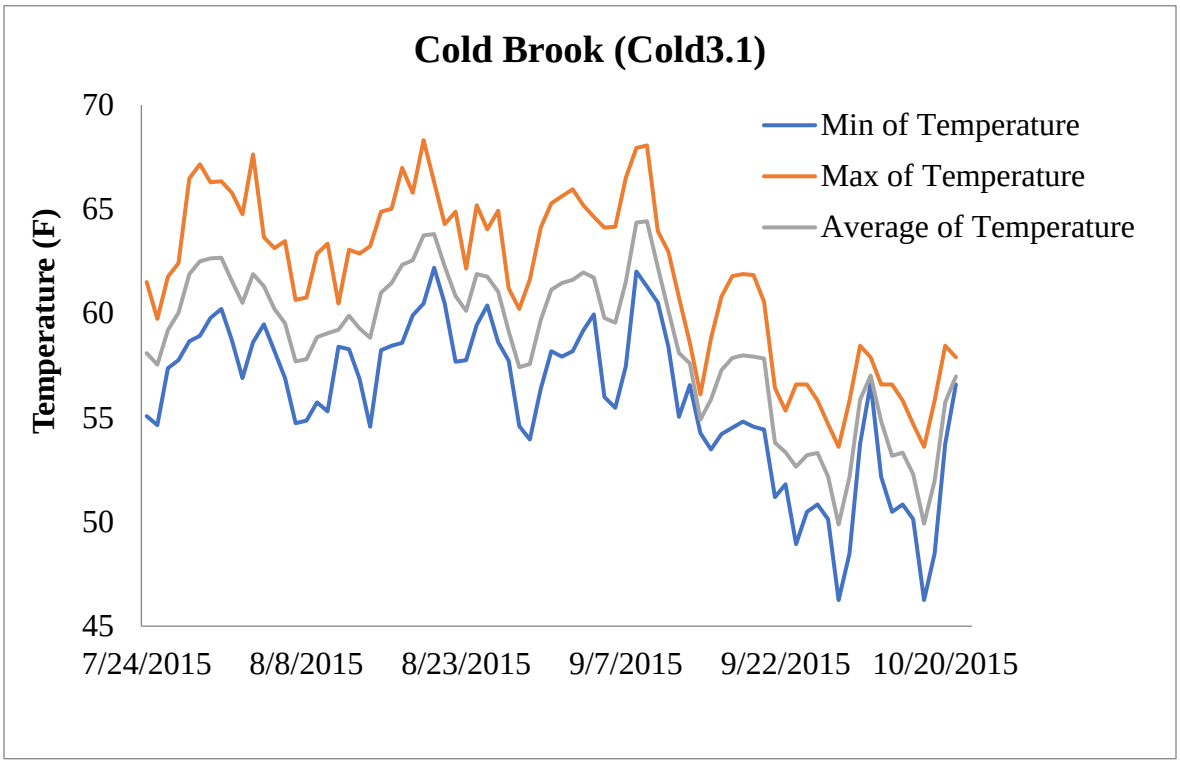



Figure 8. Stream temperatures in Cold Brook monitored at the Hermitage 2015.

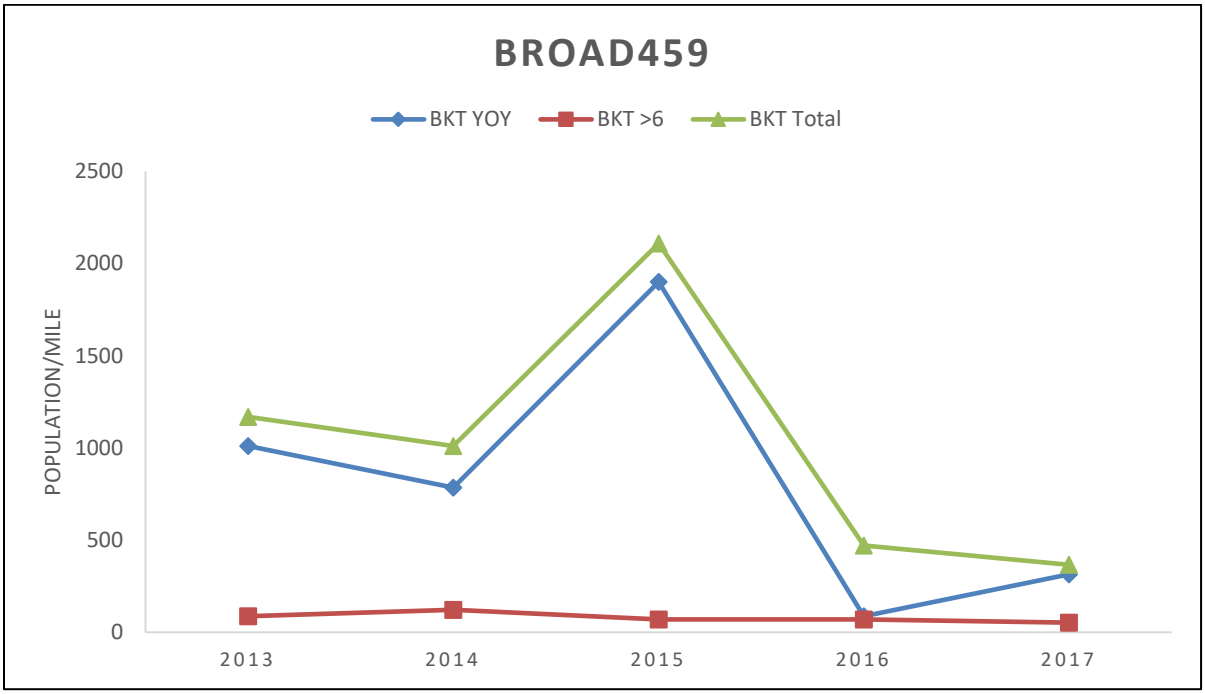



Figure 9. Population estimates for brook trout by size class and year at long-term monitoring site in Broad Brook.

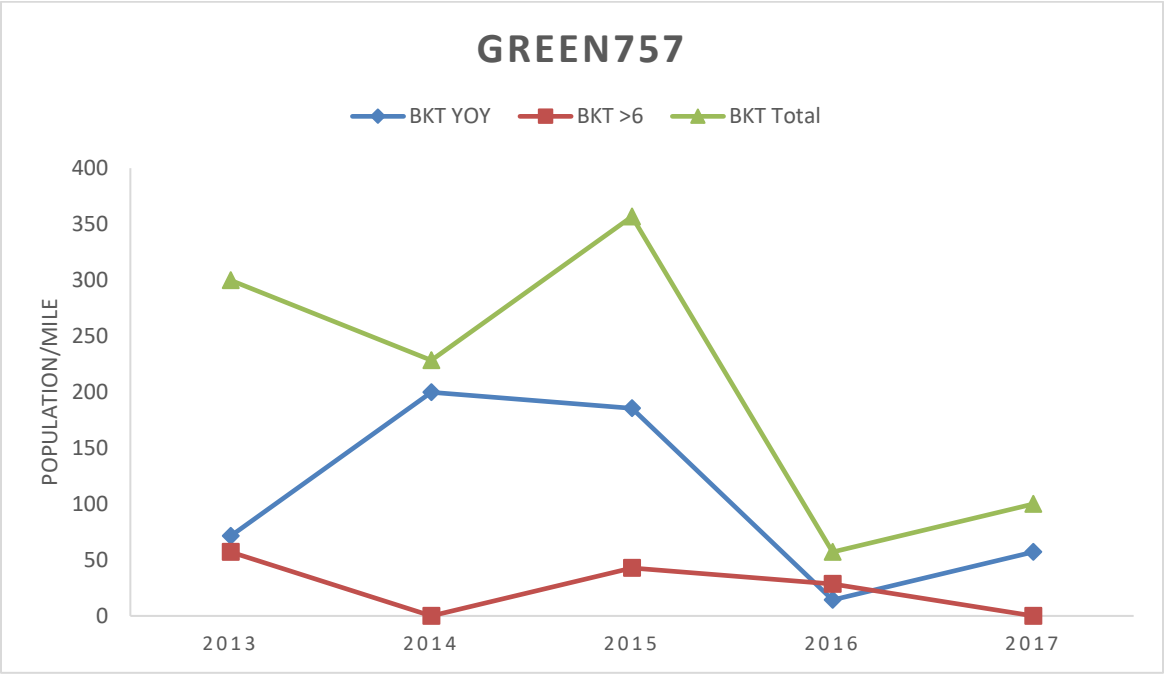



Figure 10. Population estimates for brook trout by size class and year at long-term monitoring site in Green River.

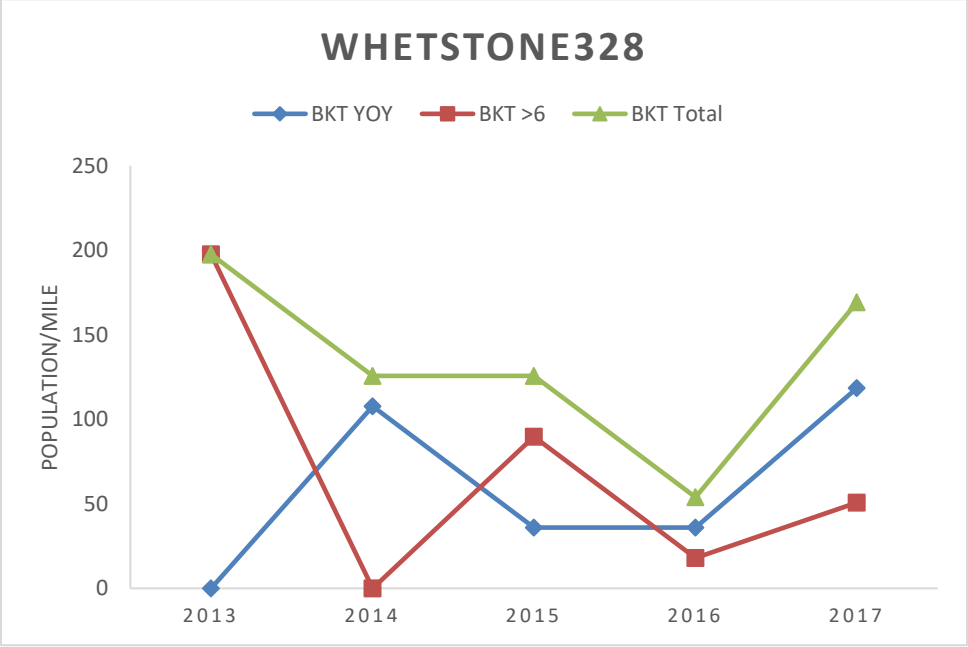



Figure 11. Population estimates for brook trout by size class and year at long-term monitoring site in the Whetstone.

# Appendix E. - Municipal Protectiveness Matrix

| Town | National Flood Insurance Program (NFIP) | Road and Bridge Standards | Emergency Management Plan (LEMP) | Hazard Mitigation Plan (LHMP) | River Corridor Protection | ERAF | Flood Resilience in Town Plan | Stormwater Mapping | Illicit Discharge Detection and Elimination | Stormwater Master Plan |
|---|---|---|---|---|---|---|---|---|---|---|
| ***Status -->*** | *Enrolled?* | *Adopted?* | *Completed?* | *Adopted?* | *Adopted?* | *Percent* | *Completed?* | *Completed?* | *Completed?* | *Completed?* |
| Brattleboro | Yes | Yes | Yes | Yes | Yes/No | 17.5 | Yes | Yes | Yes | No |
| Dover | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Dummerston | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Glastenbury | No | Yes | No | Yes | No | 7.5 | No | No | No | No |
| Guilford | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Halifax | Yes | Yes | No | Yes | Interim | 7.5 | Yes | No | No | No |
| Marlboro | Yes | Yes | No | Yes | Yes | 7.5 | No | Yes | Current Study | No |
| Readsboro | Yes | Yes | Yes | No | Interim | 7.5 | No | Yes | Current Study | No |
| Searsburg | No | Yes | Yes | No | No | 7.5 | No | No | No | No |
| Somerset | No | Yes | No | No | No | 7.5 | No | No | No | No |
| Stamford | Yes | Yes | Yes | Yes | Yes | 17.5 | Yes | No | No | No |
| Stratton | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Sunderland | Yes | Yes | Yes | Expired | Yes | 7.5 | Yes | No | No | YES |
| Vernon | Yes | Yes | Yes | Yes | Interim | 17.5 | Yes | Yes | Current Study | No |
| Wardsboro | Yes | Yes | Yes | No | No | 7.5 | No | Yes | Current Study | No |
| Whitingham | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Jacksonville Village | | | Yes | Yes | No | 12.5 | | | | |
| Wilmington | Yes | Yes | Yes | Yes | No | 12.5 | Yes | Yes | Current Study | No |
| Woodford | Yes | No | No | Expired | No | 7.5 | Yes | No | No | No |

## Appendix F. Partnering Organizations

BCCD – Bennington County Conservation District

BCRC – Bennington County Regional Commission

CRC – Connecticut River Conservancy

CRJC– Connecticut River Joint Commissions

TU – Trout Unlimited

Trout Unlimited Vermont Council

CRVTU – Connecticut River Valley Chapter of Trout Unlimited

DRWA – Deerfield River Watershed Alliance

DCRC – Deerfield Creating Resilient Communities

DU – Ducks Unlimited, Vermont

GRWA – Green River Watershed Alliance

LRA – Lake Raponda Association

TNC – The Nature Conservancy

USFA-GMNF – US Forest Service-Green Mountain National Forest

VLT – Vermont Land Trust

VRC – Vermont River Conservancy

WCNRCD – Windham County NRCD

WRC – Windham Regional Commission

## Appendix G. Responsiveness Summary

# Vermont Department of Environmental Conservation
# Agency of Natural Resources
# Responsiveness Summary to Public Comments Regarding

# Deerfield River (Basin 12) Tactical Basin Plan

# Responsiveness Summary of Public Comments

On December 10, 2019 the Vermont Department of Environmental Conservation (VDEC) of the Agency of Natural Resources (ANR) released a final draft of the Deerfield River Tactical Basin Plan for a public-comment period. The public comment period, which ended on January 20, 2020 included two public meetings. A press releases was also sent out to regional publications by DEC and the Windham Regional Planning Commission sent out notice of the draft plan release to municipalities in the basin.

The public comment meetings were held on:

- December 10, 2019 – 6:30-8:00 PM – Brattleboro, VT
- December 19, 2019 – 6:30-8:00 PM – Windham, VT

The VDEC prepared this responsiveness summary to address specific comments and questions submitted during the comment period and to indicate how the plans have been modified in response to those comments. Comments may have been paraphrased or quoted in part. The full text of the comments provided for each plan individually is available for review by contacting the Department of Environmental Conservation

Public comment was received at the open meetings listed above and written comments were received during the public comment period which ran from December 10, 2019 through January 20, 2020.

Please note that page numbers referenced in Comments refer to the DRAFT Plan rather than the final version.

**Comments regarding the Reclassification of Waters – not including fisheries:**

**Comment:** Whetstone and Broad Brooks are highly developed so A(1) and B(1) classifications may be helpful to preventing warming of the water.

**Response:** Reclassification recommendations made by VDEC are based on the monitored conditions of Vermont's aquatic macroinvertebrate and fish communities.

Recommendations from the Vermont Fish and Wildlife Department (VFWD) are based on in-stream fishery surveys. Both Departments have numeric criteria which must be met in order for reclassification to be recommended. Neither the lower Whetstone Brook (developed portion) nor the lower Broad Brook currently have VDEC data that meet the criteria for B(1) or A(1) classification. The Whetstone Brook has been identified as meeting B(1) criteria for fisheries.

**Comment:** Outstanding Resource Waters (ORW), strengthen Class 1 discussion and reclassifying A(1) and B(1) waters. How do you implement that?

**Response:** Outstanding Resource Waters and reclassification are two separate pathways for establishing statutory recognition of high-quality surface water uses and values. While these uses and values being recognized for protection may overlap, there have been no surface waters designated and/or reclassified under both methods to date in Vermont. Each method has a separate process for implementation and criteria established for determining whether a water merits designation. The processes and criteria associated with these designations can be found in statute, at 10 V.S.A. § 1252-1253 for water classification and 10 V.S.A. § 1424a for ORW.

**Comment:** Outstanding Resource Waters (ORW), Class 1 wetlands, A, A(1), B(1) and B(2) waters should each be listed in the glossary with a brief description drawn from the Water Quality Standards (WQS) and Wetland Rule.

**Response:** The specific classifications of all waters can be found within the VWQS as Appendix F. WATER QUALITY CLASSIFICATIONS for water classes. There are no ORWs in Basin 12, however other designated ORWs can be found in Past Water Resources Panel Decisions by Year. The list and description of all Class I wetlands can be viewed in Appendix A of the Vermont Wetland Rules at the following link: https://dec.vermont.gov/watershed/wetlands/class1wetlands

**Comment:** Clarify East Branch Deerfield listing on assessment list – the plan is silent on what needs to be assessed to reach an A(1) status for the East Branch. On the implementation list there are no notes at all about the East Branch and several other branches so it is unclear if this assessment will be part of next year's 5 year assessment by the Department and if so, what parameters will be assessed or does the plan expect others to do the assessment.

Since it seems from the plan that there is no assessment on them at all now, it might be appropriate to include a brief discussion about the logging history of this watershed and that in most cases in Vermont, logging up until recent times lead to straightening, channeling or flash damming of streams and rivers. That discussion might help people understand that just because they see what streams look like today, logging altered

streams are a far cry from natural or healthy and most of the Deerfield watershed experienced concerted and almost universal logging.

**Response:** The East Branch Deerfield is not being recommended for A(1) reclassification based on its current condition. The East Branch Deerfield is recommended for additional monitoring to determine its potential for A(1) reclassification.

**Comment:** There should be a fuller explanation of the procedure for how to nominate waters and wetlands to a higher status by offering a narrative or a link to a narrative about the possibility of further protections for the streams and lakes of the basin.

**Response:** The classification of high quality waters, designation of ORWs, and designation of Class I wetlands all require formal rulemaking. Individuals can petition the Agency to initiate the rulemaking process to reclassify waters or designate ORWs or Class I wetlands pursuant to 3 V.S.A. § 806. The relevant statutory provisions in Title 10 outline the process for petitioning the Agency to amend its rules: 10 V.S.A. § 1253 for water classification, 10 V.S.A. § 1424a for ORW, and 10 V.S.A. § 915 for Class I wetlands. The Agency is in the process of developing a procedure for filing petitions for reclassification; this procedure is still under development and will be posted on ANRs website when completed. Until that time petitioners can work with their Watershed Planners to nominate waters for either reclassification or ORW designation.

**Comment:** Outstanding geological formation at Bond Brook Falls with a gorge and falls, swimming holes, rock walls, other features that may make it worth ORW designation.

**Response:** Unique geologic features would be considered natural value(s) for consideration in meriting Outstanding Resource Water designation. Field verification will be needed, and documentation provided as part of any petition to consider candidate waters for ORW designation

**Comments regarding Agriculture:**

**Comment:** There are no longer any Accepted Agricultural Practices there are only the Required Agricultural Practices (RAP) and it should be noted in the plan for cultivating citizen enforcement that the RAPs apply to all permitted SFO, MFO and LFO as well as any unpermitted farm operation that creates a discharge of any kind to waters of Vermont.

**Response:** References to the RAP information has been corrected.

**Comment:** The terms Large Farm Operation, Medium Farm Operation, and Small Farm Operation should be defined in the Glossary.

**Response:** Added with links to full definitions

**Comment:** In the land use section of the plan, permitted farms under the S/M/LFO program should be identified and located on a map (not yet in the draft), albeit there will be few sites on this map.

**Response:** The Agency of Agriculture, Food and Markets (VAAFM) provides aggregated farm information by HUC12* basins for the purpose of measuring progress and prioritizing agricultural strategies in tactical basin plans. Below is a table of the distribution of farm operations by HUC12 watershed and farm operation size. Identifying farm specific points on a map is not included so as to not target individual landowners, rather focus agricultural strategies at a watershed scale.

| HUC12Name | Total Farm Operations | MFO | CSFO | SFO* |
|---|---|---|---|---|
| East Branch Deerfield River | | | | |
| East Branch North River | 3 | | | 3 |
| Fall River | 1 | | 1 | |
| Headwaters Deerfield River | | | | |
| Lower Green River | | | | |
| North Branch Deerfield River | 2 | | | 2 |
| Pauchaug Brook-Connecticut River | 2 | 1 | 1 | |
| Pelham Brook-Deerfield River | | | | |
| Sherman Dam-Deerfield River | 1 | | 1 | |
| Taylor Brook-North River | | | | |
| Upper Green River | 1 | | | 1 |
| Vernon Dam-Connecticut River | 4 | | 3 | 1 |
| West Branch Deerfield River | | | | |
| Whetstone Brook | 3 | | | 3 |
| **Total Farm Operations** | **17** | **1** | **6** | **10** |
| **VAAFM estimates 10 small farms in the Basin will fall within RAP jurisdiction. Outreach will need to continue to help landowners understand where they fall within the RAP farm size categories and RAP requirements.* | | | | |

* Hydrologic Unit Code (HUC). Every watershed is identified by a unique HUC consisting of 2 to 12 digits based on the levels of classification in the hydrologic unit system.

**Comment:** The Plan's focus on phosphorus reduction should provide a greater emphasis on stormwater detention/retention and stream buffer design elements on agricultural tracts where cattle farming currently exists. The "privilege of farming" in our state for decades has created a public perception [that] commercial cattle operations are exempt from necessary environmental regulations due to state-supported farming rights legislation. Though great strides have been taken in recent years to address stormwater issues related to cattle farming operations, in reality pollutants from these animals are still leaving pasture sites at a measurable level collecting in our streams, ponds, and lakes.

From a land use perspective, farming can have the environmental impact of manufacturing and industrial enterprises, if not properly managed at the tract level. As a state, we have promoted cattle farming as part of our cultural identity, where our recognition as a "Green State" could be challenged specifically on the environmental allowances afforded to our commercial cattle operations. In my opinion, farming in Vermont needs to move towards mandating organic practices, if there is truly sincere effort in protecting our threatened streams, ponds, and lakes for the future. The state has mandated towns meet the MRGP benchmarks for road erosion, yet similar implementation horizons are not imposed for agricultural operations.

**Response:** The Vermont Clean Water Act, Act 64, addresses water quality throughout Vermont by addressing the sectors that have potential to cause pollution. These sectors are agriculture, developed lands, wastewater, roads and natural resources processes. Agricultural non-point source water quality programs and the application of the Required Agricultural Practices (RAPs) on small, medium, and large farms is managed by the Agency of Agriculture, Food and Markets (VAAFM).

Agricultural regulatory programs and basin priorities are offered in Chapter 4. Required Agricultural Practices are in place for all farm operations in the state and farm inspections are underway in the Basin. As these programs are carried out, improvements to buffers and production facilities will be implemented with the intended effect of decreasing runoff and phosphorus inputs from agricultural operations.

**Comment:** In the glossary it references the AAP, needs to be updated to the RAP's, and add dissolved oxygen.

**Response:** RAP reference has been corrected; dissolved oxygen has been added

**Comments regarding Dams and Hydro Facilities:**

**Comment:** Dam inspection laws and regulations are changing – add something addressing this.

**Comment:** You talk about dams and dams are listed. Dams are part of the basin and the waterway. Two categories: bigger and smaller dams. With smaller dams, many, many, many of them that interfere with critters and macroinvertebrates. Should more be said about dams and their impacts? New rules for registering and inspecting smaller dams? How do they contribute to water quality and fisheries?

**Response:** Agreed. Dam safety legislation (Act 161) and dam impacts information has been added to Chapter 4.

**Comment:** Control of water flow by power companies: A brief discussion should be added about the 2019 Vermont Supreme Court decision regarding the Lamoille River Hydroelectric Dam about power companies not being the only stakeholder considered in deciding about desirable water flows in rivers and streams; ecosystem and native wildlife being major may also be important determinants. This discussion would benefit from mentioning the Federal Energy Regulatory Commission (FERC) licensing process with particular inclusion of the dates when the Deerfield River hydroelectric dams are next scheduled for relicensing.

**Response:** This decision is extensive and deals with a number of issues related to the State's review of federal permits pursuant to Section 401 of the Clean Water Act. Vermont's established statutory authority to implement the Water Quality Standards through the 401-certification process and determine the conditions necessary to comply with those Standards, was upheld by the Court in the decision. Those interested can find the decision 2019 VT 84, Docket No. 2018-339 at https://www.vermontjudiciary.org/sites/default/files/documents/op18-339.pdf.

The current FERC license for the Deerfield hydroelectric projects are scheduled to expire in 2037.

**Comment:** The Dams listing in the basin plan appendix does not agree with the dams listed for water supply. They should agree because regardless of the use (or non-use) the dam exists and thus these two should agree.

**Response:** The list of Water Supply Sources in Appendix B. describes waters used for drinking water whether actively or not. It is not a list of dammed water supplies (i.e., surface waters that are impounded for an existing or potential public water supply use).

**Comment:** More information about dams: Consider including a specific subsection of the Basin Plan devoted to dams, in addition to Appendix C "Dams in Basin 12" including a short description of Vermont's recent 2017 dam registration law for which a link should be provided along with a brief discussion of the impacts of dams on the natural watershed environment and how the removal of unnecessary dams results in the more robust movement of fish and wildlife. Brief mention of how the law applies to Vermont private property owners and businesses is also desirable to include.

**Comment:** Missing Information Regarding Vermont's New Dam Legislation. There should a new section added that includes information regarding of Vermont's new dam law. This should include the benefits of dam removal to water quality and the quality of fisheries and wildlife, and to flood prevention/mitigation. Dam owners need to be aware that they must register their dam with the State of Vermont. Once a dam is identified, knowing the identity dam owners with help Vermont agencies and other interested stakeholders, e.g., Connecticut River Conservancy and TU, assist in finding

appropriate ways to manage, or remove dams, including assisting with financial and technical aspects.

**Response:** Agreed. Information has been added on dam safety legislation, impacts to property owners, information and a link to the Dam Safety Program has been added.

**Comment:** Need to address flow impacts to fisheries below Searsburg Dam.

**Response:** Flow through the Searsburg Dam is regulated through FERC and dam operations are licensed through that agency. The Deerfield dams were licensed in 1997 for 40 years. The next opportunity to change flow requirements will be when this permit expires in 2037.

Current operations must also comply with the conditions set out in the 401 Water Quality Certification which is a required State permit granted during FERC licensing process. Permit conditions require that minimum flows shall be released on a continuous basis and not interrupted. These flows are set in permit tables for each of the three dams and cover specific calendar periods.

**Comment:** Investigation for Possible Removal of Specific Dams. We recommend further investigations of the timber crib dam on the Deerfield River in Readsboro Center to assess fish passage and whether removal makes sense from standpoint of natural barriers to fish passage. If a determination is that this (and other dams) should be removed, mention of the needs to identify dam removal should be mentioned as being needed.

**Response:** This dam will be assessed by VFWD. Dam removal over the entire Basin is a strategy in the Plan where dams are no longer in use for sanctioned activities, or otherwise maintained through private ownership. Act 161 of 2018 (an Act Relating to the Regulation of Dams, 10 V.S.A. Chapter 43), amends the State Statute for the regulation of non-power, non-federal dams. The amendments to the statute included the addition of a purpose statement, definition of a "dam," requirements for developing inspection schedules, hazard classifications, dam inventorying, and dam recording in the land records. In addition, the statute authorizes the Dam Safety Program to develop Dam Safety Rules to implement both the administration and technical standards applicable to VDEC's regulation of dams.

**Comment:** TU is looking into identification of dam impacts on Mill Pond Brook and Glastonbury River and removal possibilities.

**Response:** VDEC supports TUs efforts to identify dams for removal.

**Comments regarding Fisheries Assessment and Appendix D:**

**Response Overview:** Many comments received pertain to the *Fisheries Assessment of Basin 12* which is included in the Plan as Appendix D.

These comments are valuable to the planning process and are addressed as extensively as possible. However, the Tactical Basin Plan is a water quality and aquatic habitat management plan, so while many of the strategies and resource concerns overlap with fisheries habitat, the Vermont Fish and Wildlife Department (VFWD) is responsible for the management of fisheries resources. As such, the VFWD has developed several Fisheries Management plans (e.g. Trout, Bass, and Sturgeon), as well as the more comprehensive Wildlife Action Plan. The scope of the basin plan does not extend into the realm of fisheries management. This is under the sole purview of the Vermont Fish and Wildlife Department which conducts monitoring and planning for fishery resources.

The goal of TBPs is water quality and aquatic habitat protection and improvement. VDECs Monitoring and Assessment Program (MAP) uses data collected by fisheries staff to support these broader goals and VFWD uses VDEC-MAP data in fisheries management planning. TBPs support fisheries management and habitat improvement for all fish communities. VFWD plans have a stronger focus on trout populations and other game species. Fisheries management plans address management goals set out in the Vermont Wildlife Action Plan and the Connecticut River Atlantic Salmon Commission's *Connecticut River American Shad Management Plan* among others.

The *Fisheries Assessment of Basin 12* report is compiled by VFWD to provide the Watershed Planner with an overall characterization of the status of fisheries in the basin in order to help identify priority areas for, and development of, implementation strategies many of which have co-benefits for water quality, aquatic habitat and fisheries restoration.

Many of the suggestions in the comments received are beyond the purview of the tactical basin plan due to the regulation of hydropower facilities which are under the authority of the Federal Energy Regulatory Commission (FERC). The operational permits of these facilities regulate water level and flow fluctuations, temperature changes due to dam releases and periodic scouring and flooding of habitat.

Other water quality impairments, such as acid rain and mercury deposition, which may impact productivity, are also beyond the scope of what a basin plan can address.

**Comment:** The assessment of fish needs to be strengthened. The data for fish is very thin.

**Response:** See above regarding the *Fisheries Assessment of Basin 12* report.

**Comment:** The fishing appendix needs some additional information as to who identified the species in the watershed. The source is never given and it should be identified for potential follow up by interested citizens.

**Response:** The source of data is from the Vermont Department of Fish and Wildlife.

**Comment:** Lack of instream habitat is a contributing issue to lower trout abundances in both tributaries as well as main stems.

**Response:** Agreed. Lack of habitat is one of the contributing factors in trout abundance. Other factors add to the impact including water chemistry, temperature and flow fluctuations. Working with dam operators to mitigate flow alterations and implementing habitat restoration projects are included in the Implementation Table.

**Comment:** With only certain reaches of certain rivers sampled it is unclear how population levels presented in this appendix are actually established. Even if the numbers come by reference reach, say so.

**Response:** Population estimates are made for a specific site utilizing standard sample methods (depletion method) and are not intended to represent the entire river as those densities can change depending on where you are- that is why the coordinates are listed. Fish community monitoring is also conducted by VDEC-BASS and monitoring data is available from Vermont Integrated Watershed Information System.

**Comment:** When reviewing Table 5 should a reader assume that if a river is not listed in the table that means the rivers not been sampled? If so, say so. If not let us know that too and what no listing means instead.

**Response:** The goal of Table 5 is to generally characterize trout populations within the last 18 years at representative sites throughout the basin (likely more representative than data from 20-30 years ago; and consistent with the B(1) fishing criteria). Older data, (MacMartin survey), data from outside sources such as the US Forest Service and consultants may not be included in the table. If a site is not listed it does not mean there is no data, it likely indicates that the data is outside of the "recent" 18-year timeframe. Sites with Asterix "*" indicate data collected by an outside source and are included because the data was relatively recent and thought to be representative of the site. VFWD is directly involved with site selection and sampling for some of these sites.

**Comment:** What is the function of Table 6? If the statistics are district wide as the table says, does that mean all streams, rivers, and ponds in Windham and Southern Windsor Counties that comprise the F&W district? If so, how does that data base connect to the plan and what is its import and if the sampling is not from the full district then the Table heading should be clarified as to what "District" means.

**Response:** The goal of Table 6 is to objectively compare how the Deerfield or Basin 12-13 stacks up against representative sites (233 sites) throughout the southeastern portion of the state (District 1) utilizing relatively recent data (2000-2018). It aims to answer: are trout populations lower, higher or similar to the rest of the District? Figure 4 shows the District and associated sampling sites but we can better describe the area/District in the future.

**Comment:** If the source of the information for Table 7 is not VFWD then the source should be identified in the chart so a citizen could follow up if they desired to do so. From the narrative that would probably mean USFS but the Table should say so.

**Response:** Table 7 is data collected by VFWD.

**Comment:** An ongoing confusion that the plan does not explain is that VFWD has a B(1) classification that denotes the fish density of the reach of river. VDEC has a B(1) classification that includes a wide range of parameters to be classified as a B(1) water.

**Response:** Recent revisions to the Vermont Water Quality Standards now allow for the reclassification of surface waters to Class B(1) for one or more uses under the Vermont Water Quality Standards, including fishing (as a separate use). we have been in the process of working with the Vermont Department of Fish & Wildlife on the reclassification procedure that would provide the relevant data standards per the attendant methodology to be submitted as part of any rulemaking process. Procedures necessary to reclassify surface waters for any designated use under Class B(1) are in development and we are committed to moving these forward in order to facilitate the Agency's rulemaking authority as soon as practical. Currently there have been no surface waters reclassified to Class B(1) for any designated use since this revised classification system was adopted as part of the Water Quality Standards in 2017. All surface waters in Vermont are managed to support designated uses valued by the public at a level of Class B(2) or better (Table 2). Designated uses include swimming, boating, fishing, aquatic biota, aquatic habitat, aesthetics, drinking water source and irrigation. VDEC has established criteria for swimming, boating, aquatic biota, aquatic habitat, aesthetics, and drinking water source uses and VFWD has established criteria for the fishing designated use. Monitoring data collected by both Departments supports the recommendations in this Plan.

**Comment:** If they are different things using the same designation, then:

First, there is no adopted VT law or rule about classifying a reach of river B(1) or any other number for that matter based on its fishery. This may be an internal designation used by the fishery biologists at VFWD but it is jargon few others understand.

**Response:** Per § 29A-104 of the Water Quality Standards, a body of water may be assigned different classifications for different uses, including fishing and related recreational uses. Recreational fishing criteria are laid out in the VWQS in § 29A-306 Use-specific Management Objectives and Criteria by Class, sub-section (e). While the methodology to determine adherence to Class B(1) fishing criteria has yet to be approved as a formal procedure, the Department has been using this methodology to determine if streams consistently meet fish population and density metrics. These metrics reflect the Wild Salmonid Stream Classification Guidance developed by VFWD in 2017.

**Comment:** Second, it is confusing to be using exactly similar designations to identify different attributes of a stream. Since B(1) is both in law and is used extensively in the WQS, VFWD should adopt a different indicator than B(1) for this and any other plan or document using both designations.

**Response:** Surface water classifications for all designated uses use the same classification system of A(1), A(2), B(1) and B(2). Fishing is a designated use under this classification regime pursuant to the 2017 VWQS (and in accordance with Act 79 passed in the 2016 legislative session) which created Class B(1). Designated uses are now to be independently classified. This means that a waterbody may in the future be classified at different levels for individual uses, so long as the Class B(2) minimum water quality conditions are maintained for those uses that are not being proposed for reclassification.

**Comment:** But if in fact VFWD is nominating a reach of river to be classified as B(1) as a fishery as the sole parameter under the "one or more uses" under the established WQS B(1) designation than that should be made clear especially since it usually takes all of the parameters under the WQS B(1) classification to create a healthy fishery. So if it has only a B(1) fishery why would it be a B(1) if the other traditional B(1) parameters do not apply?

**Response:** As *Table 2. Criteria for Water Classes* depicts, each designated use has specific levels of criteria that must be met to achieve that class. Any surface water can be classed based on one designated use. While conditions under several uses may exist, only one is required for the water to meet a class level. Fishing can be the only use met by a water's condition.

Yes, the information provided was to identify sites that could potentially be reclassified as B(1) under the Wild Salmonid Stream Classification Guidance § 29A-306 Use-specific Management Objectives and Criteria by Class (e) Recreation – Fishing. Utilizing the criteria outlined by the Agency:

Class B(1).

(A) Management Objectives. Waters shall be managed to achieve and maintain very good quality fishing.

(B) Criteria.

(i) Measures of wild salmonid densities, biomass, and age composition indicative of very good population levels.

(ii) Waters that are designated cold water fish habitat shall comply with the Temperature Criteria in § 29A-302(B) of these rules.

Description:

Wild, self-sustaining salmonid populations which are capable of supporting multiple age classes totaling a minimum of 1000 per mile (all species/ages/sizes); and/or 200 per mile > 6 inches (total length); and/or 20 pounds/acre (all species/ages/sizes).

**Comment:** B(1) for fish cannot be applied as a definition even if criteria is met if there is another impairment such as the Deerfield below Harriman. But what if a B(1) fishing stress occurs below the 3.5 miles of "impaired waters." Do the upstream impaired waters become protected for fishing?

**Response:** VDEC would not support reclassifying a water to B(1) if it is currently impaired or stressed. None of the mainstem of the Deerfield River is proposed for reclassification. However, as stated above, a water may be reclassified for only one existing use. Therefore, the hypothetical situation stated is possible if the upper reach is included in the reclassified section.

**Comment:** Language for the stream nominated – inconsistencies in designation B(1) based on amount of sampling.

**Response:** Reclassification is recommended based whether or not surface waters meet criteria for each specific designated use that has been identified. B(1) recommendations for the Fishery designated use are different from those for Aquatic Biota designated use. This may be the cause of confusion.

**Comment:** Green River, Broad Brook, Whetstone Brook: there is a problem with the term "low to moderate abundances of trout" – these specifications are relative. Should omit "low to moderate abundances of trout" because these streams are nominated for classification and this statement may provide support to those opposed to such classification.

**Response:** Fisheries is not recommending the Green River for B(1) Fishery. The Green River is being recommended by VDEC for A(1) Aquatic Habitat.

At some VFWD sampling sites trout abundances do meet B(1) fishing criteria, though not consistently enough to merit Class B(1) fishing classification. The VDEC uses the index for biological integrity (IBI) to assess aquatic biota (i.e., biological condition). This combines the community rating scores for macroinvertebrates as well as endemic fish species, populations and density, which are different than the parameters used by VFWD to assess (recreational) fisheries populations and density.

**Comment:** Small headwater streams - Streams with relatively high abundance include Bond Brook. But not nominated. Land [Lamb]Brook not nominated and may have sufficient fish populations. Deerfield Main Stem should also be considered for B(1).

**Response:** VFWD makes recommendations for B(1) fishing reaches based on VFWD's current data. They did not include these brooks at this time because data supporting reclassification has not been collected by VFWD.

**Comment:** Vermont's designation of "Outstanding Resource Waters (ORW)" offers potential for significant protection of wild native trout. Vermont NFC is examining the complex, detailed criteria for seeking designation of Outstanding Resource Waters and will engage staff in future basin plans on this prospect. Waterways classified as A(1) with wild native trout populations should be considered for the ORW designation.

**Response:** VANR looks forward to continued discussions of ORW opportunities for the Basin and other basins across the state. ORW may be applied for: a waters' value as fish habitat; its existing usage and accessibility for recreational, educational, and research purposes and for other public uses. These would be applicable to fishing of wild native trout populations. Also please see responses under the Reclassification of Waters heading.

**Comment:** Tables with no data at the back for stocked and wild trout streams – West Branch isn't stocked. Says no data for Black, but data is in for this. Table 8 (for example). Figure 2 shows no data for some streams that then have data in the tables. US Forest Service Data listed – is it state or US Forest Service Data?

**Response:** Table 8 does not contain data on Black Brook. USFS data was used to characterize populations in the Somerset area. The map is specific to VFWD data showing sampling locations – see table headings for clarity on the source of the data

**Comment:** Harriman Bypass is not a small headwater stream.

**Response:** Duly noted and revised.

**Comment:** Deerfield mainstem, West Branch and Broad Brook are large streams

**Comment:** West Branch Deerfield is not stable. Data shows Brook trout above Searsburg Dam and Brown and Brook in Rake Branch.

**Response:** Duly noted and revised.

**Comment:** Fisheries strategies need to include Black Brook and East Branch above Somerset Reservoir.

**Comment:** Strategic wood additions will also be placed in East Branch and Black Brook.

**Comment:** Mitigation of Physical Habitat Deficits of Selected Streams. There is need to enumerate specific steps in a task list that defines what should be done on the East Branch tributaries with physical habitat deficits. These include Vose Brook, Box Cover Brook, and the East Branch itself. By doing so, following stream assessment work, projects identified on these streams would be eligible for ERP funding from the State of Vermont—along with TU grant funding used as matching funds.

**Comment:** Marie has included woody additions in Somerset area streams (Vose, Heather, Rake, Deerfield, Deer Lick, Deer Cabin, East Branch and Blind Brook). TU is asking VDEC to add the East Branch and Black Brook above Somerset Dam as well as Redfield Brook to compliment USFS activities.

**Response:** Specific project locations will be integrated into the Watershed Projects Database when restoration projects are identified through sector-based assessments. ANR encourages organizations to conduct assessments of need before projects are undertaken. Volunteer organizations may opt to do habitat improvement work in any watershed with the approval of the landowner, and after consulting the regional River Management Engineer, if jurisdictional, and after obtaining relevant permits. Consultation with the VFWD is recommended to ensure consistency with the VFWD screening tool, which was provided to Trout Unlimited and interested stakeholders.

**Comments on the Searsburg and Harriman Reservoirs:**

**Comment:** Fish data below Searsburg Dam Data – what and where is this data? The gates don't function well at Searsburg Dam causing fish passage and water temp issues.

**Comment:** Address impacts to Deerfield below Searsburg.

**Comment:** Addendum data suggest Deerfield below Harriman, Bond Brook and Lamb Brook are B(1) candidates.

**Comment:** Assessment of Stream Temperatures Perturbed by Dams. In Appendix A 2014 Report Card (Objective 2, pg 101), the regions above and below Somerset, Searsburg and Harriman Dams, assessment of temperatures are described as both "in

progress" and "on going." Can those be objectives be included on the 2019 Tactical Basin Plan?

**Comment:** TU is asking ANR to support working with TU to support fisheries sampling and habitat work as a priority in the 1 to 2 mile range below Somerset.

**Comment:** TU is asking ANR to work with TU and USFS to evaluate fisheries below Somerset, Searsburg and Harriman Hydro dams for the following reasons: continuity with "ongoing 2014 tactical plan priorities," supporting TU and USFS efforts to improve fisheries in these areas (large wood, dam activities). Helping to assess the fisheries to define needs thus sorting out the interaction of artificial flows, acidity and temperatures as they relate to habitat and define the fisheries on a reach by reach basis. For instance, we may wonder if quality spawning tributaries occur on the East Branch, does that translate to more fish in the East Branch or mainstem below Searsburg? Does temperature below Harriman Reservoir regulate fish growth? What if the dam in Readsboro was removed? Would larger trout move through the river seasonally and create fisheries for larger trout?

**Response:** VFWD does not currently monitor below the Searsburg reservoir. VFWD has conducted preliminary assessments (longitudinal point measurements) which are included in the appendix. TU or other groups are encouraged to undertake further study. VFWD can provide technical assistance in study design. Studies may also be requested when the next FERC relicensing period opens in 2037.

VFWD makes recommendations for B(1) fishing reaches based on their own current data**,** not on data from outside sources. VFWD did not include these brooks at this time.

**Comment:** You undercut your argument for B(1) fisheries in Whetstone and Broad Brooks.

**Response:** Both of these brooks currently meet criteria for B(1) for fisheries.

**Comment:** The Commissioners of Fish and Wildlife and Environmental Conservation should both sign the plan along with the approval signature from the Secretary. The acceptance of the plan by both commissioners increases its scope as a planning document for two critical agencies within ANR.

**Comment:** VDEC and F&W Collaboration on the Basin Plan. In order to achieve greater balance fisheries and broader watershed issues, we see a need that both VDEC and F&W sign off on the Basin Plan. We therefore recommend that a joint VDEC and F&W meeting be convened to address this issue that includes leaders of both agencies be scheduled.

**Response:** The Tactical Basin Planning process is administered by, and Basin Plans are produced by, the Department of Environmental Conservation pursuant to 10 V.S.A. § 905b and 10 V.S.A. § 1253. VDEC has the responsibility of overseeing and maintaining water quality and is therefore the official lead for the Agency of Natural Resources, but also works collaboratively with VFWD in compiling relevant data. The Secretary of the Agency, which includes both VDEC and VFWD, approves and signs all TBPs. It is important to make the distinction that Tactical Basin Plans are Watershed Management Plans pursuant to 40 CFR 130.6 and 10 VSA 1253(d), and not intended to replace fisheries management plans that are developed and approved by the VFWD.

**Comment:** Implementation of Stream Culvert Projects. VDEC should work with stakeholders to get AOP to become a standalone water quality indicator so that culvert projects will qualify for funding without the need to otherwise justify water quality impairment. Undersized culverts: 1) exacerbate flooding causing a "fire hose effect;" 2) prevent critical fish and aquatic invertebrate movement; and 3) prevent sediment and large wood transport important for fish cover and stream habitat.

**Response:** The Vermont legislature and the Clean Water Board set the priorities for how Clean Water Fund dollars can be invested. AOP has not been prioritized as a water quality issue. VFWD has prioritized AOP and funding through that Department may be available for these types of projects. If a culvert has been identified as a water quality problem due to excessive erosion and sediment loss it may qualify for funding through VTrans Better Roads Program or the CWSRF.

**Comment:** Clarification of Charts and Figures. We recommend further clarification regarding the relevance of information relating to the following charts and figures:

- When offering a graph of wild trout populations, include all species of wild trout through 2019.
- When citing data that shows a B(1) population of wild trout, identify the name of the agency or organization contributing the data.
- Create a grid of potential B(1) trout waters that identifies trout species within B(1) reaches of stream as is defined in the Passumpsic River Tactical Basin Plan.
- If data supports stream classification of B(1), but it is not cited as such, provide the reason for not doing so.

**Response:** Suggestions will be considered in future reports.

**Comment:** Stamford Pond Fishery Classification. Based on prior fishery assessments, wild brook trout have been identified in Stamford Pond. Given the scarcity of wild brook trout ponds throughout Vermont, additional fish survey data of this potential high value resource should be considered.

**Response:** To be considered by VFWD for future survey.

**Comment:** Missing Habitat Status Information re. Whetstone and Crosby Brook Fisheries. In Appendix A 2014 Report Card (Objective 27, pg 108), it seems that in the 2014 Basin Plan there was a plan to implement fisheries habitat improvement projects on Whetstone, Broad, Newton and Crosby Brooks and it was "not started." If this is the case, can this objective be included on the 2019 tactical plan? In addition, it seems that some habitat improvement projects were undertaken on Whetstone Brook and Crosby Brook. Can those be described and referred to as "partially completed" in this table?

**Response:** Crosby Brook planning has been moved into Basin 11 and will be addressed in that plan. Some work has been completed on Whetstone Brook, most significant being the removal of extensive bed armoring placed after TS Irene which has restored the natural streambed. Clean Water funding is now focused on water quality improvements limiting the opportunity for funding fish habitat improvement projects through basin plans so Objective 27 has not been carried over.

**Comment:** If it is determined that USFS data cannot be used to designate B1 or A1 for fish, TU asks an ANR staff to accompany USFS so data can be used for designation.

**Comment:** ANR is not certain USFS data can't be used for designating B(1) for fishing. Will Eldridge seemed to think USFS data was used for B(1) fishing nominations for the White River Tactical plan. Lael Will did not seem to think USFS data was usable. The tactical plan should clarify.

**Response:** VFWD selects monitoring sites based on fisheries management priorities which extend beyond reclassification. If reclassification opportunities coincide with VFWD priorities than data is used for that purpose. VFWD collects long term data for management purposes and does not duplicate USFS work on federal lands. Many streams in the GMNF have already been reclassified to A(1) and that protection will also protect the fishery. USFS data and its application to B(1) recommendations for fisheries is solely within the purview of the VFWD. It is the prerogative of VFWD whether or not to incorporate the data into their decision making. Clarification of USFS data use is under review in VFWD.

**Comment:** Maximizing Tributary Fish Production to Repopulate Streams. If stream treatments were focused on tributary production to quickly maximize the repopulate of trout, e.g., on Deerfield River's mainstem, even if top flow from dams damages fish populations., this would be a cost effective approach that should be mentioned as desirable (i.e., for "the biggest bang for the buck"). Along the Deerfield River's mainstem this includes Bond, Heather, and Medbury Brooks, but currently not Vose Brook which appears damaged with no pools and cover.

**Response:** These brooks are all or mostly on USFS lands. Vermont state agencies do not conduct monitoring or treatment projects on federal lands unless partnering with federal agencies.

**Comment:** We wish to express our gratitude to the VDEC and F&W members present at the January 9 meeting who so generously listened to our questions and thoughtfully provided well considered answers at the time.

**Response:** Thank you. VDEC and VFWD appreciate the involvement and efforts of TU in working to improve water quality and habitat conditions.

**Comment:** Native Fish Coalition (NFC) asserts the Deerfield watershed and its cold-water fishery deserve special attention for the benefit of wild native trout. The coalition supports specific strategies listed in the basin plan and recommends one additional strategy.

**Response:** Duly noted.

**Comment:** NFC supports expansion of ongoing efforts by staff of Soil Conservation Districts and Vermont Fish and Wildlife Department to work with municipal and state highway agencies and private landowners when road projects are planned near wild native trout habitat (Plan, Developed Lands/Road).

**Response:** VANR appreciates this feedback and has strategies in the plan to address AOP such as replacing culverts, removing dams and weirs.

**Comment:** NFC endorses the plan's effort to re-classify all qualifying brooks that meet water A(1) criteria, the classification granted to the highest water quality. NFC recommends that waters with documented populations of wild, native brook trout be granted A(1) status. Stream and pond monitoring records by Vermont Fish and Wildlife Department can document existence of wild native populations to support A(1) status.

**Response:** VANR appreciates this feedback and welcomes a continued discussion with the Native Fish Coalition and VFWD in terms of a targeted monitoring of waters with consideration for emerging technology to identify other streams that may warrant A(1) criteria.

**Comment:** NFC's strongest endorsement in this plan goes to wood addition and other habitat enhancement by VT Fish and Wildlife Department in targeted streams. This work produces near-term and enduring benefit for native trout. Those streams are: Rake, Deer Cabin, Deer Lick, Blind, Glastenbury, Vose, Heather Brook, and the Deerfield main stem above Rake Branch. Strategies set forth in this basin plan coincide with plans by the U.S. Forest Service for complementary habitat work in the national forest.

**Response:** VANR appreciates the native fish coalitions support for this work. These brooks are included in the Implementation Strategies.

**Comment:** Native Fish Coalition recommends that streams and ponds qualifying as wild native brook trout habitat have signage recognizing this resource. Consistent with its activity in other states, the Vermont chapter of NFC will lead an educational sign project to include design, funding and placement of signs by NFC.

NFC notes that the Passumpsic Tactical Basin Plan published by Vermont Agency of Natural Resources in October 2019 endorsed an NFC-sponsored sign project (Strategy no. 43, page 62).

**Response:** The VFWD Commissioner is currently evaluating the signage proposal. In the Deerfield there are only two sections that rely on stocked fish. All other streams are supported by wild populations.

**Comment:** With the improvement of the North Branch, I see a direct connection to economic growth. This region, home to Mount Snow and many vacation homes, has ample facilities to host visiting fishermen. There are also ample access point to the main stem and its tributaries, not to mention that East Branch in Stratton and Somerset is within easy reach of Dover/Wilmington. Improving the fishery here would drive local economic growth as well as fish and wildlife license sales.

**Response:** VANR is working with the US Forest Service, Trout Unlimited and other partners on habitat improvements to support the native fishery.

**Comment:** As you know, Trout Unlimited is active and concerned about the East Branch, so I will leave most of those comments with them, I am however, very concerned about the lack of access to this important waterway.

**Response:** Concern regarding this issue is noted. Access to waters through private land is not under the control of the VANR. Private ownership of any parcel is temporary and access options may become available with change in ownership.

**<u>Comments regarding Flooding and Flood Resiliency:</u>**

**Comment:** General Question: floods come from rivers. Haven't talked much about flood resiliency. Wilmington has been through a lot with flooding and the Deerfield river. Many businesses and streams are along the river – maybe better cooperation if better understanding of the potential benefits of this work.

**Response:** Please see the section titled Tropical Storm Irene in Chapter 1 for flood resiliency information. Additions have also been made to Chapter 4 to address flood resiliency.

**Comment:** With the emphasis on the North Branch of the Deerfield, was flooding one of the considerations that had bearing on that?

**Response:** Flooding and flood resiliency are reasons for the North Branch Deerfield being a priority river. Others include the impacts from development such as stormwater runoff and the bacteria TMDL on the river. Chapter 4, f) Hazard Mitigation and Flood Resiliency lists the TBP goals for building greater flood resiliency. Flood mitigation is addressed in the Implementation Table with these strategies:

- Acquire RCE on lands located in floodplain and alluvial fans
- Increase the number of river and floodplain restoration projects to re-establish connections to floodplains
- Increase River Corridor Easements which incorporate channel management, riparian buffer provisions and flood resiliency and protection from conversion & development

**Comment:** The Wilmington Planning Commission has just attempted to put together a new floodplain and corridor protection regulations and was just shot down due to a small, vocal number of landowners. How do you answer their concerns about having their property values decline as a result? Are there any studies or relevant research we could point to about property values?

**Response:** We are not aware of studies analyzing the impact of river corridor regulations on property values. We are also unaware of towns with adopted river corridor bylaws adjusting assessed values downward. To be sure, there are some parcels within the River Corridor that cannot be developed if subject to town River Corridor regulations or Act 250. If the expectation by a landowner is to increase the value of a parcel by adding improvements such as a new home or business, then there is a chance that on certain parcels river corridor regulation would preclude increasing the value in that regard.

While we understand that landowners have land use expectations, the notion that river bottom lands prone to flooding and erosion have the same development value as other parcels is flawed and highlights the fact that there are inadequate real estate disclosure requirements around environmentally sensitive and/or hazardous areas.

Notwithstanding individual property owner land use expectations, it is important to understand that River Corridor regulation is intended to ensure that future encroachments do not create an adverse impact for other properties and public infrastructure. Private development in floodplains and river corridors largely externalizes the costs to the community and taxpayers, in the form extremely expensive and recurring flood recovery costs. River corridors provide an important tool to inform land-use planning and development to make sure new investments are not in conflict

with predictable and dynamic river evolution processes. Said another way, a primary objective of the river corridor is to avoid putting new investments in harm's way and avoid further channelizing our rivers to protect new investments from ongoing river adjustments. Channelization, typically in the form of streambank armoring, is expensive, often fails, and exacerbates erosion hazards by transferring erosion to other properties and infrastructure elsewhere in the system.

Generally, courts have shown great deference toward government entities enacting hazard-based regulations, as those regulations are geared at ensuring that actions of one property owner do not create hazards for another. More reading on this topic is here: https://www.floods.org/NoAdverseImpact/NAI_AND_THE_COURTS.pdf

Also please see the newly added section in Chapter 4 on Hazard mitigation and flood resiliency.

**Comments on Forests and Forestry:**

**Comment:** Is there some overlap or common goals between tactical plan and US Forest Service Integrated Somerset Project? There are probably some common goals.

**Response:** Yes, there are some similar goals between the two. The Somerset IRP looks to manage forestlands for improved water quality, forest health and forest resources. All of these goals complement and enhance the basin planning goals for clean water, healthy forest ecosystems and improved habitat.

**Comment:** The mention of Act 64 - AMP information needs to be updated with new legislation.

**Response:** Corrected

**Comment:** Sedimentation from logging operations, incursion into buffer zones and loss of tree canopy are detriments to healthy brook trout populations. Vermont Forest and Parks Department recommends logging operations abide by "Acceptable Management Practices (AMPs)," which were updated in 2018. However, AMPs permit logging roads and activity as close as 50 feet from stream banks; trees may be harvested even closer.

Vermont's Wildlife Action Plan (ANR, 2015, A3, p. 78) lists wild native brook trout as a "Species of Greatest Conservation Need" (medium priority). Given the laxity of AMPs in and near streams, Vermont Department of Forest and Parks is encouraged to more actively monitor and regulate logging activities adjacent to waters classified as A(1), particularly for erosion control, road crossings and buffer zones. This is consistent with the basin plan under Forest Management actions (p.79). It also upholds the Wildlife Action Plan.

**Response:** The VDFPR *Accepted Management Practices (AMP) for Logging Jobs in Vermont* present a suite of practices which, when adhered to, provide to the operator or landowner the presumption of compliance with WQS, regardless of waterbody classification (see §2-03.B of the WQS and 10 VSA §1259f). Logging jobs occur throughout Vermont in Class A(1) watersheds on a regular basis, in compliance with AMP's, with A(1) conditions maintained. The 2018 revisions of the AMPs included several edits which provide additional water quality protections, including added surface water protections associated with stream crossings.

The VDFPR has AMP District Foresters on staff who routinely visit timber harvesting projects to ensure that loggers are complaint with the revised AMPs. In addition, the Agency has been partnering with the USFS to monitor timber harvesting operations on publicly managed lands in the GMNF.

**Comments on Invasive Species:**

**Comment:** Figure 14:

- There is no green color along the CT River to designate exotic species - Eurasian milfoil, curly leaf pondweed, European water nymph, water chestnut and also *Najas guadalupensis* (not considered invasive in VT, but considered invasive in NH though not regulated)
- Also, the lower portion and mouth of Broad Brook (Rte 142 bridge down) has had Eurasian milfoil and curly leaf pondweed in the past; I have not been back to that particular site for about 10 years
- I have seen in other state documents that Sadawga Lake also has curly leaf pondweed. You also mention that somewhere later in the draft plan.
- Same issue with CT river as above.

**Response:** While only one lake is listed in Figures 14 and 15 as being altered for aquatic invasive species infestation, there are more waters that are known to host them. The mainstem of the Connecticut River in particular has numerous invasive species present. However, these waterbodies not been officially listed in Part E of *Priority Listing of Vermont Waters*. Figures 14 and 15 just show those waters listed as impaired or altered in Vermont's *Priority Listing*.

**Comments on Mount Snow Resort:**

**Comment:** TU is asking ANR to continue to work with Mount Snow to remove the Snow Lake Dam as they committed to doing when West Lake was approved.

**Comment:** Snow Lake at Mount Snow

The Mount Snow Master Plan water quality remediation plan to revert Snow Lake to its original stream channel with wooded buffers needs to be completed and approved by

ANR so that Mount Snow (Vail Resorts) can implement the plan. The current ski season is year two of West Lake being used as the primary snowmaking water source at Mount Snow. Since Snow Lake is not being used for snowmaking any longer, it can be removed as an onstream impounded snowmaking lake. Snow Lake warms the NBDR waters, and the dam prevents fish from migrating upstream. As well, there are sedimentation concerns within and downstream of Snow Lake.

Vail Resort's "Epic Promise" to be the best environmental stewards within the lands they operate, is a cornerstone of their corporate image. It is advantageous that Vail has the financial means and desire to reduce their environmental impact. Snow Lake remediation would be an important step in improving NBDR water quality, would burnish Vail's image and promise to the land, and benefit their new host community.

**Response:** VDEC is committed to working with the new MSR ownership in fulfillment of the commitment to remove the Snow Lake dam in order to improve aquatic habitat and restore aquatic organism passage. Removing the snow lake dam will also improve sediment continuity through the North Branch which will contribute to the dynamic equilibrium conditions in the river, as well as to lower water temperatures that enhance cold water fisheries/refugia habitat.

**Comment:** The North Branch of the Deerfield River: The Town of Dover and the Mount Snow ski area (i.e., the major business affecting waterways in the North Deerfield River, could be doing more in addressing the highly significant river and stream problems they contribute to, e.g., 1) man-made scoured and straightened rivers and streams contributing to flood hazard; 2) potential for excessive use of water for snowmaking affecting stream flows and temperatures; and 3) coliform bacteria and warm water temperatures due to lack of overhanging trees along stream beds.

o Funding to remedy these problems should not all come exclusively from Federal, State, or foundation sources. Instead, serious contributions from these contributing entities—and other business entities that directly benefit from use of the public water resources—is appropriate and should be sought collaboratively.

**Response:** Mt Snow Resort (MSR) is regulated under Act 250 permits, a part of which entail actions to improve water quality in the vicinity of the resort. Many of these actions are outlined in, and subject to, the Mount Snow Resort Water Quality Remediation Plan and the Mount Snow Carinthia Iron Stream Remediation Plan. These plans are in lieu of the TMDL "to address the management of stormwater runoff from lands owned or controlled by MSR within the stormwater impaired portion of the North Branch of the Deerfield River (NBDR)." VDEC WSMD works with the Resort on implementation but as yet they have not been fully implemented and water quality issues are on-going. However, an initial analysis of the latest water quality data

suggests there has been substantial improvement to the North Branch of the Deerfield River. A reassessment of the streams' impairment status is currently underway.

Included in the original Plan framework was the planned removal of Snow Lake and restoration of the NBDR stream channel, thus reducing thermal loading and restoring the natural hydrologic and sediment transport regime. VDEC, VDFW and the Natural Resources Board (Act 250) are all involved in working with MSR to complete this restoration.

**Comment:** Mount Snow Snowmaking

Increased water flows within the NBDR from water taken from Cold Brook for use at Mount Snow and discharged into the upper portion of the NBDR and its tributaries needs to be monitored and its effects modeled. Millions of gallons of water are pumped from West Lake, a snowmaking pond fed by Cold Brook, and placed onto Mount Snow. Subsequently, this water drains into the upstream portion of the NBDR and its tributaries, above its natural source. This increased volume of water raises questions about its effects, especially within the context of increased rain events associated with climate change:

● Modeling should be done to figure out the impact of the unnaturally increased total load carried by the tributaries impacted by the snowmaking (Jack's Brook, Iron Stream, upper portions of NBDR) and the NBDR from the base of Mount Snow down to its intersection with Cold Brook.

● Is fluvial erosion exacerbated because of the millions of gallons of additional water the upstream portion of the NBDR and its tributaries is now carrying due to the expanded snowmaking operation?

● Does sedimentation increase from the additional runoff and what should be done to remedy that? Revegetation of on-mountain roadways/trails?

● Should culverts along the tributaries and upper portions of the NBDR be enlarged to handle the additional flow, and, if so, should Vail Resorts be responsible for upgrading them?

● Is winter/spring flooding more likely or exacerbated with deeper snow-pack due to increased snowmaking and should flood attenuation measures, such as floodplain or river corridor preservation and restoration, be considered on-mountain and along the upper sections of the NBDR to address that concern?

● Are there other structural concerns due to increased flooding potential above natural amounts? Should Vail Resorts be held partly responsible for funding

floodproofing/rehabilitation costs associated with increased risk to those structures identified as vulnerable?

**Response:** The VTANR has directed the use of several and increasing means to achieve the control of the sediment and the site is being monitored by VTANR staff on a regular and on-going schedule of site inspections. The West Lake/Cold Brook Restoration was completed in 2017 with a good remediation outcome that is expected to yield much higher quality river habitat in Cold Brook after the conclusion of the project resulting from the restoration of the floodplain and wetlands, and the remediation of Cold Brook with the construction of the pilot channel and restoration of fish and wildlife habitat. Vermont Rivers Program staff have periodically visited the project in 2018 and 2019 to observe the site conditions after heavy rainfall events. The Cold Brook stream flows in the pilot channel in the last two years have developed gravel meander bars and moved the pilot channel towards dynamic equilibrium. While any new culvert replacement projects must adhere to the VDEC stream alterations general or individual permit(s), the state cannot compel replacement of culverts unless a proposed in-stream activity represents a greater potential risk to fish life, wildlife, and the rights of riparian owners. For all stream alterations activities, project proponents shall submit an application for coverage under either the General or Individual Permit (depending on the activity) on a form provided by the Secretary.

Existing stormwater permits issued under both the construction and operational phases of MSR development are reviewed periodically to ensure that BMPs remain functional and effective.

**Comment:** Iron Stream

The Master Plan Phase I Carinthia Act 250 permit called for the Carinthia parking lot to be paved with water entering a managed stormwater drainage system for limestone treatment and sediment collection. As it stands, the parking lot remains a dirt lot. Work was done Summer 2019 to implement some stormwater drainage along with limestone trenching in the lot. How much of what was approved has been completed, and how much remains not completed? Without a paved "cap" does the iron-rich soil with petroleum deposits and other contaminants that comprises the parking lot continue to contribute to sedimentation and contamination of the Iron Stream? If yes, then Vail Resorts needs to address the problem, regardless if they install the underground parking garage. ANR should also stand firm that the underlying contaminated soil at this brownfield site be removed per the ANR approved brownfield remediation plan.

Water quality monitoring reports required by the iron seep prevention plan should be made available to interested parties and abutters. As an abutter, it is unclear to me if the monitoring is taking place, and if so, what the results are.

Additionally, the culvert for Iron Stream that crosses under Handle Road needs to be placed in such a manner that aquatic organisms can travel upstream. Currently, the culvert is perched several feet above the downstream channel on the east side of Handle Road.

**Comment:** Not sure what the answer is for addressing the iron that comes from Iron Brook, but not far from that, just upstream the headwaters of the North Branch are near pristine, and hopefully will be maintained.

**Response:** Since it was last submitted to DEC in 2015, the Mount Snow's Iron Seep Remediation Plan has been revised to reflect changes to the proposed design of Lot E and the re-routing of the off-site drainage that runs from Pond E to the outlet on the east side of the parking lot.

A new 30-inch drain was installed in the summer of 2019 and is currently operational, and the old 30-inch drain line has been filled and terminated. In combination with lining the swale along the west side of Lot E with low permeability material, these steps have been taken to minimize the exposure of surface water to organic fill materials beneath Lot E. Significant quantities of organic fill materials were removed from the trench and adjacent areas that were excavated to install the new pipes and drainage structures. These features have also been bedded with crushed limestone to provide an additional measure of protection for any groundwater flows that are intercepted.

The timing for the construction of other components of the Carinthia project are to be determined and will be reviewed as they are proposed. Since one of the key elements of the remediation plan has recently been implemented, MSR began the required water quality monitoring associated with that project in the fall of 2019.

The ongoing protection and enhancement of high quality waters such as the headwaters of the North Branch has been identified as a priority in the Deerfield Tactical Basin Plan (see strategies 1, 2, 3) and is a priority management objective per the surface water classification under the Vermont Water Quality Standards and Surface Water Management Strategy (see links).

**Comment:** Carinthia Pond

The Carinthia pond was supposed to have a stream bypass according to the Forest Service plan and agreement made in conjunction with Mount Snow Master Plan permitting in the 2010 timeframe. Water warms in the impounded pond and increases stream temperature in Jack's Brook. The planned bypass would resolve this issue. This needs to be followed-up with the Forest Service and Mount Snow, and if it hasn't been done, then Vail Resorts should install the bypass to benefit this NBDR tributary.

**Response:** Mount Snow has installed and is utilizing a bypass flow system that allows conservation flows to be passed downstream of Carinthia Pond.

VDEC will discuss with USFS to determine current status and if this project is part of the Somerset Integrated Resource Plan (IRP). Jack's Brook currently meets Vermont Water Quality Standards for class B(2) aquatic biota criteria (see table below).

Monitoring Site Summary - River/Stream

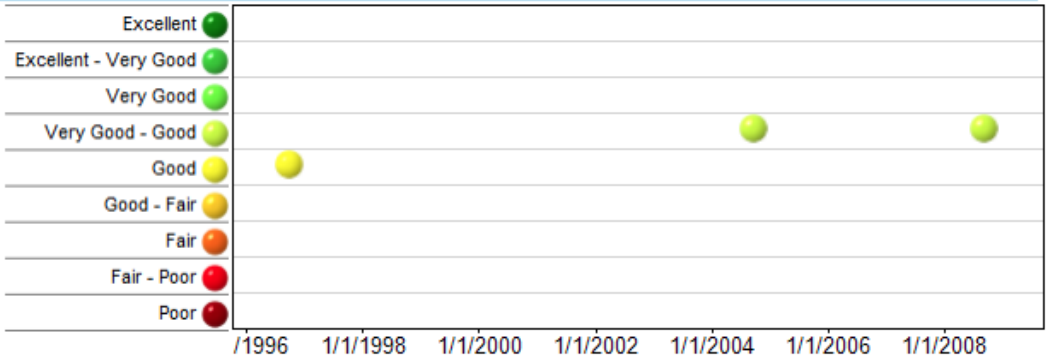
## Jacks Brook

**River Mile: 0.3**
**Control for Iron Brook, renamed at request of Landowner at Tannery Refuge.**
**Dover, VT (42.9552612304688, -72.8891296386719)**

**Macroinvertebrate Assessment**

Macroinvertebrate population Assessments are a measure of the biological integrity of the macroinvertebrate community and an indicator of the health of the aquatic biota. (For More Details)

More Info




**Comment:** Talking with the town clerk from Dover, last week, I was surprised to learn that there was very little, if any, communication between Mount Snow and the State that included the town of Dover. I think it would be nice if the town knew a little more about how the plans to remove Snow lake were progressing, fixing the iron seepage and any tree planting that were planned-not sure where the communication lines are.

**Response:** The NRB (Act 250) distributes information on Act250 proceedings to the towns involved in any permit. Recipients include the: Selectboard, planning commissions, town clerk, conservation commission, development review board and zoning administrator among others**.**

**<u>Comments related to Pollutants:</u>**

**Comment:** In the analysis made for waters stressed by acid and mercury – are they precipitated? Can any remedial steps be taken?

**Response:** Both sulfur and nitrogen oxides are released as by-product of coal combustion and delivered to Vermont via the prevailing winds. Along the way in the

presence of sunlight and water these precursors transform and become the acids that fall as acid deposition. Mercury is released in its elemental form (Hg) when coal is burned and arrives in that state unchanged. Thus, both the acids and mercury result from atmospheric releases from distant coal-fired power plants from sources outside of Vermont. When deposited, their presence is exacerbated in regions of Vermont like the Deerfield River Basin, a watershed with low buffering capacity waters and therefore, the ability to neutralize incoming acid deposition. The geological meaning of the term "low buffering" refers to waters or watersheds lacking adequate calcareous bedrock and surficial geology to buffer. Mercury deposition and its transformation to methylmercury (MeHg) within waterbodies is exceedingly complex but reservoirs with manipulated water levels resulting in exposed shoals and shoreline are waters most at risk to methylation. Vermont already emits the lowest amount of acid-forming precursors in the nation and remains committed to its long-term lake monitoring program (VLTM) in partnership with the US EPA with the purpose of documenting trends on acid-sensitive lakes. These acid-sensitive lakes are mostly located in remote and undeveloped regions of the southern Green Mountains and in areas of the Northeast Kingdom. In these areas, full recovery of surface waters may be difficult to achieve.

Due to federally mandated air pollution control regulations associated with the passage of the 1992 Clean Air Act and later actions to address the nation's air quality, some of Vermont's stressed and impaired lakes are showing signs of chemical recovery. Vermont has a TMDL for both "Acid and Hg" and a long-term history of monitoring these lakes. VTDEC's analysis of trends highlight the success that resulted from legislation to curb emissions by the decreasing trends in sulfate and increases in alkalinity and pH.

The cause of many of Vermont's acid lakes and rivers to become stressed or impaired resulted from the long distance transport of pollutants from out of state sources. The VTDEC determined in the mid-1980's after a motion was presented to conduct "large-scale watershed liming" in sensitive regions, that had been thoroughly vetted was not in Vermont's best interest. After researching the current state of the science, scientific peer reviews from Europe, Canada and the US and our scientists understanding of these waters, that common liming as a remediation practices would not be practical, and the potential harm liming might pose would not be considered in Vermont. Thus, the VTDEC through the WMD and the AQCD have maintained a strong reliance on monitoring, research and assessment as the best tools to implement policies that will improve Vermont's and the nation's air quality, and in turn leads to a restored biological community within these lakes.

**Comment:** What about the testing? How often? How much data do you have? How far back does this go?

A subset of 12 acid-sensitive lakes have been sampled three times per year since 1980 partially supported by an EPA Long Term Monitoring grant to study the effectiveness of the 1992 Clean Air Act and its amendments. It is a tremendous data set with some lakes having been assessed for 39 years and these results can be accessed via the Watershed Management's public facing data portal: the Vermont Integrated Watershed Information System (https://anrweb.vt.gov/DEC/IWIS/). In addition to the core set of 12 lakes, all 30+ acid impaired lakes are sampled at least once every five years to determine their current acid status. This monitoring has documented the slowly improving acid status of many of our acid lakes.

**Comment:** "Impaired for Acidity" Waterbody Criteria. Clarification is needed for what criteria are used to indicate that a water body is impaired for acidity. It is also arguably true that streams, including B(1) fisheries, can have "low pH" (i.e., high acidity) yet maintain high fish counts.

**Response:** For lakes, the criteria used to determine acid-impairment is based on alkalinity values. Values consistently below 2.5 mg/L CaCO3 are considered acid-impaired. This value has been used historically based on scientific literature describing minimal impacts on fish and macroinvertebrate communities. This value is considered by VTDEC to be the minimal adequate level of alkalinity in the springtime to prevent acid stress on aquatic organisms in Vermont's lake systems. See the 2003 TMDL for 30 acid-impaired lakes: https://dec.vermont.gov/sites/dec/files/documents/WSMD_mapp_TMDL_2003_Acid.pdf and the 2016 Vermont Surface Water Assessment and Listing Methodology https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/WSMD_AssessmentAndListingMethodology.pdf .

For streams, the criteria used for determining acid-impairment is based on the aquatic biological community. New biological metrics have recently been developed to more accurately reflect these communities.

**Comment:** One particular issue that stood out in reviewing the Deerfield River and Lower Connecticut River Tactical Basin Plan (DRLCRTBP) was the environmental sensitivities of our lakes and ponds, specific to atmospheric acid and mercury particulates falling into these waterbodies. Does the state take the important step to inform the public about consuming fish caught in these types of identified lakes/ponds? As a fisherman, it is critical for recreational fishers to be aware (through signage at boat launch/public access areas) of present-day situations related to water quality, where a "catch and release" approach is necessary for ponds/lakes exhibiting

potential health-related concerns. This recognition through signage may not be viewed as a favorable option locally, though a compelling argument to the contrary regarding public notification could be made for those threatened ponds/lakes.

**Response:** The Vermont Department of Health puts out this information through the Fish Consumption Advisory. The Deerfield chain is highlighted cautioning consumption of fish from Grout Pond, Somerset Reservoir, Harriman Reservoir, Sherman Reservoir, and Searsburg Reservoir. This is provided in the Plan in the fisheries section of Chapter 1. The Department of Health currently does not post fish consumption advisory signage at affected waterbodies.

**Comment:** I think it is imperative to address the bacteria issues and thermal loading of the main stem North Branch.

**Response:** Agreed. The bacteria impaired reach on the North Branch Deerfield is a priority area for water quality restoration. Strategies to address bacteria in the Implementation Table include:

- Identify and mitigate sources of bacteria causing impairment
- Address stormwater runoff discharges from ski area development impairing water quality
- Conduct stormwater master planning to identify and prioritize actions
- Address stormwater runoff entering Whetstone Brook
- Conduct wastewater planning and feasibility studies for small communities without municipal systems

Regarding thermal loading please see responses above concerning Snow Lake.

**Comments regarding Priority Waters, Strategies and Actions:**

**Comment:** Restoration Priorities – add East Branch North River – it has stream modifications and undersized culverts.

**Response:** These restoration needs are widespread throughout the Basin. The East Branch North River is less impacted than many other areas. It will be addressed but is not a priority river at this time. Recent changes to road standards now require culverts to be appropriately sized to the watershed so as culverts are replaced over time these issues will be addressed.

**Comment:** Is the concept of restoration and priority connected to grant funding?

**Response:** Although they are not explicitly connected, listing waters helps to identify projects that need funding. Waters listed as restoration priorities in Chapter 3 are highlighted due to one or more identified pollutants that need to be addressed. VDEC is required by statute and by USEPA to work on restoration of these waters in order to

bring them into compliance with the VWQSs. This requirement helps focus limited state Clean Water Grant funding resources on these target areas although funding is not exclusively reserved for priority waters.

**Comment:** It would be helpful to have a list of projects that could be accomplished by volunteers.

**Response:** All potential projects are listed in the on-line Watershed Projects Database or on the Clean Water Project Explorer. Volunteers can view the projects to determine which may be best suited for their organization. A separate list of these projects does not exist. Volunteers should consider partnering with larger regional and local groups to support volunteer efforts. These groups are listed as partners in Appendix F.

**Comment:** I am very pleased to see the North Branch of the Deerfield as a focus point. With the smaller tributary streams (Blue Brook, Cold Brook, Negus Brook, Cheney Brook) seemingly in better shape, it seems the right thing to do to improve the main stream.

**Response:** The mainstem Deerfield is a focus area for habitat restoration.

**Comments regarding Lakes & Ponds:**

**Comment:** Could land protections be addressed for riverfront/lakefront property conservation? Floodplain protection?

**Response:** Please see b) Lakeshore Protection and f) Hazard Mitigation and Flood Resiliency sections in Chapter 4.

**Comment:** Mention LakeWise Assessments/shoreline protection?

**Response:** Information added

**Comment:** Lake Raponda: talk about Outstanding Resource Waters. You've said Raponda has too many water problems for this, but it might be eligible for this type of designation. Is this good or bad? Where are we at with this? From the lake's perspective – would be valuable to have professionals' advice and opinions as to what can be done to mitigate these problems. For example: if landowners wanted to come together and designate their property as conserved land would this be helpful?

**Response:** Outstanding Resource Water (ORW) is a designation available for waters that have "exceptional natural, cultural, recreational or scenic values." As stated in Chapter 3, these waters must display outstanding qualities of one or more of the 14 features listed there. These features are designated as those that deserve a higher level of protection. Lake Raponda assessment data show that shoreline development, road erosion and other issues are impacting water quality and aquatic habitat in and along

the lake. These issues are being assessed and work is being done by the Lake Raponda Association and landowners to improve conditions. There are some natural features that may qualify as exceptional given the number of historically documented rare plants in the lake. Documenting and confirming these rare plant communities may be one justification to pursue an ORW designation for the protection of this natural community.

**Comment:** I am also somewhat concerned for Grout Pond, after the meeting we had at the Windham Regional Commission, when it was mentioned that there did not seem to be a way of dealing with human waste there. Not sure if this is true or not, or how many camps contribute to this, but this is a major concern for a potential outstanding water resource. There should also be signage at this site that warns of mercury content in fish.

**Comment:** There are roughly a dozen campsites strung out along the NW shore of Grout Pond. Most are very close to the water. There is an outhouse in the parking lot that is about 100 yards from the nearest campsite, but there are no accessible facilities for most of the sites, some of which are a half mile or more from the parking lot. Those campers are not going to trudge to the outhouse, especially after dark. They are supposed to dispose of their waste in a sanitary way, i.e. dig a hole and bury it. Obviously, that is problematic.

**Response:** This information has been provided by the USFS:
The USFS is aware of these concerns and are in the process of proposing a site redesign for the campground within the Somerset Integrated Resource Project. The redesign includes adding two composting privies easily accessible from the more remote sites along the pond mentioned. The redesign plan also includes increasing the capacity of one of the vault toilets at the parking lot to a double vault toilet and adding an additional vault toilet near a group campsite and proposed new drive-in sites.

To further address water quality and erosion concerns, planning is underway to move all constructed features of the pond-side campsites back 50' from the shoreline and hardening (grading and fine-gravel surfacing) campsites along the pond.
PDFs of the concept plan and a written description can be found in the Draft Environmental Assessment.

**Comment:** Add 2014 Shoreland Protection Act and its link with an explanation of the Act. Related to that, in the tasks when discussing steps to improve lake health, it should be noted that protecting lakes is not voluntary but that riparian shore landowners are required to meet the conditions of the Act.

**Response:** Information and a link to the Act has been added

**Comment:** The DRLCRTBP referenced septic tank education programs, in particular for properties abutting lakes and large ponds. The state does a good job permitting private on-site wastewater systems for residential properties; unfortunately, the state does not require periodic inspections of these septic systems buried in the ground for many decades with little to no maintenance. Failing septic tanks are a contributing factor to algae blooms and increased phosphorus/nitrogen levels in our recreational lakes. In my opinion, the state needs to take a more aggressive stance in ensuring private septic tanks are compliant today and into the future. How best to unfold a program of this magnitude should be done by looking at the successes in other peer states.

**Response:** A properly functioning onsite, soil-based wastewater system may require minimal maintenance for decades of use. The effluent water treated in these systems can reduce Nitrogen by more than 70%, Phosphorus by more than 80%, and viruses by more than 95% in the first 18 inches of soil, making these a critical component to the health of environment. If you have concerns about the functionality of a particular system, you may contact your local ANR Regional Office for additional information on how to assess or report the system (https://dec.vermont.gov/water/ww-systems). Studies have shown that soil-based wastewater systems are rarely the responsible component to algae blooms, with fertilizer usage and direct animal waste contributing magnitudes more to the environment. Communities that are concerned about their wastewater infrastructures may contact the Drinking Water and Groundwater Protection Division's Regional Office Program to participate in a community meeting or septic social event. Additional resources on the functionality of wastewater systems may be found at: https://dec.vermont.gov/water/programs/ww-systems/program-education. Thank you for your interest in protecting Vermont's environment!

**Comments regarding Recreation:**

**Comment:** Access to Recreational Waters: Recreation access is severely limited on Broad and Whetstone Brooks. The foot access is limited because of almost complete private property ownership along the banks of both rivers and where there is not private but public ownership through a road right of way, the banks are steep and uninviting for foot access. There is virtually no safe parking for vehicles for people who wish to stop and fish the streams anywhere along either stream and those few and far between parking areas are limited in size. The limited number of parking areas target fishers to the same location putting increased fishing pressure on those locations instead of spreading the pressure out over the entire length of the streams. Not only is that not helpful for the propagation of wild fish but lack of available fish at those sites does little to nothing to enhance a fishing experience.

We would note that what applies to fishing applies to all other recreation uses of these streams canoeing, kayaking, swimming, and birding. There are no access or parking

points along either stream. VFWD are suggesting classifying these waters as B(1) for their fisheries but with no access who cares.

**Comment:** Insufficient Fishing/Recreation Access. The Basin Plan contains a lack of formal fishing/recreation access on the Whetstone and Broad Brooks. Could the plan include the need for Vermont F&W to look into how the public can provide easier access to these (and perhaps other streams) for fishermen and other recreational users? There are also reports of some landowners whose property abuts brooks harassing fisherman who use bridges to access to these streams to then moving up and downstream to fish. These areas include the following: Broad Brook below Weatherhead Hollow Bridge, and Broad Brook in Vernon. Perhaps for streams designated as B1, ANR could prioritize acquiring state public access points and provide education regarding the legal access of the public in walking on their private property.

**Response:** Classification of waters, including for secondary recreation and fisheries, is based on whether or not resource conditions meet set criteria. Access to waters through private land is not held under the jurisdiction of the VANR and is not part of the reclassification criteria. Access to private property is at the discretion of the landowner, recreational interests are encouraged to contact and secure permission from landowners prior to entering, the Agency does not sanction public access to private property.

**Comments regarding Stormwater:**

**Comment:** Bringing roads up to MRGP standards can require costly civil engineering designs, in order to develop a permitted plan to mitigate road erosion. This requirement is particularly challenging for towns with mountainous terrain, where slopes greater than 15% will likely necessitate professional stormwater engineers to remedy the drainage issue identified.

**Response:** Compliance with the requirements of the Municipal Roads General Permit is required pursuant to 10 V.S.A. § 1264(c)(6). Towns can participate in the Better Roads grant program and the Municipal Roads Grant-In-Aid program which will provide state Clean Water funding to assist with the cost of MRGP practice implementation. The Watershed Planner can connect towns with these resources.

**Comment:** Green Infrastructure design techniques were referenced in the DRLCRTBP, though I feel their importance in the Basin Plan recommendations should be greater emphasized. Habitat preservation necessitates sound stormwater management techniques; where detention ponds, retention ponds, drainage swales, berms, riparian bank protection, site-specific wetland plantings, stream buffers, etc. are potential options that should be mandated of cattle farmers. Factors such as topography, river corridor proximity, soil science, geology etc., have to be considered in these scenario

designs. Annual inspections for state compliance related to effective stormwater controls would complement program implementation.

**Response:** Duly noted. Language and links have been added to the stormwater section of Chapter 4.

**Comment:** Though its applicability is more subjective in our intense winter climate, I feel villages need to incorporate more non-structured stormwater design options for parcels over an acre in size. The state's recent initiative to promote a "3-acre minimum" for stormwater management reviews arguably is too large and does not effectively address non-point pollution at a necessary regional scale. The legislation will allow the vast majority of our village parking lots and larger building footprints to continue to shed concentrated drainage flows onto our downstream neighbors, if parcel-specific detention systems are not conceptualized.

Our towns need to take a lead in promoting non-structured detention/stormwater filtration, where green infrastructure emphasizes the importance of promoting environmental protection locally. The State of Vermont should incentivize the installation of bio-swales and rain gardens in our villages as pilot projects, in an effort to help educate the public on evolving engineering design standards for the future. It is recognized the maintenance demands in overseeing non-structured stormwater controls will be more costly and require additional staff training to implement at the local level, where discounting their applicability in local operational structures is common posture.

**Response:** The draft 3-acre rule, formally General Permit 3-9050, requires, in part, permit coverage for any discharge of regulated stormwater runoff from impervious surface of three or more acres, which was never previously permitted or was permitted under an individual permit or general permit that did not incorporate the requirements of the 2002 Stormwater Management Manual or any subsequently adopted Stormwater Management Manual. In other words, it requires permit coverage for otherwise unpermitted existing impervious surfaces of three or more acres.

For new development or redevelopment of impervious surfaces, stormwater permitting triggers are lower than three acres. Currently, new development or redevelopment of one or more acres of impervious surface requires a stormwater permit, and as of July 1, 2022, this will cover new development or redevelopment of one-half acre or more acres of impervious surface and the expansion of existing impervious surface by more than 5,000 square feet, such that the total resulting impervious surface is equal to or greater than one acre.

The permit will be implemented first in the Lake Champlain, Lake Memphremagog, basins and in stormwater-impaired waters throughout the state. Implementation in the greater Connecticut River watershed is not scheduled until 2033.

**Comment:** As a person who has worked for several years in a management capacity for a major Vermont ski resort, I feel the state needs to create a collaborative relationship with these private ski resorts, in order to have them help promote stormwater management on-site, which could potentially have regional benefits, if done strategically. The state tends to be viewed as a threat/challenge to the ski resort industry, where any efforts to mitigate local stormwater issues are ignored until they become much bigger problems to remedy (at a later date). Site specific engineering improvements to an existing issue may impact the resort's existing stormwater permit, which is treated by these private industries with the utmost importance from a financial management perspective. There is a perception the state goes out of their way to penalize for-profit resorts through assessed fines ultimately serving as a dedicated revenue source, leveraged through VOSHA non-compliance or negating environmental mandates. This unfortunate viewpoint perpetuates an "us verse them" sentiment.

**Response:** Stormwater regulations have been in place in Vermont since 1980. When properly implemented, stormwater management practices applied according to permit conditions have been shown to improve surface water quality at several ski resorts in Vermont. Where pollutants do impair waters, regardless of the adjacent land use, a clean-up plan must be implemented. These either take the form of a Total Maximum Daily Load (TMDL) plan or a Water Quality Remediation Plan (WQRP) if there is an identifiable landowner.

Many ski areas began development prior to stormwater being identified as a water quality problem. These legacy conditions are continuing to cause pollutant discharge to surface waters that now must be remedied.

VDEC works with landowners and businesses to provide regulatory oversight and technical assistance to ensure proper design and construction of stormwater treatment and control practices as well as construction-related erosion prevention and sediment control practices, necessary to minimize the adverse impacts of stormwater runoff to surface waters throughout Vermont.

Finally, the Department relies on enforcement actions, including financial penalties, only in cases of significant non-compliance. Any penalties assessed as part of an enforcement action are directed to the State's General Fund and are not available as revenue for the Department.

**Comment:** I didn't see any information about waters which are surrounded by gas stations and auto repair stations. This is the case in Wilmington, there are 2 gas stations and an auto repair shop within 100 feet of a water way, and then there are two other gas stations just 1/4 mile from the same waterway (Beaver maybe)?

**Response:** Local zoning ordinances can address this concern which may (or may not) be subject to state stormwater jurisdiction.

The Multi-Sector General Permit for Stormwater Discharges (MSGP) is a federally mandated National Pollutant Discharge Elimination System (NPDES) permit administered by VDEC, that covers new and existing discharges of stormwater from industrial facilities. Industrial facilities conduct activities and use materials that have the potential to impact the quality of Vermont's waters. The permit requires facilities to examine potential sources of pollution, implement measures to reduce the risk of stormwater contamination, and test stormwater discharges for sources of pollution. As these facilities make improvements they will be required to come into compliance with the new regulatory standards.

**Comment:** Can someone look into the storage of mulch and landscaping materials in the floodplain and river corridor along Route 9 in West Brattleboro on the Whetstone Brook?

**Response:** This situation will be referred to partner organizations who can work with the landowner to encourage best management practices for the storage of these materials.

**Comment:** Will the road failure issues above Halifax Gorge be addressed in the Plan?

**Response:** VDEC has met with VTrans to discuss this road failure. Route 112 is a state highway and therefore VTrans has jurisdiction over any work required.

**Comments regarding Wetlands:**

**Comment:** In the condition of wetlands image, what does 500 feet mean?

**Response:** This was a scale bar and has been removed to avoid confusion.

**Comment:** What level of protection is there on the Sadawga wetland? Would that enhance protections of unusual species?

**Response:** The floating bog in Sadawga Lake is being recommended for study by the Wetlands Program to assess whether or not it may meet criteria to be reclassified as a Class 1 wetland. If this appears to be the case, the information could be used to petition to have the wetland changed to Class I. Class 1 protections will give further protection to the rare plants within the bog.

**Comments regarding Wildlife:**

**Comment:** Wildlife corridors: In addition to the Basin Plan's reference to wildlife habitat protection, more substantive discussion is needed about the role of water ways (streams and rivers) and water bodies (lakes, ponds and reservoirs) as important

wildlife travel corridors fostering wildlife survival and genetic diversity. Not only is it good for fisheries to have cooler waters from the shade of overhanging trees, but this watershed feature also serves as pathways favored by wildlife. These watershed features are desirable and should be actively encouraged and promoted where feasible.

**Comment:** Should connectivity issues be addressed for wildlife?

**Response:** Language will be added on this topic to the Climate Change Adaptation for Wildlife section in Chapter 4.

**Comment:** Please add more information on the positive impact beavers have on water quality, habitat protection and flood resiliency.

**Comment:** The section in the DRLCRTBP speaking about beaver dams seemed a little confusing to me. It referenced allowing beaver dams to exist factoring their importance in maintaining natural water flows and creating aquatic habitats. The action of physically impounding streams/wetlands would have to go through environmental permitting processes if done by a property owner, yet a group of beavers indiscriminately damming up a watercourse is viewed as helping manage water flows and aquatic ecosystems?

**Comment:** Working towards stream equilibrium and stream resilience: are there types of methodologies that have and have not been approved for river and floodplain restoration projects? Beaver dam analogues, etc. are new methods that have had good success. Are those approved methods?

**Response:** Beaver are a keystone species that are native to North America. Prior to European settlement they were abundant in Vermont but were essentially extirpated as a result of unregulated harvest and a human caused habitat shift from forest to agriculture. In response, many other native species likely declined, such as fish, aquatic organisms, otter, moose, waterfowl and other fish and wildlife which evolved with and, in many cases, depended on beaver created wetlands for survival. Beaver were reintroduced in the early 1900's because it was recognized that the creation of wetlands by beaver are an ecological natural process that promotes functions and values that are not readily replicated by man-made structures. These are incredibly complex systems that tend to cycle on a regular basis and that humans have yet to duplicate in ways that minimize risks to aquatic systems.

There is an ongoing effort on the part of a large group of partner organizations including but not limited to the VDEC, the VFWD, The Nature Conservancy, the U.S. Forest Service, researchers from University of Vermont, Keene State University, the U.S. Fish and Wildlife Service (USFWS), and others to explore options for promoting beaver created wetlands through a wide variety of means.

In addition, the VFWD has worked with VDEC to develop Best Management Practices for dealing with Human Beaver Conflicts to address flooding, tree cutting, and downstream concerns related to beaver created wetlands. The VFWD has provided technical assistance, education, and beaver baffle installations for over 20 years to maintain beaver created wetlands in the face of conflicts with human infrastructure.

*Please see Chapter 1 of the Beaver BMP document: Condition of Wetlands*

**Comment:** Could beavers be trapped and relocated to the East Branch below Somerset Reservoir, the creation of beaver ponds could serve the purpose of warming the way too cold water.

**Response:** VFWD does not recommend the live trapping and relocation of beaver for several reasons:

- In general, areas not currently occupied by beaver are likely vacant because the environmental conditions (available food, gradient, etc.) may not support a beaver family group. Relocating beaver into an area that does not have the appropriate habitat conditions, could result in beaver abandoning the site.
- Beaver are territorial and will defend their family group from other introduced beaver.
- Beaver moved in the fall will likely starve because the development of a winter food cache is unlikely.
- The live-trapping and movement of wildlife by the public is illegal.

**General Comments:**

**Comment:** An important message to bring back to our communities is that is it a positive outcome that approximately 50% of the projects listed in the 2014 plan have been completed.

**Response:** Agreed. *Appendix A. 2014 Report Card* lists all of the Actions in the 2014 TBP. The status column shows the level of completion as of the writing of this plan.

**Comment:** I believe that by addressing the concerns outlined in this letter, the NBDR will be greatly improved both in water quality and conditions that wildlife and biota depend on. As well, the Deerfield Valley will be more resilient to flooding and climate change. I hope the ANR and DEC will take these comments and suggestions seriously as you move forward with finalizing the draft Deerfield River and Adjacent Connecticut River Tributaries Tactical Basin Plan.

**Response:** This public comment is very valuable to VANR and its Departments in planning focus areas and in prioritizing projects going forward. Public input is appreciated.

**Comment:** Communities (like Wilmington) in the basin are challenged with available local match dollars for many grant programs. If there is a way the state could develop "work program" projects similar to LHMP Program, where the local match responsibilities could be funded through in-kind staffing, our elected officials would likely be more responsive in promoting projects/programs as part of the tactical basin program.

**Response:** Clean Water grant funding does allow in-kind match funding which can include local staff time, machine and operator costs, and other non-monetary contributions. Not all grant program require match. The Watershed Planner can assist in reviewing budget options for grant applications.

**Comment:** The Basin Study prepared by the Vermont Department of Environmental Conservation for our portion of the Connecticut River watershed is an exemplary document highlighting the environmental impacts faced in our region. The draft Plan evaluates the Basin with a surprising amount of detail and technical expertise. It was a pleasure to review the document and very educational from a personal perspective.

**Response:** Thank you!

**Comment:** Protecting our healthiest waters is in the best interest of our political economy, our culture, and our public health. I know a lot of real estate agents don't agree, but my priority is value in water health rather than real estate. Why water health and real estate value don't coincide is a sad miseducation of our economists.

**Response:** Agreed. A strategy to support outreach has been added to the Implementation Table:

- Conduct outreach to the real estate industry on the economic benefits of clean water and on applicable wetland and stormwater rules.

**Comments regarding Technical Formatting:**

**Comment:** If you could remove the references to TransCanada please. Maybe only old projects scorecard? In future presentations please say Great River Hydro.

**Response:** These references are only in the Report Card which is pulled directly from the 2014 Plan. At that time TransCanada was operating the Deerfield River Hydro system. All references in the 2019 plan are to Great River Hydro.

**Comment:** Lower Deerfield River below Harriman Reservoir is listed twice in Exotic Species.

**Response:** Corrected.

**Comment:** SGCN is missing in your ACRONYMS list.

**Response:** Added

**Comment:** is indicated by the " • " bullets below the sub-comment:

The following should be added to the Glossary:

**Response:** is indicated by the "o" bullets below the sub-comment:

- dissolved oxygen, temperature, and conductivity with an explanation of their relevance to healthy streams;
    - Detailed information of the impacts and causes can be found in the Vermont Surface Water Management Strategy.
    - Dissolved oxygen and conductivity are defined in the Glossary of the VSWS
- Clean Water Fund and the Environmental Revolving Fund along with their links to help a citizen or town access either or both for water quality improvement projects.
    - Information and link have been added
- CRVTU Connecticut River Valley Chapter of Trout Unlimited (here as well as Acronyms.)
    - Acronym added

**Comment:** First link to water quality standards does not work (it may be the other link – it is one of them)

**Response:** Corrected

**Comments regarding Mapping:**

**Comment:** On some maps it is hard to see what streams flow into what streams/rivers.

**Comment:** It would be helpful to highlight the town boundaries more in the maps so people looking at the maps can relate to the region more easily.

**Response:** Some maps edits have been made. The scale of the Basin is difficult to display on letter size paper in this report. We recommend viewing waterways in more detail on the on-line ANR Natural Resources Atlas.

**Comment:** Tweak map legends to account for color blind, cannot distinguish us forest service properties from state forests and parks.

**Response:** Edits have been made.

**Comment:** Figure 14: It was a little difficult on the map to distinguish TMDL from Flow Regime – the red color was so similar - the dotted line outline, at first, was not apparent. As I looked at it for a bit the difference became more apparent.

**Response:** Flow regime alterations are designated with dashed lines.