VERMONT
WATER INVESTMENT DIVISION

Deerfield River & Lower Connecticut River Tactical Basin Plan

Fall 2024 | DRAFT

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:

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Department of Environmental Conservation

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Cover Photo: North Branch Deerfield River, Wilmington, Marie Levesque Caduto

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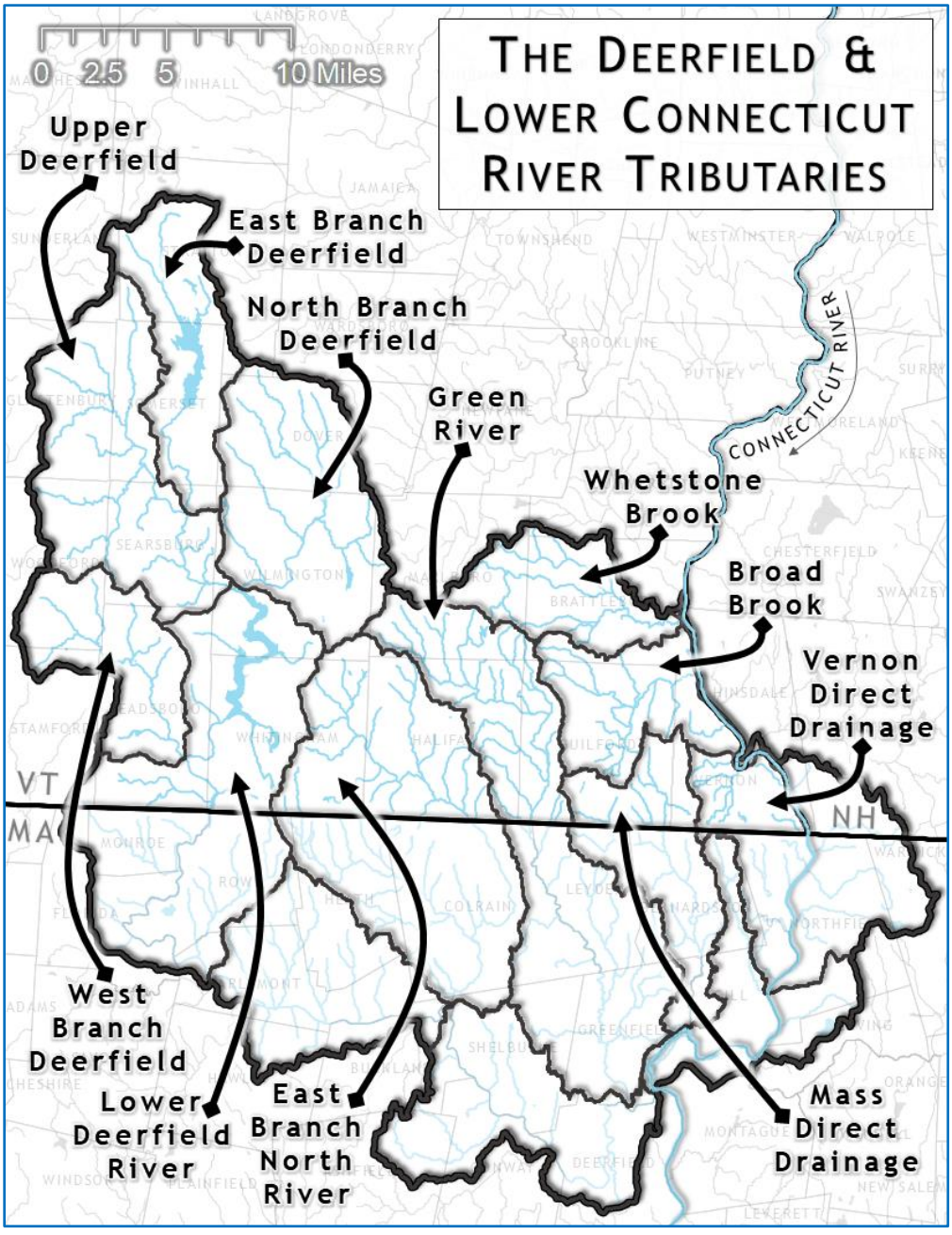
Basin 12 Towns

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

**Towns with a very small area in the basin*



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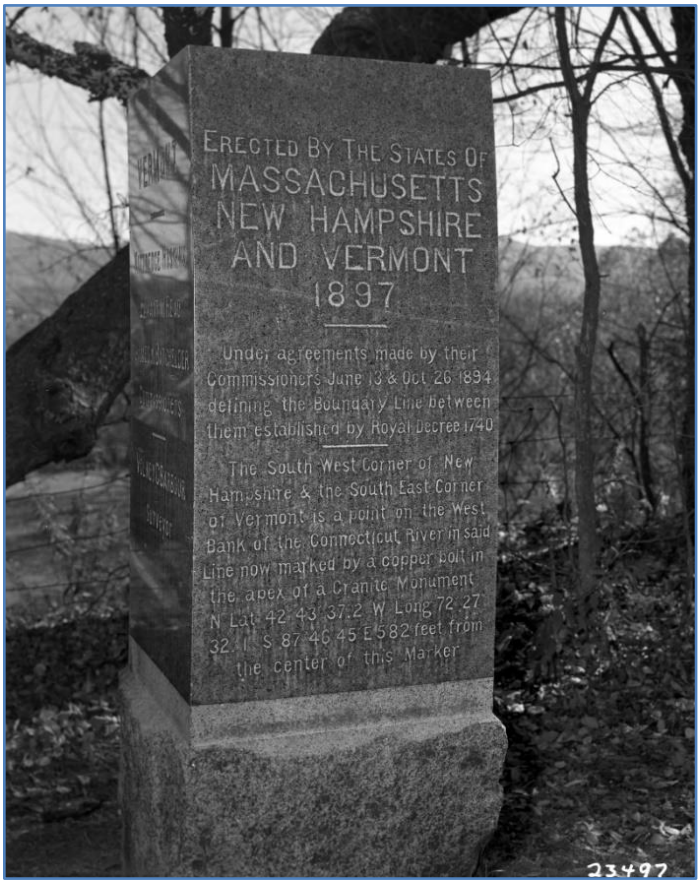
Western Abenaki (Alnôbaôdwawôgan) Place Names in the Basin:

English – Abenaki – Meaning

- Connecticut River – Kwenitegw – long river
- Deerfield River – Pokwômtegw – very low river
- Whetstone Brook – Kitadowôganisibosis
- Broad Brook (Guilford) – Wanaskategw – end of the river, confluence
- Green River – Pocomegon
- Fall River (Bernardston, Guilford) – Also Wanaskategw – end of the river, confluence
- Brattleboro – Wantastegok – at the river where something is lost
- Vernon – Koasek – at the little white pines

With appreciation to Rich Holschuh, The Atowi Project, Chair: Vermont Commission on Native American Affairs



Tri- State Border Marker

Executive Summary

The Basin 12 Tactical Plan encompasses the Deerfield River which flows through south central Vermont and crosses the Vermont-Massachusetts border before it joins the Connecticut River in Greenfield Massachusetts and the lower Connecticut River mainstem south of the West River.

The Deerfield River has four branches in Vermont: North, South, East and West, and two other main tributaries, the East Branch of the North River and the Green River. The Deerfield River system drains 14 Vermont towns in two counties and is about 318 square miles in area. The Connecticut River from Brattleboro south to the Massachusetts border, is controlled by two hydroelectric dams and includes the tributaries Whetstone, Broad and Newton Brooks and the Fall River covering the towns of Brattleboro, Marlboro, Guilford and Vernon.

In overview, the Basin water quality conditions are assessed at *Very Good* or better with a few exceptions in some of the population centers near ski area development and the town of Brattleboro. One stream is a candidate for reclassification from B(2) to A(1) and seven are candidates for B(2) to B(1) for aquatic biota; there is one candidate lake for reclassification from B(2) to A(1) for aesthetics; and 13 streams from B(2) to B(1) for fishing. Four wetlands are candidates for Class I designation.

Although many surface waters monitored meet or exceed water quality standards, there are waters in need of restoration and continued monitoring. Twelve lakes and ten stream or river segments are identified for restoration. These lakes are mostly impaired by acid and mercury deposition with one having invasive Eurasian watermilfoil. River impairments range from bacteria, temperature, sediment, nutrients and pH.

Sector-based strategies are proposed to meet overall protection and restoration goals, as well as strategies to address the Long Island Sound Dissolved Oxygen TMD. Focus is placed on voluntary participation and project implementation by watershed partners in the Basin. 77 detailed strategies and monitoring priorities for each sub-watershed are recommended for the next five years. Monitoring priorities have been identified to fill data gaps, track changes in water quality condition, and identify waters for reclassification and Class I wetland designation.

Target areas and strategies for restoration and protection are summarized in Table 1.

Table 1. Focus areas and priority strategies for restoration and protection.

Focus Areas	Priority Strategies
AGRICULTURE	
Connecticut River - Brattleboro, Vernon	Work on agricultural lands along the Connecticut River to establish and enhance riparian buffers following the stabilization of water level fluctuations from hydropower production
Deerfield River, North Branch Deerfield, Connecticut River, Whetstone Brook	Increase protections on agriculture lands along the river to ensure future floodplain capacity
Basin wide	Implement field practices to study N-reduction potential of BMPs and track results of practices implemented
Connecticut River	Re-evaluate the success and ways NMPs are implemented on small farm operations to improve use and outcomes
State-wide	Develop a Pay-for-Ecosystem Services program to compensate farmers for allowing floodplain fields to flood for downstream flood protection
DEVELOPED LANDS - STORMWATER	
Dover, Wardsboro, Whitingham, Wilmington	Conduct stormwater master planning to identify and implement prioritize actions
Brattleboro, Stratton	Prioritize projects, develop final designs and implement stormwater treatment projects identified in the Stormwater Master Plans and Stormwater Mapping Reports
Snow Lake	Remove Snow Lake and restore the nature stream channel
North Branch Deerfield, Whetstone Brook	Identify and mitigate sources of bacteria causing impairment
DEVELOPED LANDS - ROADS	
Marlboro, Halifax, Readsboro, Vernon	Provide technical and financial assistance to towns needing to mitigate stormwater discharges and improve the storage of salt and sand at town garage sites
Basin-wide	Conduct gully erosion inventory and identify, prioritize and address gully erosion from roads and failed Class 4 roads

Focus Areas	Priority Strategies
WASTEWATER	
Guilford, Vernon	Provide outreach on the Village Wastewater Solutions and conduct wastewater planning and feasibility studies for small communities without municipal systems
Basin-wide	Encourage and support upgrades to public wastewater treatment facilities to help remove nitrogen from discharges and other upgrades and refurbishments as needed
NATURAL RESOURCES	
Basin-wide	Support and enhance the riparian buffer and floodplain plantings throughout the landscape
Basin-wide	Support reclassification and designation of rivers, streams, lakes, ponds and wetlands throughout the Basin
Basin-wide	Identify priority areas for conservation easements including forestland, agricultural and riparian land and conduct outreach to landowners to develop opportunities
RIVERS	
Connecticut River	Secure stable funding for the USGS monitoring gauge at Northfield, MA
Green River, East Branch North River, Whetstone Brook	Buy-out properties that are highly vulnerable to flooding from inundation and erosion hazards from willing sellers
North Branch Deerfield	Remove Snow Lake and dam, install properly sized road culvert, and re-establish river channel
Basin-wide	Support river and stream restoration projects to improve stream geomorphic compatibility, aquatic organism passage, and flood resilience as identified in statewide and local assessments. Prioritize dam removals, and bridge and culvert replacements when possible
LAKES	
Somerset, Harriman, Sadawga, Raponda, South Pond	Support and fund existing and new Greeter Programs on lakes and ponds with active boat launches

Focus Areas	Priority Strategies
Sadawga, Grout, Howe, Lily	Establish Lay Lake Monitoring on appropriate lakes and ponds
WETLANDS	
Basin-wide	Restore degraded wetlands for habitat, water quality improvement and climate change mitigation
Basin-wide, Connecticut River	Assess areas of prior converted wetland and hydric soils for restoration
FORESTS	
Whetstone Brook, Green River	Protect headwater streams and sensitive upland surface waters
Basin-wide	Remove or replace undersized stream crossings with properly sized structures
CLIMATE CHANGE ADAPTATION	
Basin-wide	Monitor habitat conditions & effects of stressors on habitats; restore critical habitats or ameliorate threats when/where opportunities arise to secure/restore numbers of Species of Greatest Conservation Need (SGCN) populations & targeted abundance levels
Connecticut River	Work to maintain wildlife corridor connectivity with populations to the south in Massachusetts and across the Connecticut River into New Hampshire
SOCIAL EQUITY	
Connecticut River	Monitor tritium levels in the river and in fish tissue to protect subsistence fishing availability
Basin-wide	Identify communities where water quality concerns prevent use of waters or present unhealthy conditions and address these conditions
Connecticut River	Work to reduce contaminants that restrict fish consumption to protect those dependent on subsistence fishing for nutrition
Basin-wide	Seek opportunities to increase public access to lakes and rivers that are free and accessible to diverse populations (e.g. VRCs "A Swimming Hole in Every Town" program)

Focus Areas	Priority Strategies
Basin-wide	Locate implementation projects where they will offer dual advantages of open space and cleaner environment to underserved populations

The 2020 Basin Plan identified 64 strategies to address protection and restoration of surface waters. Of these 3 are complete, 9 are in progress, 38 are ongoing, and 2 are currently under discussion and 12 are being carried forward in this plan. (Figure 1). The 2020 report card, Appendix A, provides the status for each strategy identified in the 2020 Plan. General information on progress in the 2023 Vermont Clean Water Initiative Performance Report, Connecticut River watershed is included in the Several strategies will be carried over to this plan.

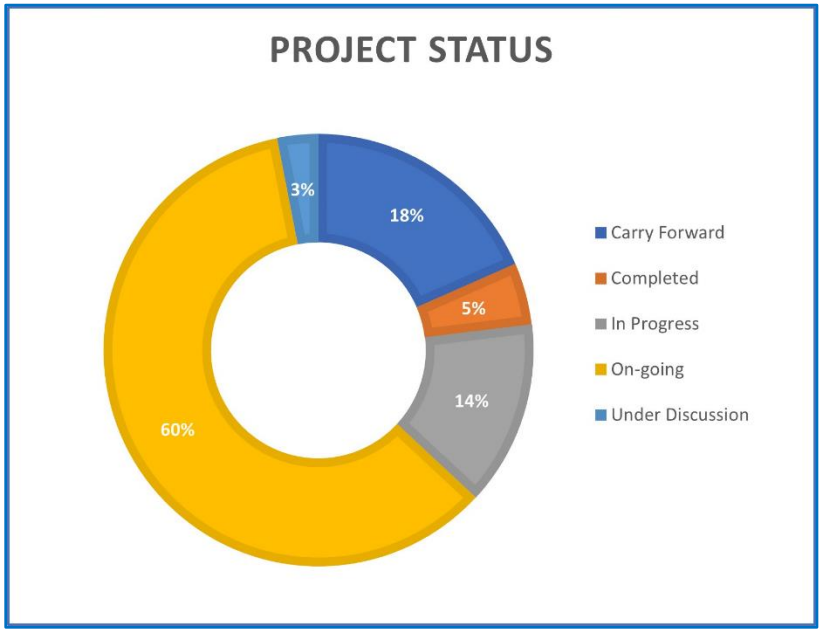


Figure 1. Status of strategies from the 2016 TBP

The 77 priority strategies identified in this plan reflect input from the public, state and federal water quality staff, sector-based workgroups, watershed groups, and regional planning commissions. Key concerns identified during the basin planning process include development pressure and a lack of zoning regulation, road-related and stormwater runoff causing sediment discharge, dams and undersized culverts creating barriers to flow and wildlife passage, climate change impacts on flooding and water temperature, wetland conservation, and invasive species.

What is a Tactical Basin Plan?

A Tactical Basin Plan (TBP) is a strategic guidebook produced by the Vermont Agency of Natural Resources (ANR) to protect and restore Vermont's surface waters. The agency develops these watershed plans for each of the 15 major basins in the State of Vermont. TBPs target strategies and prioritize resources to those actions that will have the greatest influence on surface water protection or restoration.

Figure 2. Policy requirements of Tactical Basin Planning.

Figure 3. Five-year basin planning cycle.

TBPs are integral to meeting a broad array of both state and federal requirements including the U.S Environmental Protection Agency's 9-element framework for watershed plans (Environmental Protection Agency, 2008), US Clean Water Act Section 303(e) for state-level water quality planning, and state statutory obligations including those of the Vermont Clean Water Act, and 10 VSA § 925 and 10 VSA § 1253 (Figure 2).

Tactical basin planning is carried out by the Water Investment Division in collaboration with the Watershed Management Division and in coordination with other state agencies and watershed partners. A successful basin planning process depends on a broad base of partnerships with other state, federal, regional, and local government agencies, and other stakeholders, including community and non-profit groups and academic institutions. The partnerships support and strengthen the Agency's programs by proposing new ideas and input, increasing understanding of water quality issues, and building commitment to implementing solutions.

Basin-specific water quality goals, objectives, strategies, and projects described in this Plan aim to protect public health and safety ensure public use and enjoyment of Vermont waters and their ecological health as set forward in the Vermont Surface Water Management Strategy and the

Vermont Water Quality Standards. The TBP process shown in Figure 3, allows for the issuance of plans for Vermont's 15 basins every five years.

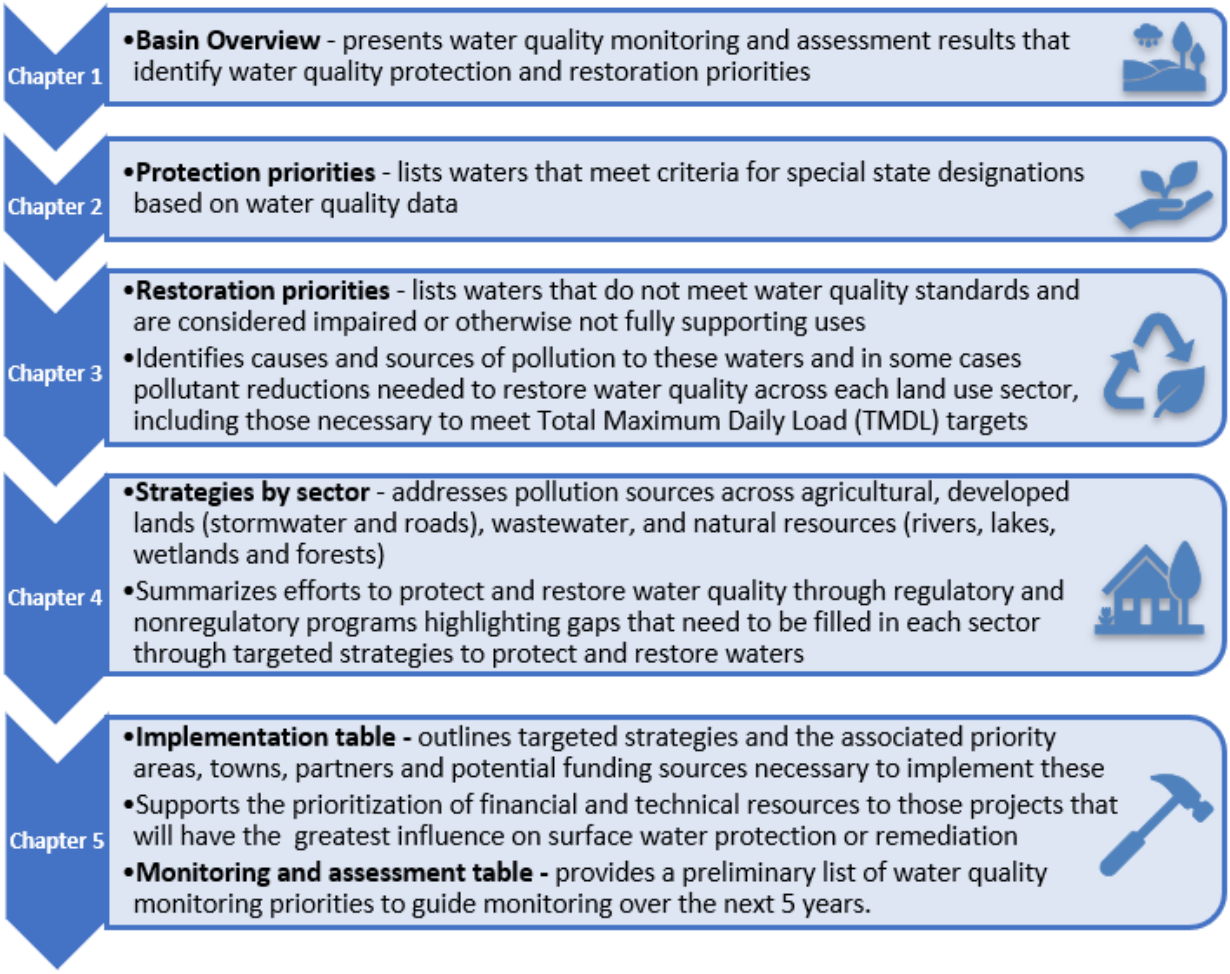


Figure 4. Chapters of Tactical Basin Plans

Chapters 1 through 4 in the TBP describe water quality in the Basin, protection and restoration priorities, and efforts to protect and restore water quality for each sector. This information supports the targeted strategies listed in the implementation table in Chapter 5 (Figure 4).

Tactical Basin Plans identify strategies that help ANR, and its partners, prioritize activities for the next five years. These strategies inform individual projects that are identified and tracked in the Watershed Projects Database and the Watershed Projects Explorer. The Project Database and Explorer are found on ANR's Clean Water Portal and are regularly updated to capture project information throughout the TBP process.

Chapter 1 – Basin Description and Conditions

A. Basin Overview

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 in Greenfield Massachusetts. 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.

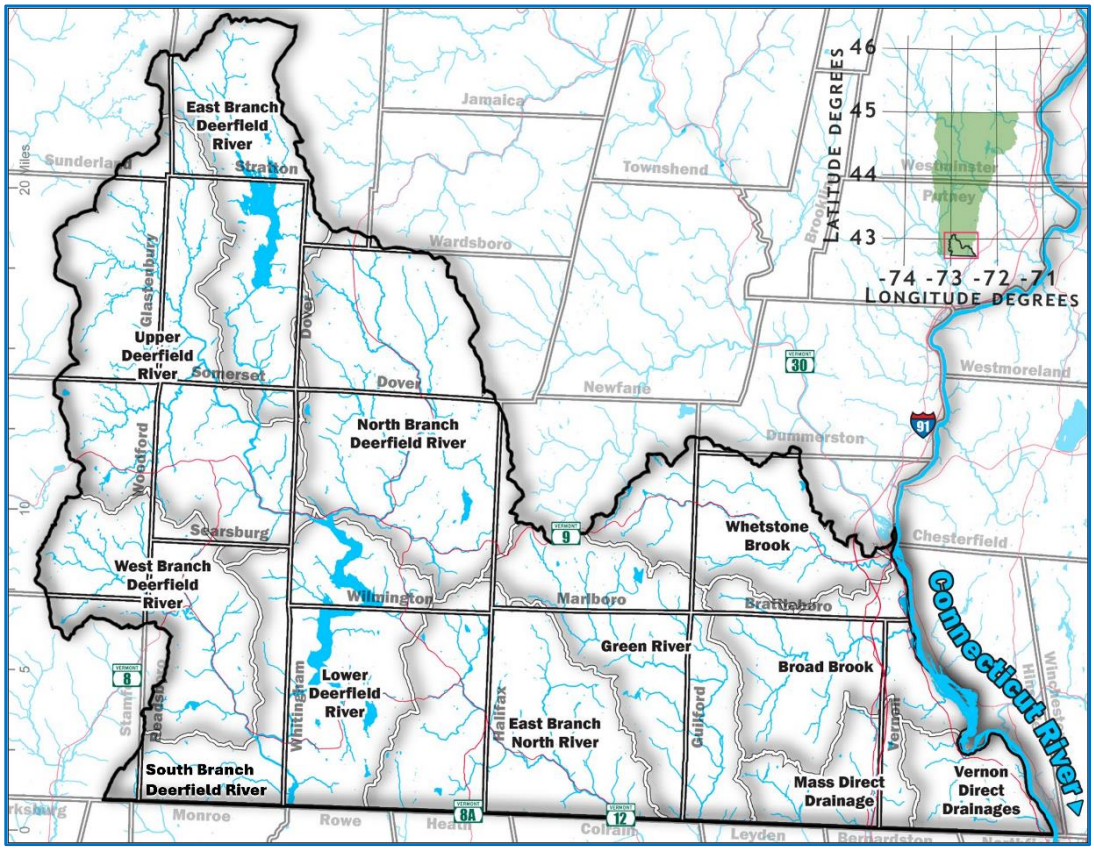


Figure 5. Major Sub-basins

Detailed information about each of these rivers and other smaller watersheds within the Basin can be found in the previous the Basin 12 Assessment Report.

There are a total of 56 lakes and ponds in the Basin. Harriman and Somerset Reservoirs are 1949 and 1525 acres respectively, are the largest, followed by Sadawga (191 ac.) and Raponda (124 ac.).

Land Use and Land Cover

Basin 12 is a predominantly forested landscape. Forested land covers about 82% of the Basin while about 5% is wetlands and 2% open water. Developed and agricultural land cover about 6% and 4% of the Basin, respectively (Figure X).

The large areas of properly managed forests, riparian buffers, and wetlands are principally responsible for the good water quality in the Basin. As are areas where good management practices and high-quality local stewardship exist on agricultural and developed lands. A significant amount of land is permanently conserved. Over 27% of the Basin is within the Green Mountain National Forest which covers most of the western basin, including almost all the Upper Deerfield, and most of the East and West Branches. With the addition of lands owned by Great River Hydro, the majority of Basin 12 land in Stratton, Somerset, Glastenbury, Woodford and Stamford is under some form of land protection and close to 100% forested.

Yet, areas of the Basin are experiencing degraded water quality in rivers, streams and lakes. Fourteen waterbodies are listed as Impaired or Altered and need remediation and restoration.

Most of the agricultural and developed lands are located along the mainstems of the larger rivers and streams, the majority along the Connecticut River and the North Branch Deerfield River. Concentrated development is focused on the two ski resort areas around Mt Snow and Hermitage in Dover, and in town centers including Brattleboro, Vernon and Wilmington. A large portion of road networks are located along tributaries, and the mainstem of the rivers. Large wetland complexes are scattered throughout the Basin with many found in the remote headwaters of the Deerfield River.

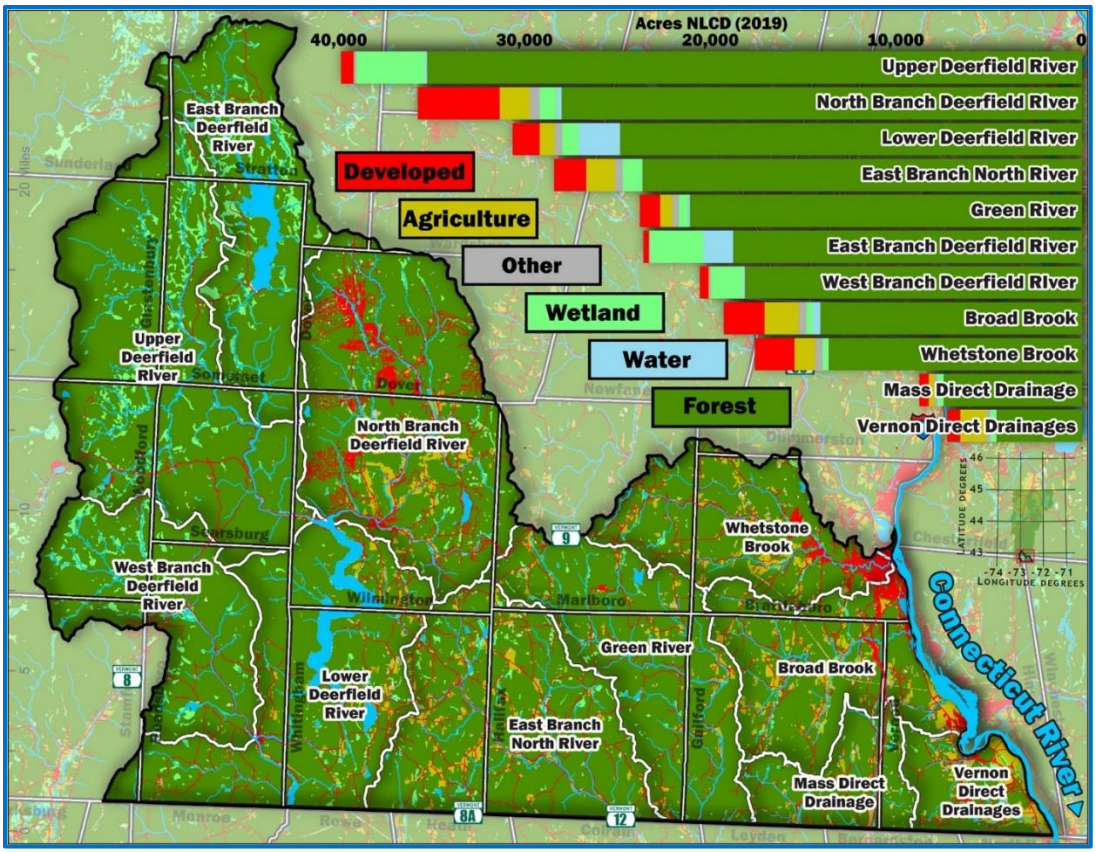


Figure 6. Land Cover

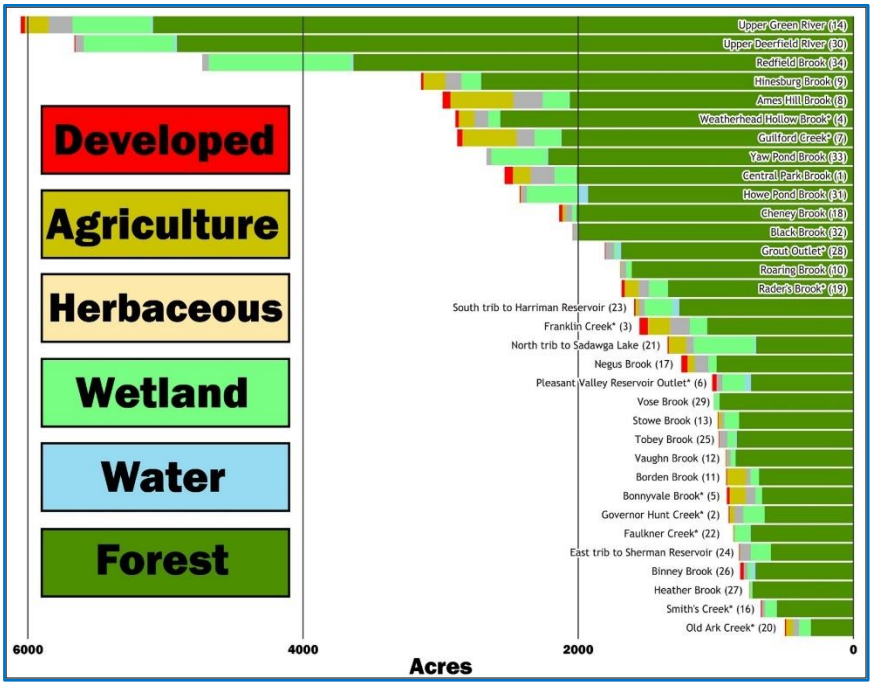


Figure 7. Land Cover by Acreage of Sub-watersheds

Climate Change Implications for Water Resource Management

Vermont is experiencing climate-related events each year and those events are projected to increase in frequency, complexity, and severity. It is imperative that Vermont and Vermonters adapt to threats posed by climate change now and build resilience for the storms that we will inevitably face in coming decades. Of the many natural hazards that impact Vermont, flooding poses the greatest risk to Vermont infrastructure and communities (VT Climate Action Plan).

Adapting how we manage and use our surface waters in the face of climate change is one of the chief overarching challenges for basin planning. Climate is defined by long-term weather patterns, which in turn influence human and natural systems. In Vermont, climate change is causing increases in storm intensity and total precipitation (Betts, 2011) (National Oceanic and Atmospheric Administration, 2013). These increases will likely lead to a rise in flooding, water quality and ecosystem impairments, and reduced water-based recreational availability to Vermonters (Pealer & Dunnington, 2011).

The 2021 Vermont Climate Assessment established state-level climate change information with implications for local surface waters. Vermont's average annual temperature has increased by almost 2°F (1.11°C) since 1900 with warming occurring twice as fast in winter (Galford, 2021). 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) all of which can be exacerbated or alleviated by land-use management decisions.

Aquatic habitats affected by increased runoff and streamflow could experience increases in sediment mobilization, nutrients and scouring in addition to increased water temperature. In response, local freshwater plant and animal species may shift their geographic ranges and alter their abundance and seasonal activities (Stamp J, 2020).

The 2021 Vermont Climate Assessment suggests extreme weather events such as droughts and floods are expected to continue to increase with climate change. Vermont experiences 2.4 more days of heavy precipitation than in the 1960s, typically in summer. 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) all of which can be exacerbated or alleviated by land-use management decisions. Aquatic habitats affected by increased runoff and streamflow could experience increases in sediment mobilization, nutrients and scouring in addition to increased water temperature. In response, local freshwater plant and animal species may shift their geographic ranges and alter their abundance and seasonal activities (Stamp et al., 2020).

The Vermont Climate Assessment highlights five key messages for water resources in Vermont:

- Due to extreme variation in precipitation with our changing climate, periods of prolonged dry-spells and drought, coupled with higher water usage in snowmaking and agriculture could exacerbate low water availability.
- Increases in overall precipitation, and extreme precipitation, have caused average annual streamflows to rise since 1960. Climate change will further this pattern, although the overall increase in streamflow comes with disruptions in seasonal flows cycles.
- Increases in heavy precipitation jeopardize water quality in Vermont. Storms produce large runoff events that contribute to erosion and nutrient loading. Combined with warm temperatures, this creates favorable conditions for cyanobacteria blooms.
- Increased occurrence of high streamflows increases the risk of flooding that causes damage to many roads and crossing structures. Risk reduction requires addressing outdated and unfit structures.
- Nature-based solutions are an effective, low-cost approach to climate change adaptation. River corridor, floodplain, and wetland protection dampen flood impacts and improve water quality along with green infrastructure.

Protective measures, such as strategic land acquisition and limitations on development in riparian areas, may be the most economical solution to address the challenges presented by climate change and to achieve healthy surface waters (Watson, Ricketts, Galford, Polasky, & O'Niel-Dunne, 2016) (Weiskel, 2007). But where pollution from historic and current land use occurs, strategies are identified in this plan that will complement protective measures, such as river corridor easements, riparian area plantings, floodplain and wetland restoration, dam removals, and agriculture, forestry, and stormwater best management practices. Ongoing efforts to strengthen ecological resilience and the role of natural infrastructure in protecting built communities can be found on the Climate Change in Vermont website and in the forthcoming Vermont Climate Toolkit (VCT) which will provide municipalities with tools and resources to assess their climate emergency preparedness, evaluate their financial capacity to address infrastructure resilience, and prioritize investment in that infrastructure.

Recent Statewide Flooding

The last two years have brought intensive rains leading to catastrophic flooding to many Vermont communities. While not surpassing water levels experienced during 2011's Tropical Storm Irene in southern Vermont, many Basin towns sustained severe damage to private property and municipal infrastructure, warranting federal disaster declarations. It is predicted that Vermont will continue to experience flooding events on a regular basis. In response to this and numerous previous flooding events, the Vermont legislature passed Act 143 in 2024 relating to natural disaster government response, recovery, and resiliency. The Act creates the Community Resilience and Disaster

Mitigation Grant Program for the purpose of awarding grants for municipal disaster mitigation projects. These grants will provide funding for:

> (A) technical assistance for natural disaster mitigation, adaptation, or repair to municipalities;
>
> (B) technical assistance for the improvement of municipal stormwater systems and other municipal infrastructure;
>
> (C) projects that implement disaster mitigation measures, adaptation, or repair, including watershed restoration and similar activities that directly reduce risks to communities, lives, public collections of historic value, and property; and
>
> (D) projects to adopt and meet the State's model flood hazard bylaws.

Additionally, the legislature also passed Act 121 relating to the regulation of wetlands, river corridor development, and dam safety. This act requires the development of a State River Corridor Base Map to identify areas suitable for development located in existing settlements in river corridors that will not contribute to fluvial erosion hazards, establish minimum flood hazard area standards, protect, regulate, and restore wetlands so that the State achieves a net gain of wetlands acreage, and enables the Dam Safety Revolving Loan Fund to provide financial assistance for emergency and nonemergency dam projects.

Further recommendations to increase flood resiliency across Vermont include:

- Seek to make permanent the Flood Resilient Communities Fund (FRCF) that was created through an ARPA funding allocation in 2021 and has been a successful flood mitigation program. Additionally, evaluate expanding eligibilities for the FRCF program to maximize the impact of federal hazard mitigation funding and coordinate flood resilience work at the statewide level across state agencies.
- Consider additional conservation practices and incentives for agricultural lands that are located in river corridors and low-lying floodplains that often provide ecosystem services in major flood events.
- Increase funding for private property buyouts and slope stability mitigation to protect public health and safety and build longer term flood resilience.

B. Water Quality Conditions

The Vermont Water Quality Standards (VWQS) provide the basis used by the Vermont Department of Environmental Conservation (DEC) in determining the condition of surface waters including whether the water meets or does not meet the criteria. The assessment of a water's condition within the context of the VWQS requires consideration of the water's classification, designated and existing

uses, and the corresponding narrative and numeric water quality criteria (see Chapter 2 for definitions). This assessment categorizes Vermont's surface waters as either "full support, altered, or impaired".

DEC uses a five-year rotational monitoring approach, where basin sites are typically monitored once every five years. This state-collected data is augmented by community-science monitoring programs throughout the state, including the LaRosa Partnership Program and the Lay Monitoring Program. Water quality monitoring and assessment work is described in detail in the Water Quality Monitoring Program Strategy.

Most surface water monitoring is led by programs in the WSMD, including the Rivers Program, the Lakes and Ponds Management and Protection Program and the Wetlands Program. The result of this work offers site specific assessments of the Basin's waters. Monitoring programs in this basin include:

Within the Rivers Program, the Biomonitoring and Aquatic Studies Section focuses on biological monitoring of aquatic macroinvertebrate and fish communities, plus targeted water chemistry and temperature monitoring. Biomonitoring staff also support the LaRosa Partnership Program (LPP), a community-based nutrient and chloride monitoring program. See the LaRosa Partnership Program's database reports to interact with data collected through this program. The Connecticut River Conservancy (CRC) and the Deerfield River Watershed Alliance (DRWA) participate in LPP by sampling streams throughout this Basin and conducting targeted monitoring for pollutant tracking. The Rivers Program also supports stream geomorphic assessments that evaluate geomorphic and physical habitat conditions of rivers and the Streamflow Protection section administers a cooperative agreement with the U.S. Geological Survey to maintain and operate a number of stream gages in Vermont.

The Lakes and Ponds Management and Protection Program (LPMPP) supports the Inland Lake Assessment and Lay Monitoring Programs, which evaluate nutrient conditions and trends on lakes, as well as shoreland condition, and more in-depth lake assessments through the Spring Phosphorus Program and Next Generation Lake Assessments. The Lakes and Ponds Management and Protection Program (also performs surveys to monitor the spread of aquatic invasive species in Vermont's public waters through the Vermont Aquatic Invasive Species Program.

Jointly, the Rivers Program and Lakes and Ponds Management and Protection Program maintain a network of twelve stream and five lake sentinel sites statewide respectively, which are monitored every year for biology, temperature, water chemistry and hydrology (at a subset of sites). These sentinel sites have negligible prospects for development or land use change and are closely monitored to isolate long term impacts related to climate change.

The Wetlands Program conducts biological assessments on the functions and values of wetlands.

In addition to the WSMD's surface water monitoring programs in this basin, the following programs also contribute monitoring data to determine the health of Vermont's surface waters:

- The Vermont Fish and Wildlife Department (VFWD) conducts fishery assessments and targeted temperature monitoring to assess the health of recreational fish populations and opportunities for habitat restoration.
- A network of streamflow gages is funded and operated in partnership among DEC, Vermont Agency of Transportation (VAOT) and Vermont Department of Public Safety (VDPS).
- The Vermont Agency of Agriculture, Food, and Markets conducts monitoring at sampling sites throughout Vermont on rivers and tributaries that pass through agricultural use areas. The Agency also runs the Ambient Surface Water Study to establish baseline levels of pollutants and to monitor for the presence of neonicotinoids, glyphosate, corn herbicides, and nitrate.
- The Drinking and Groundwater Protection Division and the Watershed Management Division monitor Per- and Polyfluoroalkyl Substances.

Tactical Basin Plans include monitoring information reported by Vermont State agencies as results relate to the designated uses defined by the Vermont Water Quality Standards. Most of the DEC monitoring data can be accessed through the Vermont Integrated Watershed Information System (IWIS) online data portal.

Compilation of this data following the 5-year monitoring cycle highlights the changes that have taken place over time. These changes are described by water resource – rivers and streams, lakes and ponds, wetlands – with a separate section for recreational fisheries. The full Basin-12 Assessment Report is available on the Basin 12 website.

Rivers and Streams

Biological Assessment

Biological communities reflect overall ecological integrity (i.e., chemical, physical, and biological integrity). Therefore, biological survey results directly assess the status of a waterbody relative to the primary goal of the Clean Water Act (CWA). These communities integrate the effects of different stressors and thus provide a broad measure of their aggregate impact. They also integrate the stressors over time and provide an ecological measure of fluctuating environmental conditions. Where criteria for specific ambient impacts do not exist (e.g., nonpoint-source impacts that degrade habitat), biological communities may be the only practical means of evaluation.

Aquatic biomonitoring can be used for detecting aquatic biota impairments and providing information to help determine the extent and severity of potential stressor(s). This monitoring can also identify streams at or near a reference level condition that may be suitable for higher levels of protection through reclassification. Each community of macroinvertebrates and fish is rated from *Poor* - not meeting Vermont Water Quality Standards - to *Excellent*. If a stream fails to meet minimum water quality criteria, it is a candidate for the impaired waters list.

DEC maintains 12 sentinel streams statewide which are monitored every year, including a site on the Green River in Guilford. These sentinel sites have negligible prospects for development or land use change and are closely monitored to isolate long term impacts related to climate change. However, because stream site locations are targeted, it is not possible to determine the overall biological condition of the Basin.

Macroinvertebrate and fish monitoring is conducted following procedures outlined in the WSMD Field Methods Manual (DEC, 2022). Applying biocriteria and determining assessments for both communities is outlined in the VWQS (2022).

More information about the biological and chemical results of these sampling sites and events can be found online through the Vermont Integrated Watershed Information System (IWIS).

The map in Figure 8 shows the results of the most recent Macroinvertebrate and Fish Community assessments. *Poor* scores represent the greatest deviation from reference conditions and *Excellent* scores represent non-significant deviation from reference conditions. There are currently no criteria for assessing Brook Trout Only streams (where brook trout are the only observed taxa).

Macroinvertebrate & Fish Community Monitoring Results

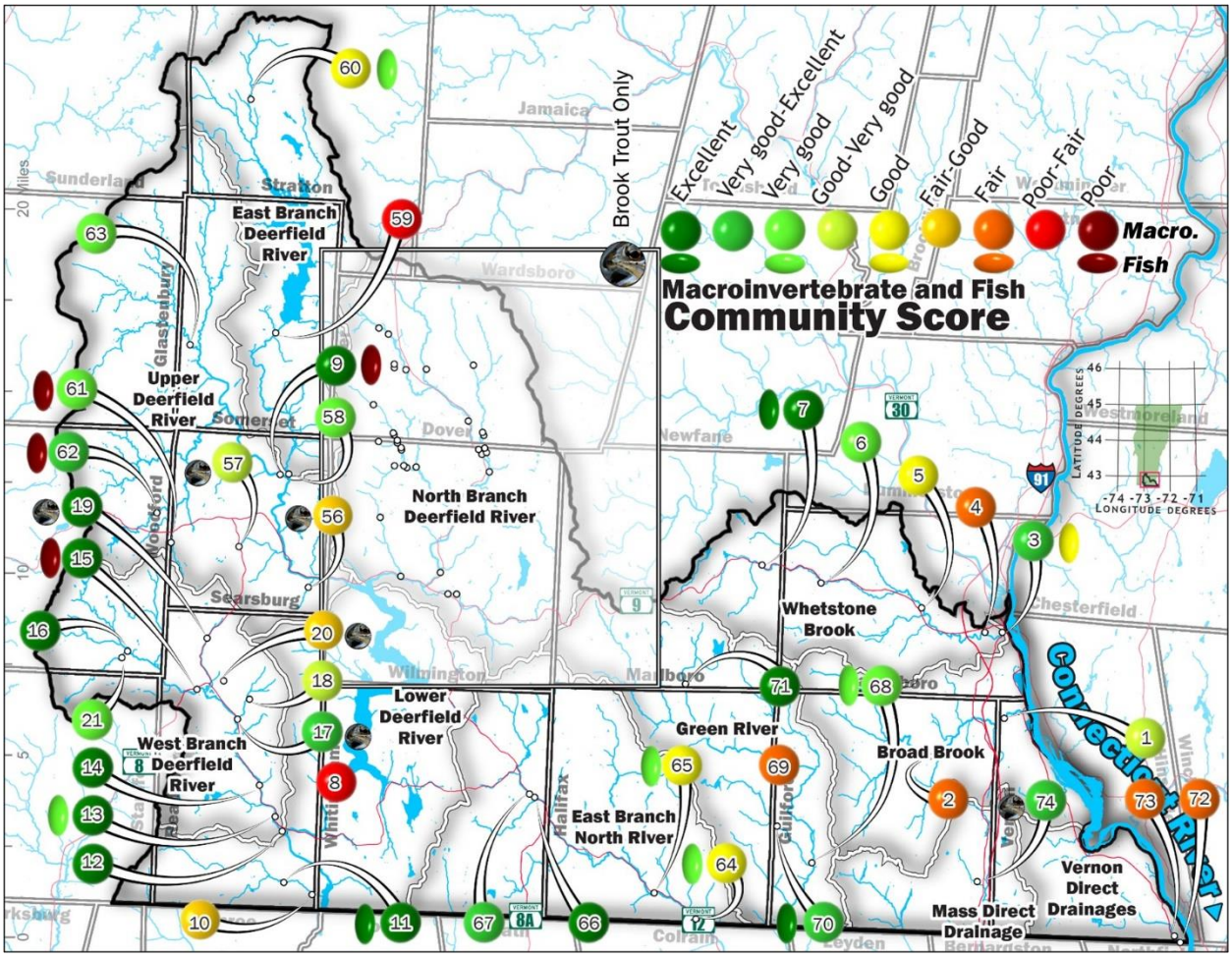


Figure 8. Biological Condition of Macroinvertebrate and Fish Communities

Table 2. Biological Condition of Macroinvertebrate and Fish Communities

Map ID	Location Name, River Mile
1	Broad Brook, 0.9
2	Broad Brook, 4.1
3	Whetstone Brook, 0.2
4	Whetstone Brook, 1.0
5	Whetstone Brook, 2.9
6	Whetstone Brook, 8.6
7	Whetstone Brook, 10.7
8	Deerfield River, 52.4
9	Deerfield River, 67.5

Map ID	Location Name, River Mile
21	Reservoir Brook, 0.4
56	Medbury Brook, 0.4
57	Bond Brook, 1.7
58	East Branch Deerfield River, 0.1
59	East Branch Deerfield River, 5.3
60	East Branch Deerfield River, 12.6
61	Rake Branch, 1.0
62	Red Mill Brook, 0.7
63	Glastenbury River, 0.4

10	South Branch Deerfield River, 0.3		64	East Branch North River, 10.3
11	South Branch Deerfield River, 1.3		65	East Branch North River, 11.7
12	West Branch Deerfield River, 0.1		66	East Branch North River, 17.6
13	West Branch Deerfield River, 0.6		67	East Branch North River, 17.8
14	West Branch Deerfield River, 1.8		68	Green River, 16.6
15	West Branch Deerfield River, 5.9		69	Green River, 19.9
16	West Branch Deerfield River, 8.5		70	Green River Trib 6, 1.7
17	Lamb Brook, 0.1		71	Pond Brook, 1.3
18	Lamb Brook, 0.7		72	Newton Brook, 0.2
19	West Branch Deerfield River Trib 7, 1.8		73	Newton Brook, 0.6
20	West Branch Deerfield River Trib 7 Trib 1, 0.7		74	Fall River, 15.2

Concentrated monitoring is performed in the North Branch Deerfield River watershed (Figure 9) due to several impaired waters in Dover and Wilmington and to monitor numerous stormwater permits.

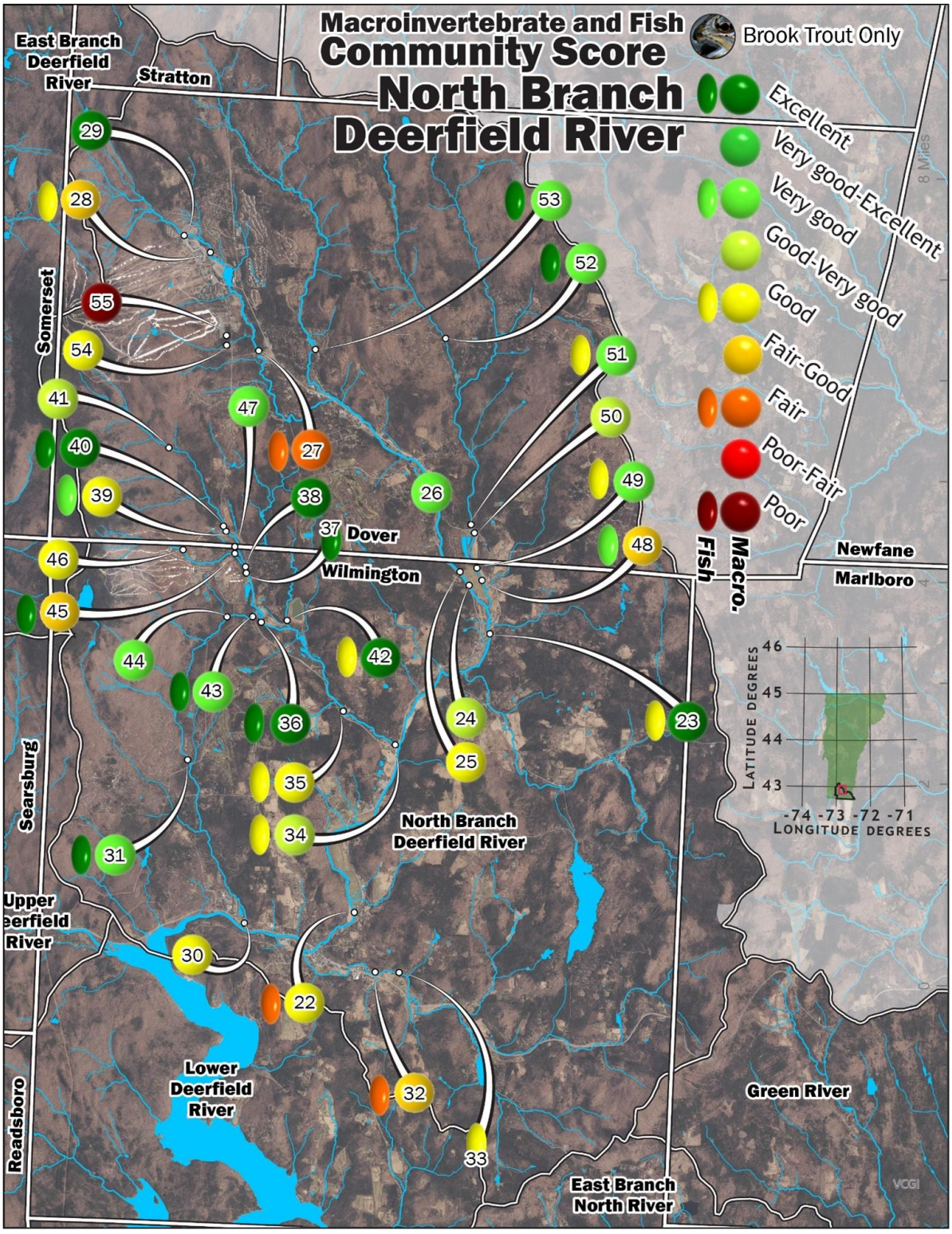


Figure 9. North Branch Deerfield - Biological Condition of Macroinvertebrate and Fish Communities

Table 3. North Branch Deerfield - Biological Condition of Macroinvertebrate and Fish Communities

Map ID	Location Name, River Mile
22	North Branch Deerfield River, 2.0
23	North Branch Deerfield River, 5.8
24	North Branch Deerfield River, 6.3
25	North Branch Deerfield River, 6.5
26	North Branch Deerfield River, 7.6
27	North Branch Deerfield River, 11.0
28	North Branch Deerfield River, 12.1
29	North Branch Deerfield River, 12.6
30	Binney Brook, 0.1
31	Rose Brook, 0.9
32	Beaver Brook, 1.0
33	Beaver Brook, 1.2
34	Cold Brook, 0.1
35	Cold Brook, 0.7
36	Cold Brook, 2.2
37	Cold Brook, 3.0
38	Cold Brook, 3.1

Map ID	Location Name, River Mile
39	Cold Brook, 3.3
40	Cold Brook, 3.4
41	Cold Brook, 4.3
42	Airport Trib, 0.1
43	Haystack Brook, .1
44	Haystack Brook, 0.3
45	Oak Brook, 0.1
46	Oak Brook, 0.7
47	Cold Brook Trib 6, 0.1
48	Ellis Brook, 0.3
49	Ellis Brook, 0.5
50	Ellis Brook, 0.9
51	Ellis Brook, 1.0
52	Ellis Brook, 2.9
53	Blue Brook, 0.7
54	Jacks Brook, 0.3
55	Iron Stream, 0.2

Macroinvertebrate Monitoring Results

Macroinvertebrate and fish community assessments were completed at 76 sites in the Basin between 2012 and 2022. Macroinvertebrate sampling was conducted at 72 unique sites for a total of 159 assessed samples, and fish sampling was conducted at 36 unique sites for a total of 54 sample events assessed.

For the assessed macroinvertebrate samples 49% exhibited *Very Good* or better condition. 25% of samples showed assessments that scored below *Good*. Some of these sites have identified stressors that need to be addressed while others will need further assessment to determine the cause of the low assessments.

In addition, to ensure a comprehensive understanding of water quality basin wide, a gap analysis was conducted by DEC to identify sites without current monitoring data (Figure 10). Some of these will be prioritized based on watershed size, land use and other factors for the 2026 monitoring season and can be found in the Chapter 5 Monitoring and Assessment Table. Thirty-four rivers and streams within this Basin lack data needed to determine the support status of aquatic biota.

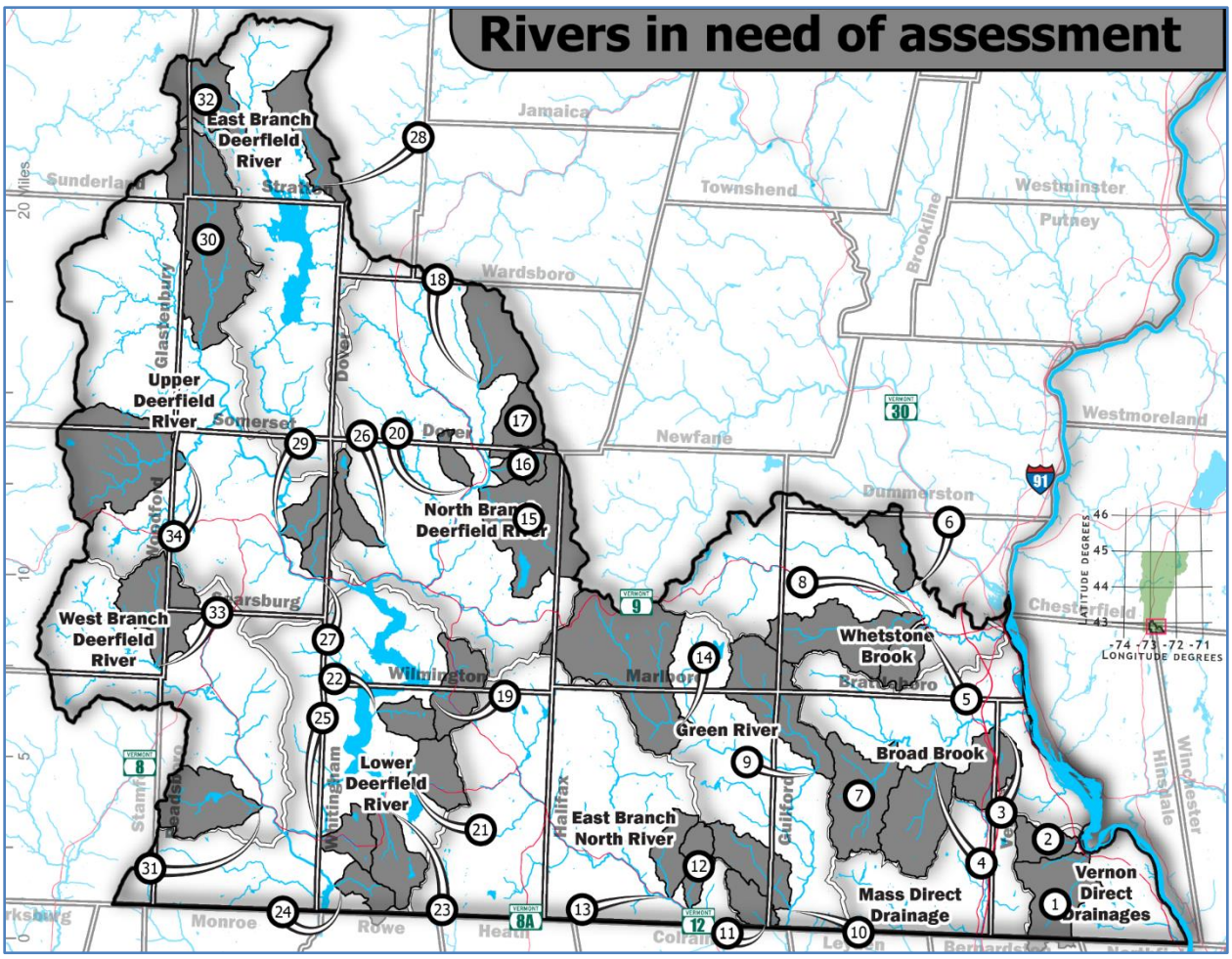


Figure 10. Rivers in Need of Assessment for Aquatic Biota

Table 4. Rivers in Need of Assessment for Aquatic Biota

Map ID	Name	Map ID	Name	Map ID	Name
1	Central Park Brook	13	Stowe Brook	25	Tobey Brook
2	Governor Hunt Creek*	14	Upper Green River	26	Binney Brook
3	Franklin Creek*	15	Bill Brook	27	Heather Brook
4	Weatherhead Hollow Brook*	16	Smith's Creek*	28	Grout Outlet*
5	Bonnyvale Brook*	17	Negus Brook	29	Vose Brook
6	Pleasant Valley Reservoir Outlet*	18	Cheney Brook	30	Upper Deerfield River
7	Guilford Creek*	19	Rader's Brook*	31	Howe Pond Brook
8	Ames Hill Brook	20	Old Ark Creek*	32	Black Brook

Map ID	Name	Map ID	Name	Map ID	Name
9	Hinesburg Brook	21	North trib to Sadawga Lake	33	Yaw Pond Brook
10	Roaring Brook	22	Faulkner Creek*	34	Redfield Brook
11	Borden Brook	23	South trib to Harriman Reservoir		
12	Vaughn Brook	24	East trib to Sherman Reservoir		

* - unnamed stream, name created by DEC for internal use

Additionally, eleven rivers and streams require more monitoring to evaluate attainment of aquatic biota use. These streams have limited biomonitoring data that indicates indeterminate or failing condition, but not enough data to fully evaluate the attainment of Aquatic Biota.

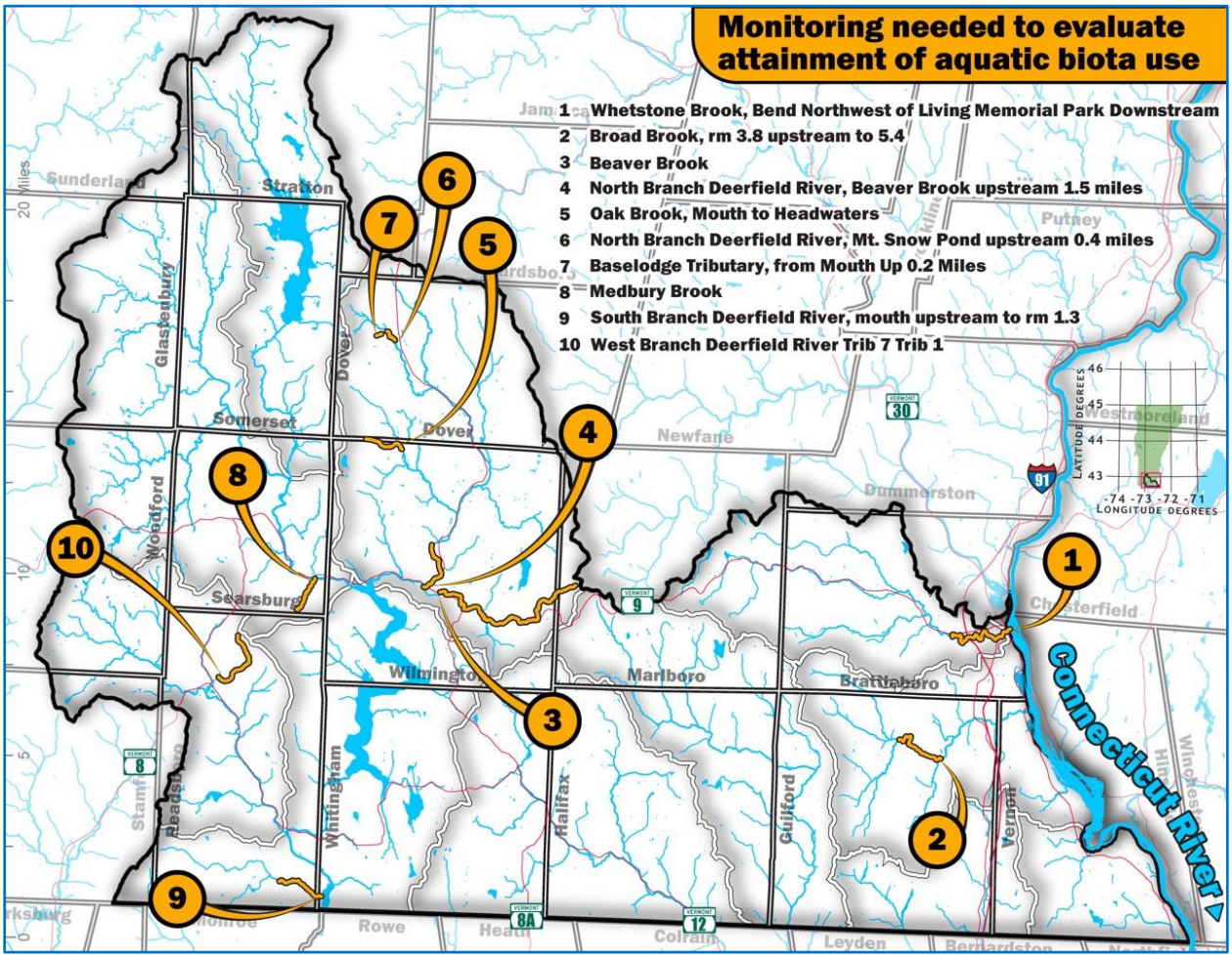


Figure 11. Rivers in Need of Additional Assessment for Aquatic Biota

Fish Monitoring Results

Fish community assessments were completed at 36 unique sites between 2012 and 2022. When considering only the most recent sample events at these sites, six of the sample sites had only Brook Trout, which means that a community assessment could not be made; however, a density criterion can be applied for upward reclassification of Brook Trout only streams. Three additional sites were deemed unable to be assessed for other reasons. Of the remaining sites where fish communities could be assessed, 18 (51%) had fish communities in *Excellent* or *Very Good* condition during the most recent survey, indicating the fish communities at these sites exceed the VWQS for class B(2) streams. Ten (29%) sites had most recent fish assessments exhibiting communities in *Good* condition which meet the VWQS for class B(2) streams and are priorities for maintenance and protection.

Seven sites (20%) had most recent fish assessments exhibiting communities in *Fair* or *Poor* condition. Assessments at four of these sites with *Fair* or *Poor* fish-assessments were in contrast with *Very Good* or better macroinvertebrate-based conditions. Often, a fish community can suggest different stressors than a macroinvertebrate community; therefore, assessing both the macroinvertebrate and fish community at a site provides useful information. Sites that fail to pass VWQS for a single community but score well for the other may be prioritized for further sampling to determine if anthropogenic impacts are responsible for the degradation. These sites are included in the Chapter 5 Monitoring Table (Table 23).

Stream Geomorphic Assessment

Fluvial geomorphology is a subdiscipline of geomorphology that investigates how flowing water shapes and modifies Earth's surface through erosional and depositional processes. The Rivers Program conducts a three-phase approach to assess the physical condition of rivers in the State of Vermont. Phase 1 is a watershed assessment. Phase 2 is a rapid field stream assessment, and Phase 3 is a survey assessment. There is limited coverage of Phase 1 or Phase 2 Stream Geomorphic Assessments (SGAs) in the Basin (Figure 12). Much of the Deerfield River is altered by the large hydroelectric dams limiting assessment only to areas outside of the altered reaches.

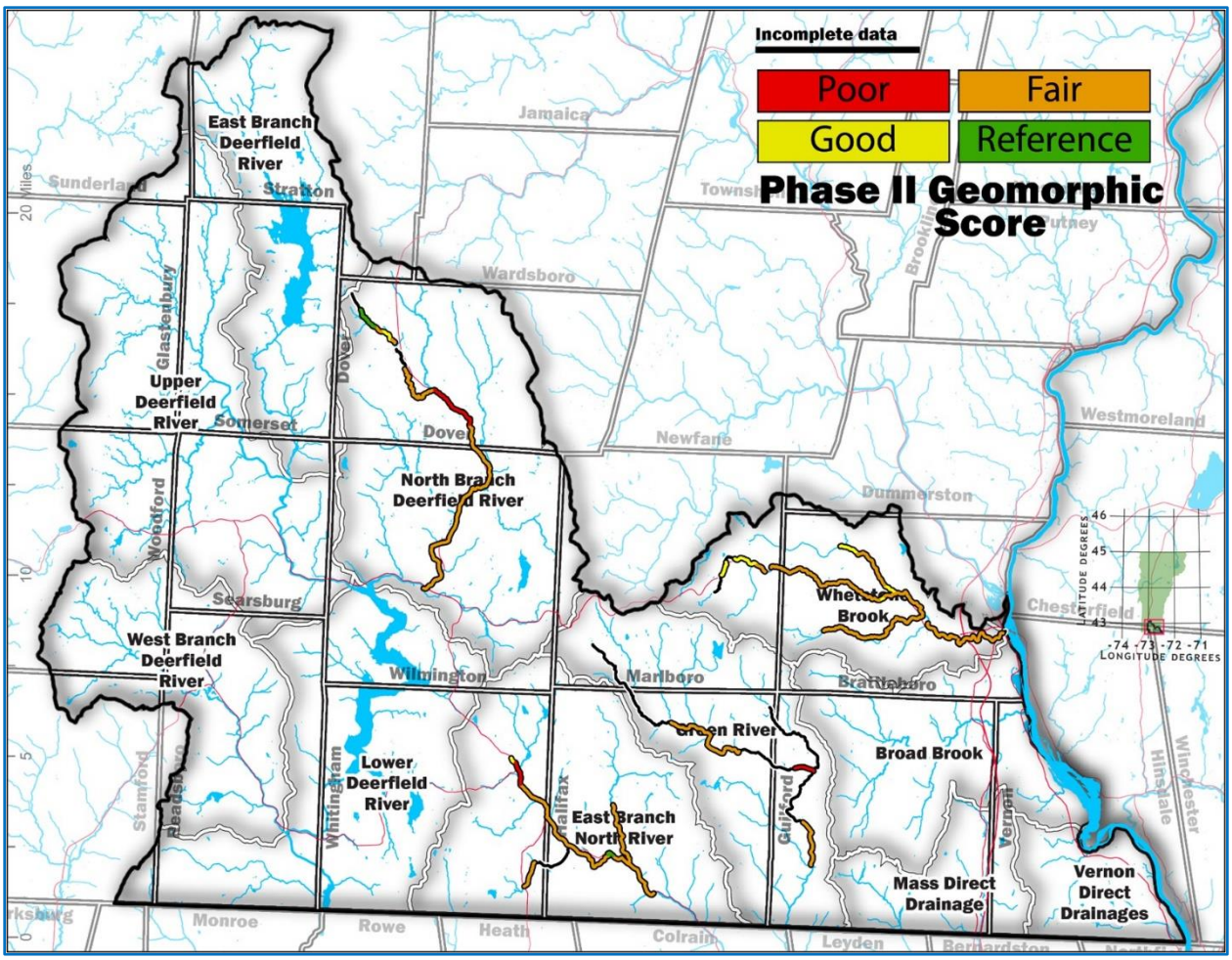


Figure 12. Assessed Reaches

Figure 12 gives the overall Phase 2 geomorphic condition score of assessed rivers and streams in the Basin. For more information on these type of assessments see the Geomorphic Assessment webpage.

Most assessed reaches are in *Fair* geomorphic condition. A limited number rate as *Poor* and only two short reaches rate *Good*. The River Corridor Plans from these assessments provide numerous restoration and protection opportunities which are recommended for implementation. This plan also recommends that additional assessments be conducted on the Broad Brook watershed. Final SGAs and River Corridor Plans can be accessed at: Stream Geomorphic Assessment - Final Reports.[1]

The geomorphic condition is closely reflected in the assessed habitat conditions as seen in Figure 13.

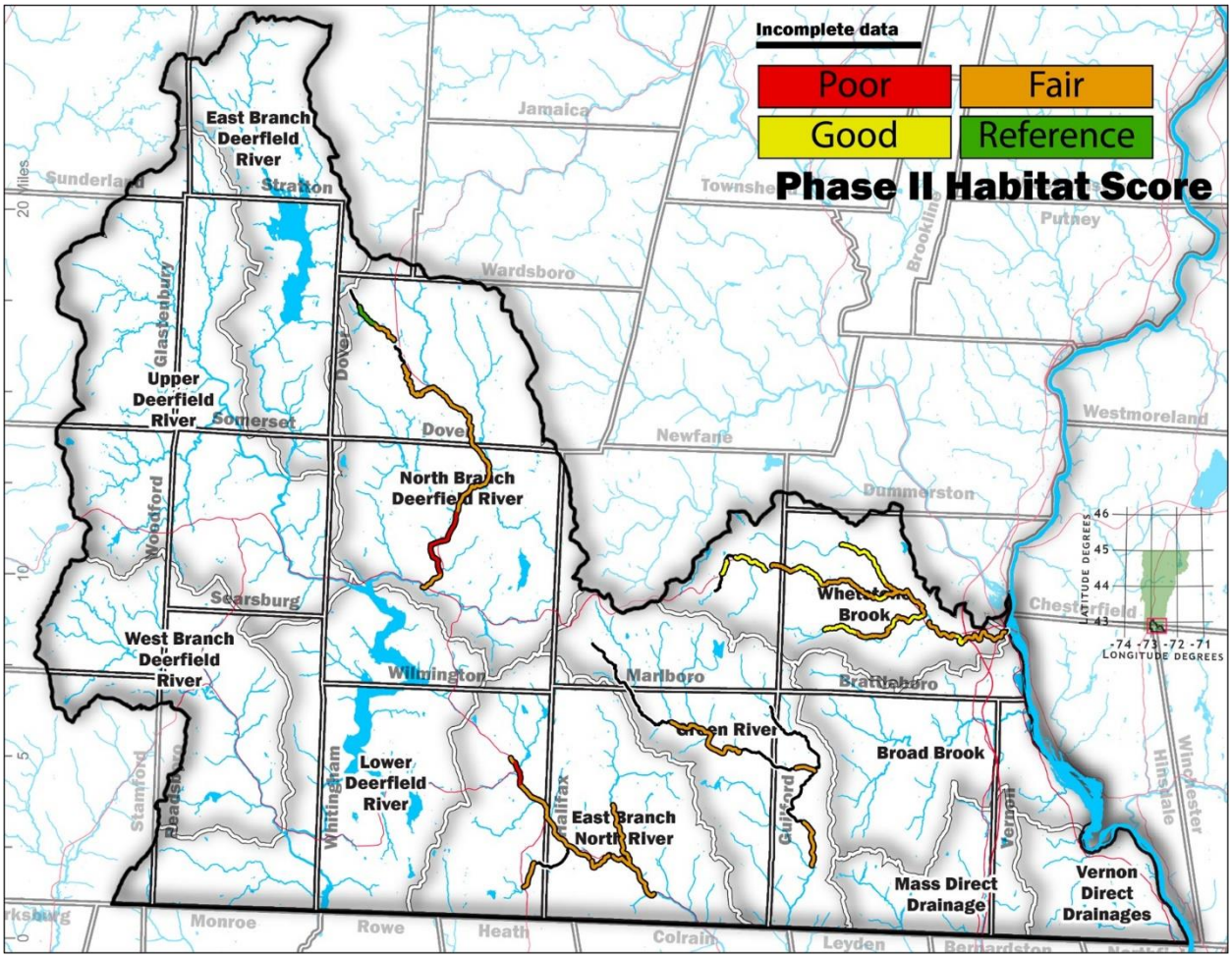


Figure 13. Habitat Condition of Assessed Rivers and Streams
[1] https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

Lakes and Ponds

There are 33 lakes and ponds in the Basin that are ten acres or greater. The two largest are Harriman and Somerset reservoirs created to store water for hydroelectric production. Only 11 of the 33 are natural un-dammed waterbodies, the largest being Grout Pond at 86 acres. Lakes that are ten acres or greater should be managed in accordance with the Vermont Hydrology Policy and meet the Hydrology Criteria (§29A-304) in the 2022 VT Water Quality Standards to ensure full support of designated uses. More information on dam location, status, purpose, and ownership can be found in Appendix B.

Lake Scorecard Assessment

The Vermont Lakes and Ponds Management and Protection Program (LPMPP) shares lake assessments using the Vermont Inland Lakes Scorecard (Figures 14 & Table 4). The scorecard provides available data on overall lake health by providing a rating of a waterbody's nutrient trend, shoreland and lake habitat, atmospheric pollution, and aquatic invasive species. The Lake Scorecard's rating system is detailed here. Lake-specific water quality and chemistry data can be accessed online through the Lay Monitoring Program webpage.

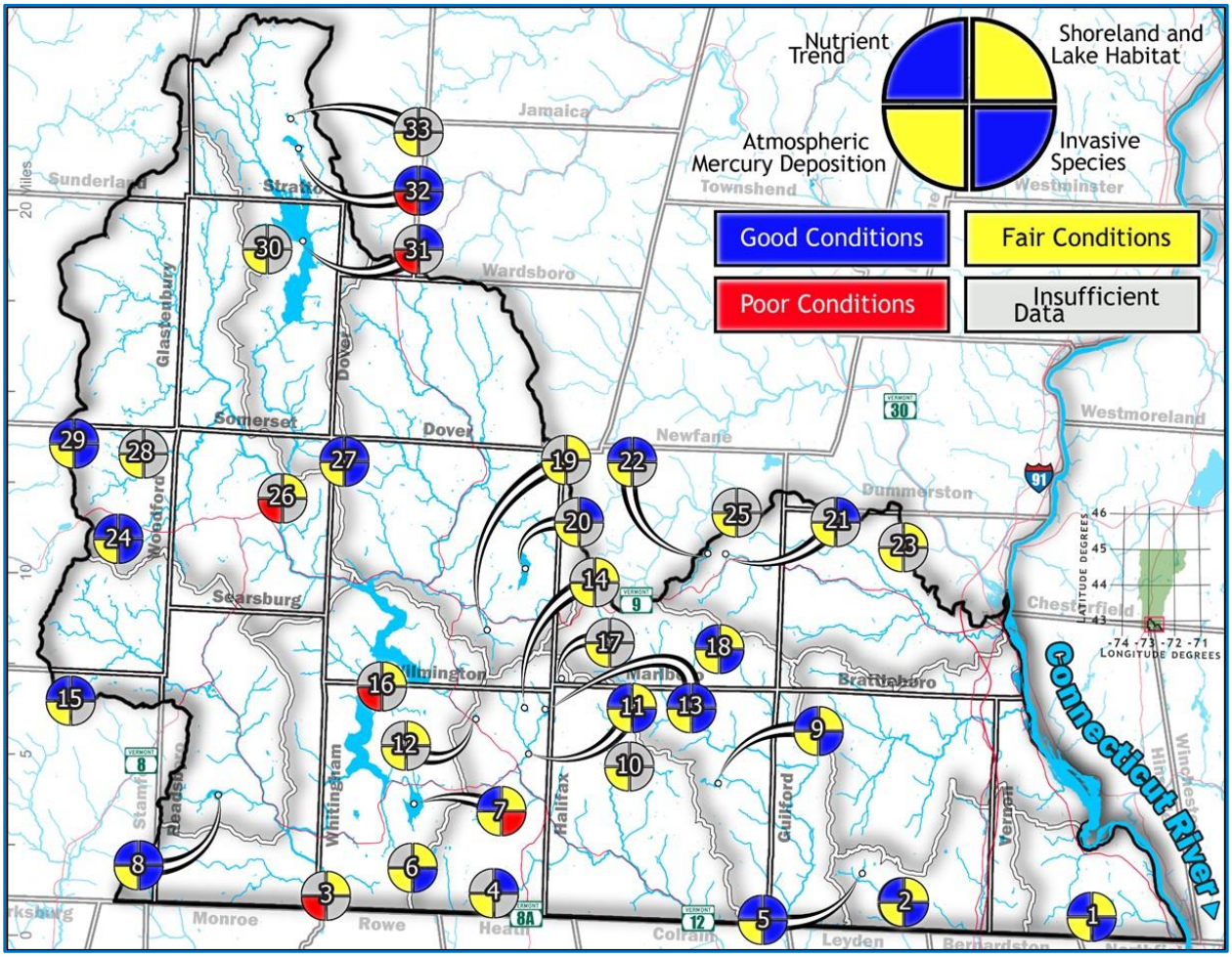


Figure 14. Condition of Lakes and Ponds

Table 5. Lake Scorecard Ratings

Map ID corresponds to the map above

Map ID	Lake ID	Area (ac)	Max Depth (ft)	Nutrient Trend	Shoreland	AIS	Mercury
1	LILY (VERNON)	40.3	13	Good	Fair	Good	Fair
2	WEATHERHEAD HOLLOW	30.8	10	Good	Fair	Good	Fair
3	SHERMAN	88.2	57		Fair		Poor
4	SHIPPEE	23.9	6		Good		Fair
5	SWEET	16	11	Good	Good	Good	Fair
6	NORTH (WHITHM)	26	10		Fair	Good	Fair
7	SADAWGA	191.3	10	Good	Fair	Poor	Fair
8	HOWE	53.3	33	Good	Good	Good	Fair
9	DEER PARK	18.7	9	Good	Fair	Good	Fair
10	BLUE;	11					Fair
11	JACKSONVILLE	16.3	8	Good	Fair	Good	Fair
12	RYDER	13.8	12		Fair		Fair
13	GATES	30.2	7	Good	Good	Good	Fair
14	LAUREL	16.7	17		Fair		Fair
15	STAMFORD	10.6	14	Good	Good		Fair
16	HARRIMAN (WHITHM)	1949.4	160		Fair		Poor
17	GATES-NE;	11.2					Fair
18	SOUTH (MARLBR)	68.5	35	Good	Fair	Good	Fair
19	SPRUCE (WILMTN)	14	4		Fair		Fair
20	RAPONDA	123.8	12	Good	Fair	Good	Fair
21	MARLBORO-431;	11.4	2		Good		Fair
22	HIDDEN	19.6	6	Good	Good		Fair
23	PLEASANT VALLEY	21.8	38		Fair		Fair
24	ADAMS (WOODFD)	33.6	15	Good	Good	Good	Fair
25	HALLADAY;	10.5					Fair
26	SEARSBURG	15.5	14		Fair		Poor
27	HAYSTACK	28.1	30	Good	Good	Good	Fair
28	MILL (WOODFD)	10.5	0				Fair
29	LITTLE (WOODFD)	22	8	Good	Good	Good	Fair
30	SOMERSET-W;	10.5					Fair
31	SOMERSET	1525.3	85		Good		Poor
32	GROUT	86.1	33	Good	Good	Good	Poor
33	GROUT-N;	16.9					Fair

All of the recently assessed lakes show good trends in water quality. Lake Raponda Association has been awarded the "Gold Lake Wise Award," for having 15% or more of all the properties on the lake having earned the Lake Wise award for implementing lake-friendly shoreland practices.

All of the Basins lakes are impacted by atmospheric deposition of acid and mercury. These pollutants are attributable to the prevailing weather pattern that carries mid-west air pollution through the region, the proximity to those pollution sources and to the lack of buffering capacity of the bedrock geology. Two main airborne pollution types affect the acidity of lakes and ponds in Vermont: sulfur oxides and nitrogen oxides. Due to implementation of the Clean Air Act the acidic conditions are slowly improving over time. Lily Pond is being proposed for removal from the Impaired Waters List as of 2024.

Table 6. Acid 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	
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	
Proposed for De-Listing		
Lily Pond (Vernon)	X	

Mercury contamination has resulted in fish consumption advisories in nearly every lake in Vermont. Dramatic shifts in water level, due to the way reservoirs are managed for hydroelectrical production, cause the release of bio-available mercury that is otherwise sequestered in the sediments. This mercury is more easily transferred up the food chain to fish and loons and other larger birds and mammals. The Vermont Department of Health posts a Health Alert for fish consumption for all Vermont waters recommending limits to fish consumption statewide.

Only one lake, Lake Sadawga, is known to have invasive Eurasian watermilfoil. Maintaining the clean condition of the Basins lakes is a priority and this Plan supports the continuation and

expansion of the Lake Greeter programs that assist boaters at lake launch sites to identify and clean invasive plants from their boats to prevent the spread to other lakes and rivers.

Wetlands

The Vermont Wetlands Program uses its Bioassessment Project to gather data about the health of Vermont wetlands. Plant species are used as the primary biological indicator to assess wetland health. Based on a 2017 analysis of bioassessment data, the principal factors that correlate with poor wetland condition are:

- presence of invasive species,
- disturbance to the wetland buffer or surrounding area,
- disturbance to wetland soils, and
- disturbance to wetland hydrology (how water moves through a wetland) through ditching (e.g., agricultural), filling (e.g., roads) and draining (e.g., culverts).

Wetlands in remote areas and at high elevations tend to be in good condition, with the most threatened wetlands occurring in areas of heavy agricultural use and high development pressure often exhibiting habitat loss.

Wetland Bioassessment and Vermont Rapid Assessment Method

Seventeen wetlands in the Basin have been assessed using the Vermont Rapid Assessment Method (VRAM) assigns each wetland a score ranging from 15 to 100 with higher numbers representing more intact ecological condition and higher levels of wetland functions and values. Eighteen wetlands in the Basin have been assessed using the VRAM (Figure 15), the highest scoring wetland, at Stamford Pond, scored a 95. Note that the VRAM assessments in this watershed are not meant to be representative of the Basin's wetlands, wetlands are selected or recommended for assessment rather than chosen through random sampling. A fuller inventory of all the wetlands in the Basin is taking place over time.

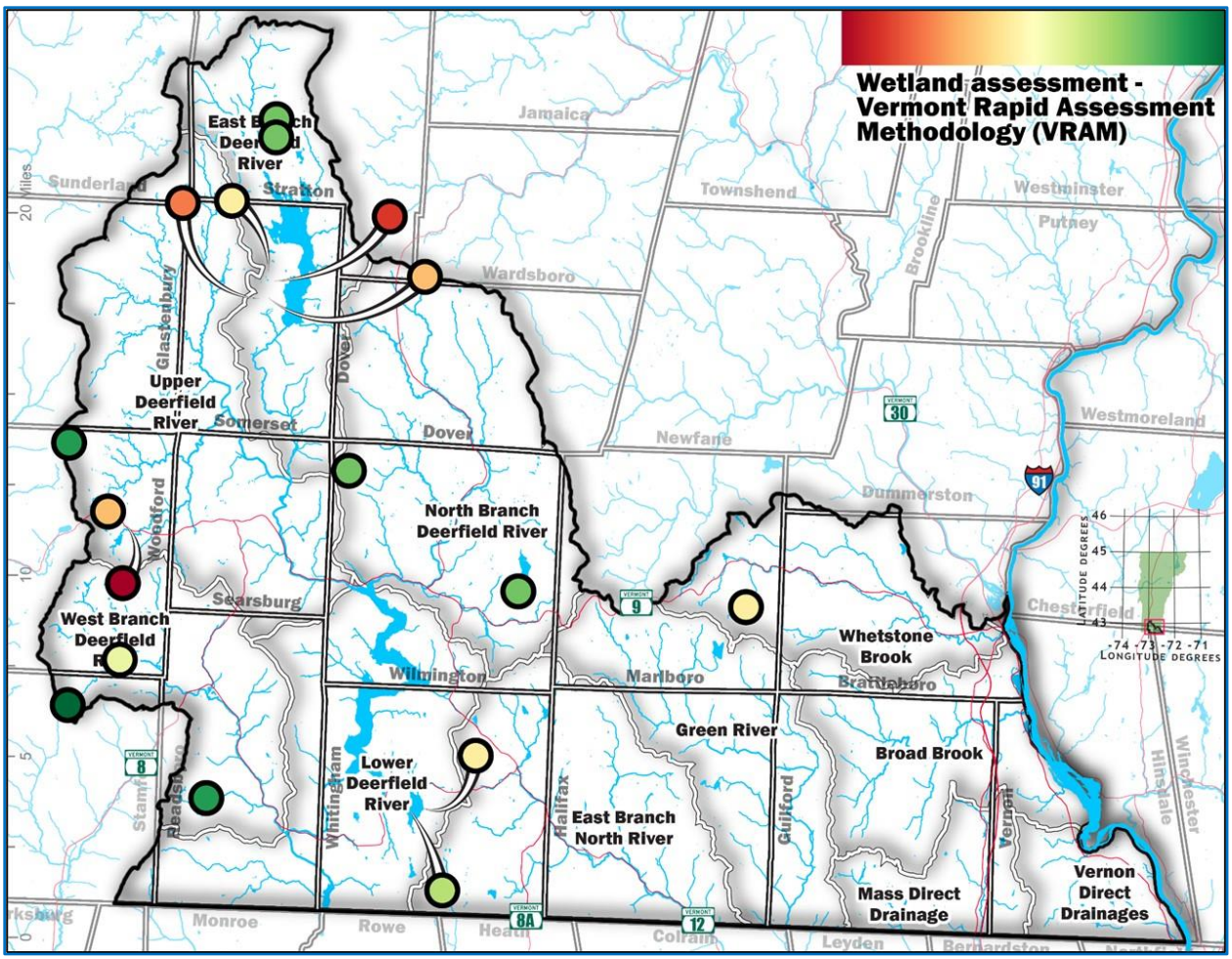


Figure 15. Wetland VRAM assessments Completed
(Red = poor Green = excellent condition)

Recreational Fisheries

The Vermont Fish & Wildlife Department (FWD) is responsible for protecting, conserving, and managing the fishes of Vermont. As such, monitoring fishery populations and important nursery areas to document biological and habitat conditions to manage for high-quality recreational fisheries occurs annually. FWD completed 80 monitoring events between 2000-2023 in rivers and streams in the Basin (Appendix X). Native Brook Trout are found throughout the Basin while Brown trout are found in many of the Basin's rivers and streams. No wild rainbow trout occur in the basin. Trout populations range from abundant, >1000 fish per mile, in numerous small headwater streams such as Scooter Brook, Lamb Brook, Bond Brook, Cold Brook, Fall River, Haystack Brook, and Oak Brook, to relatively low productivity in areas including North Branch Deerfield and Green River. The mainstem Deerfield below the Harriman Reservoir also has high trout abundances (Appendix C).

Recreational fishing is popular in lakes and ponds including Harriman Reservoir, Somerset Reservoir, Sherman Reservoir, Lake Raponda, Lake Sadawga, South Pond, and Weatherhead Hollow. Warm water fisheries are provided in Lake Sadawga and Weatherhead Hollow, while other lakes such as Sherman Reservoir, Lake Raponda, and Somerset are mixed between warm water fishes and stocked trout. Migratory species such as American Eel, a Species of Greatest Conservation Need (SGCN), have also been observed in the Basin, such as in Weatherhead Hollow.

During the reconstruction of the Sweet Pond dam in 2018, an eel ramp was incorporated in the project to allow passage of young eels to the pond where they grow to maturity before returning to the ocean to spawn.

Eel Ramp at Sweet Pond Dam

Stresses to the Basin's fishery include warming water temperatures associated with on-stream impoundments, flow alterations due to hydroelectric operations and water withdrawals, encroachments to riparian habitats, and climate change.

The mainstem Deerfield is highly modified due to a series of hydroelectric facilities which alter natural flow patterns, riverine processes, and fragment habitat. Private ornamental ponds are numerous throughout the Basin (and state) and efforts to educate landowners on the impacts that instream impoundments have on cold-water habitats should be prioritized.

Intense development associated with ski resorts results in loss of forested landscape, excessive culverting, unnatural snowpack, flow alterations, reduced riparian areas, and sediment runoff can degrade water quality, impact natural stream processes, and threaten aquatic populations. Encroachments to riparian habitats, water withdrawals, and nutrient runoff associated with agricultural practices undoubtedly add stress to these populations.

Excess sediment that enters waterbodies from poor land use practices can degrade water quality and interrupt physical and ecological processes. Encroachments to river channels and floodplain habitats due to rip-rapping, berming etc. can exacerbate bank erosion in adjacent reaches increasing sedimentation in streams. Nutrient and sediment loading into rivers increases siltation and algae

production and can limit the capacity of the waterway to support macroinvertebrates, fish, freshwater mussels, and other aquatic organisms (DFW, 2015).

Climate change is increasing temperatures as well as the frequency, magnitude and duration of flood and drought events. Floods can cause short term impacts to fish populations, but they also create habitat complexity and diversity, and recharge ground water supply. Post- flood recovery responses can degrade aquatic habitat for decades. Widening, deepening and straightening of stream channels, removal of in-stream wood and gravel bars, berming and rip-rapping stream banks, and raising bed elevations during post flood recovery efforts resulted in the loss of aquatic habitats including a diversity of substrate types, depths, flows, and cover, necessary to support healthy fish populations.

Drought and the lack of water can also stress fish populations. Droughts result in the reduction in the quality and distribution of habitats for certain species such as trout who need cold well-oxygenated water to survive. Regulation of water withdrawals is necessary to ensure that climate related increases in drought events are mitigated for by conserving enough water for aquatic species such as trout during drought events.

It has been well-studied that the loss of aquatic habitat diversity and complexity is directly linked to decreased diversity and abundance of fish and macroinvertebrate populations (Lau et. al 2006). Channelization, removal of instream habitat features (wood, gravel bars), loss of functioning riparian and floodplain habitats, and instream impoundments degrade riverine habitats and reduce habitat complexity. Efforts to improve river stewardship, aquatic passage, riparian habitats, flow regimes (during the FERC relicensing process), and floodplain access are management tools that could be applied to the Deerfield watershed, and tributaries to the Connecticut River.

VDFW management recommendations for the Basin include:

- Conduct Outreach and education to promote river and lake stewardship.
- Implement climate change adaptation strategies:
    - Protect and restore riparian habitats
    - Improve aquatic habitat connectivity
    - Improve post-flood recovery efforts
    - Promote the natural flow regime
    - Help stop the spread of exotic species and pathogens
    - Improve water quality

The condition of the Basin's fishery is dependent on the water quality and on the condition of the in-stream and riparian habitat for rivers and streams, and the littoral habitat of lakes and ponds.

Maintaining clear, cold, and well-oxygenated water is an important habitat requirement for trout. Water temperature increases due to the lack of riparian vegetation, sedimentation from road runoff,

development and channel erosion, and barriers to aquatic organism passage are all impacting the Basin's fishery.

Improving fishery conditions through riparian and shoreline planting, mitigation of erosion and sediment, removal or replacement of undersized culverts and bridges, and strategic wood additions are priority projects. The Aquatic Habitat Conservation website provides further information on these topics.

Chapter 2 – Priority Areas for Surface Water Protection

The state protects lakes, wetlands, and rivers by establishing and supporting surface water management goals. Tactical Basin Plans identify surface waters that consistently attain a higher level of quality and value based on physical, chemical, and biological criteria. These waters are prioritized for reclassification or designation. This allows for the establishment of enhanced management objectives and supports implementation of strategies to protect these surface waters.

Additional pathways such as land stewardship programs, local protection efforts, conservation easements, and land acquisition are also used to increase protection of priority waters. These are described in Chapter 4 - Strategies for Protection and Restoration. One lake and 18 streams in this Basin meet or exceed standards for very high-quality condition and are prioritized for reclassification (Table 8, Figure 16).

A. Surface Water Reclassification and Designation

Vermont's surface water classification system establishes management goals and supporting criteria for designated uses in four classes of water. Designated uses include aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water supply, and irrigation. The VWQS begin classification with two broad groups based on elevation:

- All waters above 2,500 feet in elevation, are designated Class A(1) for all uses, unless specifically designated Class A(2) for use as a public water source.
- All waters at or below 2,500 feet in elevation, are designated Class B(2) for all uses, unless specifically designated as Class A(1), A(2), or B(1) for one or more uses.

Current classifications of surface waters and their uses are published in the VWQS and are identified through the tactical basin planning process or on a case-by-case basis. Table 6 lists the possible classes for each designated use.

Table 7. Uses of Waters by Class

Classification (2016)	Applicable Uses
Class A(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, or swimming
Class A(2)	Public water source
Class B(1)	One or more of: Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, or boating
Class B(2)	Aquatic biota and wildlife, aquatic habitat, aesthetics, fishing, boating, swimming, public water source or irrigation

Surface waters may be protected by the anti-degradation policy of the Vermont Water Quality Standards (DEC, 2022) or through one of the following pathways:

- Reclassification of surface waters
- Class I Wetland designation
- Outstanding Resource Waters designation

The tactical basin planning process includes the review of ANR monitoring and assessment data to identify and document surface waters that meet the criteria for a higher classification or designation. (10 V.S.A. § 1253).

Public involvement is an essential component of protecting river, wetland, and lake ecosystems. The VWQS indicate that in the basin planning process, "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." The public, watershed partners, and stakeholders are encouraged to make recommendations for additional monitoring and research where very high-quality waters may exist.

In addition, the public may petition DEC to reclassify streams and lakes, and to designate Outstanding Resource Waters. DEC has developed procedures and documents for Class I wetland designations and stream reclassification. When the public is involved in developing proposals regarding management objectives, the increased community awareness can lead to protection of uses and values by the community and individuals.

Further information on reclassification and the petition process can be found on the following WSMD webpages: Stream Reclassification, Lakes and Ponds Reclassification, and Class I Wetlands. Strategies for enhanced protection of waters are described in further detail in the following sections. Surface waters in need of supplemental monitoring to determine their potential for enhanced management are included in Chapter 5 in the Monitoring and Assessment Table.

A(2) Public Water Sources

Three waters in the Basin are designated as A(2) public water sources (Table 7). All are actively being used.

Table 8. Class A(2) Public Water Sources

Water	Location	Use
Haystack Pond	Haystack Pond and all waters within its watershed in the Town of Wilmington	Village of Wilmington water source
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 is located approximately 1.1 miles downstream from Howe Pond.	Village of Readsboro water source.
Pleasant Valley Reservoir	Pleasant Valley Reservoir and all waters in its watershed in the Town of Brattleboro, including Langlie, Kelly, and Stickney Brooks.	Town of Brattleboro water source.

A(1) & B(1) Waters for Aquatic Biota Use

Biomonitoring assessments by the WSMD identify five waters that consistently and demonstrably attain a level of quality meeting aquatic biota criteria for Class B(1) aquatic biota. (Table 9 and Figure 16).

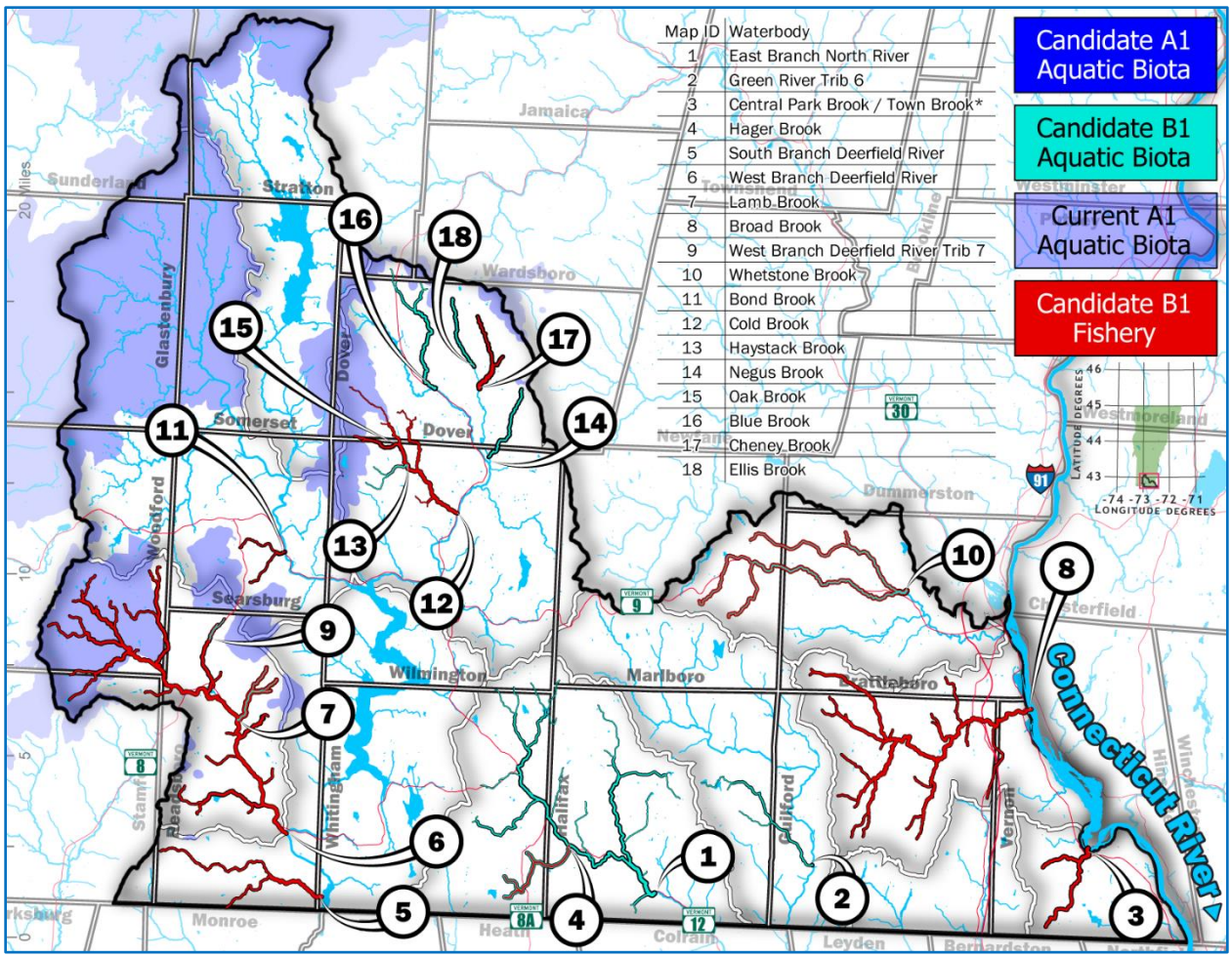


Figure 16. Protection Priorities

Table 9. Protection Priorities

Map #	Name	Use	Protection Class
1	East Branch North River	Aquatic Biota	B1
2	Green River, Trib 6	Aquatic Biota	B1
3	Central Park Brook / Town Brook*	Fishery	B1
4	Hager Brook	Fishery	B1
5	South Branch Deerfield River	Fishery	B1
6	West Branch Deerfield River	Fishery	B1
7	Lamb Brook	Aquatic Biota	B1
8	Broad Brook	Fishery	B1
9	West Branch Deerfield River Trib 7	Aquatic Biota	B1
10	Whetstone Brook	Aquatic Biota / Fishery	B1
11	Bond Brook	Fishery	B1

Map #	Name	Use	Protection Class
12	Cold Brook	Fishery	B1
13	Haystack Brook	Aquatic Biota	B1
14	Negus Brook	Fishery	B1
15	Oak Brook	Fishery	B1
16	Blue Brook	Aquatic Biota / Fishery	B1
17	Cheney Brook	Fishery	B1
18	Ellis Brook	Aquatic Biota	B1

* - local name

Five waters have historical data that suggest A(1) or B(1) condition and need additional monitoring to assess their condition for Aquatic Biota use reclassification.

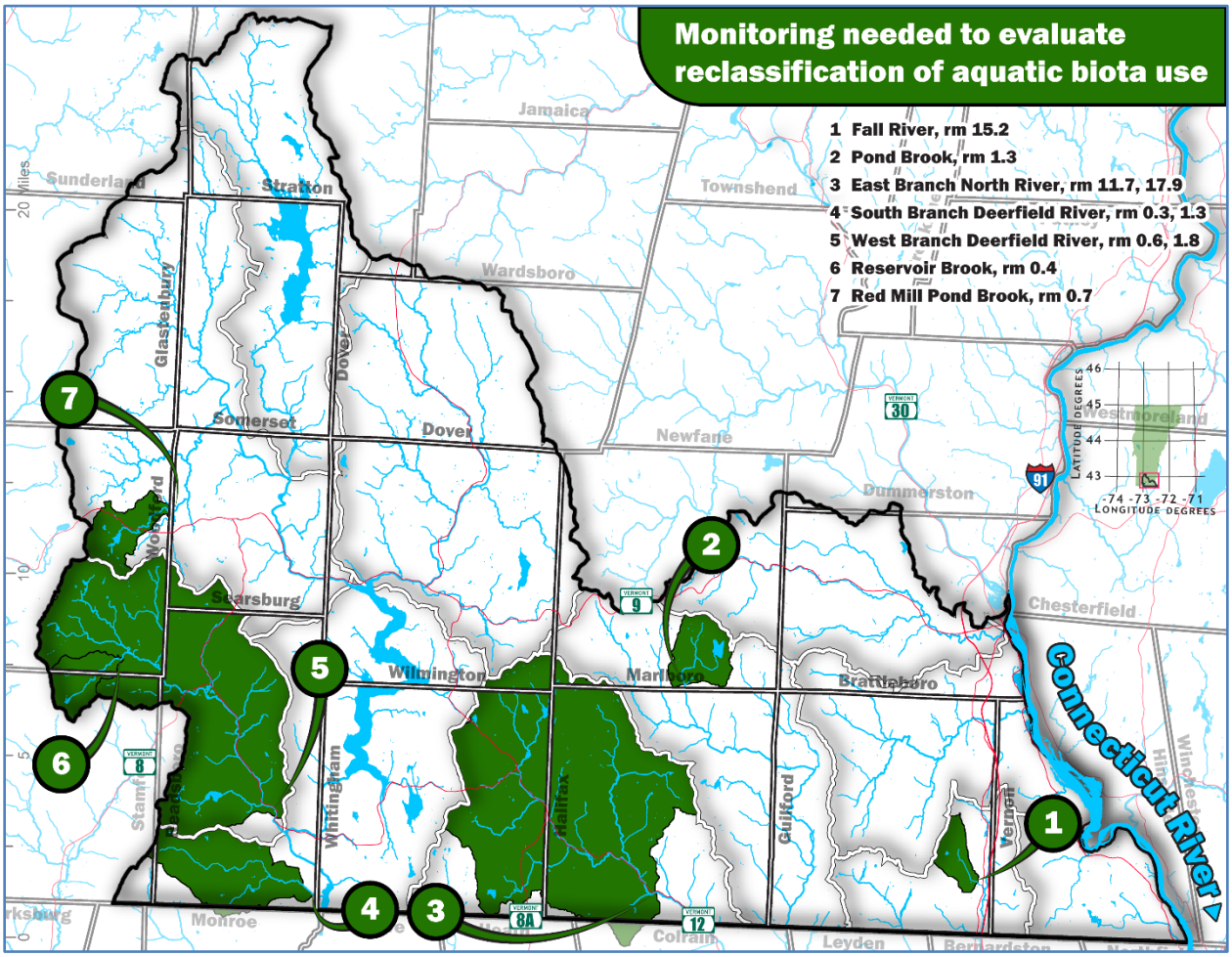


Figure 17. Priority waters for additional assessment to determine eligibility for A(1) or B(1) reclassification for aquatic biota.

B(1) Waters for Recreational Fishing Use

Rivers and streams classified as B(1) recreational fishing waters support wild, self-sustaining salmonid populations characterized by the presence of multiple age classes and a minimum abundance of 1,000 individuals per mile (all species/ages/sizes); and/or 200 large (> 6 inches total length) individuals per mile; and/or 20 pounds/acre (all species/ages/sizes). The thirteen streams that meet B(1) criteria for recreational fishing (§29A-306 of the VWQS) are listed above in Table 9. These waters shall be managed to achieve and maintain the documented quality of fishing. It is important to note that all waterbodies that would naturally support fish populations are protected and maintained for this use in perpetuity.

B. Class I Wetland Designation

The State of Vermont identifies and protects the functions and values of significant wetlands to achieve no net loss of wetlands. Based on an evaluation of 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.
- **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-Wetlands Program Class I Wetlands website highlights the designated Class I wetlands statewide and lists those recommended for Class I designation.

The Black Gum Swamps in Vernon are a candidate for Class I designation. These wetlands make up a rare natural community found at the edge of the normal range for this type of wetland and contain some very old trees; some black gum trees aged at over 400 years old. The wetlands are home to at least five rare, threatened, and endangered and two uncommon plant species.

Three wetlands are highlighted through the assessments for consideration as Class I.

1. Lily Pond (Vernon)
2. Lake Sadawga floating bog (Whitingham)
3. Atherton Meadows (Whitingham)

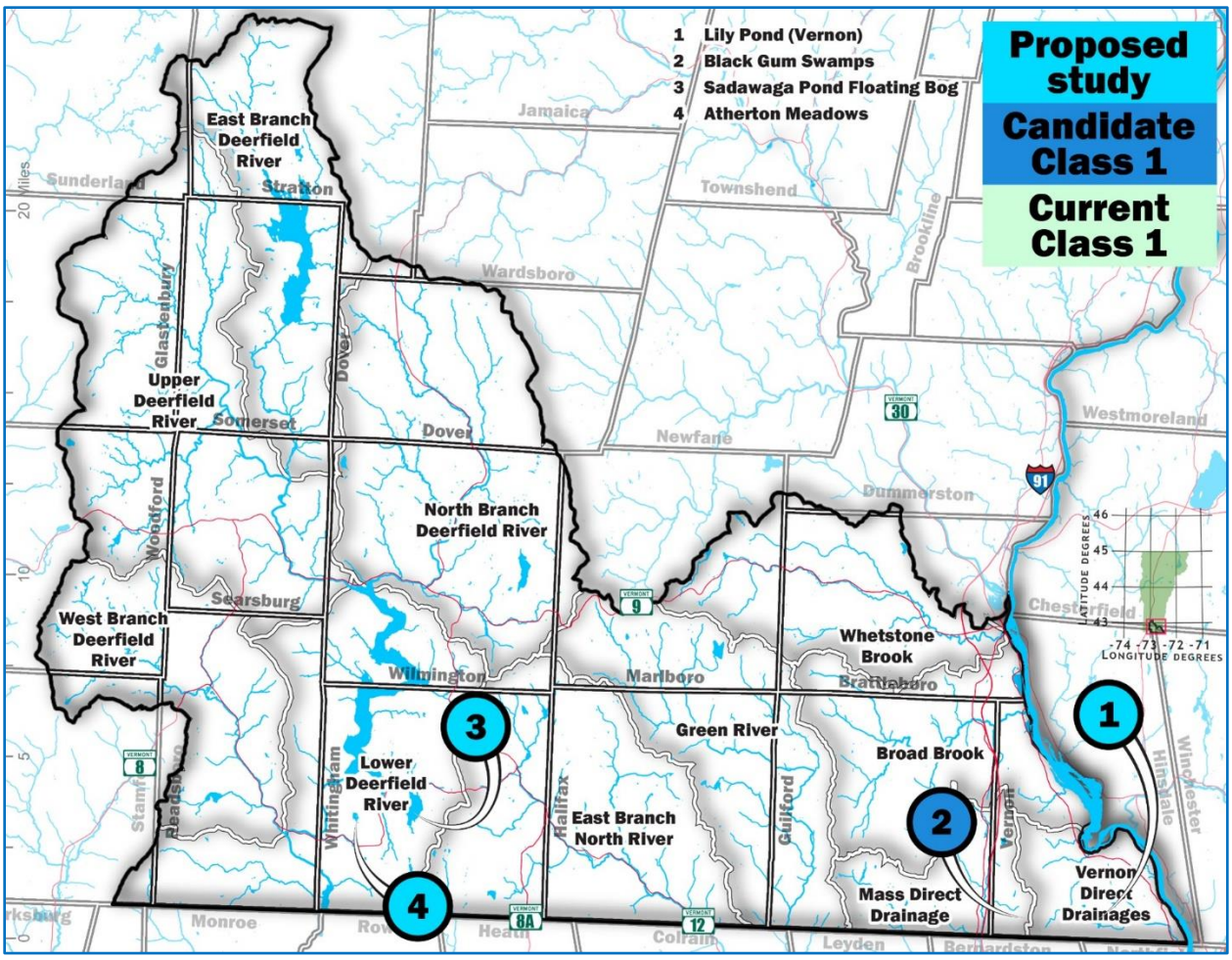


Figure 18. Wetland Protection Priorities

DEC supports the further study and designation of Class I wetlands, and the Wetlands Program welcomes recommendations for Class I candidates. Wetlands found to meet criteria for Class I designation may be proposed for reclassification through petition or departmental rulemaking authority, consistent with the Vermont Wetland Rules.

C. Outstanding Resource Waters Designation

Rivers, streams, lakes and ponds that have "exceptional natural, cultural, recreational, or scenic values" can be protected through designation as Outstanding Resource Waters (ORW; 10 V.S.A. § 1424a). ORW designation protects exceptional waters through permit conditions for in-stream

alterations, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250[1] projects, and other activities. ORWs can be designated by the ANR through a public petition process.

Six waters are recommended for ORW designation in the Basin:

- Grout Pond (Stratton)
- Howe Pond (Readsboro)
- Lake Raponda (Wilmington)
- Lily Pond (Vernon)
- Broad Brook falls and gorge (Guilford)
- Halifax Gorge (Halifax)

D. Identification of Existing Uses

Existing uses of waters and the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification (DEC, 2022).

The ANR 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. Consistent with the federal Clean Water Act, the VWQS stipulate that existing uses may be documented in any surface water location where that use has occurred since November 28, 1975. Pursuant to the definition of Class B(1) in Act 79, the ANR may identify an existing use as Class B(1) when that use is demonstrably and consistently attained.

The ANR stipulates that all lakes and ponds in the state have existing uses of swimming, boating, and fishing. The ANR recognizes that fishing activities in streams and rivers are widespread and too numerous to thoroughly document for the Basin. In the case of streams too small to support significant fishing activity, the ANR recognizes these as potential spawning and nursery areas, which contribute fish stocks downstream where fishing may occur. These small streams support the use of fishing and therefore, are protected at a level commensurate with downstream areas.

Existing uses listed in the basin plan should be viewed as a partial accounting of known existing uses based upon limited information. The list does not change protection under the Clean Water Act or VWQS for unlisted waters. Existing uses are listed on the Deerfield River Tactical Basin Planning webpage and include swimming, boating, fishing, and public water sources.

[1] Vermont's land use and development law, established in 1970. The law provides a public, quasi-judicial process for reviewing and managing the environmental, social and fiscal consequences of major subdivisions and development in Vermont through the issuance of land use permits

The public is encouraged to recommend waters for the existing uses of swimming, boating, fishing, public water source, and ecological significance given that they provide evidence of such use.

D. Wild and Scenic Designation

Beyond state water classifications and ORW designation, a national designation is being sought for he Deerfield River by partner organizations and is supported by DEC. The National Wild and Scenic Rivers designation highlights rivers that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values that should be protected in free-flowing condition for the benefit and enjoyment of present and future generations. While hydro-electric dams create reservoirs on some reaches, others are free-flowing and wild. The Deerfield River is a unique recreational and natural resource that runs for 76 miles from southern Vermont through northwestern Massachusetts to the Connecticut River, traversing the beautiful Green Mountain National Forest, in Vermont and the Berkshire Mountains, and Pioneer Valley hill towns in Massachusetts. The river offers Class II-IV rapids for paddling and rafting, an excellent wild trout fishery and reaches of it and its tributaries are pass through wild terrain with exceptional water quality.

The Deerfield River Watershed Alliance is spearheading this effort, and information can be found on their website - https://deerfieldriver.org/wild-and-scenic.

Chapter 3 – Priority Areas for Surface Water Restoration

A. Impaired and Altered Surface Waters

The DEC monitors and assesses the chemical, physical, and biological status of individual surface waters to determine if they meet the VWQS per the 2022 Vermont Surface Water Assessment and Listing Methodology (DEC, 2022). Surface waters are assessed as: full support, altered, or impaired.

The assessment results are the basis for the biennial statewide 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d) (Table 10) as well as the priority waters for protection for the aquatic life support (Chapter 2). The lists identify impaired or altered waters and includes preliminary information on responsible pollutant(s) and/or physical alterations to aquatic and riparian habitat and identifies the problem, if known. Altered and impaired waters become a priority for restoration. Additionally, the Vermont Lake Score Card identified lakes and ponds that have increasing nutrient trends and therefore are a priority for nutrient reduction strategies. To address documented water quality concerns, the strategies proposed in the Chapter 5 Implementation Table are prescribed based on the land use sector-specific practices outlined in the Vermont Surface Water Management Strategy.

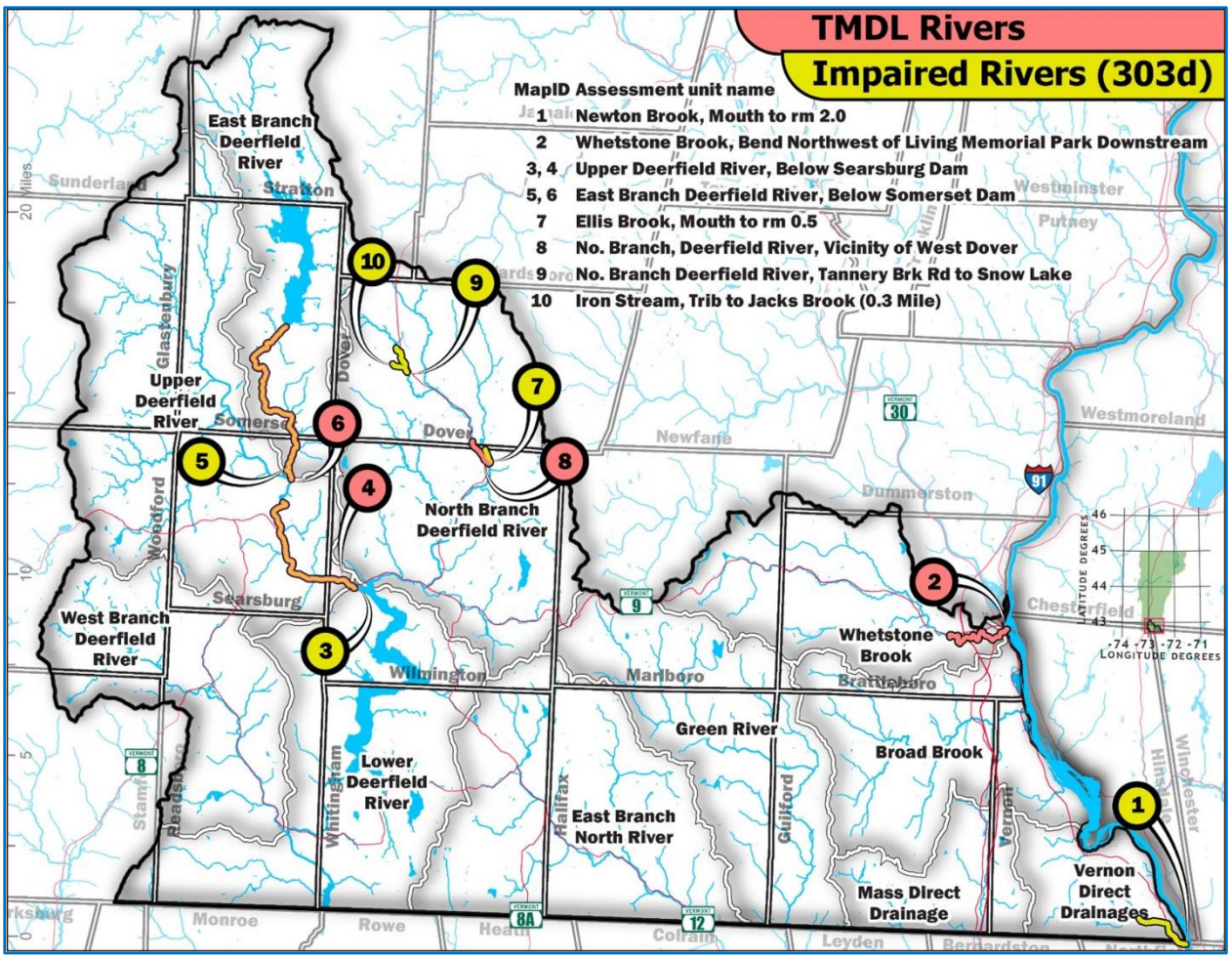


Figure 19. Priority Rivers and Streams for Restoration - Impaired
(Map # corresponds with Table 10.)

Table 10. Priority Rivers and Streams for Restoration – Impaired

PART A. SURFACE WATERS IN NEED OF TMDL					
Map ID	***Name***	***Pollutant***	***Problem***	***Impaired Use***	***TMDL***
1	Newton Brook, Mouth to RM 2.0	SEDIMENTATION / SILTATION	Agricultural activity	ALS	Needed
2	Whetstone Brook, Living Memorial Park Downstream	E. coli BACTERIA	Sources unknown, potentially faulty sewer line/septic system	CR	Completed
3	Upper Deerfield River, Below Searsburg Dam	pH, LOW	Atmospheric deposition: critically acidified; chronic acidification	ALS	Needed

Map ID	Name	Pollutant	Problem	Impaired Use	TMDL
4	Upper Deerfield River, Below Searsburg Dam	MERCURY IN FISH TISSUE	Elevated levels of mercury in all fish	FC	Completed
5	East Branch Deerfield River, Below Somerset Dam	pH, LOW	Atmospheric deposition: critically acidified; chronic acidification, low temperature dam release	ALS	Needed
6	East Branch Deerfield River, Below Somerset Dam	MERCURY IN FISH TISSUE	Elevated levels of mercury in all fish	FC	Completed
7	Ellis Brook, Mouth to RM 0.5	TEMPERATURE, NUTRIENTS	Possible impacts from NBFD WWTF, agricultural runoff and channel alterations, lack of riparian buffer; high algal cover	ALS	Needed
8	No. Branch, Deerfield River, Vicinity of West Dover	E. coli BACTERIA	High E. coli levels; cause(s) & source(s) unknown; needs assessment	CR	Completed
9	No. Branch Deerfield River, Tannery Brk Rd to Snow Lake	TEMPERATURE	High temperatures below Snow Lake impact aquatic biota	ALS	Needed
10	Iron Stream, Trib to Jacks Brook (0.3 Mile)	IRON	Land development, source(s) need further assessment	ALS, AES	Needed

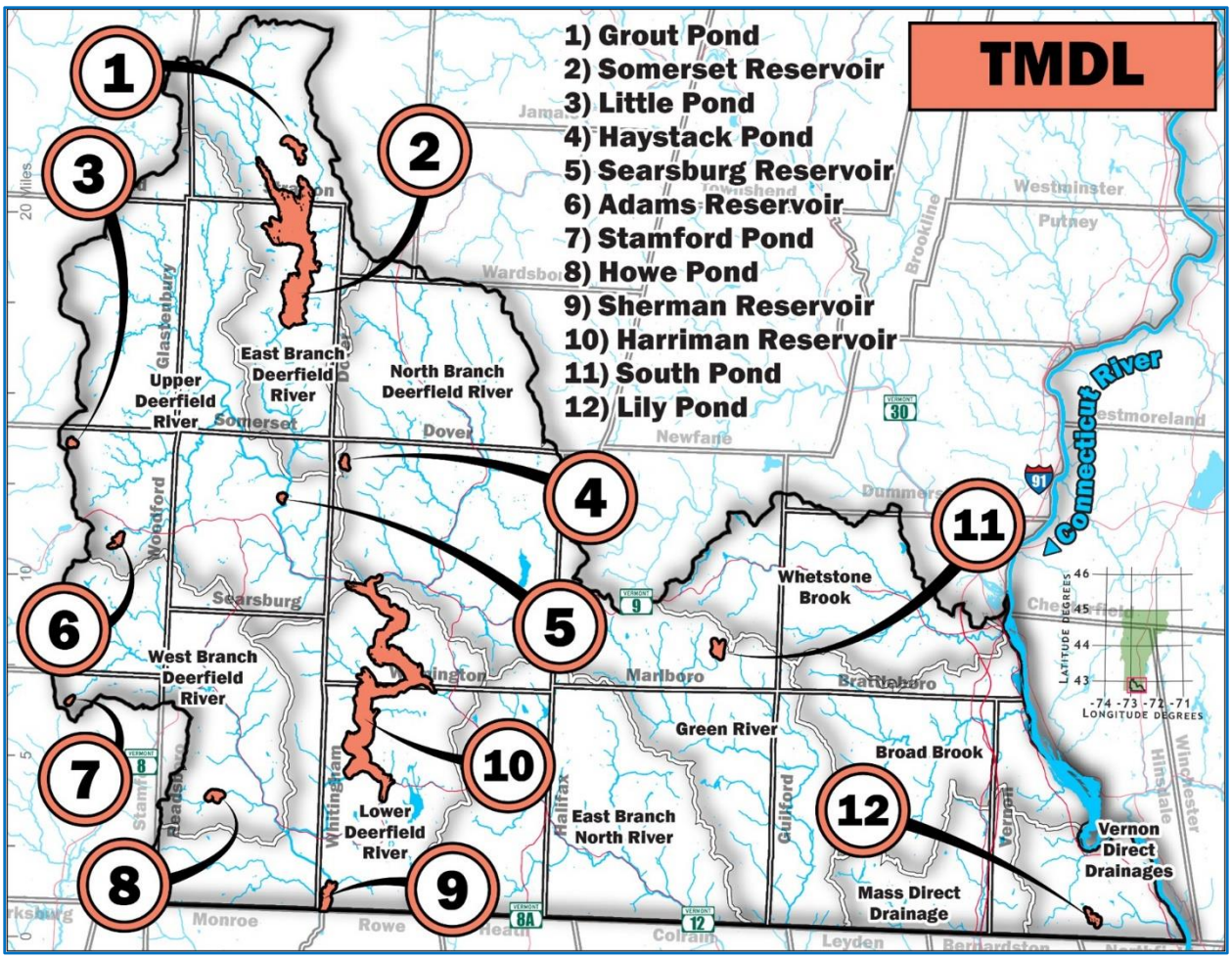


Figure 20. Impaired Lakes

Table 11. Priority Lakes for Restoration - Impaired

(Map # corresponds with Figure 20)

PART D.	COMPLETED TMDL		
	LAKES		
Map ID	*Name*	*Pollutant*	*Problem*
1	Grout Pond (Stratton)	MERCURY IN FISH TISSUE, pH	Atmospheric deposition: extremely sensitive to acidification; episodic acidification
2	Somerset Reservoir (Somerset)	pH, MERCURY IN FISH TISSUE	Elevated level of mercury in all fish except brown bullhead
3	Little Pond (Woodford)	pH	Atmospheric deposition: critically acidified; chronic acidification

Map ID	*Name*	*Pollutant*	*Problem*
4	Haystack Pond (Wilmington)	pH	Atmospheric deposition: critically acidified; chronic acidification
5	Searsburg Reservoir (Searsburg)	MERCURY IN FISH TISSUE	Elevated level of mercury in all fish except brown bullhead
6	Adams Reservoir (Woodford)	pH	Atmospheric deposition: extremely sensitive to acidification; episodic acidification
7	Stamford Pond (Stamford)	pH	Atmospheric deposition: extremely sensitive to acidification; episodic acidification
8	Howe Pond (Readsboro)	pH	Atmospheric deposition: extremely sensitive to acidification; episodic acidification
9	Sherman Reservoir (Whitingham)	MERCURY IN FISH TISSUE	Elevated level of mercury in all fish except brown bullhead
10	Harriman Reservoir (Whitingham)	MERCURY IN FISH TISSUE	Elevated level of mercury in all fish except brown bullhead
11	South Pond (Marlboro)	pH	Atmospheric deposition: extremely sensitive to acidification; episodic acidification
12	Lily Pond (Vernon)	pH, LOW	Atmospheric deposition; extremely sensitive to acidification; episodic acidification

Part F of the Vermont Priority Waters List are assessed as "altered." Alterations arise from flow fluctuation, obstructions, or other manipulations of water levels that originate from hydroelectric facilities, dam operations or water withdrawals for industrial or municipal water supply or snowmaking purposes or where aquatic habitat and/or other designated uses are not supported due to the presence of invasive aquatic species.

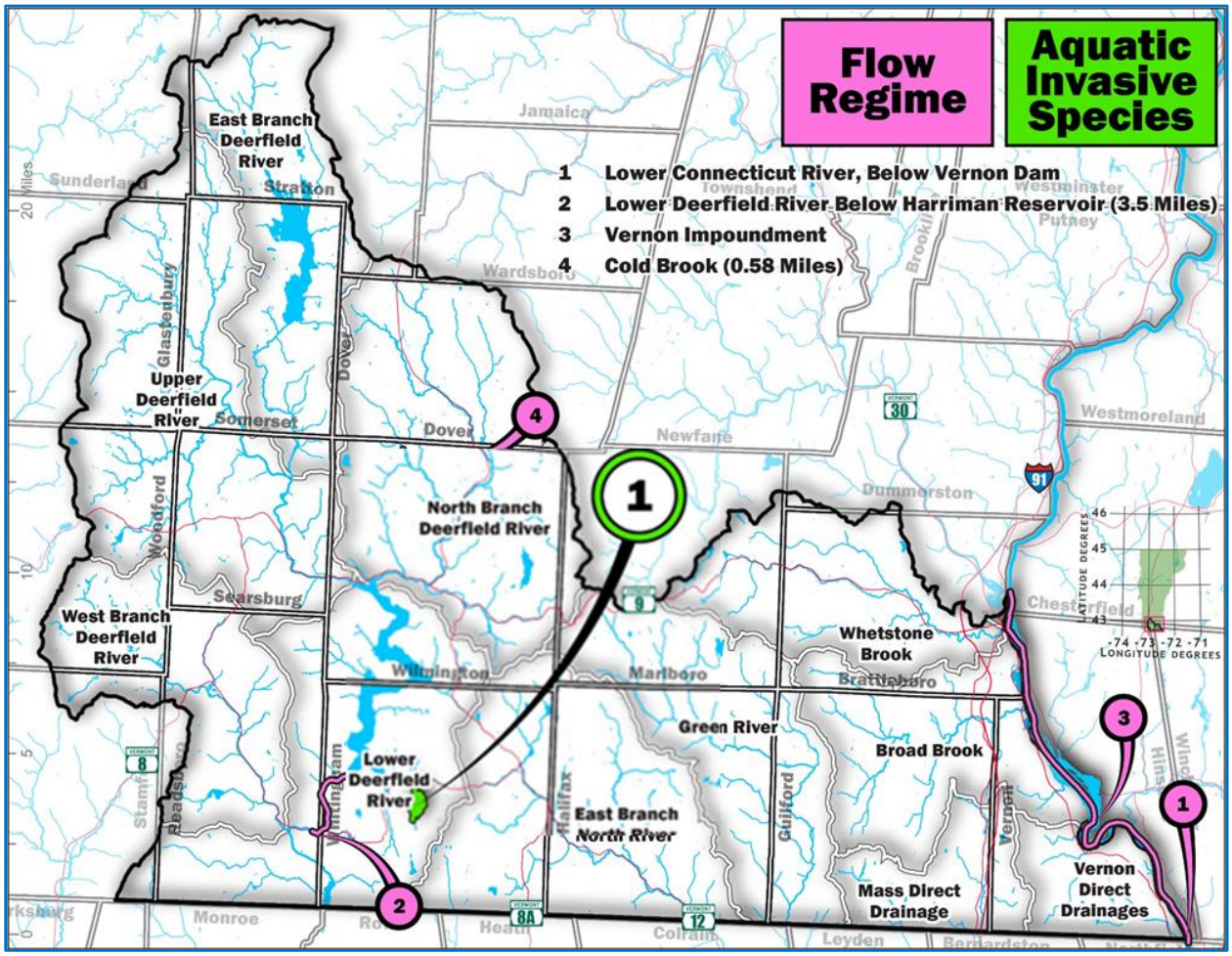


Figure 21. Altered Waters
(Map # corresponds with Table 12.)

Table 12. Altered Waters

PART E & F. INVASIVE AQUATIC SPECIES & ALTERED BY FLOW REGULATION				
Map ID	***Name***	***Pollutant***	***Problem***	***Impaired Use***
1	Lower Connecticut River, Below Vernon Dam	Artificial flow condition, fluctuating flows by hydropower production	Agreement on operation of Vernon dam was reached in 2020 that will meet VWQS; FERC license and 401 WQC still pending	ALS

Map ID	Name	Pollutant	Problem	Impaired Use
2	Lower Deerfield River Below Harriman Reservoir (3.5 Miles)	Low temperature hypolimnetic water release from reservoir affect fishery	401 certification issued (1/95); FERC license issued (4/97); VFWD evaluating the effects of release.	ALS
3	Vernon Impoundment	Water level fluctuation at dam; dewatered shoreline/wetlands	Agreement on operation of Vernon dam was reached in 2020 that will meet VWQS; FERC license and 401 WQC still pending	ALS
4	Cold Brook (0.58 Miles)	Artificial & insufficient flow below Hermitage snowmaking withdrawal	Compliance schedule established as part of act 250 process to bring the withdrawal into compliance	ALS
1	Sadawga Lake	Locally abundant Eurasian Watermilfoil growth		AES, AH, ALS, CR, RB

Additionally of concern at the Vernon Impoundment and adjacent lower Connecticut River is the population of invasive Water Chestnut (*Trapa natans*). Efforts to control the spread of this plant and prevent it from moving farther up into Vermont are on-going. VT DEC and NH DES work with the Connecticut River Conservancy and other volunteers to manage this population with frequent pulling events.

The WSMD conducts long-term monitoring of surface waters to identify increasing, stable, and decreasing trends of Total Phosphorus. Modeling water quality trends before a surface water becomes impaired or altered can lead to more effective and efficient actions to reduce stressors to these waters. Lakes with sufficient data to identify a trend in total phosphorus concentrations are shown on the map below. Trends are categorized into three groups: increasing, stable and decreasing. For the fifteen lakes with sufficient data, all are assessed as Stable.

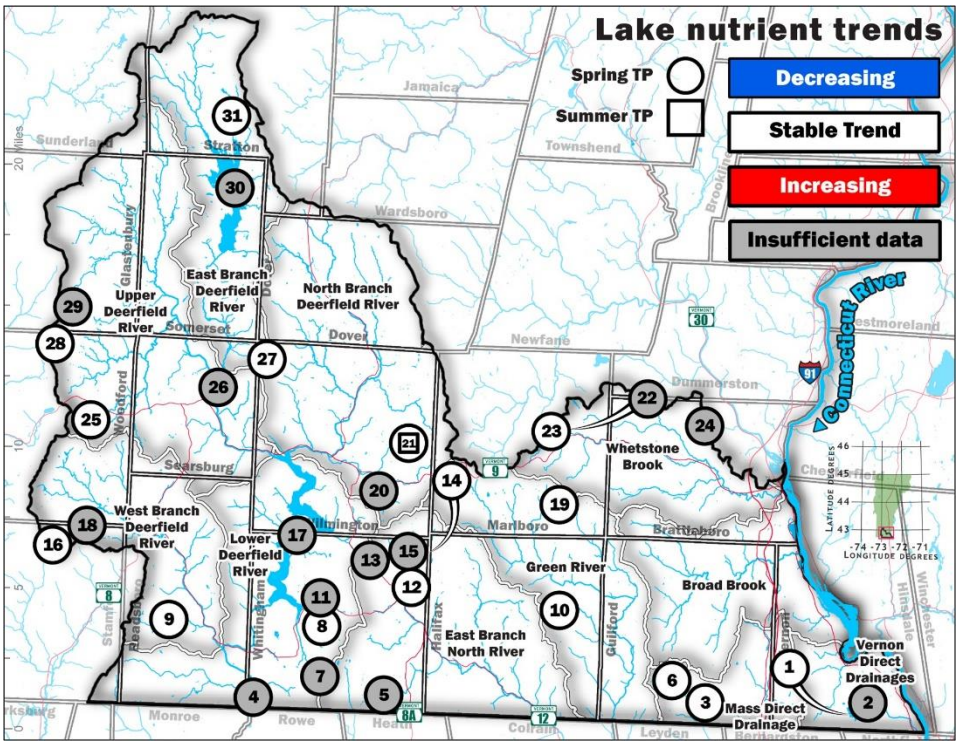


Figure 22. Priority Waters for Restoration - Altered
(Map # corresponds with Table 13.)

Table 13 Priority Waters for Restoration - Altered

Map ID	Lake ID	Map ID	Lake ID
1	LILY (VERNON)	17	HARRIMAN (WHITHM)
2	VERNON HATCHERY	18	MUD (WOODFD)
3	WEATHERHEAD HOLLOW	19	SOUTH (MARLBR)
4	SHERMAN	20	SPRUCE (WILMTN)
5	SHIPPEE	21	RAPONDA
6	SWEET	22	MARLBORO-431;
7	NORTH (WHITHM)	23	HIDDEN
8	SADAWGA	24	PLEASANT VALLEY
9	HOWE	25	ADAMS (WOODFD)
10	DEER PARK	26	SEARSBURG
11	CLARA	27	HAYSTACK
12	JACKSONVILLE	28	LITTLE (WOODFD)
13	RYDER	29	LOST (GLASBY)
14	GATES	30	SOMERSET
15	LAUREL	31	GROUT
16	STAMFORD		

The strategies proposed in the Chapter 5 Implementation Table are prescribed based on the land use sector-specific practices outlined in the Vermont Surface Water Management Strategy.

B. Total Maximum Daily Loads (TMDLs)

For waters that are listed as impaired, the Federal Clean Water Act requires a plan that identifies the pollutant reductions a waterbody needs to undergo to meet Vermont's Water Quality Standards, and it must identify ways to implement those reductions. A Total Maximum Daily Load (TMDL) is the calculated maximum amount of a pollutant that a waterbody can receive and still meet VWQS. 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 pollution reductions needed.

Under certain circumstances, there are alternative restoration approaches that may be more immediately beneficial or practicable in achieving VWQS than pursuing the TMDL approach in the near-term. An alternative restoration approach is a description of actions, with a schedule and milestones, that is more immediately beneficial or feasible to achieving VWQS. These plans are often referred to as Water Quality Remediation Plans (WQRP).

TBPs are the implementation plans guiding the execution of actions necessary to meet TMDL requirements specific to each planning basin, see Chapter 4 and the implementation table for associated strategies.

TMDLs in the Basin include:

- Vermont Statewide Total Maximum Daily Load (TMDL) for Bacteria-Impaired Waters
    - Appendix 16 - No Branch-Deerfield
      Appendix 17 - Whetstone Brook
- Dissolved Oxygen TMDL – Long Island Sound (LIS), developed by Connecticut and New York States
    - Vermont Enhanced Implementation Plan for the Long Island Sound TMDL
- Northeast Regional Mercury Total Maximum Daily Load for
  For:
    - Harriman Reservoir
    - Sherman Reservoir
    - East Branch Deerfield River, Below Somerset Dam
    - Grout Pond
    - Somerset Reservoir
    - Upper Deerfield River, Below Searsburg Dam
    - Searsburg Reservoir
- Acid Impaired Lakes

- 2012 TMDL Lily Pond (Vernon)
- 2004 TMDL Harriman Reservoir, Lost Pond
- 2003 TMDL Adams Reservoir, Grout Pond, Haystack Pond, Howe Pond, Little (Woodford), Somerset Reservoir, South Pond (Marlboro), Stamford Pond

Water Quality Remediation Plans:

- Mount Snow Resort Water Quality Remediation Plan
- Mount Snow Carinthia Iron Stream Remediation Plan
- Mount Snow Carinthia Iron Stream Remediation Plan – 2019 Performance Report

The Mercury TMDL is primarily focused on regional efforts to reduce atmospheric deposition and so is not described in greater detail beyond the link provided above. The bacteria TMDLs will be addressed in part by regulations and actions that will be implemented in the Basin.

Long Island Sound TMDL

The Long Island Sound watershed encompasses 16,820 square miles in five states. It is the second largest estuary on the East Coast and receives water from 16,000 miles of rivers and streams. The 410 mile long Connecticut River is its largest tributary. 42% or 3932 square miles of Vermont, drains to the Connecticut River. 382 square miles of those are in Basin 12.

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. 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 these organisms uses up the available oxygen in the lower water column and in the bottom sediments, gradually reducing the dissolved oxygen concentration to unhealthy levels.[2] (NY DEC, 2000).

Due to the Long Island Sound TMDL, nitrogen is a key pollutant of concern in the Connecticut River watershed. Total Nitrogen (TN) levels show correlation with development and impervious surface increases. Wastewater discharges, stormwater and agricultural runoff are common contributors of nitrogen.

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

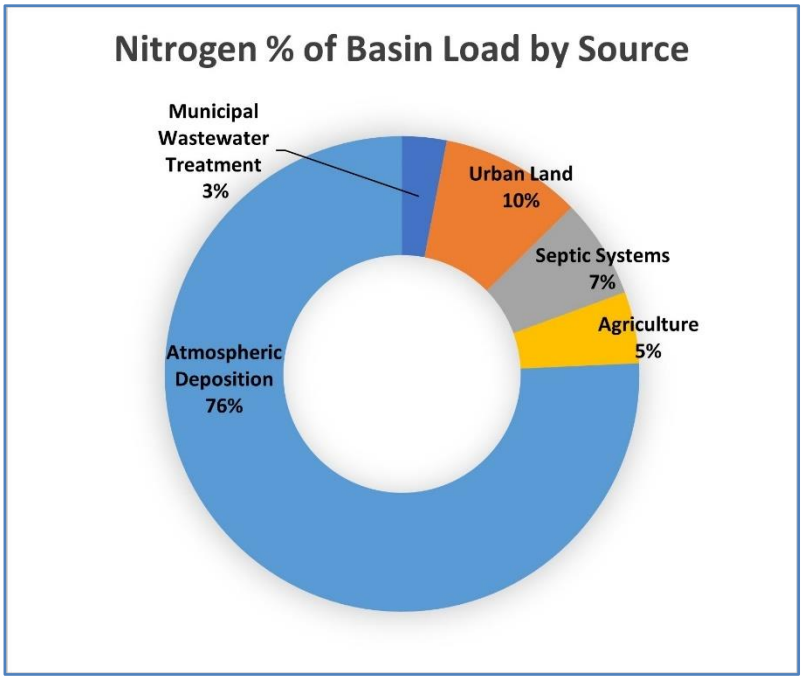


Figure 23. Estimated % Nitrogen by Source

Vermont's nitrogen export to LIS is estimated to be about 12% of the total load to the Sound based on the United States Geological Survey (USGS) SPARROW model[3] (Astor, 2019). Basin 12 is responsible for approximately 10% of Vermont's total load. This delivered loading consists of 3% from municipal wastewater treatment, 10% from developed land runoff, 7% septic system effluent, and 5% from agriculture through nitrogen fixing crops, farm fertilizer and manure.[4] Approximately 76% of nitrogen from this Basin comes from atmospheric deposition.[5] Figure 23 shows the delivered loading in percent contribution. Efforts to reduce atmospheric deposition have been occurring at the national level through the 1990 Clean Air Act and its amendments. Total atmospheric nitrogen deposition has declined since 1985.

SPARROW data estimates the amount of nitrogen discharged from smaller catch basins within Basin 12 shown in Figure 24.

[3] Spatially Referenced Models of Streamflow and Nitrogen, Phosphorus, and Suspended-Sediment Loads in Streams of the Northeastern United States
[4] Ibid.
[5] Ibid.

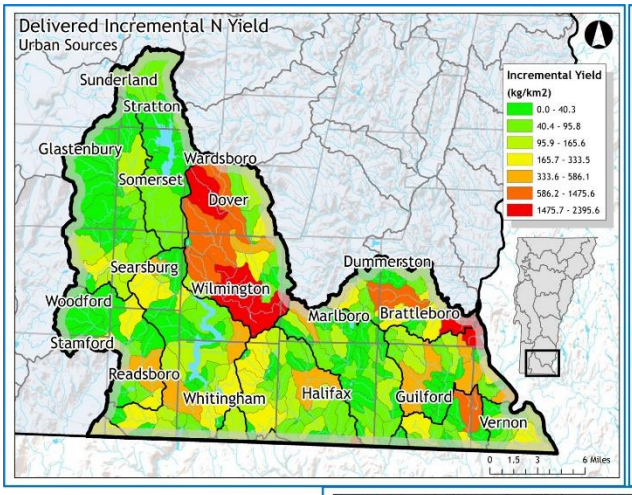


Figure 24. A

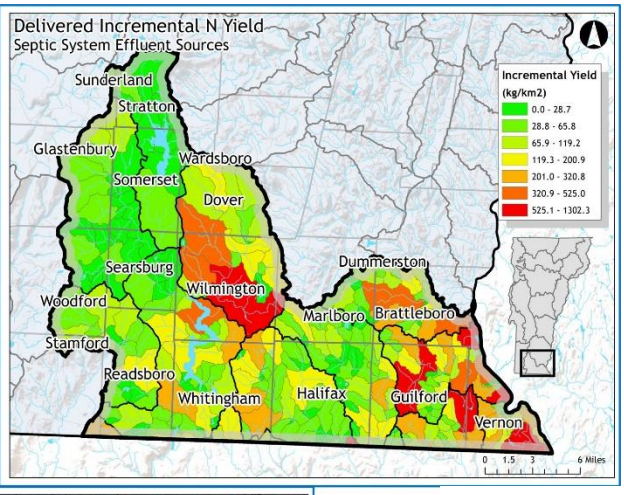


Figure 24. B

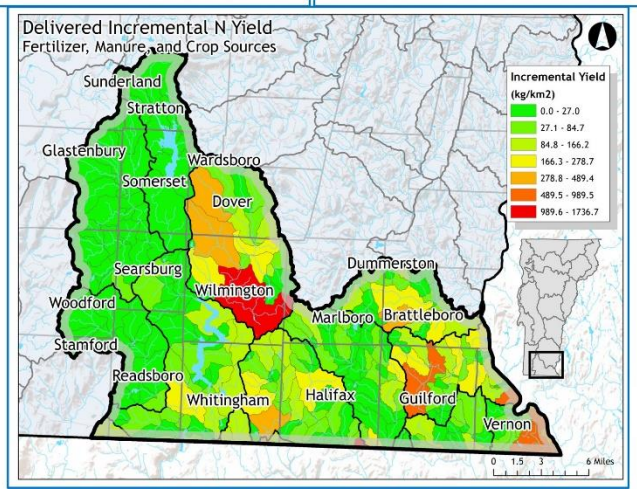


Figure 24. C

Nitrogen loading reaching Long Island Sound per square kilometer (Yield) from catchments in Basin 12 from: Urban sources (A), Septic systems (B) and agricultural (manure, fertilizer, nitrogen fixing crops) (C).

Figure 24. SPARROW Estimated Percentage of Nitrogen by Source

In 2017, USEPA embarked on its Nitrogen Reduction Strategy to investigate and better define control strategies to reduce nitrogen in the Long Island Sound. Information on the most current developments and strategies can be found in USEPA's Long Island Sound Study.

The sources of nitrogen to be addressed in Vermont include wastewater and septic discharges, agricultural lands, developed lands, and forest practices. Act 64, the Vermont Clean Water Act, helps implement overarching strategies and steps required to meet loading reductions for the Long Island Sound's TMDL. Each of the five watershed states completed a section of the LIS TMDL Enhanced Implementation Plan Report in 2013. To meet TMDL requirements, Vermont has implemented both regulatory and non-regulatory initiatives. These include the creation of the State's engagement strategy to develop, maintain, and enhance the Agency's partnerships; support for those partnerships, support for project prioritization, funding, and implementation; and advanced tracking methods for each land use sector.

The Vermont Enhanced Implementation Plan for the Long Island Sound TMDL (DEC, 2013) was added to the LIS-TMDL to address four goals:

1. To identify the Vermont sources of nitrogen as they are currently understood, across broad land use sectors, such as developed, agricultural and forested lands;

2. To identify the 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 period of 1990;

3. To 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

4. 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% non-point source nitrogen reduction and if these strategies are sufficient to maintain that control into the future (DEC, 2013).

The Vermont State section tasks TBPs with identifying actions and priority projects for the remediation of impaired and altered waters. Action items include both data collection and assessment efforts and specific implementation activities (DEC, 2013). The Implementation Table in Chapter 5 offers strategies and actions to address nitrogen reductions that are necessary to achieve compliance with the TMDL. Additionally, the Monitoring Table (Table 23) recommends continued and supplemental monitoring efforts to support the goals and fill current data gaps in nitrogen trends and source tracking.

One such effort is underway for the agricultural sector.

In 2023 the Windham County Natural Resources Conservation District received funding from the Long Island Sound Futures Fund of the National Fish and Wildlife Foundation to address nitrogen inputs to the upper Connecticut River watershed of Vermont and New Hampshire.

The project, titled *Working with Agricultural Producers and Partners to Restore and Protect Water Quality in the Upper Connecticut River Basin,* has identified and gathered a bi-state team of key stakeholders and partners working in agriculture in the upper Connecticut River Valley to select best management practices for reducing Nitrogen pollution to Long Island Sound. The team will design and plan implementation trials and monitoring and assessment studies to identify BMP practices with the greatest impact on reducing Connecticut River nitrogen inputs.

Progress toward the reduction of nitrogen to the Sound is being made particularly through efforts in the lower watershed in Connecticut and New York through investments in wastewater treatment and agriculture. These efforts have resulted in the total area of the hypoxic waters being reduced

from 208 square miles (1987-1999 baseline period average) to 102 square miles (2019-2023 5-year average), a reduction of 51% (LIS Study, 2024).[6]

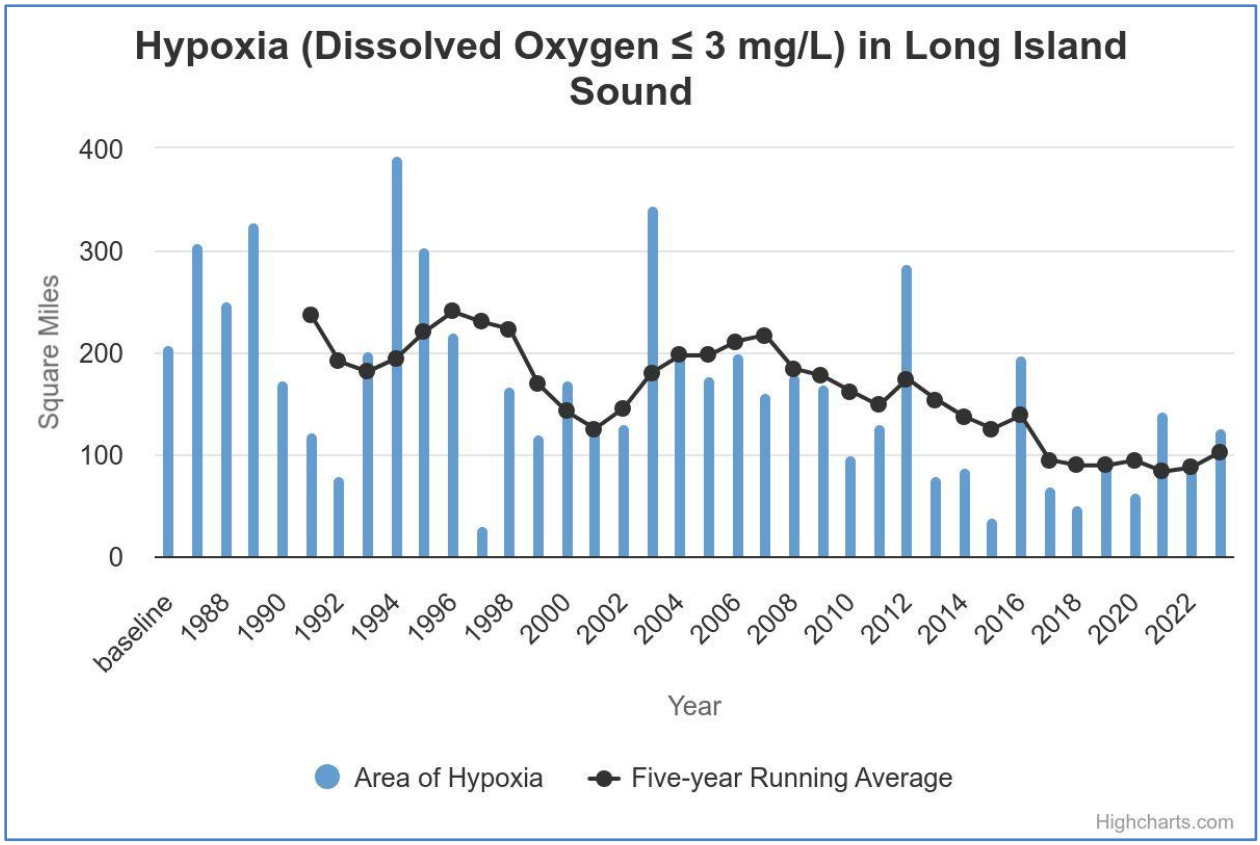


Figure 25. Decreases in the Frequency of Hypoxia in Long Island Sound 1994 - 2021

Significant reductions in the nitrogen load are still needed to meet water quality goals by the attainment date goal of 2035. This plan puts forward strategies to help better understand and reduce Vermont's contribution.

State Programs to Meet Regulatory Targets

Regulatory programs play a significant role in ensuring that pollutants and stressors responsible for degraded water quality are addressed. To this end DEC issues a wide array of permits meant to protect all Vermont's natural resources from degradation. These regulatory programs can be found through the Environmental Assistance Office which provides assistances to Vermonter's in need of permits.

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[6] Extent of Hypoxia, Long Island Sound Study, https://longislandsoundstudy.net/ecosystem-target-indicators/lis-hypoxia/

Engagement Strategy

The Watershed Planning Program engages partners using strategies that strengthen the partners' sense of ownership and therefore participation in the planning process and implementation. The desired outcomes of the state's engagement strategy work toward:

- Multi-partner collaboration across sectors and localities to assist with developing, writing, and implementing TBPs;
- Strategic inclusion and engagement with different sectors and localities throughout the ~~TMDL~~ planning process to ensure that all concerns, needs, and goals are addressed; and
- Strategic communication efforts to ensure understanding of and support for the plan among key stakeholders as well as throughout the watershed;
- Financial support and technical assistance to partners and develop programs to expand capacity in our stakeholder networks.

These efforts will continue to promote widespread and improved understanding of the requirements for TMDL implementation efforts, support diverse and sustained collaboration, and help in building new partnerships. As a result, the TBP implementation efforts will continue to enhance shared ownership and a well-informed partnership working on the ground. This will enhance reasonable assurance that Vermont will achieve improvements in local water quality goals for the Connecticut River.

Chapter 4 – Strategies to Address Pollution by Sector

ANR's approach to remediation of degraded surface waters and protection of high quality waters includes the use of both regulatory and non-regulatory tools with associated technical and financial assistance to incentivize implementation. Tactical basin plans address water quality by land use sector (Figure 26). Ongoing protection and restoration efforts and recommendations to meet water quality objectives are developed for each sector. These recommendations support the development of the strategies in the Chapter 5 Implementation Table.

Figure 26. Land Use Sector Framework
with practices used to enhance, maintain, protect, and restore water quality

A. Agriculture

Agricultural land use makes up approximately 3.7% of the land cover in the Basin (Figure 27). The majority of this is in hay and pasture with only a small percentage in cultivated crops. The highest concentrations of agricultural land are found along the floodplains of the Connecticut River and the lower Green River. Animal operations include milk, beef, sheep and goats.

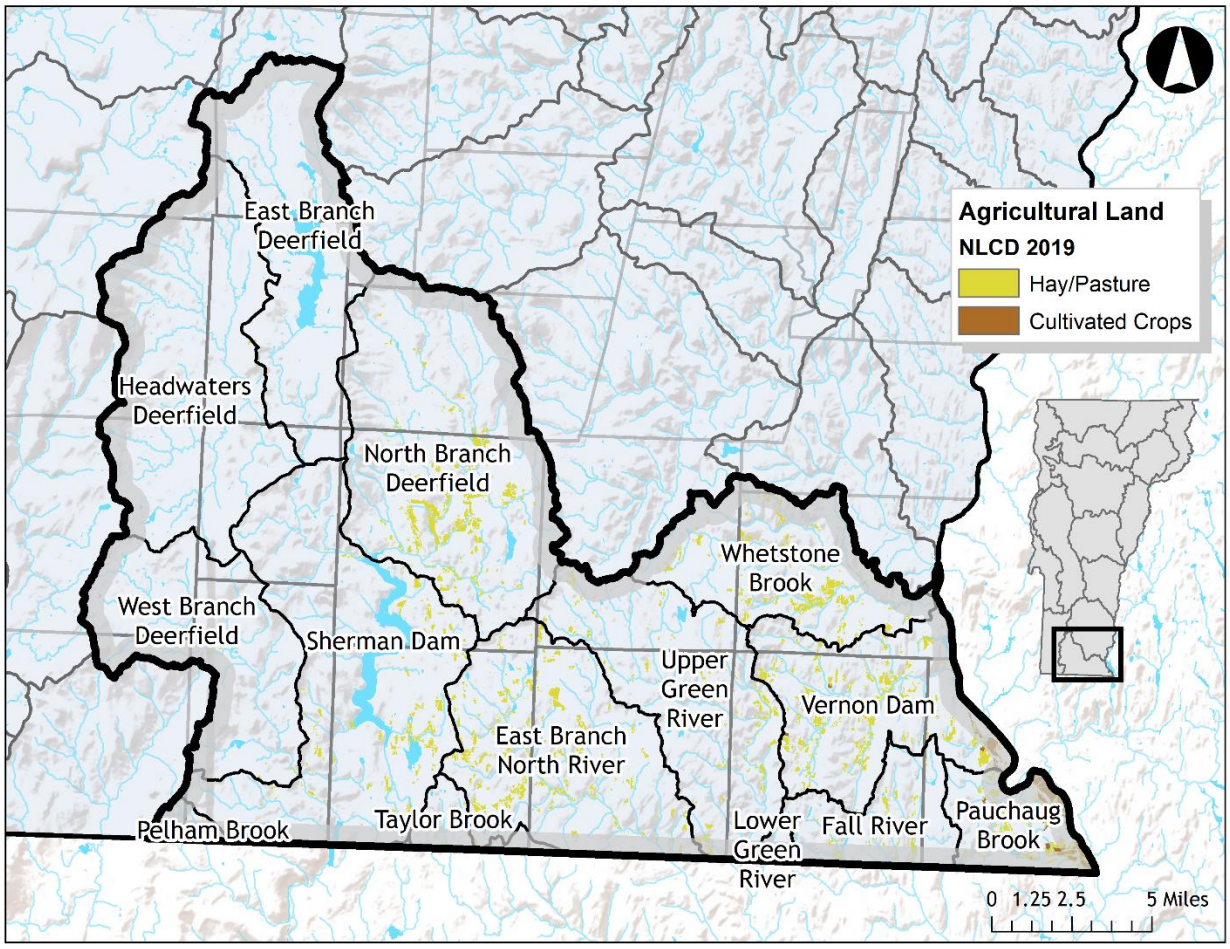

Figure 27. Agricultural Lands

Agricultural runoff constitutes 5% of the Basin's estimated TMDL baseline total nitrogen (TN) loading (kg/yr) to Long Island Sound. Agricultural runoff may also be a contributing factor to E. coli stream impairments in the Whetstone Brook and North Branch Deerfield River.

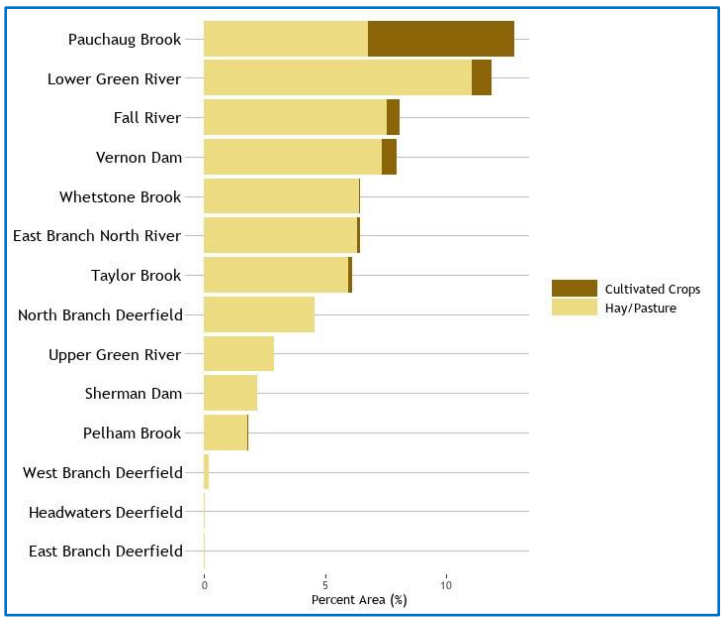

Figure 28. % Agricultural Lands in Hay/Pasture & Crops
(Source: NLCD 2019)

Without proper management of fields and farmsteads, agricultural land use can be a source of nutrients, sediment, pathogens, and toxins to surface waters. Improving the soil health of fields as well as managing application of nutrients through use of Agricultural Best Management Practices (BMPs) help address water quality concerns and protect surface waters. Examples of field BMPs that improve soil health are reduced tillage and the use of cover crops to increase organic matter, reduce compaction, promote biological activity, and reduce erosion. On farmsteads, BMPs such as improved waste storage facilities, clean water diversions, and improved barnyard production areas can help reduce nutrient laden runoff to nearby surface waters.

The Agency and AAFM address agricultural water resource impairments by collaborating with federal, local, and regional partners to target agricultural BMP implementation in the watershed to achieve greatest pollutant load reduction for dollars spent.

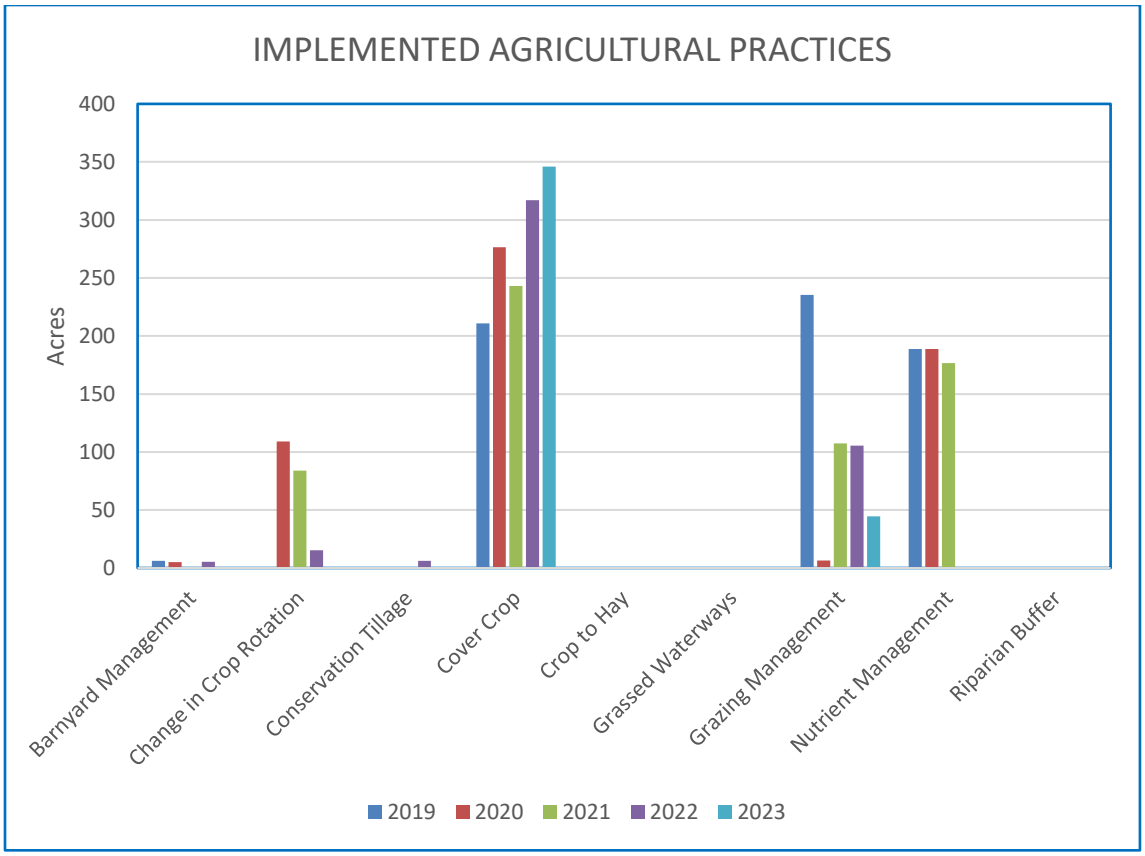

Figure 29. Acreage of BMPs Installed by Year

Cover cropping is the most popular BMP implemented in the Basin, followed by nutrient and grazing management practices (Figure 29).

Between 2019 and 2023, Vermont Clean Water Funding has provided $1,928,965 in funding for implementation of Best Management Practices on Basin farms.

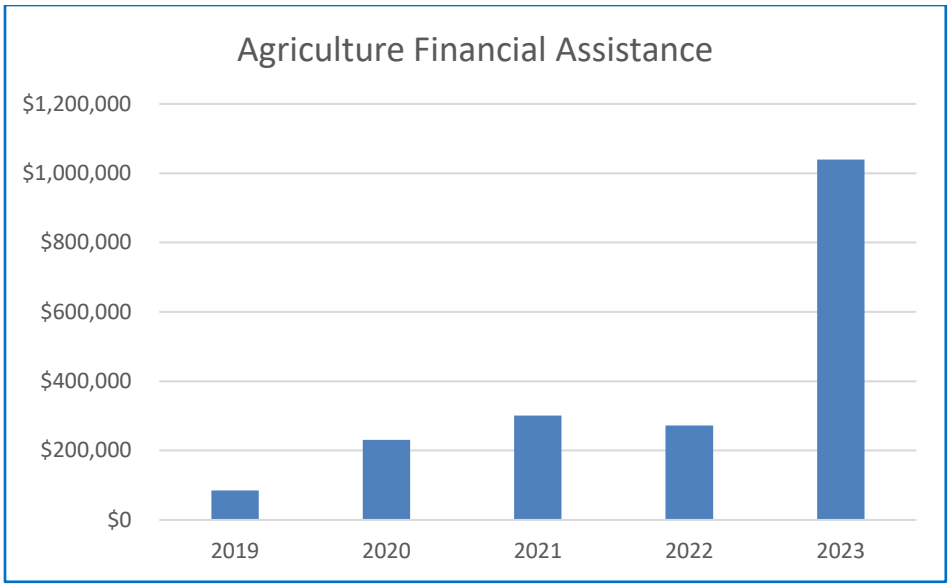

Figure 30. Clean Water Funding for Agriculutral BMPs

There is one agricultural impaired water in the Basin. Newton brook in Vernon is listed as impaired for sedimentation/siltation, and nutrients due to agricultural activity. Watersheds of agricultural-impaired streams are priority areas for the purpose of expediting their recovery and subsequent removal from the 303(d) List of Impaired Waters. Newton Brook is a focus area for restoration in the plan. While not impaired, agricultural impacts are also noted on Ellis Brook in Wilmington.

Regulatory programs

Vermont Agency of Agriculture, Food, and Markets (AAFM) regulatory programs play a significant role in protecting surface waters by setting required farm management practices to ensure environmental stewardship. In addition to the Required Agricultural Practices (RAPs), Vermont farms are regulated by additional sets of rules promulgated by the AAFM based on farm animal numbers (see Table 14). The permit program requirements also aim to reduce the amount of nutrients entering state waterways. Although the Large Farm Operation and Medium Farm Operations (LFO and MFO) Programs have been operating under permit programs for more than 10 years, the Certified Small Farm Operations (CSFO) program began in 2017. The CSFO certification expands farm operation oversight and regular inspections to farms that meet the CSFO threshold. The RAPs also expand requirements for Small Farm Operations (SFOs), which do not need to certify. Increased regulatory oversight and required agricultural practices are expected to lead to enhanced field and farmstead management throughout the Basin. As of 2023, the AAFM has identified 27 agricultural operations ranging in size from SFOs to MFOs in the Basin that need to comply with the RAPs.

Table 14. Number of Farms by Size as of 2024 (Source: AAFM)

Farm size	Animal Units	Inspection Schedule	# Facilities / Operations
Large Farm Operation (LFO)	700 or greater mature dairy cows or equivalent	Annually	0/0
Medium Farm Operation (MFO)	200-699 mature dairy cows or equivalent	Every 3 years	3/2
Certified Small Farm Operation (CSFO)	50 -199 mature dairy cows or equivalent; or growing more than 50 acres of annual cropland; or growing more than 50 acres of vegetable	Every 7 years	4/4
Small Farm Operation (SFO)	Operate 4 or more acres for farming; or annual gross income more than $2,000; or have filed a 1040(F)tax form once in the last 2 years	N/A	21/21

In SFY 2023 approximately 80% of farm facility production areas inspected were compliant with the RAPs. Information regarding farm inspections, compliance, and enforcement actions can be reviewed on AAFM's Water Quality Interactive Data Report.

Technical and Financial Assistance

Technical assistance throughout the Basin is provided by the Windham and Bennington County Natural Resources Conservation Districts, UVM Extension, the Natural Resources Conservation Service (NRCS), and the Connecticut River Watershed Farmers Alliance (CRWFA), all of whom promote the voluntary adoption of conservation practices. AAFM, provides technical and financial assistance and helps facilitate compliance with water quality regulations. AAFM and NRCS financial assistance programs provide most of the direct funding support to farmers as well as to the agricultural partner organizations. Outreach, education, technical assistance, and financial assistance is available for farmers to implement both field Best Management Practices (BMPs), such as cover cropping, crop rotation, and reduced tillage practices, and farmstead BMPs, such as waste storage facilities or clean water diversion practices. These agricultural assistance and outreach programs are essential tools in promoting field and farmstead BMPs that protect water quality, improve soil health, and increase farm viability. Additional support for habitat enhancement projects ae available through partnerships with the Connecticut River Conservancy.

AAFM and partners provide educational opportunities and technical assistance to farmers to promote and assist with conservation practice adoption, yet a gap in farmer knowledge of these practices has been identified. The Farm Team model, facilitated by the Natural Resources Conservation Districts, in which agricultural service providers and partners from multiple

organizations coordinate their assistance to individual farms, is one potential solution being explored to create efficient and effective outreach and technical assistance.

The Basin agricultural working group, hosted by the Windham County NRCD, identified additional needs and recommend the TBP address the need to:

- Re-evaluate the success and ways NMPs are implemented on small farm operations
- Expand RAP outreach, and create a framework to connect local providers with VAAFM Water Quality Specialists (farm inspectors) and to available state and federal funding
- Provide technical assistance to aid producers in access to and interpretation of nutrient recommendations through UVM extension to meet 590 nutrient requirements
- Create helpful guidelines and outreach materials to promote NMP and implementation
- Improve outreach on farm diversification and business planning
- Expand livestock grazing and and pasture education and outreach, as well as the availability of cost share programs supporting exclusion fencing and pasture improvements related to water quality and soil health
- Increase training and outreach for service providers and producers on new climate-smart agriculture (e.g: Silvopasture, soil health, nitrogen management)
- Create a program to incentivize projects that increase flood storage and compensate farmers for allowing their fields to flood thus protecting downstream communities
- Improve conditions on agricultural lands through:
    - Replacement of undersized stream crossings, culverts & bridges to address groundwater concerns, wildlife crossings, flooding, sedimentation

Traditional funding for agricultural practices on non-RAP farms in the watershed has also been identified as a gap in that these farms are very small in scale but may be significant contributors of nitrogen to the watershed. Identification of these smaller farms that may need BMPs to address water quality issues is needed along with capacity to complete outreach and the development of practices that feasibly address water quality issues.

B. Developed Lands

Stormwater runoff from developed land contributes pathogens, sediment, nutrients, and toxins to waterways, as well as driving stream channel erosion if stormwater is not managed to reduce volume and pollutant loads. Concentrated stormwater discharges may also lead to sedimentation by initiating or exacerbate slope instability resulting in gullies and landslides.

Most stormwater management is achieved through State and federal regulations. Areas developed prior to stormwater rules and permitting often lack effective stormwater management practices. These areas are a focus in the plan.

While developed lands comprise only 6% of the basin, densely developed areas or large contiguous areas of impervious surfaces have potential to be source of surface water impairment. Concentrated development is focused at the two ski resort areas around Mt Snow and Hermitage in Dover, and in town centers including Brattleboro and Wilmington.

Stormwater

The tactical basin planning approach engages local, regional, and federal partners in the development of strategies needed to accelerate adoption and monitoring of stormwater-related Best Management Practices (BMPs) to meet the state's clean water goals and TMDL targets. Basin stakeholders have been actively participating in voluntary actions and implementing priority projects and municipalities are working on meeting regulatory requirements and are working to remediate identified discharges.

Regulatory requirements 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 permits for developed lands include:

- Operational Stormwater Permits
- Construction Stormwater Discharge Permits
- Municipal Separate Storm Sewer System (Ms4) General Permits
- Multi-Sector General Permit (Industrial)

Stormwater General Permit 3-9050 (Three-Acre General Permit)

General Permit 3-9050 addresses runoff from impervious surfaces. This permit covers all operational stormwater permitting, including new development, redevelopment, and permit renewal. Projects that expand or redevelop one half-acre (0.5 acres) or more of impervious surface are required to apply for stormwater operational permit coverage. Additional information on the ½ acre threshold can be found on the stormwater program website. This permit serves as the statutorily required "Three-Acre General Permit" under the Vermont Clean Water Act which takes effect in Basin 12 in 2033.

Stormwater Mapping and Master Planning

Stormwater infrastructure mapping projects are completed for municipalities by the Clean Water Initiative Program to supplement any existing drainage data collected by towns. The intent of this work is to provide a tool for planning, maintenance, and inspection of the stormwater infrastructure. Towns with completed mapping and reports are shown in Table. 14.

Strategies to address stormwater in Tactical Basin Plan often result from Stormwater Master Plans (SWMP). SWMPs are developed with municipal and public involvement to create a comprehensive listing of identifiable problems. Plans result in a prioritized list of projects offering a strategic approach to address stormwater runoff. Additionally, TBPs use recommendations from the Vermont Nonpoint Source (NPS) Management Program Plan which summarizes the causes and sources of NPS pollution and identifies strategies to protect and restore waters impacted by NPS pollution.

Table 15. Towns with Completed Assessments

(Click town to link to report.)

Town	Mapping & Report(s)	SWMP
Brattleboro	X	X
Dover	X	
Dummerston	X	
Guilford	X	
Marlboro	X	
Readsboro	X	
Stamford	X	
Stratton	X	X
Sunderland	X	X
Vernon	X	
Wardsboro	X	
Whitingham	X	
Wilmington	X	X
Woodford	X	

Illicit Discharge Detection & Elimination Studies

Illicit discharges are discharges of wastewater or industrial process water into a stormwater-only drainage system. All towns with mapped stormwater infrastructure have completed IDDE studies except for Stratton. These can be found with the stormwater reports in Table 15.

Outreach Efforts

Collaborative outreach efforts in the basin have facilitated adoption of green stormwater infrastructure, as well as environmental stewardship practices around landscaping. Partners and the Agency often include social marketing practices to engage the community. Examples of collaborations are listed below:

- The Vermont Green Infrastructure Toolkit helps municipalities in the adoption of Green Infrastructure policies and practices. (The ten Regional Planning Commissions of the Vermont Association for Planning and Development Agencies, DEC-WID.
- "Raise the Blade" and "Don't P" on your Lawn campaigns (DEC and partners)
- The Franklin County Stormwater Collaborative.
- The Green Infrastructure Round Table supports the use of Green Stormwater Infrastructure through (Partners facilitated by Lake Champlain Sea Grant and DEC)
- Resource for landslide or gully stabilization, Lake shore stabilization handbook led by NRPC (DEC and LC Sea Grant assistance,); and The Landslide Handbook by USGS, and Regenerative Stormwater Conveyance designs

Roads

It is estimated that more than 75% of Vermont roads were constructed prior to any requirements for managing stormwater runoff (ANR, 2012). Where road networks intersect stream networks, roads and their ditches effectively serve as an extension of the stream system. Roads can increase stormwater runoff, and, in this basin, unpaved roads are an important source of sediment to receiving waterbodies.

Stormwater runoff from roads is a source of sediment and nutrients to streams, lakes, and wetlands as well as a driver of stream channel erosion if roads are not designed or maintained to shed stormwater. Road infrastructure can impinge on stream floodplains and be a barrier to aquatic organism passage (AOP) when bridges and culverts are not adequately sized. In addition, improper

winter management practices contribute excessive Chlorides in the form of winter deicing salts that degrade aquatic habitat.

Roads are included with developed land in basin comprising 6% of the basin's land cover. The transportation network includes state and municipal roads, private roads and driveways. Private roads can comprise a significant percentage of the road network in some towns. The roads most likely to contribute sediment and nutrients are hydrologically connected[7] to surface waters.

The Agency primarily addresses public road-related discharges through regulation. Working with partners, the Agency also provides guidance and financial assistance to facilitate compliance. Partners have helped the community reduce use of winter road salt as well as improve stormwater management on private roads and reduce natural resource conflicts with culvert crossing. State resources are directed towards hydrologically connected roads, and priority road segments identified in road erosion inventories.

Municipal Roads General Permit

The Municipal Road General Permit (MRGP) is a stormwater permit for Vermont cities and towns and is intended to achieve significant reductions in stormwater-related erosion from paved and unpaved roads. All towns in the basin, except for Glastenbury and Somerset, have met the permit requirement to conduct a Road Erosion Inventory (REI) of hydrologically connected roads to determine if they meet MRGP standards.

Road Erosion Inventories (REI) are used by Vermont municipalities to:

- identify sections of local roads in need of sediment and erosion control,
- determine individual road segment compliance with MRGP required practices,
- prioritize road segments that pose the highest risks to surface waters, and
- estimate costs to remediate those sites using Best Management Practices.

As of 2023, road segments are surveyed and scored according to either open drainage REI or closed drainage REI supplemental documents. The latest REI survey and scoring documents (2023) are available for roads with either open or closed drainages. REI's are required by the Municipal Roads General Permit. The MRGP is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The permit is required by the Vermont Clean Water Act (Act 64).

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[7] **Hydrologically-connected road segments**: a road segment, equal to 100 meters in length, where the Secretary has determined that road and drainage characteristics indicate a likelihood of discharges to surface waters or wetlands. This definition includes those road segments identified as hydrologically connected on the ANR Atlas. The Secretary has developed a hydrologically-connected road segment layer using GIS analysis of roadway distance to waters.

The implementation of the priorities identified in REI's will reduce sediment, nutrients, and other pollutants associated with stormwater-related erosion generated from unpaved municipal roads and outfalls. A secondary benefit of upgrading roads to MRGP standards is improving the flood resilience of the municipal transportation system from the increased frequency of localized high intensity rain events associated with climate change. The inventories are conducted for hydrologically-connected roads. These road segments can be viewed using the Stormwater - Road Segment Priority layer on the ANR Natural Resource Atlas and REI results by town can be viewed in the MRGP Implementation Table.

Towns must update their REI each five-year MRGP cycle and use the results to prioritize road upgrades with goal of all municipal roads meeting the MRGP standard by 12/31/2036. The current MRGP cycle is 1/2023-1/2028. Towns were required to bring 15% of non-compliant segments up to the MRGP standards by 12/2023.

DEC reissued the MRGP in January 2023. The new permit continues the implementation requirements of the previously issued permit, requiring towns to upgrade at least 7.5% of their non-compliant segments to meet MRGP standards annually. The re-issued permit requires a second, town-wide reassessment of all hydrologically connected segments by the Fall of 2027. After the updated REI is completed, 20% of total *Very High Priority* segments will be required to be upgraded to meet MRGP standards each year, as part of the 7.5% annual requirement mentioned above. One change in the reissued MRGP is that the Active Channel Width is now required for new intermittent stream crossings, as well as replacements to existing non-compliant intermittent structures.

As a result, the Agency expects an acceleration in the rate of road segments improved annually. For progress, see MRGP Implementation Table Portal. Towns with the highest percentage of road segments needing to be addressed under permits are a focus for assistance (See Figure 31).

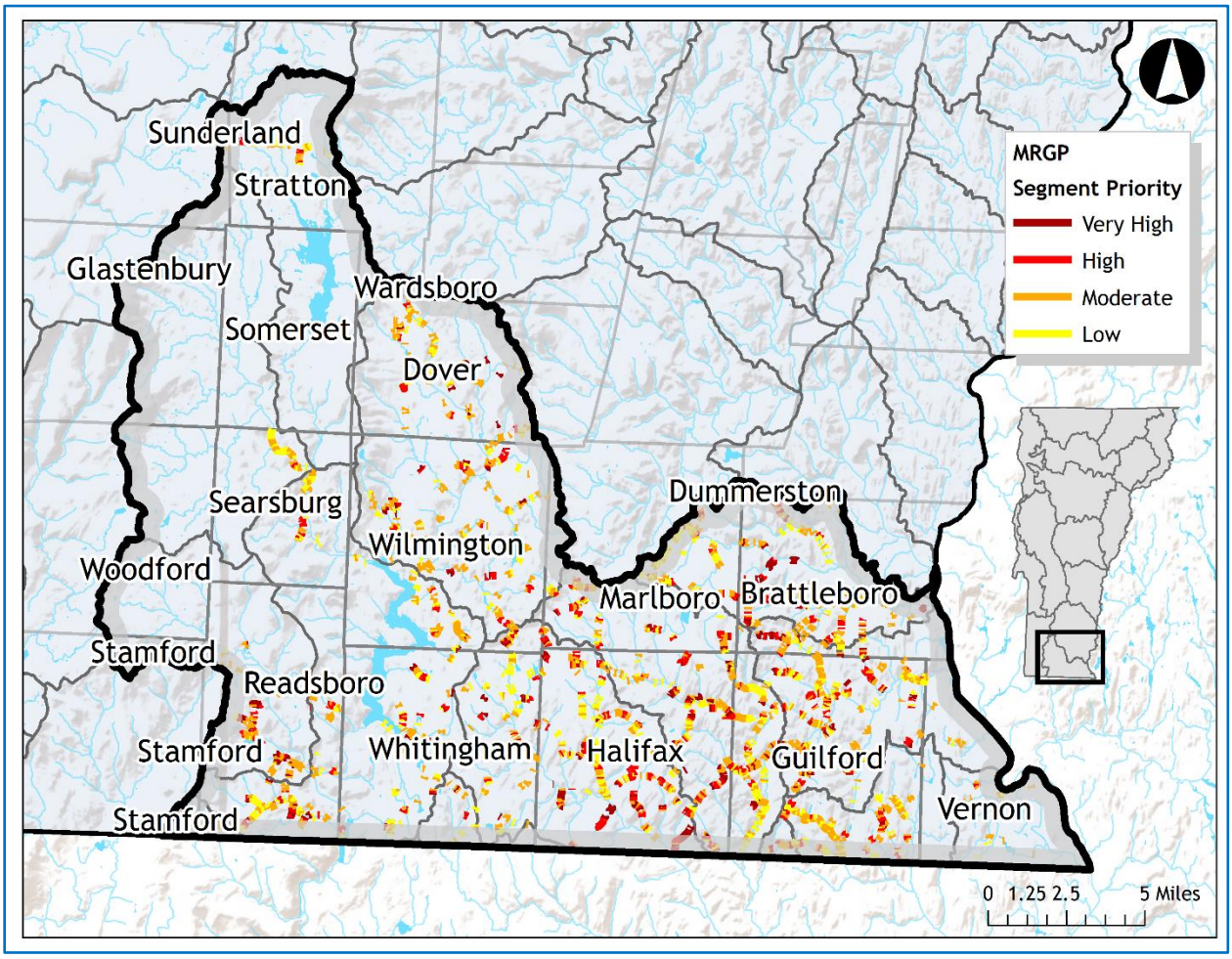


Figure 31. REI Project Priorities

VTrans Municipal Grants in Aid & Vermont Local Roads

The VTrans Municipal Grants In Aid Program provides technical support and grant funding to municipalities to promote the use of erosion control and maintenance techniques that save money, while ensuring best management practices are completed in accordance with the MRGP. The Vermont Local Roads team provides training, technical assistance, communication tools and opportunities for information exchange to assists municipalities in improving their road networks. These programs help implement the strategies described here and listed in Chapter 5.

Clean Water funding is also available through the VTrans Better Roads grants to assist with development of designs, capital budgets, cost estimates and implementation of road projects.

Partners have assisted municipalities in applying for these grants helping the municipalities take advantage of financial assistance to address non-compliant roads. All the towns in the basin, except Glastonbury and Somerset, have taken advantage of the Grants-in-Aid Program to address hydrologically connected roads.

Transportation Separate Storm Sewer System General Permit – TS4

The Transportation Separate Storm Sewer System General Permit (TS4) covers stormwater discharges from all Vermont Agency of Transportation (VTrans) owned or controlled impervious surfaces. The TS4 general permit combines the stormwater requirements for VTrans associated with its designated regulated small MS4s; industrial activities, commonly regulated under the Multi-Sector General Permit; and previously permitted, new, redeveloped, and expanded impervious surface, commonly regulated under State Operational Stormwater permits.

In 2021 VTrans developed a Route 9 Corridor Management Plan to identify transportation needs and issues along a the roadway between Brattleboro and Bennington and incorporate the needs and issues into upcoming VTrans projects and maintenance work. VTrans Corridor Plans focus on what can be accomplished within five years or less, although some next steps may take longer to get started. From Brattleboro to Woodford 10 projects were identified in the plan that address water quality or flood resiliency improvements. Implementation of these projects are planned for 2025-2026.

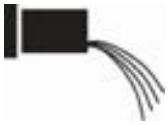
Vermont Transportation Resilience Planning

VTrans has also developed the Vermont Transportation Resilience Planning Tool as a web-based application that assesses the risk to bridges, culverts, and road segments based on their vulnerability to damage from floods and the criticality of their location in the roadway network, and then identifies potential mitigation measures based on the factors driving the vulnerability. The use of this tool to prioritize projects is part of VTrans Resilience Improvement Plan.

Vermont Road and Bridge Standards

In addition to the MRGP, towns can voluntarily adopt the most current version of the Vermont Road and Bridge Standards. These standards are administered by VTrans and go above and beyond MRGP standards. For example, municipalities may adopt MRGP standards for non-hydrologically connected roads. Towns adopting the Vermont Road and Bridge Standards may be entitled to higher cost share rates in federally declared flood event reimbursements. DEC will coordinate with VTrans District Offices to gather up to date information on adopted Road and Bridge Standards, coordinate outreach to municipalities, and update the Vermont Flood Ready website.

Managing road runoff in the upper watershed catchments will lessen the pressure on the downstream areas receiving larger contributions of runoff. Waters being impacted or impaired lower in the watershed does not negate the need for action high up in the watershed. Lack of good management in the upper parts of the sub-basins can often be the cause of water quality issues further downstream due to cumulative impacts. For this reason, road BMPs for water quality are recommended basin wide and on steep slopes.



C. Wastewater

Wastewater discharges to surface waters or ground waters represent a regulated and readily measurable and controlled source of pollutants, including pathogens and nutrients. Vermont addresses these discharges primarily through implementation of the National Pollutant Discharge Elimination System (NPDES), and the Indirect Discharge and other state permit programs. DEC provides financial assistance and technical assistance to municipalities and other permittees to upgrade wastewater treatment infrastructure and along with partners supports the community's development of community onsite systems and maintenance of residential onsite systems.

Direct Discharges from Wastewater Treatment Facilities

Most municipal wastewater, originating from a combination of domestic, commercial, and industrial activities, is collected and conveyed with a wastewater collection system (WWCS) to a wastewater treatment plant (WWTP), and treated to established standards identified in permits before being directly discharged into a receiving water. Collectively the WWCS and the WWTP are the wastewater treatment facility (WWTF). The six municipal wastewater treatment facilities and two industrial facilities in the Basin process more than 5 billion gallons of wastewater per year. (Table 16).

Table 16. Wastewater Treatment Facilities

Facility (permit ID)	Permit effective date	Planned permit re-issuance year	Permitted flow (MGD)	IWC* 7Q10 /LMM	Current Percent of Design Flow (2023)	Treat ment type	# of CSOs	Receiving water
Brattleboro (3-1242)	2016	2025	3	.0052 / .0015	51%	RBC	0	CT River
Cold Brook FD 1 (3-1296)	2017	2025	.028 (direct discharge flow)	0.0186 / 0.0036	Have not reached capacity that necessitates a	Aerated lagoons and	0	Indirect - Rose and Haystack

					direct discharge. In 2018, the facility processed 4.7 MGD at the Haystack treatment system and 7.1 MGD at the Golf Course system.	indirect spray disposal fields		Brooks Direct – North Branch of the Deerfield
Facility (permit ID)	**Permit effective date**	**Planned permit re-issuance year**	**Permitted flow (MGD)**	**IWC* 7Q10 /LMM**	**Current Percent of Design Flow (2023)**	**Treatment type**	**# of CSOs**	**Receiving water**
NorthStar Nuclear Decommissioning Company LLC (formerly Entergy Nuclear VT Yankee) (3-1199)	2022	2028	4.3	0.4346 / 0.2202	Did not discharge in 2023	*None*	0	CT River
Long Falls Paperboard, LLC (formerly FiberMark) (3-1136)	2012	2025	2	0.0037 / 0.0013	15%	Primary clarification/ aerated stabilization	0	CT River
Readsboro (3-1215)	2023	2029	0.075	0.004 / 0.002	43%	Aerated lagoons	0	Deerfield River
Whitingham (3-1229)	2013	2024	0.012	NA[1]	72%	RBC	0	Harriman Reservoir
Whitingham-Jacksonville (3-1230)	2023	2029	0.05	0.12 / 0.032	50%	RBC	0	East Branch North River
Wilmington (3-1281)	2018	2026	0.135	0.0897 / 0.0183	67%	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.

An overarching consideration for the issuance of wastewater discharge permits in the 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.

Before issuing the permit, the DEC WSMD also conducts a reasonable potential analysis to ensure all water quality criteria in receiving streams are met. The Wastewater Management Program is working with the Monitoring and Assessment Program to increase the frequency of instream sample collection upstream of WWTFs prior to permit renewal. The upstream data is used during the reasonable potential analysis, described below, to calculate the resulting downstream concentration once mixed with the WWTF effluent under critical conditions to determine if there is reasonable potential to violate VWQS. The increased instream sampling as well as increased effluent sampling requirements being incorporated into WWTF permits contribute to more statistically accurate, data-based determinations for WWTF permit effluent limits.

Permit limitations must control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic pollutants) which may be discharged at a level that will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality. At each renewal, permit writers use this "reasonable potential analysis" to determine whether a discharge, alone or in combination with other sources of pollutants to a waterbody and under a set of conditions arrived at by making a series of reasonable assumptions, could lead to an excursion above an applicable water quality standard. If the expected receiving water concentration determined exceeds the applicable VWQS at critical conditions, limits are included in the permit. A permit writer conducts a reasonable potential analysis using effluent and receiving water data, and the findings are included in the permit issuance documentation, which can be viewed on the Wastewater Program's discharge permit database.

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 consists of 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.

The 2PAD Digestion System has allows the facility to accept additional septage, high-strength industrial wastewater, and dairy processing wastewater from nearby homes and businesses. In response to the Long Island Sound TMDL, the MBBR provides tertiary treatment for Total Nitrogen removal via nitrification and denitrification. In 2023, the Facility discharged 59% of their Long Island Sound TMDL Total Nitrogen baseline annual average.

Cold Brook Fire District 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. The facility has not needed to discharge under the direct discharge permit.

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. The extraction and observation wells that were intercepting groundwater before entering the turbine building were abandoned in April 2023 prior to demolishing the building. Until the remaining turbine building basement is backfilled, stormwater and groundwater is pumped from the basement and collected in frac tanks for sampling prior to discharge.

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 facility reduced production starting late 2022 and recently stopped making paper so the discharge has greatly decreased.

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 2023, the Facility discharged 56% of their Long Island Sound TMDL Total Nitrogen baseline annual average.

Whitingham

The Whitingham WWTF is a secondary wastewater treatment facility that discharges to the Deerfield River. The Facility's sister-plant is Whitingham-Jacksonville. The treatment system consists of three settling tanks in series followed by two aerated flow equalization tanks, an RBC unit, a secondary clarifier and two ultraviolet light disinfection units. The RBC unit is currently being upgraded, with construction expected to be completed in 2024. In 2023, the Facility discharged 76% of their Long Island Sound TMDL Total Nitrogen baseline annual average.

Whitingham-Jacksonville

The Jacksonville WWTF is Whitingham's sister plant and discharges into the East Branch of the North River. It 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. The RBC unit was upgraded in 2023. In 2023, the Facility discharged 37% of their Long Island Sound TMDL Total Nitrogen baseline annual average.

Wilmington

The Wilmington WWTF utilizes a rotating belt filter, two parallel RBCs, and aerated lagoons to provide secondary treatment to wastewater prior to discharge into the North Branch Deerfield River. The rotating belt filter is an innovative treatment technology that provides screening and primary treatment to influent wastewater. In 2023, the Facility discharged 95% of their Long Island Sound TMDL Total Nitrogen baseline annual average.

Technical and Financial Assistance

The DEC and partners assist municipalities in discharge permit compliance by providing access to funding and technical assistance. Vermont provides loans and grants to supports municipal WWTF and associated infrastructure upgrades through the Clean Water State Revolving Fund, Vermont Pollution Control State Revolving Fund, and the Vermont Engineering Planning Advance Program; and grants via the Vermont Pollution Control Grants and the Clean Water Fund (created via Act 64: the Vermont Clean Water Act). The US Department of Agriculture also provides loans via USDA Rural Development Water and Environmental Loans and Grants.

The DEC Wastewater Management Program works cooperatively with local organizations, such as Vermont Rural Water Association and Vermont Energy Investment Corporation, to facilitate technical assistance related to optimization of nutrient removal and energy efficiency at WWTF.

The DEC and partners are also available to assist municipalities with asset management planning, which includes needed upgrades and timeline as well as funding sources and deadlines. Without a plan, facilities tend to delay upgrades and therefore Clean Water State Revolving Fund funding requests until required by permits. As permit reauthorization occurs at the same time for all facilities within the same basin, they may end up competing for a set amount of annual funding. This planning is especially important in the Winooski basin, which has the highest number of WWTF. With an asset management plan in place, municipalities could plan over a longer time period as well as multiple Clean Water State Revolving Fund cycles.

PFAS Monitoring

As part of a statewide investigation of potential conveyors of PFAS, DEC will support a sampling program for wastewater treatment facilities. Other sources included in the investigation are industry, land application sites, and landfills. As part of implementing the DEC 2023 PFAS Road Map, $1.25 million dollars of American Rescue Plan Act funding has been dedicated for a two-phased project to (1) quantify PFAS in municipal wastewater discharges across the State and (2) focus resources on identifying and reducing or eliminating PFAS sources in select communities. DEC will partner with a contractor to conduct quarterly influent and effluent sample collection at each of Vermont's 94 municipal WWTFs and analysis for PFAS utilizing current analytical methods. This first phase of the project is expected to take place over one year. Upon completion of phase 1, the information obtained will be used to select municipalities for additional PFAS investigation. The second phase will involve collaboration with DEC and municipal officials to plan and conduct targeted collection system sampling for PFAS analysis to identify sources and mass loading to municipal WWTFs.

Soil Based Wastewater Disposal Systems (Septic Systems)

In Vermont's mostly rural landscape, the majority of wastewater is treated through soil-based wastewater disposal systems. If not installed appropriately, wastewater may reach groundwater that enters surface waters or be discharged to surface waters.

The State of Vermont has regulatory jurisdiction over the design, permitting, and installation of all new wastewater systems and potable water supplies including septic systems. All new wastewater systems and potable water supplies under 6,499 gallons per day must obtain a Wastewater System and Potable Water Supply Permit.

Larger systems of 6,500 gallons per day and over are permitted through Vermont's Indirect Discharge Program, a NPDES permit. Indirect discharge systems are soil-based disposal systems, which also include primary treatment, and may include secondary or tertiary treatment levels depending on discharge requirements. Water quality related indirect discharges are monitored. Systems can be municipality or privately owned.

Financial and Technical Assistance

For residential systems under 6,440 gallons, state financial assistance is available to qualifying homeowners for system upgrades and until 2024 includes American Rescue Plan Act funding. Technical assistance and education are provided by Town Health Officers, including investigating citizen concerns about failed septic systems.

The WSMD Lakes and Ponds Management and Protection Program and the Drinking Water and Groundwater Protection Division support outreach to homeowners during neighborhood

gatherings organized by partners. At these wastewater workshops, homeowners learn about the options for a well-functioning onsite wastewater system and good maintenance practices for wastewater systems on lakeshores. Lakes in the basin that would benefit from wastewater workshops include Lakes Raponda and Sadawga. Communities adjacent to *E. coli* impaired stream segments with possible septic sources (e.g., Whetstone and Ellis Brooks) or where residential development is dense and adjacent to waterways may also benefit from these workshops, and other interested river and lake communities are encouraged to participate. More information can be found at the Wastewater Workshop website.

Village Wastewater Solutions

Many historic villages do not have municipal treatment facilities. Closely spaced on-site septic systems adjacent to waterways can be the source of elevated levels of contamination. Failed or poorly functioning systems can contribute E. coli, phosphorus, or nitrogen to surface waters. Additionally, failed systems can cause cross-contamination of nearby drinking water wells.

Momentum has been growing in rural villages to explore options to deal with concerns about pollution from septic systems and the need for economic growth in village centers that is limited by the lack of centralized shared wastewater systems.

DEC provides direct funding and technical assistance to small communities without municipal treatment to help evaluate and plan for wastewater needs. It is anticipated there will be a steady demand by small communities for wastewater evaluations and planning in the coming years. Small lots and older on-site sewage systems, without municipal treatment infrastructure, re-development or the re-sale of property may require expensive upgrades. Another factor is the economic viability of small communities which cannot support commercial or residential growth due to the lack of wastewater treatment options. Alternative treatment systems are available to communities not wishing to build large waste treatment facilities, including several advanced technologies for small community scale systems that have been approved for use in Vermont.

Resources available for assisting municipalities include the Clean Water State Revolving Fund, as well as Village Water and Wastewater Initiative American Rescue Plan Act grant funding. Nine basin towns are included in the draft Clean Water State Revolving Fund Project Priority List articulated in the draft FFY23/FFY24 "Intended Use Plan" as developed by the DEC Water Investment Division.

Assistance in planning for on-site systems as well as connections to existing sewer is also available through the Vermont Engineering Planning Advance Program. The loan program is available to municipalities without existing municipal water or sewer systems for conducting a feasibility study for community-based drinking water and/or wastewater solutions. Consulting engineers assess the town's needs and goals offering treatment options.

The Village Wastewater Solutions Initiative offers these resources for further information:

- Organizing Village Wastewater Solutions
- Wastewater Solutions for Vermont Communities

An example of a decentralized wastewater disposal system for rural villages can be found in the town of Warren, Vermont. Areas with elevated E. coli levels like the Connecticut River could benefit from this type of approach. Funding is the most common barrier to identifying and remediating E. coli sources, however significant federal funding has become available through the American Rescue Plan Act (ARPA) and is available to help address this issue.

D. Natural Resources

Forests, lakes, ponds, rivers, floodplains, and wetlands are all examples of natural systems that provide continuing benefits both socially and ecologically. Natural resource restoration and protection projects help to prevent and reduce nutrient and sediment pollution, improve flood resiliency by mitigating flood hazards, enhance habitat function, and support Vermont's outdoor recreational opportunities. These projects are also the most economical and have a long-term benefit with little to no maintenance requirements. Restoration and protection of natural systems offer a cost-effective, long-term means to mitigate water quality and the effects of climate change and enhance the ecosystem services - flood control, wildlife habitat, filtration of pollutants - these natural resources provide.

While Agency regulatory programs protect natural resources, the Agency's also works to support landowner interest in natural resource protection and restoration and depends on partners to provide some of this assistance.

Rivers

In response to historic channel management, floodplain and riparian corridor encroachments, and watershed-wide land use and land cover changes, most Vermont rivers are actively adjusting their shape, size, and course as they seek to re-establish equilibrium (i.e., balance). Human activities can prevent or disrupt this balance by changing flow inputs to the channel (e.g., deforestation, increasing impervious surfaces and runoff, or water withdrawals) or by changing the sediment regime (e.g., dams, dredging). Legacy and present-day impacts, such as development within riparian corridors,

channel straightening, berm and dam construction, removal of riparian vegetation, and construction of undersized crossing structures, have contributed to stream instability state-wide. The key consequences of these activities are degraded water quality, loss of resilience and the ecosystem services provided by rivers that fully achieve dynamic equilibrium.

Improving all forms of connectivity, upstream-to-downstream and river-to-floodplain, encourages river equilibrium. Enhanced equilibrium will also help to achieve climate resilience through mitigating impacts of increased runoff and streamflow (Climate Change section) as well as work towards reducing sedimentation and nutrients. The ANR's strategies to enhance stream stability and storage include implementing projects, such as, but not limited to, active in-stream restoration, the removal of constraints, the protection of natural processes through easements, floodplain restoration to reduce channel incision, dam removals and other efforts that move the river and floodplain toward equilibrium conditions. The Rivers Program supports partners in project identification and prioritization through use of the stream geomorphic assessments and ANR provides technical support and financial assistance for project implementation as well.

River Corridor Plans

A River Corridor Plan (RCP) is a synthesis of the physical data collected during Phase I and II Stream Geomorphic Assessments (SGAs) based on protocols and guidelines developed by the Rivers Program. These plans identify causes of channel instability and make recommendations for restoration and protection projects. All SGAs and RCPs can be found at: Stream Geomorphic Assessment - Final Reports, and are linked in Table 17.

Table 17. River Corridor Plans

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

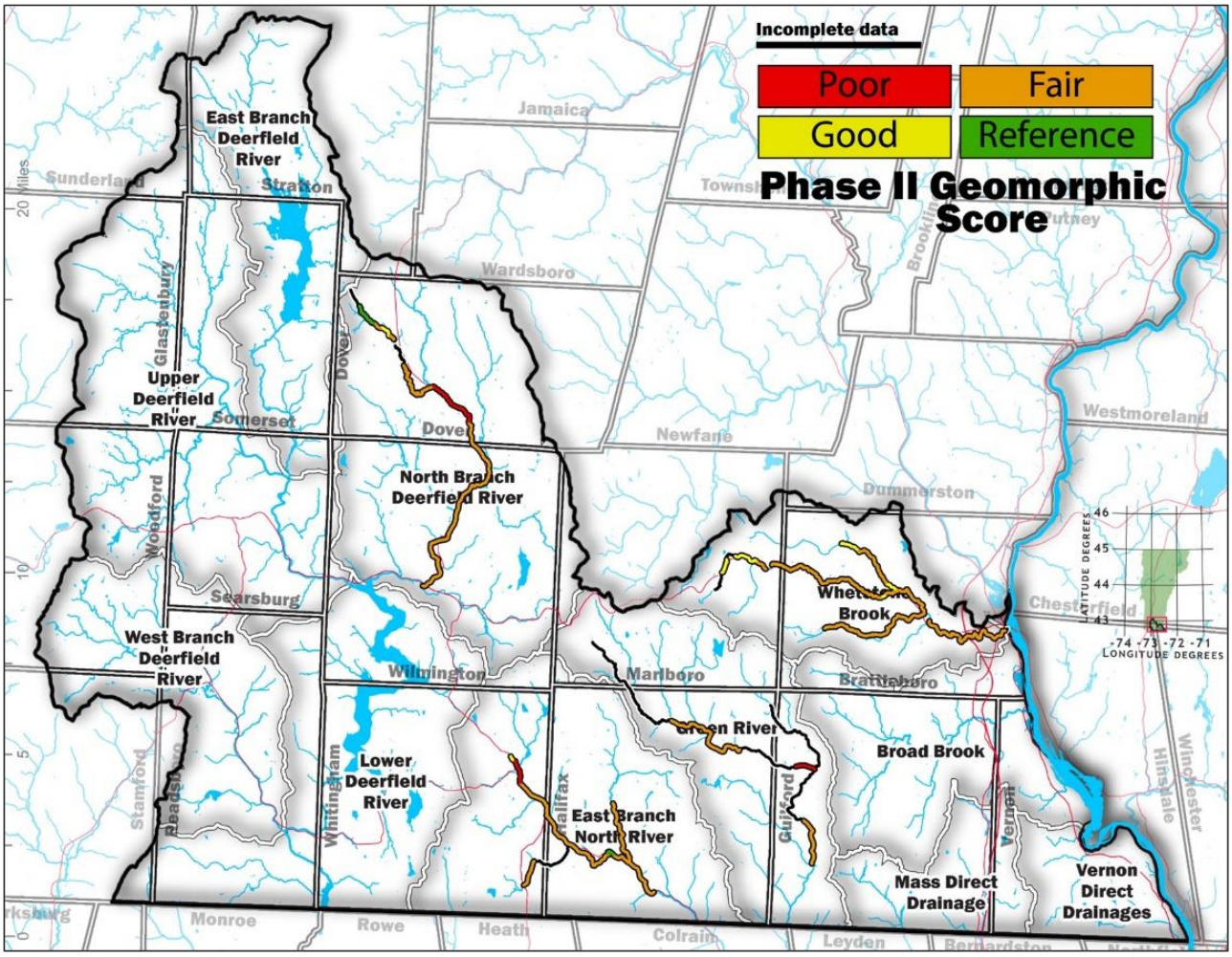


Figure 32. Geomorphic Conditions of Assessed Rivers and Streams

Rivers are in a constant balancing act between the energy they produce from the slope of the channel, and the volume and weight of the moving water and the energy they expend to carry water, sediment, and debris downstream. A change in any one of these factors will trigger adjustments of the other variables until the river system comes back into equilibrium. These changes can be caused by natural events such as storms and by human activity such as channel manipulation. The impact of these changes may be seen immediately and for decades after the activity occurred.

The legacy from Tropical Storm Irene in 2011 and other large flood events like those in July 2023 will be felt for years to come. While such flooding impacts are unlikely to be fully mitigated, the goal of managing toward, protecting, and restoring the equilibrium condition of Vermont rivers is to lessen or avoid conflicts between human investments and river dynamics in a manner that is

technically sound, and both economically and ecologically sustainable. In addition, it will help to mitigate impacts of increased runoff and streamflow from climate change.

Where funding, local support, and interest exists, priority projects and objectives identified in RCPs and SGAs should be pursued. Priority sub-watersheds for restoration include the North Branch Deerfield River and the lower Whetstone Brook.

River Restoration and Conservation

Active river restoration can include, but is not limited to, the reconnection of floodplains through berm removal, dam removals, woody buffer plantings (trees and shrubs), in-stream wood additions, head-cut stabilization, encroachment removal, and upgrading structure size. Partners including the Connecticut River Conservancy and the Windham County NRCD have planted many buffers throughout the Basin. Additionally, projects have been implemented or are in process to remove berms along the riverbanks, remove dams and to continue riparian buffer plantings.

ANR prioritizes river reaches that are identified as high priority sediment and nutrient storage areas for conservation. One option for protection, outside of land acquisition, is purchasing river corridor easements to avoid future encroachment and flood damage as well as to restrict channel manipulation. River Corridor Easements protect rivers from channel management that can degrade the functions of a river corridor.

Project Highlight:

First identified in 2007 as a potential floodplain restoration project, a vacant 12-acre parcel in Brattleboro just upstream from the commercial district has been completely restored and is now active available floodplain for water quality protection, flood mitigation and community open space. The twelve acre industrial lot had been filled with hardpack, berms surrounded the perimeter along Whetstone Brook and little vegetation was able to grow. Over the following 17 years working in partnership the Watershed Planning Program, the Windham NRCD, the Town of Brattleboro, the Vermont River Conservancy and USEPA undertook the clean-up of toxic soils, removal of the berms and fill, and the restoration of a wetland and the floodplain creating a public open space with trails and stream access. The land is fully conserved with a River Corridor Easement and transfer to town ownership. The flood storage created is predicted to lower the flood levels downtown by 1 – 2 feet in future flood event.

Birge Street Restoration - Before and After

Restoration and Strategic Wood Additions

Process-based restoration is defined by Beechie et al. (2010) as work that "aims to reestablish normative rates and magnitudes of physical, chemical, and biological processes that create and sustain river and floodplain ecosystems (e.g., rates of erosion and deposition, channel migration, growth and succession of riparian vegetation)." One area that process based restoration has been focused on restoring is the incorporation of wood back into river systems through different formats to help generate those processes that help move a stream toward equilibrium. Large woody material is a critical component of rivers. It improves fish habitat, stream stability, floodplain connection, nutrient processing, and sediment storage, but it is generally lacking in most Vermont streams due to past and present river management practices to accommodate land uses such as logging, agriculture, and urban and residential development.

Likewise, the long-term absence of beaver populations from many stream basins due to past overharvest has likely contributed to more streams becoming single-threaded, flashy, and incised than would have historically existed on the landscape. Strategic wood addition, beaver dam analog construction, and post-assisted log structures are examples of low tech process-based restoration techniques meant to initiate stream channel evolution toward a more complex, connected, resilient configuration where sited, designed, and implemented appropriately. Process-based restoration should move the stream toward becoming self-sustaining, such that over time additional work to maintain these or other created structures is not needed to achieve the goals of the project.

Process-based restoration continues to be implemented in several areas of the Basin by VFWD which has completed one project on Broad Brook in Vernon and has several projects planned on state lands in the Basin. The regional chapter of Trout Unlimited has also implemented several projects on tributaries in the upper Deerfield watershed.

Viable projects can be identified basin-wide by targeting initial field assessments on streams that adhere to the general stream slope and width recommendations of the Vermont Rivers Program or FWD Strategic Wood Addition Handbook. A further layer of prioritization focusing on B(1) fishing

candidate streams would add wildlife co-benefits and potentially help leverage other funding sources for this work.

For clean water funding consideration, partners should consult early with the Fisheries and Rivers Programs and other trained partners to collect appropriate field data to assess whether a project has a high probability of providing water quality benefits. Additionally, training and workshops on assessment and implementation of this work are needed to grow the knowledge base required to increase implementation.

Dams and Dam Safety

There are 55 known dams of different types, sizes, and condition in the Basin. There are likely many more that have not been documented. While some dams are used to generate energy and recreational opportunities such as boating, fishing, and swimming, all dams also impede a river's ability to transport flow and sediment; cause streambank erosion and flooding problems; degrade and alter fisheries habitat; create barriers to fish and other aquatic organisms' movement and migration; alter downstream water temperature; degrade water quality; and impede river-based recreational activity.

Each known dam is categorized by the status of its use and rated for its hazard potential. The hazard potential classification of the dam is based on the potential loss of human life, property damage, and economic loss that would occur in the event of a dam failure. These ratings are High, Significant, Low and Minimal.

Of the 55 inventoried dams, 43 are in-service, five are fully breached, and 7 have been removed or deleted. The 43 active in-service dams may constrict the stream channel enough to reduce sediment transport, prevent lateral movement, and inhibit aquatic organism passage (AOP) if mitigating actions have not been taken (e.g., fish ladder). Additional dam information can be found in Appendix B.

Table 18. Dams Use Status

DAM USE STATUS	# of DAMS
In Service	43
Breached	5
Removed / Deleted	7

The Vermont Dam Safety Rules are in place to protect public safety and provide for the public good through the inventory, inspection, and evaluation of dams in the State. The Vermont Dam Safety Program administers the rules which apply to all non-power dams (dams that do not relate to the generation of electricity energy for public use) and all non-federal dams (dams that are not owned by

the US or are subject to Federal Energy Regulatory Commission license or exemption). The rules set requirements and standards on 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.

All dams, even small dams for backyard ponds, are significant structures that can have major public safety and environmental implications. Dams are rated for their hazard potential. The hazard potential classification of the dam is based on the potential loss of human life, property damage, and economic loss that would occur in the event of a dam failure. These ratings are High, Significant, Low and Minimal. Table 19 shows the hazard class of the Basin's dams.

Table 19. Dam Hazard Class

DAM STATUS	# of DAMS
Breached/Removed	11
Unknown	5
Minimal	9
Low	12
Significant	5
High	13
TOTAL	55

Dam removals are pursued by private and public dam owners, often with the help from watershed groups and partners. Dams removed in the Basin since 2019 include:

- Beaver brook Dam, Wilmington
- Cold Brook Dam, Wilmington
- Guilford Dam, Guilford

Plans are underway for the removal of the Snow Lake dam and another small dam on a tributary to the North Branch Deerfield both in Dover. The lead partner in these projects is the Connecticut River Conservancy with technical and funding assistance from the Windham Regional Commission, Vermont Emergency Management and DEC.

The Vermont Dam Task Force is an interdisciplinary team of natural resource professionals that collaborate to share and investigate current dam removal protocols, watershed science, funding, and dam removal opportunities. The group meets bi-monthly to collaborate on projects. VDTF maintains a list of priority dams in the state for removal. The Nature Conservancy also provides statewide support, most recently through the 2023 publication of the Scaling Up Dam Removal Guide.

Opportunities for restoration may exist at other sites upon further discussion with dam owners as the risk to public safety and ownership liability associated with aging and deteriorating dams becomes more evident. Dam owners are encouraged to contact the Vermont Dam Safety Program and their Watershed Planner if they are interested in discussing dam removal. Dam removal is a priority basin-wide where the removal will result in restoration of stream equilibrium and habitat, fish passage, and sediment reduction.

Hydro Electric Power Generation

The generation of hydroelectric power plays a significant role in Basin 12. Great River Hydro (GRH), a subsidiary of Hydro-Québec, operates three hydroelectric generation facilities on the Deerfield River in Vermont and the Vernon Dam facility on lower Connecticut River. One additional private hydroelectric facility, the Harrisville Mill dam, is located on the Green River in Halifax.

Together the GRH dams in Vermont can produce 103 megawatts of electricity. These power production benefits come with some environmental costs. These include altering aquatic habitats, blocking fish passage, disrupting the continuity of stream flow and sediment, warming or chilling the water temperature, and causing unnatural fluctuations in flow levels and stream velocity.

The Deerfield River dams impound and create Somerset, Harriman and Sherman reservoirs along the river. The dams operate on a store and peak system. Water is held in the reservoirs until power is needed by the electric grid at which time water is released and power generated. This practice alters the lakeshore habitat and interrupts natural flows and sediment transport throughout the river systems. As a result, the Deerfield River below the Somerset and Harriman dams are impaired for low temperature due to the cold water released from the bottom of the reservoir impacting aquatic life support.

The hydroelectric power dam on the Connecticut River at Vernon creates a 2,550-acre, 26-mile long reservoir, creating lake-like habitat conditions from Vernon to Bellows Falls. Fish passage is provided by a fish ladder, but this is not well used. The facility provides a viewing station used to count migratory fish and welcomes visitors to watch fish pass through the station. The dam continues to impact the migration of anadromous Sea lamprey, American shad and catadromous American eel, and can kill fish as they move downstream through the generating turbines. Additionally, other aquatic species such as freshwater mussels, dragonflies, and aquatic insects are impacted by unnatural fluctuating surface water levels. Better managing for safe fish passage upstream and downstream, and stabilizing flow rates to protect endangered and threatened aquatic species are being addressed in the Federal Energy Regulatory Commission (FERC) hydro-relicensing process the southern Connecticut River dams are currently undergoing.

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.

Operational plans proposed at the Vernon Dam under the upcoming license will limit the water level fluctuation allowed on the Connecticut River. This may alleviate some of the bank erosion caused by saturation and de-saturation of the banks and allow for vegetation to be established on the banks offering more soil stability.

Table 20. 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-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 *

* Operational changes to be limited by FERC license est. 2025

Additionally, the East Branch and Deerfield Rivers and the three reservoirs are impaired for elevated levels of mercury in all fish except brown bullhead. This impairment is included in the Northeast Regional Mercury Total Maximum Daily Load of 2007.

FEMA Mapping Updates

The Federal Emergency Management Agency (FEMA) is currently updating the Flood Insurance Rate Maps in Vermont for the National Flood Insurance Program. This will be the first map update for many towns since the 1970s or 1980s. This new update will cover the entire state in stages and may become effective in some counties as soon as 2025 as part of FEMA's Risk Mapping, Assessment, and Planning program. The portions of Basin 12 being updated include are the Connecticut River from the Vernon Dam south into Massachusetts, in the towns of Vernon and Guilford and the Deerfield River basin from Stratton south into Massachusetts.

Most high-risk flood hazard areas in the basin will be mapped as Zone A, using a new Baseline Engineering strategy that combines computer modeling and high-resolution ground data (Lidar). Other areas with existing detailed flood studies will be labeled as Zone AE, with the older studies

aligned with current topography. The new Flood Insurance Rate Maps will include aerial photographs that show houses and roads.

Flood Insurance Rate Maps are the basis of floodplain regulations and the National Flood Insurance Program. When the new maps go into effect, FEMA requires that town bylaws meet current standards for participation in the National Flood Insurance Program. To support towns in the timely adoption of updated bylaws, DEC provides a model bylaw that meets or exceeds the National Flood Insurance Program requirements, addresses river corridors consistent with Act 250 review, and ensures municipal eligibility for the maximum amount from the Emergency Relief and Assistance Fund. For ease of adoption in the limited time that will be available to the towns, it was designed for use as either a stand-alone bylaw or an appendix to a zoning bylaw.

The regional planning commissions, with financial and technical support coordinated by the DEC regional floodplain managers, are facilitating the planning commissions and selectboard's bylaw adoption. This process also benefits from the participation of other partners in the support of meaningful community engagement in consideration of public safety, equity, and the multiple benefits of functioning river corridors and floodplains. The DEC Rivers Program details the FEMA mapping process in Vermont online. Although DEC supports a town's adoption of enhanced river floodplain protection, the current update to a town's bylaw is a time-sensitive priority. This TBP TBP recommends regional planning commissions offer targeted outreach to communities to adopt model flood hazard bylaws as part of the map update process. Flood hazard bylaw updates reduce river and infrastructure conflicts, ultimately mitigating downstream erosion and pollutant transport by increasing stream lateral and longitudinal connectivity.

New updated floodplain maps will help guide TBP strategies to be targeted to locations where floodplain restoration and reconnection will help mitigate flooding and protect people and infrastructure from future damage.

Flood Hazard Mitigation and Climate Resiliency

Since 2014, Vermont has required a "flood resilience" component be incorporated into all municipal and regional 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 to minimize long term economic, social, and natural resource impacts. Working with Regional Planning Commissions ANR provides resources and assistance to make flood resiliency an integral part of town planning by offering river corridor maps and model language for town and regional plans and local zoning ordinances.

Financial incentives for municipalities have been established in accordance with the requirements of 10 V.S.A. §§ 1427 and 1428 for the adoption and implementation of municipal zoning bylaws that protect and preserve river corridors, shorelands and buffers. Communities become eligible for

financial incentives based on adoption of a suite of mitigation activities. Once adopted by a municipality the Emergency Relief and Assistance Fund (ERAF) 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. For communities that take specific steps to reduce flood damage the State will contribute 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 or have applied);
2. Town Road and Bridge Standards (adopt standards that meet or exceed the 2013 template in the current: VTrans Orange Book: Handbook for Local Officials);
3. Local Emergency Management Plan (adopt annually after town meeting and before May 1);
4. Local Hazard Mitigation Plan (adopt a FEMA-approved local plan (valid for five years) or, submit a draft plan to FEMA Region 1 for review).

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.

Figure 33. Emergency Relief and Assistance Fund Cost Share per $1 Million

From: https://floodready.vermont.gov/find_funding/emergency_relief_assistance

Figure 33 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 full ERAF protections are in place.

Only three of the eighteen towns in the Basin, Brattleboro, Stamford and Vernon, have adopted the full requirements and will receive the maximum 17.5% State match for future damages. Seven towns have reached the 12.5% match rate, and nine towns remain at the 7.5% rate. Detailed information municipal protections in place can be found in Appendix D, and the most updated list can be found at Flood Ready Vermont.

Fish Communities and their Habitat

Barriers, thermal modification, lack of naturally vegetated riparian areas and woody instream habitat threaten fish populations statewide and within the Basin. FWD's state-level population and habitat management objectives strategies are available in the 2018 VT Management Plan for Brook, Brown, and Rainbow Trout. Dams along the Deerfield and Connecticut Rivers and their tributaries are partly responsible for thermal modification, and most are complete barriers to upstream fish movement. Some improvements in operational impacts from hydroelectric facilities are obtained through involvement in the federal relicensing process which is currently in process for the Vernon Dam. For dams not federally licensed this process is overseen by the Vermont Public Utility Commission. Other dams that no longer function as intended in addition to road crossings that block fish movement are being slowly removed through various local partnerships.

Instream fish habitat has been severely impacted in some areas following the removal of woody habitat and alteration of stream channels after past and recent major flood events. It is too early to estimate the impacts of July and December 2023 flooding. Projects to restore fish habitat and protect water quality are currently ongoing and have occurred though various local, State, and federal partnerships. These efforts, along with culvert upgrades, dam removals, in-stream habitat improvements, and riparian protection and restoration work, offer co-benefits to flood mitigation, nutrient reduction and riparian habitat enhancement.

In addition to recreationally important species, several anadromous and catadromous fish species are of concern in the Basin and the wider Connecticut River watershed. Notably,

- American Shad (*Alosa sapidissima*) (SGCN)
- American Eel (*Anguilla rostrata*) (SGCN)
- Sea Lamprey (*Petromyzon marinus*) (SGCN) – native to the Connecticut River
- Atlantic Salmon (*Salmo salar*) (SGCN) – Extirpated
- Shortnose Sturgeon (*Acipenser brevirostrum*) (Endangered)

The Atlantic Salmon restoration program on the Connecticut River was cancelled over a decade ago and are no longer assessed above the Vernon Dam. A single Shortnosed Sturgeon has been seen above this dam and recently, eDNA sampling has detected their presence in the Connecticut River above the dam. American Shad, American Eel, and Sea Lamprey continue to migrate through the Connecticut River watershed.

NOAA fisheries program states that "dam removal and fish passage improvement efforts will go a long way toward restoring these sea-run fish populations" and "improving and adding fish passage at the three [FERC] licensed dams, along with the previous dam removals, will allow fish to reach 43 river miles of high-quality upriver spawning and rearing habitat to many species of sea-run fish, including American shad."8 NOAA's work includes:

- Preserving existing habitats
- Improving existing habitat and restoring access to historical habitat (e.g., dam removals)
- Establishing benthic fish passage at dams that have not been removed
- Monitoring bycatch and stock recovery
- Educating the public

The Connecticut River Basin Fishway Passage Counts project annually counts the number of fish passing through fish passage structures including those at the Vernon and Bellows Falls dam.

American shad

Used by Permission, MassWildlife/Bill Byrne/Massachusetts Division of Fisheries and Wildlife (MassWildlife), Copyrighted, All Rights Reserved - https://www.fws.gov/ media/american-shad

8 https://www.fisheries.noaa.gov/species/shortnose-sturgeon; https://www.fisheries.noaa.gov/feature-story/atlantic-salmon-recovery-it-takes-ecosystem; https://www.fisheries.noaa.gov/feature-story/tributaries-small-rivers-big-returns

Lakes

A lake's physical characteristics are driven by its watershed size, topography, geology, soil fertility and erodibility, and vegetation. A lake's water quality is impacted by human activities and the land uses on the immediate shoreland and farther up into the watershed. The loss of native vegetation at the shoreline, the locations of roads, the development pressures around the shoreline and along tributaries, and into the watershed, and activities such as agriculture and forestry all contribute to overall lake and pond health. All these activities impact how water moves across the landscape and ultimately into the lake and ponds.

Preventing and mitigating water quality degradation, preserving and enhancing lake habitat and shoreline stability and ensuring recreational uses of lakes and ponds are priorities for the Basin. Recommendations included are guided by data from the VT Inland Lakes Scorecard depicting the condition of lakes and ponds, along with input from the Lakes and Ponds Management Program and Basin stakeholders.

Protecting and Improving Lakeshore Condition

Shoreland disturbance contributes to degraded lake water quality and lakeshore habitat. The Shoreland Protection Act (Chapter 49A of Title 10, §1441 et seq.), regulates shoreland development within 250 feet of a lake's mean water level for all lakes greater than 10 acres in size. The intent of the Act is to prevent degradation of water quality in lakes, preserve habitat and natural stability of shorelines, and maintain the economic benefits of lakes and their shorelands. The Act seeks to balance good shoreland management and shoreland development. The Shoreland Best Management Practices guidance helps property owners protect and restore lakeshore properties. It is comprised of multiple Best Management Practice documents highlighting different shoreland management activities to improve water quality and the health of lakeshore habitat.

The Lake Wise Program encourages lakeshore owners to implement practices that improve and protect lake water quality conditions and habitat. A Lake Wise Award certifies a property is well managed, using shoreland Best Management Practices, and is maintained to protect the lake. Lake Wise assessments review shoreland practices for their benefit to water quality and wildlife habitat and suggest actions if improvements are needed. Lakes with a Fair shoreland score will benefit from implementing Lake Wise Program best management practices.

Fifteen lakes in the Basin are rated as having Fair shoreland habitat conditions on the VT Lake Scorecard and should be considered for Lake Wise assessments. No lakes in the Basin have a Poor rating. If communities in any of these fair rated shorelands are interested in pursuing Lake Wise,

they can contact the Lake Wise Program. Watershed partners are currently working with some of these lake communities and outreach will be planned for the additional lakes in the next five years.

Lake users interested in becoming involved in the health of their favorite lake or pond can find information on the VDEC Lakes and Ponds website as a first step to moving toward a healthier lake or pond.

Lake Watershed Action Plans

Lake Watershed Action Plans (LWAPs) are assessments to identify pollution sources in the lake watershed that result in water quality and habitat degradation. Vermont DEC LPMPP uses the following metrics to determine priority lakes for Lake Watershed Action Plans: Increasing Phosphorus Trends, Disturbed Shoreline/Watershed, and an engaged Lake Association or other watershed group. Sources of data for these metrics include data from the VT Lake Scorecard, Next Generation Lake Assessments Reports (NGLA), Lake Wise and AIS program Engagement. The LWAPs result in a prioritized list of projects and strategies to address the sources of pollution and habitat degradation identified in the assessment. The plan may also contain recommendations to preserve natural features and functions, encourage use of low impact green stormwater infrastructure, and maintain the aesthetic and recreational uses of lakes. To date no lakes in the Basin have completed LWAPs or have received funding to develop an LWAP.

LPMPP's NGLAs are available for Weatherhead Hollow, Spruce Pond, Shippee Pond, Lake Raponda, Marlboro Pond-431, Howe Pond, Grout Pond and Lily Pond at NGLA Reports. This assessment may be appropriate for Sadawga Lake and Adams Reservoir. NGLAs are a comprehensive, quantitative multiday survey of a lake's condition during the summer index period. Data collected from NGLAs can help prioritize lakes for future LWAPs or identify priority catchments within a lake watershed for project identification, outreach, and development without needing a full LWAP process.

Cyanobacteria

Cyanobacteria, also known as blue-green algae, are naturally found in fresh water in the U.S., and Vermont waters. Cyanobacteria grow well in water that has high amounts of nutrients like phosphorous and nitrogen. Cyanobacteria can multiply quickly to form surface scums and dense populations known as blooms, especially during the warm days of late summer and early fall. Some types of cyanobacteria can release natural toxins or poisons (called cyanotoxins) into the water, especially when they die and break down. The LPMPP and the VT Department of Health, work with trained volunteers to monitor the frequency and magnitude of cyanobacteria blooms and assess spatial and temporal trends in bloom occurrence.

Volunteer monitors, along with staff from the Vermont Department of Health and LPMPP, file weekly online reports that are then displayed on the Cyanobacteria Tracker Map. The program helps citizens, and health, environmental, and recreational officials, assess the safety of our beaches. It also provides important data to better understand when and why blooms occur. No consistent cyanobacteria monitoring is in place in the Basin however, blooms have been documented on Basin lakes. Annual reports on long-term chemical and biological monitoring programs including cyanobacteria blooms are available on the DEC LPMPP website.

Preventing Aquatic Invasive Species

Aquatic invasive species (AIS) can affect water quality by degrading shoreline habitat, generating imbalance in lake food webs, and altering chemical and physical factors important to aquatic systems (e.g., hydrology, nutrient transport, and oxygen concentration). AIS have been confirmed in one Basin lake. Additional aquatic invasive species populations may exist but have not been confirmed with recent lake surveys. Sadawga Lake has populations of Eurasian watermilfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*).

New AIS introductions occur mainly in waterbodies that have launch sites for watercraft, are near infested waters, and lack spread prevention programs. Incoming boats from AIS infested waters are a high risk for introducing AIS in and on motors, propellers, trailers, ballast tanks and other boating equipment. Vermont Fish and Wildlife Department (FWD) manages seventeen lake access areas in the basin. The VT Public Access Greeter Program, Vermont Invasive Patrollers, and Vermont Invasive Patrollers for Animals, are spread prevention programs that incorporate AIS identification training, surveying and monitoring, watercraft inspection, and decontamination programs. VT Public Access Greeter Programs are supported by DEC's Aquatic Nuisance Control Grant-in-aid funding. Greeters interact with boaters at boat access areas, inspect watercraft, identify and remove any suspicious matter, and collect and report AIS data. Greeters also distribute educational material on aquatic invasive species. Vermont Invasive Patrollers Program trainings are offered on an annual basis.

The Aquatic Nuisance Control Grant-in-aid Program provides financial assistance to municipalities and agencies of the state for aquatic invasive and nuisance species management programs. Lake Raponda, South Pond, Harriman and Somerset Reservoirs have Greeter programs. A map of active greeter and control efforts is available online. It is strongly recommended that an inspection program be initiated at Sadawga Lake, and inspection program coverage be expanded at Harriman and Somerset Reservoirs to help minimize the spread of these invasive plants in the Basin.

Wetlands

Wetlands cover at least five percent of the Basin and are important for safeguarding many of its high quality surface waters. As recently as the 1980s, wetlands were seen as obstacles to development, agriculture, and transportation, and consequently, were systematically drained and altered. These losses and alterations diminish the important ecosystem services provided by wetlands such as sediment and nutrient attenuation, wildlife habitat, and flood water storage. Protecting the remaining wetland resources is an important strategy in the basin. Additionally, restoring degraded wetlands is essential to improving water quality. Wetland conservation and restoration and identifying sites with the greatest potential for improving water quality are priority recommendations.

Wetland Assessment and Protection

The Wetlands Program regulates wetlands in accordance with the Wetlands Rules which are focused on protecting wetland functions and values. The Program also monitors and assesses wetland conditions. The Program relies on wetland mapping to help preliminarily identify the locations of regulated wetlands (Class II and Class I). Enhanced wetland mapping is being developed for the entire Connecticut River valley with an anticipated completion date of 2024. Current maps can be found at Wetland Inventory Map.

Enhanced protection, in the form of a Class I wetland determination, can be afforded to wetlands determined to be exceptional or irreplaceable in their contribution to Vermont's natural heritage, based on their functions and values. Three wetlands have been identified as candidates for Class I assessment and support for reclassification. There are:

- Atherton Meadows (Whitingham
- Lake Sadawga floating bog (Whitingham)
- Lily Pond (Vernon)

The Vernon Black Gum Swamps are rare Red Maple-Black Gum Swamp wetland natural communities in Vermont. The combined 28-acres of these seven basin wetlands are located within the Vernon Town Forest and the Roaring Book Wildlife Management Area. Vernon Black Gum swamp complex has been left alone for hundreds of years and supports one of the oldest forest communities in Vermont. These Swamps formed over thousands of years and support a rare natural community found at the edge of the normal range for this type of wetland and contains some very old trees; some black gum trees aged at over 400 years old.

The Vernon Black Gum Swamps meet the criteria for Class I. This plan recommends conducting further wetland assessments of the remaining three and evaluating interest in reclassification. Stakeholders are encouraged to reach out to their basin planner and Wetlands Program staff for technical support to research and submit Class I wetland designation petitions for review.

Lily Pond is approximately 47 acres in size and is the only wetland in Vermont known to occur on a well-drained glacial outwash. Because of this it is home to the unique and rare Outwash Plain Pondshore natural community. It is the only occurrence of this natural community in the state, with an S1 state rank and a B in Natural Community condition, indicting good estimated viability and ecological integrity. This community occurs along most of the edges of the pond, where the land is submerged in the spring and exposed in the summer. Glacial outwashes consist of very porous deep sand and gravel deposits which allows the groundwater table to drop substantially in the summer, creating sizable water fluctuations around the pond. Lily Pond is home to eighteen different rare, threatened, and endangered plant and animal species and is an important migratory stopover and waterfowl corridor.

Atherton Meadows wetland in the Atherton Meadows Wildlife Management Area in Readsboro. This site consists of a 22-acre beaver-impounded wetland with several smaller forested wetlands nearby, in a depression on the top of a mountain. The beaver wetland includes floating peatland, open water, and aquatic bed vegetation. Woodland Seeps occur on the edges and in nearby swales. This wetland provides several important wildlife functions including roosting, staging, feeding, and nesting habitat for waterfowl; buffers and nest sites for wading birds in the forms of snags, open water, and deep marsh; wintering habitat for white-tailed deer in the smaller softwood swamps; habitat for moose in the deep marsh; active beaver activity; ability to support muskrat, otter, and mink; and possible amphibian and reptile habitat.

More information about these wetlands can be found in the Vermont's Class I Wetlands: An Interactive Journey StoryMap.

Wetland Mapping and Restoration

Wetland restoration is the process of returning a degraded wetland to an approximation of its pre-disturbance condition. The United States lost over half of its wetlands through ditching and filling between 1780 and 1980, and Vermont has lost as much as 35 percent. While conservation and protection of wetlands are critical for preventing continued loss of remaining intact wetlands, wetland restoration is essential for rehabilitating those that have historically been degraded or lost. Clean water goals for wetland restoration include assessing areas of degraded and prior converted wetlands and areas of hydric soils for restoration potential and implementing restoration as sites and opportunities are identified. This plan recommends that wetland restoration and conservation be explored where water pollution reduction and flood protection is evident.

Recommendations for wetland restoration can be found in Stream Geomorphic Assessments and River Corridor Plans (Table 17). Priority wetlands for restoration include Kettle Pond in Brattleboro and the Tanney Wildlife Sanctuary in Dover.

Wetlands can also be protected through easements or other conservation programs that restrict certain uses within the eased area. Such conservation programs include the Farm Service Agency's Conservation Reserve Program, Natural Resource Conservation Service's Wetland Reserve Easement program, a 2020-2025 RCPP opportunity administered by the Clean Water Initiative Program that targets smaller privately owned wetlands (10-50 acres), and Vermont's River Corridor Easement program. For the latter, VT Wetlands and Rivers Programs are developing template language so that river corridor easement footprints can be readily expanded to protect wetlands adjacent to the river corridor.

Wetland restoration and protection has the potential to reduce downstream nitrogen loading, improve water quality, reduce flooding, enhance aquifer recharge, and mitigate climate change through carbon storage. The Clean Water Initiative Program's current RCPP wetland easement program allows for limited restoration (e.g., tree planting) on smaller 10 – 50-acre wetlands, while Wetland Reserve Easements allow more intensive active restoration efforts. In small headwater and lowland streams, growing interest among multiple partners in process-based restoration techniques like beaver dam analogues and stage zero floodplain restoration is also likely to enhance wetland restoration in the Basin.

Forests

Forest lands cover approximately 82% of the Basin. As the dominant land cover, forests are important for safeguarding many high-quality surface waters. Yet, nutrient runoff can and does originate from forestlands from poorly managed and legacy logging practices. Reducing runoff and erosion from forests is important to meeting the state's clean water goals. Forest management activities offer many benefits, maintaining healthy forest communities, improving wildlife habitat, addressing non- native invasive species, contributing to the working landscape economy, and remediating poor legacy road infrastructure. Improving management and oversight of harvesting activities by following the Acceptable Management Practices and providing educational outreach and technical assistance to forest landowners and land managers are Basin priorities. Providing funding to implement improvement practices will grow the practice of good stewardship and water quality protection.

Forestry AMPs and Skidder Bridge Programs

Acceptable Management Practices for Logging Jobs are scientifically proven methods designed for loggers, foresters, and landowners to prevent soil, petroleum products, and excessive logging slash from entering the waters of the State and to minimize the risks to water quality.

Stream crossings can have a significant negative impact on water quality. These impacts can be minimized by making sure that stream crossing structures are properly sized and installed correctly before crossing streams with logging equipment. The FPR and watershed partners provide portable temporary bridge rental opportunities for use during timber harvests. These "Skidder" bridges reduce the occurrence of sedimentation, channeling, and degradation of aquatic habitat, allowing loggers to harvest timber in compliance with AMPs. When properly installed, used, and removed, Skidder bridges provide better protection from stream bank and stream bed disturbance than do culverts or poled fords. These reusable bridges are also economical, easy to install, and can be transported from job to job.

Specifications for building skidder bridges can be found at: Temporary Wooden Skidder Bridges. Information on the bridge rental program is found at: Temporary Bridge Rentals. These bridges should be utilized on logging projects basin-wide especially on steep slopes and areas with erodible soils adjacent to surface waters.

Additional guidance is available from the Department of Forests, Parks and Recreation (DFPR) in the Vermont Voluntary Harvesting Guidelines to Protect Forest Health and Sustainability, and through support for local skidder bridge programs, and forest land conservation efforts.

Enhanced coordination between ANR and the US Department of Agriculture – Natural Resources Conservation Service such as the Regional Conservation Partnership Program (RCPP) has also brought additional technical and financial assistance statewide to forest landowners developing and implementing water quality improvement projects in Vermont, including buffer establishment, stream habitat and stream crossing improvement, forest trail and landings improvement, and forestry easements. After an initial grant of $16 million in 2015, this RCPP grant was extended for five years in 2020 with an additional $10 million in assistance to farmers and forest landowners. Importantly, RCPP is a standalone program from the US Department of Agriculture – Environmental Quality Incentives Farm Bill program, allowing separate caps of $450,000 for each program per landowner.

Use Value Appraisal Program & AMPs

Use Value parcels (Current Use) encompass approximately 20% of the Basin, in conjunction with public and private conserved lands, this leaves only 40% of the entire Basin without some level of protection (Figure 34).

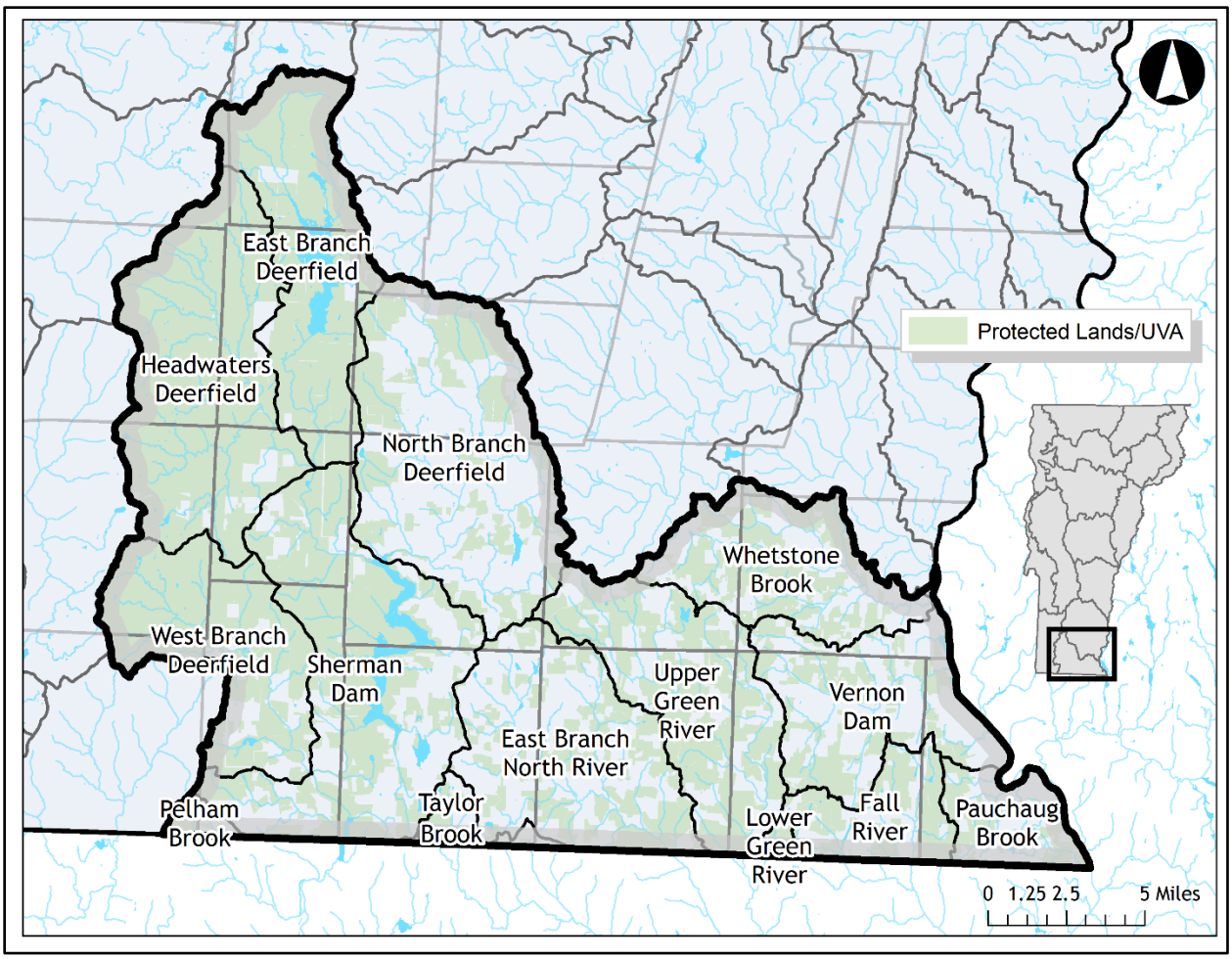


Figure 34. Protected Forest Lands
(Dark green = Public, Light green = Private, Orange = Use Value Appraisal Program)

Vermont's Use Value Appraisal Program (UVA) enables eligible private landowners who practice long-term forestry or agriculture to have their land appraised for tax purposes based on the property's value for the production of forest or agricultural products rather than on its residential or commercial development value. Compliance with UVA requires that the AMPs be employed to the maximum practicable extent. If AMPs are not employed on the UVA parcel resulting in a discharge, it may affect parcel eligibility in UVA and be a water quality violation. While there is overlap between requirements of the AMPs and UVA, they should be viewed as distinct from each other. In addition, Act 146 creates a new enrollment subcategory in the Managed Forestland category called 'Reserve Forestland,' with enrollments in the subcategory beginning July 1, 2023. This change to UVA accelerates the development of old forest conditions, and it does so in a way that preserves working lands as the primary focus of the Managed Forestland category of the UVA program. More information is available on the UVA Reserve Forestland website. County Foresters are available for consultation when questions arise about UVA, AMPs, and other practices to protect water quality.

Increased enrollment in the UVA program is encouraged wherever landowners express interest, and this plan particularly encourages increased enrollment in Source Protection Areas with substantial remaining UVA-eligible parcels. Major surface water source protection areas with unprotected lands are located within the North Branch Deerfield watershed in Dover and Wilmington near Mount Snow and Haystack Mountain, whereas unprotected groundwater source protection areas are distributed across the basin. Voluntary forestland protections beyond UVA enrollment such as forest easements, deed restrictions, or long-term leases are especially encouraged in these surface water and groundwater source protection areas in accordance with their Source Protection Plans and via a variety of funding programs.

Forest Road Assessments and Management

The ANR is in the process of assessing and prioritizing erosion issues along hydrologically connected forest roads on ANR-owned lands. State Forest roads in the Basin being assessed include those within Atherton Meadows and Roaring Brook WMAs and Woodford, Molly Stark and Fort Dummer State Parks.

The ANR Road Erosion Inventory App will become a resource for contractors and volunteers on private land in the future. The downloadable app can be used to assess and prioritize road segments in the field. Landowners may also use it to prioritize their own efforts as well as for supporting funding requests.

Watershed Planning and Social Equity

Vermont's natural resources are held in trust for everyone and should be a source of inspiration and enjoyment for all. The Agency of Natural Resources is committed to ensuring that everyone living in and visiting Vermont has meaningful access and equal opportunity to participate in Agency programs, services, and activities and that everyone feels safe and welcome on Vermont's public lands. The Agency's Office of Civil Rights and Environmental Justice, advances this mission.

ANR is committed to the work needed to engage our state's diverse population in shaping our shared work. As an Agency, we strive to be inclusive, both leading and supporting important work needed around diversity, equity, and inclusion – in our land management practices, in our environmental policies and permitting, and in ensuring our public processes are accessible, equitable and transparent.

Ensuring clean surface water for consumptive and recreational uses, ensuring fish caught in Vermont are safe for consumption, ensuring access to waters for all abilities and in all communities,

providing open space availability in more densely populated areas and ensuring clean water projects are equitably implemented in all communities are areas where tactical basin planning can work toward equity and environmental justice.

Focus areas for the basin include:

- Clean surface water for consumptive and recreational uses
- Safe consumption of fish caught in Vermont for subsistence anglers
- Access to waters for recreation for all abilities and economic levels in all communities
- Open space availability and access in more densely populated areas
- Equitable implementation of clean water projects in all communities, for example through explicit consideration of environmental justice in grant funding decisions.

Chapter 5 – Implementation Table

A. Progress in the Basin

The 2020 Basin Plan identified 64 strategies to address protection and restoration of surface waters. Fifty strategies (or 78%) have been implemented or are in progress by ANR and its watershed partners. The 2020 Report Card, Appendix X, provides the status for each strategy identified in the 2020 Plan. Several strategies will be carried over to this plan.

The TBP addresses all impaired and altered waters in the Basin as well as protection needs for high quality waters. The list of strategies in the Implementation Table (Table 21) and the Monitoring and Assessment Table (Table 23) cover future assessment and monitoring needs, as well as projects that protect or restore waters and related education and outreach.

The process for identifying priority strategies is the result of a comprehensive review and compilation of internal ANR and external watershed partner monitoring and assessment data and reports. The monitoring and assessment reports include SWMPs and stormwater mapping reports, SGAs, RCPs, bridge and culvert assessments, Hazard Mitigation Plans, flood modeling, agricultural assessments, REIs, biological and chemical monitoring, lake assessments, wetland assessments, fisheries assessments, and natural communities and biological diversity mapping.

The Clean Water Initiative Program coordinates funding, tracking, and reporting of clean water efforts for state partners, including the Agencies of Agriculture, Food and Markets; Commerce and Community Development; Transportation, and other ANR Departments (FWD and FPR), and federal partners including the Natural Resources Conservation Service and the US Fish and Wildlife Service's Partners for Fish and Wildlife Program.

The Division's reporting on financial investments made and projects completed occurs annually. Progress made in addressing the strategies in this plan will be reported in the 2028 TBP and the CWIP Performance Reports.

B. Public Participation

Public input is key to the development of the TBP, and the strategies included in the Implementation Table. Public participation is sought throughout the planning process with guidance from the Watershed Planning Program Communication Plan.

A series of nine public meetings were held to gather community input. These meetings were co-hosted with several of the partners listed below and brought over 95 participants into the basin discussions.

Additionally, 20 people responded to the on-line survey. The survey was widely distributed through state and partner distribution systems. Respondents identified themselves as being from withing the Deerfield and Connecticut River watersheds as well as from New Hampshire and Massachusetts. This information helps inform the strategies and projects proposed in this plan.

Key concerns identified include development pressure and a lack of zoning regulation, road-related and stormwater runoff causing sediment discharge, dams and undersized culverts creating barriers to flow and wildlife passage, climate change impacts on flooding and water temperature, wetland conservation, and invasive species.

Recommendations offered by respondents include dam removals and culvert replacements for removal and replacement, increasing coverage of the Lake Greeter program to prevent the spread of invasive species, expanding outreach and education efforts to the public and municipalities on water quality issues and restoration options, addressing bacteria levels and erosion in Whetstone Brook, and working on flood mitigation.

C. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in the Basin in coordination with the ANR. These partners are non-profit, private, state, federal, or other organizations working on both private and public lands. Partnerships are crucial in carrying out non- regulatory projects to improve water quality. The Windham County Natural Resources Conservation District (WCNRCD), Bennington County Conservation District (BCCD), Windham Regional Commission (WRC), Bennington County Regional Commission (BCRC), USDA Natural Resource Conservation Service (NRCS), UVM Extension Service, US Fish and Wildlife Service (USFWS), AAFM, Vermont Agency of Transportation (VTrans), Vermont Land Trust (VLT), Vermont River Conservancy (VRC), Trout Unlimited (TU), Connecticut River Conservancy (CRC)/Deerfield River Watershed Association (DRWA), Lake Raponda Association (LRA) and other river and lake associations, and municipal governments and groups are active in:

- providing outreach and education to local stakeholders, private landowners, and municipalities.
- developing and implementing stream and floodplain protection and restoration projects (e.g., river corridor easements, tree plantings, culvert and bridge upgrades, dam removals, stream channel habitat restoration).
- developing stormwater projects (e.g., SWMPs, road erosion inventories, implementation of town road BMPs).
- working with farms in the basin developing and implementing BMPs for water quality,
- monitoring water quality (e.g., lay monitoring program on lakes and rivers).

The work necessary to meet water quality goals in this basin requires collaboration among all these groups to maximize the effectiveness of the watershed partners and the funding investments. Without funding and partners, little of this work would be possible. The Agency is grateful for the active engagement and long-term commitment of so many partner organizations and interested citizens.

D. Implementation Table

The Implementation Table (IT) (Table 20) provides a list of 77 priority strategies created as the go-to implementation guide for watershed action. The IT provides specificity for where each strategy should focus by identifying priority sub-basins and towns. A list of related individual project entries is found in the online Watershed Projects Database (WPD). Projects in WPD vary in level of priority based on the strategies outlined in the table. All projects in WPD are not expected to be completed over the next five years, but each strategy listed is expected to be implemented and reported upon in future TBPs.

As projects are developed, priority for Clean Water Initiative Program funding is given to those projects that achieve the highest water quality benefits. Projects that provide cumulative benefits (i.e., flood resiliency, water quality improvement, water resource protection, aquatic organism passage) receive additional consideration for prioritization. The Vermont ANR relies on collaboration with partners and stakeholders to help carry out the strategies identified in the basin plan and achieve implementation priorities.

Table 21. Implementation Strategies

(See List of Acronyms on page 133) * carried forward from 2020 TBP

No.	Strategies	Priority Areas	Town	Partners	Funding
AGRICULTURE					
1	Implement BMPs to improve water quality	Newton Brook	Vernon	NRCDs, AAFM, NRCS	AAFM, NRCS, RCPP
2	Increase farm buffer establishment on agricultural lands adjacent to surface waterways including wetlands	Connecticut River, North Branch Deerfield, Newton Brook, Whetstone Brook	Vernon, Brattleboro, Wilmington	NRCDs, AAFM, NRCS, FSA, USFW	AAFM, NRCS, FSA, USFW, RCPP, CREP
3	Work on agricultural lands along the Connecticut River to establish and enhance riparian buffers following the stabilization of water level fluctuations from hydropower production	Connecticut River	Brattleboro, Vernon	NRCD, CRC, CRWFA, AAFM, NRCS	AgCWIP, RCPP, TFS, CWG
4	Increase outreach and technical assistance through workshops and trainings for farmers, ag contractors and technical service providers on:	Basin Wide	All Towns	UVM Ext., NRCDs, AAFM, NRCS	AAFM, NRCS, RCPP
	a. farm diversification				
	b. livestock exclusion and pasture management practices				

No.	Strategies	Priority Areas	Town	Partners	Funding
	c. improving soil health through Soil Health Assessments				
5	Develop and host educational workshops directed to horse, beef, and small animal operations	Basin Wide	All towns	UVM Ext., NRCDs, AAFM, NRCS	AAFM, NRCS
6	Implement field practices to study N-reduction potential of BMPs and track results of practices implemented	Basin wide	All towns	NRCD, NRCS, AAFM	LISFF, RCPP
7	Provide technical assistance on new climate-smart agriculture (e.g.: Silvopasture, soil health, nitrogen management)	Basin wide	All towns	AAFM, NRCS, NRCD	AAFM, NRCS, RCPP
8	Evaluate the success and ways NMPs are implemented on small farm operations to improve use and outcomes	Basin Wide	All towns	UVM Ext., NRCDs, AAFM, NRCS	AAFM
9	Develop additional capacity for case managers to work with farmers on grant applications and to streamline service provider outreach to farmers (e.g., Farm Teams).			AAFM, CRWFA, DEC, NRCS, WRNRCD	AGCWIP, TBPSG, Workforce Capacity Grant
10	Increase protections on agriculture lands along the river to ensure future floodplain capacity	Deerfield River, North Branch Deerfield, Connecticut River, Whetstone Brook	Wilmington, Brattleboro	VDEC, NRCDs, land trusts, VHCB, DEC, VAAFM, FSA, USFW	VHCB, VEM, FEMA, RCE, AAFM, FSA, USFW, RCPP

No.	Strategies	Priority Areas	Town	Partners	Funding
11	Increase regional equity of State and Federal agricultural funding distribution through enhanced engagement in NRCD led Local Workgroups	Basin Wide	All Towns	NRCDs, AAFM, NRCS	AgCWIP, NRCS, RCPP
12	Provide technical and financial support for the acquisition and management of shared equipment necessary for effective implementation of BMPs such as cover cropping and no-till planting	Basin Wide	All Towns	UVM Ext., NRCDs, AAFM, NRCS	AAFM, VHCB
DEVELOPED LANDS - STORMWATER					
13	Conduct stormwater master planning to identify and implement prioritize actions	North Branch Deerfield, Cold Brook	Marlboro, Hermitage, Readsboro, Whitingham	RPCs, NRCDs, municipalities, ski resorts	CWIP
14	Provide technical assistance and funding to develop high and medium priority projects from SWMPs and Stormwater Mapping Reports with a focus on priority sub-basins		Brattleboro, Dover, Mount Snow, Wilmington	North Branch Deerfield ski resorts	CWIP, ERP, CWSRF, WISPr
15	Identify and mitigate sources of bacteria causing impairment	North Branch Deerfield, Whetstone Brook	Dover, Wilmington, Brattleboro	VDEC, municipalities	ERP, CWSRF, WISPr
16	Address stormwater runoff entering Kettle Pond		Brattleboro	WCNRCD, municipality	CWIP, ERP, CWSRF, WISPr
17	Address stormwater runoff discharges from ski area development impacting water quality including implementation of the Mt Snow WQRP	North Branch Deerfield, Cold Brook	Dover, Wilmington	Municipalities, ski resorts	

No.	Strategies	Priority Areas	Town	Partners	Funding
18	Conduct outreach to the real estate industry on the economic benefits of clean water and on applicable wetland and stormwater rules.			VDEC, NRCDs, RPCs	WG
DEVELOPED LANDS - ROADS					
19	Provide general support and technical assistance to towns for MRGP compliance		Dover, Guilford, Marlboro, Whitingham, Woodford	RPCs, municipalities	BR, GIA
20	Provide technical and financial assistance to towns needing to mitigate stormwater discharges and improve the storage of salt and sand at town garage sites		Marlboro, Halifax, Readsboro, Vernon	RPCs, municipalities	VTrans, CWG,
21	Support towns in purchase or rental of equipment needed to comply with MRGP			RPCs, VDEC	WG
22	Conduct gully erosion inventory and identify, prioritize and address gully erosion from roads and failed Class 4 roads			NRCDs, municipalities	CWIP
23	Conduct outreach on BMPs for private roads and driveways			RPCs, NRCDs	WG
24	Assist municipalities and private road owners in replacing culverts to achieve geomorphic compatibility and Aquatic Organism Passage (AOP)			VTrans, municipalities	Structures

No.	Strategies	Priority Areas	Town	Partners	Funding
WASTEWATER					
25	Reduce the nitrogen load from municipal wastewater discharges to address the LIS-TMDL through discharge permit renewal process	Basin-wide		Municipalities, DEC	CWSRF
26	Provide outreach on the Village Wastewater Solutions and conduct wastewater planning and feasibility studies for small communities without municipal systems		Guilford, Vernon	Municipalities, DEC	CWSRF
27	Encourage and support upgrades to public wastewater treatment facilities to help remove nitrogen from discharges and other upgrades and refurbishments as needed	Basin-wide		Municipalities, DEC	CWSRF
28	Promote septic system maintenance through local outreach and education programs, such as Village Wastewater Solutions		Dover, Wilmington, Brattleboro, Guilford, Vernon	Municipalities, NRCDs, DEC	WG, TBPSG
NATURAL RESOURCES					
29	Increase education, outreach and implementation of natural resource restoration and protection needs and opportunities	Basin-wide	All towns	ALL	CWIP, WG, WISPr
30	Support partners in investigating the potential for Wild and Scenic designation for the Deerfield River	Green River, East Branch North River, Whetstone Brook		VEM, FEMA, RPCs	TBPSG

No.	Strategies	Priority Areas	Town	Partners	Funding
31	Support reclassification and designation of rivers, streams, lakes, ponds and wetlands throughout the Basin	see Table 8		RPCs, NRCDs, municipalities	WQ Planning
32	Monitor swimming waters for bacteria and cyanobacteria to ensure health and safety			CRC, watershed assoc, NRCDs, RPCs	LPP
33	Support and enhance riparian buffer and floodplain plantings throughout the landscape	Newton Brook, Whetstone Brook, North Branch Deerfield, Connecticut River	All towns	ALL	CWIP, WG, WISPr
RIVERS					
34	Secure stable funding for the USGS monitoring gauge at Northfield, MA	Connecticut River		DEC-MAP, USGS, AAFM	DEC-MAP, USGS, AAFM
35	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
36	Remove Snow Lake and dam, install properly sized road culvert, and re-establish river channel	North Branch Deerfield	Dover	WRC, CRC, municipality, Resort	FEMA-FRCF

No.	Strategies	Priority Areas	Town	Partners	Funding
37	Increase River Corridor Easements which incorporate channel management, riparian buffer provisions, flood resiliency and protection from conversion & development	North Branch Deerfield, Green River, East Branch North River, Connecticut River	All towns	VRC, VLT, TNC, DEC	CWIP, VHCB, WISPr
38	Support river and stream restoration projects to improve stream geomorphic compatibility, aquatic organism passage, and flood resilience as identified in statewide and local assessments. Prioritize dam removals, and bridge and culvert replacements when possible	Basin-wide			
39	Create & implement Emergency Action Plans for all High and Significant Hazard dams			RPCs, VDEC - FED	
40	Scope, design, and implement high priority dam removals to improve stream geomorphic compatibility, aquatic organism passage, and flood resilience as identified in statewide and local assessments (e.g., river corridor plans, culvert inventories, hazard mitigation plans)	Binney Brook, Deerfield River, East Branch North River, Green River, North Branch Deerfield River		CRC, RPCs, NRCDs, dam owners	FEMA, HMP, PDHMP, WISPr

No.	Strategies	Priority Areas	Town	Partners	Funding
41	Scope, design, and implement high priority culvert replacements to improve stream geomorphic compatibility, aquatic organism passage, and flood resilience as identified in statewide and local assessments (e.g., river corridor plans, culvert inventories, hazard mitigation plans)	Box Cover Brook, East Branch Deerfield tributaries, Lamb Brook, East Branch North River			
42	Support targeted strategic wood additions for fish habitat improvement, sediment storage and floodplain connection where these are deemed appropriate	Black Brook, East Branch Deerfield tributaries, Harriman Reservoir tributaries		FWD, TU	EDDIBG
43	Increase adoption of flood hazard bylaws and river corridor protection through increased outreach and training for municipalities on ERAF, river corridor protections and flood resiliency		Glastenbury, Halifax, Marlboro, Readsboro, Searsburg, Somerset' Sunderland, Wardsboro, Woodford	VDEC-Rivers, RPCs, VEM	WQ Planning
44	Remove sewer lines from hazardous locations including streambeds	Whetstone Brook	Brattleboro	Municipalities, VDEC - FED	CWSRF
45	Implement infrastructure resiliency projects at Jacksonville Municipal Center and downstream properties	East Branch North River	Jacksonville village	RPCs, VDEC, municipality	FEMA, HMP, PDHMP
46	Re-assess existing SGAs and RCPs to determine need and feasibility of	Green River, North Branch Deerfield, Whetstone Brook		WG, NRCD, RPC	EDDIBG

	identified projects for design & implementation				
No.	**Strategies**	**Priority Areas**	**Town**	**Partners**	**Funding**
47	Develop an RCP for Broad Brook			VDEC-Rivers, RPCs	EDDIBG
48	Improve flow management at hydroelectric to address WQ impairment, sediment transport and to benefit downstream species	Connecticut River, Deerfield River		Great River Hydro	
49	Repair and maintain fish ladder at Green River Crib Dam			Community org	TU, WG, EBTJV
50	Monitor and assess waters with no and outdated data	see Table X		VDEC	
51	Evaluate waters for ORW designation	see Table X		VDEC	
52	Evaluate waters for Class I Wetland designation	see Table X		VDEC - Wetlands	
53	Support recreational access to water resources through the establishment and maintenance of stable access areas, portage trails and river campsites.	Connecticut River, Deerfield River			DREF
LAKES					
54	Promote & implement the Lake Wise Program to encourage lake-friendly shoreline property maintenance	All lakes & ponds		lakeshore owners, lake assoc, VDEC-Lakes	CWIP, ERP, WISPr

No.	Strategies	Priority Areas	Town	Partners	Funding
55	Establish Lay Lake Monitoring on appropriate lakes and ponds	Sadawga, Grout, Howe, Lily		lakeshore owners, lake assoc, VDEC-Lakes	WG
56	Support and fund existing and new Greeter Programs on lakes and ponds with active boat launches	Somerset, Harriman, Sadawga, Raponda, South Pond,		WCNRCD, GRH	AIS, GRH
57	Work to improve and enhance fish habitat and recreational fishing on lakes	Lake Raponda, Sadawga Lake, South Pond			
58	Work to control riparian and aquatic invasive plants	All Lakes & ponds		lakeshore owners, lake assoc	AIS GIA
59	Work to protect Lily Pond		Vernon	lakeshore owners, VANR, municipality	CWIP, VHCB, WISPr
WETLANDS					
60	Restore degraded wetlands for habitat, water quality improvement and climate change mitigation		Brattleboro, Vernon	AAFM, VDEC, NRCDs, watershed assoc	CWIP, DU, WISPr
61	Assess areas of prior converted wetland and hydric soils for restoration			AAFM, VDEC, NRCDs, watershed assoc	WG, DU, WISPr

No.	Strategies	Priority Areas	Town	Partners	Funding
62	Assess wetlands for potential reclassification	see Figure 18	Towns experiencing strong development pressure	VDEC - Wetlands	
63	Support outreach to towns and the public – especially zoning administrators, prospective land purchasers, wastewater designers, and realtors – regarding updated wetlands mapping	Basin-wide	Wilmington, Dover and Vernon	VDEC - Wetlands, RPCs	TBPSG
FORESTS					
64	Protect headwater streams and sensitive upland surface waters	Whetstone Brook, Green River		DFPR, USFS, VLT, VRC	USFS, WISPr, CWIP
65	Conduct outreach on AMPs and forest BMPs	Basin-wide		DFPR, NRCDs	WQ Planning
66	Remove or replace undersized stream crossings with properly sized structures	Basin-wide		DFPR, NRCDs	
67	Better manage forest road runoff through adherence to AMPs and site restoration	Basin-wide		DFPR, landowners	CWIP, WG, WISPr
68	Continue and expand the Portable Skidder Bridge Program	Basin-wide		NRCDs	WG

CLIMATE CHANGE ADAPTATION					
No.	**Strategies**	**Priority Areas**	**Town**	**Partners**	**Funding**
69	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	
70	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
71	Work to maintain wildlife corridor connectivity with populations to the south in Massachusetts and across the Connecticut River into New Hampshire	Connecticut River valley		ANR, RPCs, NRCDs, USFWS	SWG, CWIP, WISPr, VHCB, ATBC
SOCIAL EQUITY					
72	Seek opportunities to increase public access to lakes and rivers that are free and accessible to diverse populations (e.g. VRCs "A Swimming Hole in Every Town" program)	Basin-wide		DFPR, DFW, Watershed Groups, municipalities	VHCB, SWG, USFWS
73	Identify communities where water quality concerns prevent use of waters or present unhealthy conditions and address these conditions	Basin-wide		DEC, Watershed Groups	ANR

No.	Strategies	Priority Areas	Town	Partners	Funding
74	Locate implementation projects where they will offer dual advantages of a cleaner environment and open space to underserved populations	Connecticut River		DEC, RPC, NRCD, Watershed Groups, municipalities	CWG
75	Work to reduce contaminants that restrict fish consumption to protect those dependent on subsistence fishing for nutrition	Connecticut River		EPA, USFWS, DFW, DEC	EPA
76	Implement projects to reduce flood hazards in resource-limited communities such as mobile home parks located in floodplains	Basin-wide		DEC, municipalities	ARPA
77	Monitor swimming waters for bacteria and cyanobacteria to ensure health and safety	Basin-wide		DEC-LPP, Watershed Groups, municipalities	TBPSG, LPP

D. Monitoring and Assessment Table

The Monitoring and Assessment Table (Table 23) provides a preliminary list of water quality monitoring priorities to guide monitoring over the next five years. The ANR's Water Quality Monitoring Strategy describes the monitoring programs supported by ANR and its partners, who are listed in Chapter 2. Common goals for monitoring efforts across programs include identifying water quality conditions, tracking water quality trends, identifying pollution sources and evaluating improvements over time. The table includes more sites than there is capacity to monitor and as such, will be further prioritized before monitoring occurs.

Waters In Need of Further Assessment

Five surface waters (rivers & streams) need supplemental monitoring to determine their potential for enhanced protection. (Figure 35.) These waters are included in Chapter 5 in the Monitoring and Assessment Table.

Table 22. Monitoring Needed to Confirm Reclassification

Map ID	Name	Macroinvertebrate	Fish
1	Pond Brook, 1.3**	2023, 2024	2023, 2024
2	East Branch North River, 17.8	2025	2024, 2025
3	West Branch Deerfield River, 0.6	2026	2026
4	Reservoir Brook, 0.4	2026	
5	Red Mill Pond Brook, 0.7	2023, 2024	2023, 2024*

*Poor fish community, may be due to wetland influence on habitat and temperature.

**All data is from 2014, would require new set of data

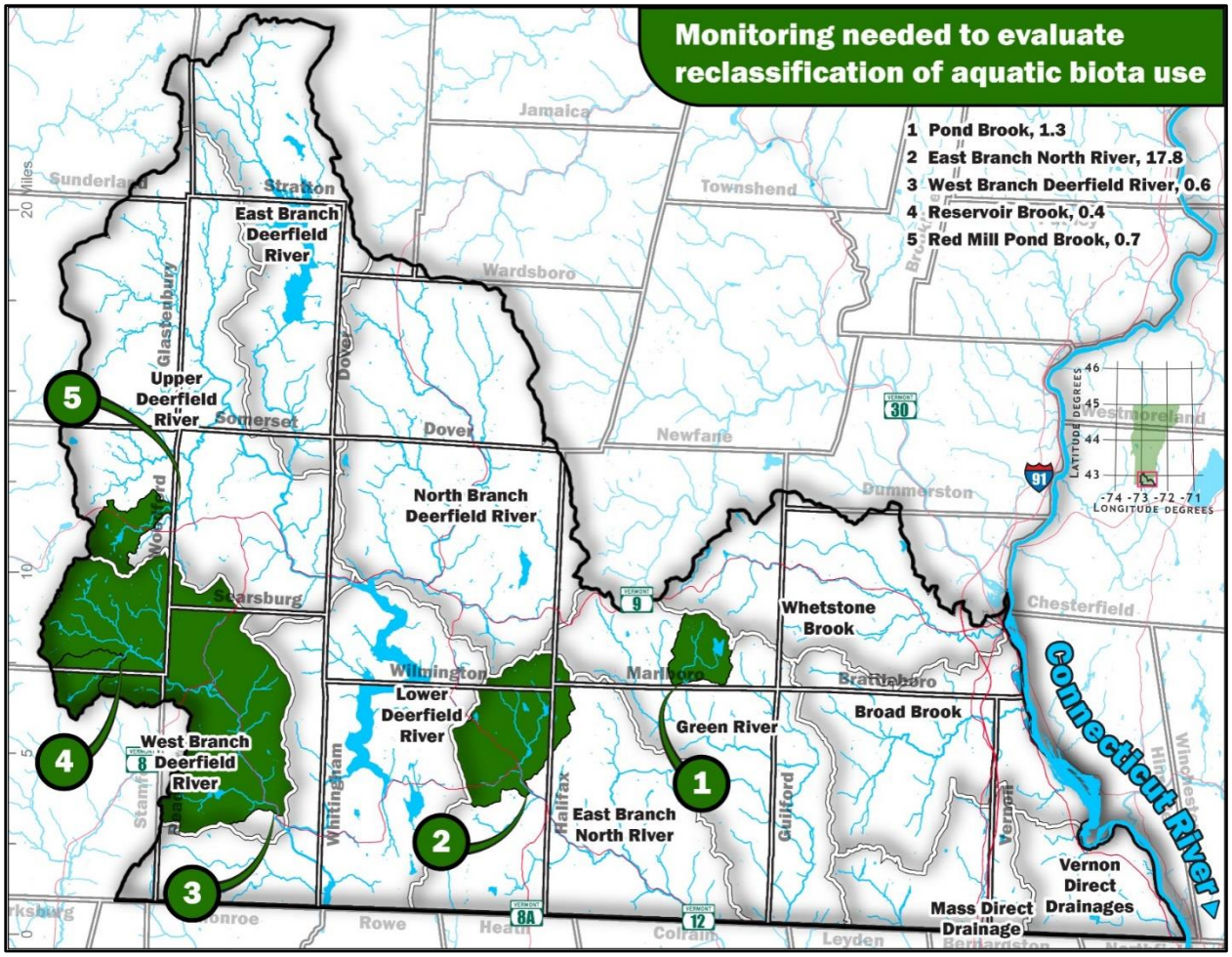


Figure 35. Monitoring Needed to Evaluate Reclassification

Table 23. Priorities For Monitoring and Assessment

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Rivers & Streams					
Deerfield River	Old data	Moderate	44.4	BASS*	Data update
			45.6		
	Old data	Low	51.3	BASS	Data update
	Old data	Low	51.8	BASS	Data update
			52.4	BASS	
	Old data	Moderate	65.6	BASS	Data update
	Old data	Low	66.3	BASS	Data update
	Support A(1)	Moderate	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	Low	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	1	BASS / USFS	Data update
Redfield Brook	no data	Low	0.7	BASS / USFS	Establish Baseline

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
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	Potential A(1)
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
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)

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
East Branch Deerfield River					
		Low	0.1	BASS / USFS / GRH	Potential A(1)
		Low	5.3	BASS / USFS / GRH	Potential A(1)
	Reclassification	Moderate	12.6	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	Low	0.6	BASS / USFS	Potential A(1)
	Reclassification	High	1.8	BASS / USFS	Potential A(1)
	Reclassification	High	5.9	BASS / USFS	Potential A(1)
	Reclassification	High	7	BASS / USFS	Potential A(1)
	Reclassification	High	8.5	BASS / USFS	Potential A(1)
Reservoir Brook		Low	0.4	BASS / USFS	Maintain A(1)
Yaw Pond Brook	pH only	Moderate	0.4	BASS / USFS	Establish Baseline
Howe Pond Brook	chem only	Low	1.9	BASS / USFS	Data update
Lamb Brook	Reclassification	Low	0.1	BASS / USFS / permittee	Data update
Lamb Brook	Reclassification	Low	0.7	BASS / USFS / permittee	Potential A(1)
West Branch Deerfield River, Trib 1	Wind station	Low	0.7	BASS / USFS / permittee	

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
West Branch Deerfield River, Trib 7	Wind station	Low	1.8	BASS / USFS / permittee	
South Branch Deerfield River					
	Reclassification	High	1.3	BASS / USFS / GRH	Potential A(1)
		Low	0.3		
Beaver Brook	no data	Low		BASS	Establish Baseline
Windsor Pond trib	no data	Low		BASS	Establish Baseline
North Branch Deerfield River					
			2	BASS	
	Evaluate WQ issue	High	5.8	BASS	Determine bacteria source
			6.3	BASS	
	Evaluate WQ issue	High	6.5	BASS	Determine bacteria source
	Old data	High	7	BASS	Data update, monitor floodplain restoration
			7.6	BASS	
	Old data		8.9	BASS	
			9.6	BASS	
	Evaluate WQ issue	High	11	BASS / Mt Snow	Permit tracking
	Old data		12	BASS	

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
	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	High	0.1	BASS / USFS	Determine source, monitor dam removal
Rose Brook	Compliance	Moderate	0.9	BASS / permittee	Permit tracking
Blue Brook	Reclassification	Moderate	0.7	BASS	Potential future B(1)
Cold Brook	Reclassification	High	0.1	BASS / USFS	Potential B(1) / Permit tracking
			0.7		
			2.2		
			3.1		
			3.4		
			4.3		
Oak Brook			0.1	BASS / Hermitage	Permit tracking

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
			0.2		
		Moderate	0.7		
Haystack Brook	Reclassification		0.1	BASS / USFS / Hermitage	Potential B(1) / Permit tracking
			0.3		
Ellis Brook	Evaluate WQ issue	Moderate	0.3	BASS / USFS	Determine source, monitor floodplain restoration
			0.5		
			0.9		
			1		
			2.9		
Negus Brook	old data	Low	0.7	BASS / USFS	Data update
Cheney Brook	old data	Low		BASS / USFS	Data update
Tannery Brook (named by DEC)	no data	Low		BASS	Establish Baseline
Iron Stream	old data		0.2	BASS / Mt Snow	Evaluate iron / data update
Jacks Brook	old data		0.3	BASS / Mt Snow	Data update

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Green River					
	Reclassification / Sentinel Stream		16.6	BASS	Potential A(1)
			17.4		
	Reclassification		19.9	BASS	Potential A(1)
Borden Brook (VT/MA)	no data	Low		BASS	Establish Baseline
Deer Park Pond Brook (Green River Trib 6)	old data / Reclassification		1.7	BASS	Potential A(1)
Harrisville Brook	no data	Moderate		BASS	Establish Baseline
Hinesburg Brook	no data	Moderate		BASS	Establish Baseline
Pond Brook	Reclassification	Moderate	1.3	BASS	Potential A(1), need fish
Roaring Brook	no data	Low		BASS	Establish Baseline
Thorne Brook (VT/MA)	no data	Low		BASS	Establish Baseline
North River (MA)					
East Branch North River	Reclassification	Moderate	10.3		Potential A(1)
			11.7	BASS	Potential A(1)
			12.6		
	old data		14.4		
			17.6		
Branch Brook	no data	Moderate		BASS	Establish Baseline

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
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
Jacksonville Pond Brook – unnamed trib	no data	Moderate		BASS	Establish Baseline
Pease Brook	no data	Low		BASS	Establish Baseline
Randall Brook	no data	Low		BASS	Establish Baseline
Sprague Brook	no data	Low		BASS	Establish Baseline
Stowe Brook	no data	Low		BASS	Establish Baseline
Vaughn 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					
Reach 04 – West River confluence to Vernon Dam	chem only		147		TMDL tracking
	EPA NRSA site		145	BASS	TMDL tracking
Reach 05 – Vernon Dam to MA line	no data	Moderate	140	BASS	Establish Baseline

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Cersosimo Setback					
Broad Brook			4.1	BASS	
	old data		0.9	BASS	Data update
Guilford Ctr Road - unnamed trib	no data	Moderate		BASS	Establish Baseline
Lee Road - unnamed trib	no data	Low		BASS	Establish Baseline
Coolidge Hwy - unnamed trib (Rt 5)	no data	Low		BASS	Establish Baseline
Weatherhead Hollow Road - unnamed trib	no data	Moderate		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
Couch Brook	no data	Moderate		BASS	Establish Baseline
Newton Brook					
	Evaluate nutrient trend	High	0.6	BASS	Track impairment
	Evaluate nutrient trend		0.2	BASS	Track impairment
Whetstone Brook			0.2		
	Evaluate bacteria		1		

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Whetstone Brook					
	Evaluate bacteria		1.1	BASS	Track impairment
	Evaluate bacteria	High	2.4	BASS	Track impairment
			2.9		
			8.6		
	Reclassification	High	10.7	BASS	Confirm Potential A(1)
Ames Hill Brook	no data	High		BASS	Establish Baseline
Halladay Brook	no data	Moderate		BASS	Establish Baseline
Pleasant Valley Reservoir trib	no data	Low		BASS	Establish Baseline
Lakes & Ponds	***only 8 lakes have NGLA completed***				
Deerfield River					
Adams Reservoir – Woodford	Evaluate nutrient and acid trends	Moderate		Lakes Program, BASS/LTM	Track impairment
Grout Pond – Stratton	Evaluate nutrient and acid trends	High		Lakes Program, BASS/LTM	Establish LMP, Track impairment
Harriman Reservoir – Wilmington, Whitingham	Evaluate shoreline condition due to water level fluctuation	Moderate		Lakes Program	Establish LMP

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Haystack Pond – Wilmington	Evaluate nutrient and acid trends	High		Lakes Program, BASS/LTM	Trank increasing P trend, Establish LMP
North Pond – Whitingham	Establish nutrient trend	Moderate		Lakes Program	Establish LMP
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	Potential ORW or Class A(1)	High		Lakes Program	Track trends
Sadawga Lake – Whitingham	Establish LMP	High		Lakes Program	Conduct NGLA, 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

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Snow Lake – Dover	Remove pond	Low		Lakes Program	Remove pond
Somerset Reservoir – Stratton, Somerset	Evaluate shoreline condition due to water level fluctuation	Low		Lakes Program	Establish LMP, Establish Greeter program
Spruce Lake - Wilmington	Evaluate nutrient trend	Low		Lakes Program	Establish LMP
Stamford Pond – Stamford	Evaluate nutrient trend	Low		Lakes Program, BASS/LTM	Establish LMP, Track impairment
Yaw Pond – Woodford, Readsboro	No data, Monitor nutrient trend	Low		Lakes Program	Establish Baseline
Green River					
Deer Park Pond – Halifax	No data, Monitor nutrient trend	High		Lakes Program	Establish LMP
South Pond – Marlboro	Evaluate nutrient and acid trends	Moderate		Lakes Program	Track impairment
East Branch North River					
Gates Pond – Whitingham	no LMP	Moderate		Lakes Program	Establish LMP
Jacksonville Pond – Whitingham	Evaluate nutrient trend, Data over 10 yrs old	High		Lakes Program	Establish LMP

Waterbody	Assessment Goal	Priority	Location (River Mile)	Partner(s)	Monitoring Action
Laurel Lake – 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	Moderate		Lakes Program	Establish LMP
Connecticut River Direct					
Broad Brook	Project development	Moderate		Rivers Program	River Corridor Plan
Keets Brook					
Sweet Pond – Guilford	monitor condition / shoreland assessment	High		Lakes Program	Monitor condition post-refill
Weatherhead Hollow Pond – Guilford	Evaluate nutrient trend	Low		Lakes Program	Track trends
Newton Brook					
Lily Pond – Vernon	Protection / Monitor nutrient trend	High		Lakes Program	Track impairment
Vernon Hatchery Pond – Vernon	Establish data to determine nutrient trend	Low		Lakes Program	Track trends

Waterbody	Assessment Goal	Priority	Location	Partner(s)	Monitoring Action
Whetstone Brook					
Hidden Lake – Marlboro	Monitor nutrient trend	Moderate		Lakes Program	Track trends
Kettle Pond – Brattleboro	Establish nutrient trend / Monitor conductivity	High		Lakes Program	address stormwater inputs
Pleasant Valley Reservoir – Brattleboro	Evaluate nutrient trend / shoreland assessment	Low		Lakes Program	Track trends
Wetlands					
Beaver Meadow – Readsboro	Reclassification	Low		Wetlands Program	Establish Baseline
Shep Meadow Pond – Somerset	Reclassification	Low		Wetlands Program	Establish Baseline
Gates Pond wetlands	Assess condition for restoration	Moderate		Wetlands Program	Establish Baseline
Renaud Wetland (CT River)	Assess condition for restoration	Moderate	42.81588, -72.54315	Wetlands Program	Establish Baseline

List of Acronyms

319	Federal Clean Water Act, Section 319
604(b)	Federal Clean Water Act, Section 604b
A(1)	Class A(1) Water Management
A(2)	Class A(2) Water Management
AAFM	Agency of Agriculture, Food and Markets
ACEP-ALE	Agricultural Conservation Easement Program – Agricultural Land Easements
ACEP-WRE	Agricultural Conservation Easement Program – Wetland Reserve Easements
Ag CWIP	Agricultural Clean Water Initiative Grant Program
AIS	Aquatic Invasive Species
AMA	Agricultural Management Assistance Program
AMP	Acceptable Management Practice
ANR	Agency of Natural Resources
ANS	Aquatic Nuisance Species
ANR	Agency of Natural Resources
AOP	Aquatic Organism Passage
AR	American Rivers
ARRA	American Reinvestment & Recovery Act
ATBC	America the Beautiful Challenge Grant
B(1)	Class B(1) Water Management
B(2)	Class B(2) Water Management
BASS	Biomonitoring and Aquatic Studies Section, DEC Watershed Management Div.
BCCD	Bennington County Conservation District
BCRC	Bennington County Regional Commission
BMP	Best Management Practice
BR	Better Roads Program
BWQC	Basin Water Quality Council
CAP	Conservation Activity Plan
CCP	Corridor Conservation Plan
CISMA	Cooperative Invasive Species Management Area
CNMP	Comprehensive Nutrient Management Plans
CRC	Connecticut River Conservancy
CREP	Conservation Reserve Enhancement Program
CRJC	Connecticut River Joint Commissions
CRP	Conservation Reserve Program
CSP	Conservation Security Program
CWA	Federal Clean Water Act
CWIP	Clean Water Initiative Program
CWSP	Clean Water Service Provider
CWSRF	Clean Water State Revolving Fund
DEC	Department of Environmental Conservation
DIBG	Design-Implementation Block Grant
DPW	Department of Public Works
DWSRF	Drinking Water State Revolving Fund
EBTJV	Eastern Brook Trout Joint Venture
EQIP	Environmental Quality Incentive Program

EDDIBG	Enhancement Development, Design, and Implementation Block Grant
ERAF	Emergency Relief and Assistance Fund
ERP	Ecosystem Restoration Program
EU	Existing Use
EWP	Emergency Watershed Protection Program
FAP	Farm Agronomic Practices
FEH	Fluvial Erosion Hazard
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Flood Insurance Rate Maps
FOVLAP	Federation of Vermont Lakes and Ponds
FRP	Flow Restoration Plan
FSA	Farm Service Agency (USDA)
FWD	Fish and Wildlife Department
GIS	Geographic Information System
GMNF	Green Mountain National Forest
GRH	Great River Hydro
GRWA	Green River Watershed Alliance
HUC	Hydrologic Unit Code
ICAR	Interagency Committee on Administrative Rules
IDDE	Illicit Discharge Detection and Elimination
IUP	Intended Use Plan
LCAR	Legislative Committee on Administrative Rules
LFO	Large Farm Operation
LiDAR	Light Detection and Ranging
LID	Low Impact Development
LIP	Landowner Incentive Program
LIS	Long Island Sound
LISFF	Long Island Sound Futures Fund
LPMPP	Lakes and Ponds Management and Protection Program
LPP	LaRosa Partnership Program
LTP	Land Treatment Planner
MAP	Monitoring and Assessment Program
MARC	Mount Ascutney Regional Commission
MCM	Minimum Control Measures
MFO	Medium Farm Operation
MPG	Municipal Planning Grant
MRGP	Municipal Roads General Permit
MS4	Municipal Separate Storm Sewer System
NASS	National Agricultural Statistics Service
NFIP	National Flood Insurance Program
NGLA	Next Generation Lake Assessments
NMP	Nutrient Management Plan
NEAS	New England Agricultural Statistics
NEGEF	New England Grassroots Environmental Fund
NFWF	National Fish and Wildlife Foundation
NOAA	National Oceanic and Atmospheric Administration
NOFA	Northeast Organic Farming Association of Vermont

NPDES	National Pollution Discharge Elimination System
NPS	Non-point source pollution
NRCC	Natural Resource Conservation Council
NRCD	Natural Resource Conservation District
NRCS	Natural Resources Conservation Service
ONRCD	Ottauquechee Natural Resources Conservation District
ORW	Outstanding Resource Water
PCP	Phosphorus Control Plan
PDM	Pre-Disaster Mitigation
PFAS	Per- and Polyfluoroalkyl Substances
PFW	Partners for Fish and Wildlife
R,T&E	Rare, Threatened and Endangered Species
RAP	Required Agricultural Practice
RCE	River Corridor Easement
RCP	River Corridor Plan
RCPP	Regional Conservation Partnership Program
REI	Road Erosion Inventory
RP	Rivers Program
RPC	Regional Planning Commission
SEP	Supplemental Environmental Program
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SHPO	State Historic Preservation Office
SPA	Source Protection Area
SVNMP	Southern Vermont Nutrient Management Program
SWG	State Wildlife Grant
SWMP	Stormwater Master Plan
SMR	Stormwater Mapping Report
SWA	Strategic Wood Addition
TFS / T4S	Trees for Streams
TBP	Tactical Basin Plan
TBPSG	Tactical Basin Planning Support Grant
TMDL	Total Maximum Daily Load
TPI	Transportation Planning Initiative
TNC	The Nature Conservancy
TS4	Transportation Separate Storm Sewer System Permit
TU	Trout Unlimited
USACE	United States Army Corp of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UVA	Use Value Appraisal program, or Current Use Program
UVM Ext.	University of Vermont Extension
VABP	Vermont Agricultural Buffer Program
VACD	Vermont Association of Conservation Districts
VAPDA	Vermont Association for Planning and Development Agencies

VDFPR	Vermont Department of Forests, Parks and Recreation
VDHP	Vermont Department of Historic Preservation
VDOH	Vermont Department of Health
VEM	Vermont Emergency Management
VFB	Vermont Farm Bureau
VFWD	Vermon Fish and Wildlife Department
VGS	Vermont Geological Survey
VINS	Vermont Institute of Natural Science
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VNNHP	Vermont Nongame and Natural Heritage Program
VNRC	Vermont Natural Resources Council
VRBS	Vermont Road and Bridge Standards
VRC	Vermont River Conservancy
VSA	Vermont Statutes Annotated
VTrans	Vermont Agency of Transportation
VYCC	Vermont Youth Conservation Corp
WCNRCD	Windham County Natural Resources Conservation District
WG	Watershed Grant
WID	Water Investment Division, VT DEC
WISPr	Water Infrastructure Sponsorship Program
WMA	Wildlife Management Area
WQRP	Water Quality Remediation Plan
WQS	Water Quality Standards
WRC	Windham Regional Commission
WSMD	Watershed Management Div., VT DEC
WUV	Watersheds United Vermont
WWTF	Wastewater Treatment Facility

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Appendices

Appendix A. 2020 Report Card

Appendix B. Dams

Appendix C. Fisheries Assessment

Appendix D. Municipal Planning and Water Resources Matrix

Appendix E. Regional Plan Conformance

Appendix F. Responsiveness Summary of Public Comments

Appendix A. 2020 Report Card

	Strategies	Priority Areas	Town	Project Status	Partner	Update Comments
	AGRICULTURAL LANDS					
1	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			On-going	WCNRCD	Windham NRCD has hired additional staff to scale up outreach and technical assistance to producers in the basin. The district has also secured additional funding through the State's Agricultural Clean Water Incentives Program for staff training, program tools and staff time for program delivery.
2	Implement livestock exclusion practices	Newton Brook	Vernon	Carry-forward	WCNRCD	Outreach efforts to producers have not yet produced response or interest. District plans to continue efforts.
3	Increase farm buffer establishment along surface waterways and upland wetlands	North Branch Deerfield, Newton Brook, Whetstone Brook, Connecticut River	Wilmington, Vernon, Brattleboro	On-going	WCNRCD	Windham NRCD continues outreach to producers regarding TFS, CREP and opportunities for wetland restoration and conservation. The current LISFF Micro wetland Planning and Prioritization Project includes mapping and outreach to potential wetland restoration/conservation sites along Newton Brook.

4	Support small farm NMP development and implementation through courses and trainings for farmers, manure applicators and technical service providers			Carry-forward	WCNRCD	This remains a need. The existing programs to support NMP programs are focused on CSFO and larger, and only apply to livestock operations. Basin has many SFOs that could benefit from NMP work.
5	Establish long-term funding for agricultural buffer projects			Completed	WCNRCD	CREP is an option for producers but remains underutilized.
6	Increase the use of cover crops			On-going	WCNRCD	Windham NRCD continues outreach to producers and is a participant in both the DEC RCPP and AFT's RCPP focused on regenerative soil health practices
7	Develop and host educational workshops directed to horse, beef, and small animal operations			On-going	WCNRCD	Windham NRCD Continues to plan and implement workshops for ag producers on a variety of water quality and soil health topics.
8	Identify areas where water quality will most benefit from farm inspections and assistance	North Branch Deerfield, Newton Brook, Whetstone Brook		On-going	WCNRCD	Windham NRCD staff respond to concerns from the public and partners and conduct targeted outreach where appropriate.
9	Increase regional equity of State and Federal agricultural funding distribution			On-going	WCNRCD	Local working group process and local fund pool establishment have increased federal funding in the basin. Windham NRCD has secured additional AAFM funding for TA and Ed and Outreach for 2023-2027.
10	Acquire RCE on lands located in floodplain and alluvial fans			Carry-forward	WCNRCD	Windham NRCD had funding to develop easements for the past three years. This funding sources has ended, however.

	DEVELOPED LANDS / STORMWATER					
11	Conduct stormwater master planning to identify and prioritize actions	North Branch Deerfield, Cold Brook, Whetstone Brook	Brattleboro, Dover, Mount Snow, Hermitage	In Progress / On-going	WRC	If a new round of funding comes out, WRC will do outreach to further communities
12	Implement priority project identified in these plans		Brattleboro, Dover, Mount Snow, Hermitage	On-going	WRC	
13	Identify and mitigate sources of bacteria causing impairment	North Branch Deerfield, Whetstone Brook	Dover, Wilmington, Brattleboro	In Progress	WCNRCD	Potential buyout of disc golf course in Wilmington would establish forested riparian floodplain at confluence of North Branch Deerfield and Ellis Brook.
14	Address stormwater runoff entering Kettle Pond		Brattleboro	Carry Forward		Brattleboro Conservation Commission is working on this project.
15	Address stormwater runoff entering Whetstone Brook	Whetstone Brook	Brattleboro	In Progress		
16	Address stormwater runoff discharges from ski area development impairing water quality	North Branch Deerfield, Cold Brook	Dover, Wilmington	Carry Forward		
17	Implement required actions to mitigate impairments addressed in the Mt Snow WQRPs	North Branch Deerfield, Baselodge tributary	Mt Snow Resort	Carry Forward		
18	Conduct outreach to the real estate industry on the economic benefits of clean water and on applicable wetland and stormwater rules.			Carry Forward		
19	Conduct outreach to landowners scheduled to fall under the 3-acre stormwater rule			Carry Forward		
	DEVELOPED LANDS / ROADS					

20	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)			On-going	WRC	
21	Complete REIs in remaining towns		Dover, Guilford, Marlboro, Whitingham Woodford	Completed & On-going	WRC	REIs have been completed for every town in the region except for Somerset (which, not being a municipality, is not part of the Municipal Roads General Permit). All were done by WRC with the exception of Brattleboro. All were done as part of the "first" MRGP permit cycle, and all will need to be re-done by 2027 as part of the second cycle, or MRGP 2.0.
22	Assist towns with support and training on data collection methods and uploading data into MRGP database			On-going	WRC	
23	Increase municipal participation in BR & GIA funding: assist in project prioritization and project proposal development			On-going	WRC	
24	Implement projects to address Class 4 road & legal trail erosion			On-going		
25	Conduct outreach on BMPs for private roads and driveways			Carry Forward	WCNRCD	The district hopes to hold some driveway erosion workshops in the future and could potentially plan some driveway and culvert projects in conjunction if interested landowners can be found.
26	Replace geomorphologically incompatible culverts and bridges			On-going	WCNRCD / WRC	Preliminary design funded for NR-16 in Whitingham. Project

						includes assessment of driveway bridge.
	WASTEWATER					
27	Reduce the nitrogen load from municipal wastewater discharges to address the LIS-TMDL			On-going	WCNRCD	District has hosted septic workshops in the past. These remain part of the district's basin planning workplan.
28	Conduct wastewater planning and feasibility studies for small communities without municipal systems			On-going		
	NATURAL RESOURCE RESTORATION: Rivers, Lakes, Wetlands & Forests					
29	Increase education and outreach on natural resource restoration and protection needs and opportunities			On-going	WCNRCD	The districts conduct outreach to landowners and municipalities about riparian best management practices, including buffers and easements.
	RIVERS: Work toward stream equilibrium and flood resilience					
30	Increase the number of river and floodplain restoration projects to re-establish connections to floodplains	Reaches with High to Extreme Sensitivity ratings		In Progress / Under Discussion	WCNRCD / WRC	Whitingham WISPr program: WRC will apply to be lead. Several projects identified and being scoped by WCNRCD.
31	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		On-going	WCNRCD / WRC	Whitingham: River Corridor Easement (WPID 5615) NR 20. Project scoped but considered too small of a parcel by River Scientist Shannon Pytlick to be viable under a cost/benefit analysis. / Multiple berm removal/floodplain restoration projects taking place within the basin

32	Increase buffer plantings	Newton Brook, Whetstone Brook		On-going	WCNRCD	The district develops riparian buffer planting projects regularly.
33	Remove dams, esp. High Hazard dams			In Process & On-going	WCNRCD / WRC	WRC is working on the Snow Lake Dam Removal project. TU applied to the Deerfield Enhancement Fund to remove a private dam in Whitingham on the East Branch of the North River. The dam is located at 42.80670°N, -72.83511°W. Deerfield Enhancement awards have not been announced yet. Ames Hill Dam removal remains a goal, no immediate solution to funding.
34	Restore floodplain of Birge Street parcel	Whetstone Brook	Brattleboro	In Progress	WCNRCD	
	SHORELANDS: protect and restore					
35	Promote & Implement the Lake Wise Program to encourage lake-friendly shoreline property maintenance	All Lakes & ponds		On-going	WCNRCD	Windham NRCD provides outreach to lakeshore owners about the LakeWise Program.
36	Establish Lay Lake Monitoring on appropriate lakes and ponds	Sadawga, Grout, Howe, Lily		Under Discussion		
37	Work to control riparian and aquatic invasive plants	All Lakes & ponds		On-going	WCNRCD	The district manages public access greeter programs at Somerset, Harriman, Raponda and South Pond. The district is also engaged in a project to map invasives within the Whetstone Watershed, and is also coordinating an early detection, rapid-response project for Japanese Stilt-grass in the basin.

38	Work to protect Lily Pond			In Progress	WCNRCD	The district has provided assistance to the Vernon Conservation Commission as they seek protections for Lily Pond.
	WETLANDS: protect and restore					
39	Restore degraded wetlands for habitat and water quality improvement		Vernon	Carry Forward		
40	Assess areas of prior converted wetland and hydric soils for restoration			In Progress	WCNRCD	The LISFF Microwetland Planning and Prioritization Project has included mapping and outreach for potential wetland restoration along Newton Brook.
41	Implement wetland restoration as sites and opportunities are identified			Carry Forward	WCNRCD	
42	Assess wetlands for potential reclassification	see Table 6	Towns experiencing strong development pressure	On-going		
43	Map unmapped wetlands		Wilmington, Dover and Vernon	On-going		
	FISHERY: protect and restore					
44	Implement strategic wood addition projects on:			On-going		
	• East Branch Deerfield below Somerset Dam					
	• Deerfield mainstem above & including Rake Branch			On-going	WRC	CRVTU submitted for a watershed grant in February to continue their work of adding strategic wood to streams they identified in our 2019 assessment in the upper Deerfield watershed. WRC provided letter of support but

						does not know status of grant application.
	• Black Brook					
	• Deer Cabin, Deer Lick, Blind and Glastonbury					
	• Heather Brook and within Vose Brook					
45	Repair and maintain fish ladder at Green River Crib Dam			Completed	WCNRCD / WRC	After a full year of work by the Green River Village Preservation Trust under the guidance of multiple federal and state river experts the fish ladder at the Green River Dam is, once again, running smoothly. - Following a plan devised by Fish and Wildlife experts from Hadley MA, and approved by Scott Jensen, VT River Engineer for Southern Vermont, last summer, the GRVPT removed 1400 cubic yards of silt and a dirt promontory that were restricting the water flow to the fish ladder. These actions have restored the fish ladder to its original functional state.
	FOREST MANAGEMENT: abate soil erosion					
46	Protect headwater streams and sensitive upland surface waters			On-going		
47	Conduct outreach on AMPs and forest BMPs			On-going	WCNRCD	The district provides outreach and T.A. to woodland owners

						as part of connecting them with NRCS funding
48	Better manage forest road runoff through adherence to AMPs and site restoration			On-going		
49	Continue and expand the Portable Skidder Bridge Program			Under Discussion	WCNRCD	The district is working with FPR to secure a new skidder bridge for Windham County loggers to rent.
	CLIMATE CHANGE ADAPTATION: mitigate potential impacts of climate change on species survival					
50	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		On-going		
51	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		On-going		
52	Work to maintain connectivity with populations to the south in Massachusetts	Connecticut River valley		On-going	WRC	GRWA applied for a Deerfield Enhancement Fund grant to do programming in the Green River Watershed in MA (and include some VT portions) as well as send the GRWA brochure to households.
	HAZARD MITIGATION & FLOOD RESILIENCY					
53	Increase outreach and training for municipalities on ERAF and river corridor protections			On-going		

54	Increase funding for technical assistance and incentives for municipalities to enhance flood resiliency			On-going		
55	Remove sewer lines from hazardous locations including streambeds	Whetstone Brook	Brattleboro	Carry Forward		
56	Buy-out properties that are highly vulnerable to flooding from willing sellers	Green River, East Branch North River, Whetstone Brook		On-going	WCNRCD / WRC	Whitingham: White House just past the municipal center. Owner declined going through the FEMA buyout process because he wouldn't get enough to buy a new house. Explored lowering floodplain behind the house, but it would require taking down part of the house spanning the river and owner is not interested in that. Disc Golf Course in Wilmington.
57	Assess dams for structural integrity: prioritize High and Significant Hazard dams for removal or repair			On-going	WCNRCD	
58	Create & implement Emergency Action Plans for all High and Significant Hazard dams			On-going		
59	Implement infrastructure project at Jacksonville Municipal Center	East Branch North River	Jacksonville village	In Progress	WRC	Funding Secured. Whitingham is hiring WRC to project manage.
	FLOW ALTERATION: Restore natural flows					
60	Work with dam operators to mitigate flow variations and work toward run-of-river management	Connecticut River, Deerfield River		On-going		
	SURFACE WATER PROTECTION: Restoration and Reclassification					

61	Monitor and assess waters with no or outdated data	see Table 17		On-going		
62	Work with partners to submit applications for reclassification	see Tables 3 & 4		On-going	WCNRCD / WRC	WRC working with the Green River to see if it can qualify for reclassification
63	Evaluate waters for ORW designation	see Table 5		On-going	WCNRCD / WRC	WRC recently put out a call to Towns for towns to consider reclassification. This summer WRC will target a few high priority rivers/wetlands to follow up on. District has worked with the LRA on reclass of Lake Raponda. LRA has chosen to put this on hold for now while they focus on their wakeboat petition.
64	Evaluate waters for Class 1 Wetland designation	see Table 6		On-going	WCNRCD / WRC	WRC recently put out a call to Towns for towns to consider reclassification. This summer WRC will target a few high priority rivers/wetlands to follow up on.

Appendix B. Dams

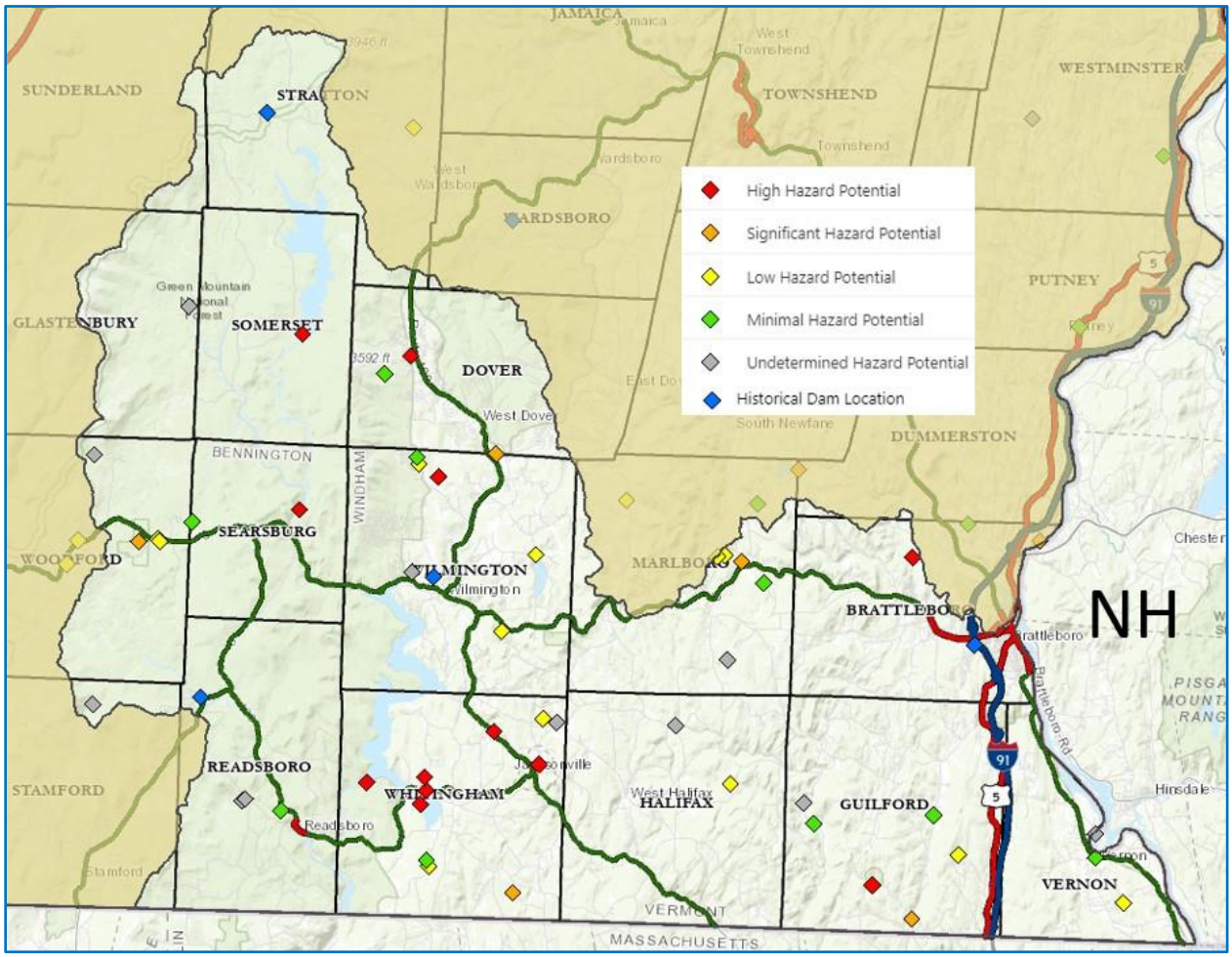

Figure B.1. Location of Dams

Table B.1. List of Dams

DAM NAME	WATERBODY	TOWN	DAM STATUS	HAZARD CLASS
Chestnut Hill Reservoir	Whetstone Brook	Brattleboro	In Service	High
Harriman	Deerfield River	Whitingham	In Service	High
Jacksonville Pond	East Branch North River-TR	Whitingham	In Service	High
Lake Clara	Lake Sadawga-TR	Whitingham	In Service	High
Lake Sadawga	Harriman Reservoir-TR	Whitingham	In Service	High
Lake Sadawga West Dike	Harriman Reservoir-TR	Whitingham	In Service	High
Pleasant Valley Reservoir	Whetstone Brook-TR	Brattleboro	In Service	High
Ryder Pond	East Branch North River	Whitingham	In Service	High
Searsburg	Deerfield River	Searsburg	In Service	High
Snow Lake	North Branch Deerfield River	Dover	In Service	High
Somerset	East Branch Deerfield River	Somerset	In Service	High
Sweet Pond	Keets Brook	Guilford	In Service	High
West Lake	Cold Brook-TR	Wilmington	In Service	High
Adams Reservoir	Red Mill Pond Brook	Woodford	In Service	Significant
Mill Pond	Whetstone Brook	Marlboro	In Service	Significant
North Branch Fire District No. 1	Ellis Brook-TR-OS	Dover	In Service	Significant
Shippee Pond	Hager Brook	Whitingham	In Service	Significant
Weatherhead Hollow Pond	Shattuck Brook	Guilford	In Service	Significant
Deer Park Pond	Green River-TR	Halifax	In Service	Low
Franklin Site No. 1	Falls River-TR	Guilford	In Service	Low
Hidden Lake	Marlboro Branch-TR	Marlboro	In Service	Low
Hidden Lake Dike	Whetstone Brook	Marlboro	In Service	Low
Lake Raponda	Bill Brook	Wilmington	In Service	Low
Laurel Lake	East Branch North River-TR	Whitingham	In Service	Low
Mirror Lake	Cold Brook-TR	Wilmington	In Service	Low
North	No. 9 Brook-TR	Whitingham	In Service	Low
Red Mill Pond	Red Mill Pond Brook	Woodford	In Service	Low
Red Mill Pond Dike	Red Mill Pond Brook	Woodford	In Service	Low
Spruce Lake	Beaver Brook-TR	Wilmington	In Service	Low
Vernon Fish Hatchery Pond	Newton Brook	Vernon	In Service	Low
Billings Pond	Rake Branch	Searsburg	Breached	Minimal
Camp Neringa	Whetstone Brook-TR	Marlboro	In Service	Minimal
Carinthia Snow Pond	North Branch Deerfield River	Dover	In Service	Minimal
Guilford-8	Broad Brook	Guilford	In Service	Minimal
Mill Pond	Connecticut River - TR	Vernon	In Service	Minimal

DAM NAME	WATERBODY	TOWN	DAM STATUS	HAZARD CLASS
Mirror Lake Diversion Structure	Cold Brook	Wilmington	In Service	Minimal
Purjes	No. 9 Brook-TR	Whitingham	In Service	Minimal
Readsboro Reservoir	Howe Pond Brook	Readsboro	In Service	Minimal
Sibley	Green River	Guilford	In Service	Minimal
Harrisville Mill	Green River	Halifax	In Service	Unknw
Little Pond	Little Pond Brook	Woodford	In Service	Unknw
Stamford Pond	Reservoir Brook	Stamford	In Service	Unknw
Vernon	Connecticut River	Vernon	In Service	Unknw
South Pond	Pond Brook	Marlboro	Breached	---
Binney Brook	Binney Brook	Wilmington	Breached	---
Gates Pond	East Branch North River-TR	Whitingham	Breached	---
Howe Pond Lower	Howe Pond Brook	Readsboro	Breached	---
Howe Pond Upper	Howe Pond Brook	Readsboro	Breached	---
Guilford-7	Thorne Brook	Guilford	Deleted	---
Beaver Brook	Beaver Brook	Wilmington	Removed	---
East Branch	East Branch Deerfield River	Stratton	Removed	---
Heartwellville	West Branch Deerfield River	Readsboro	Removed	---
Holden And Martin	Whetstone Brook	Brattleboro	Removed	---
Ruhl	Cold Brook	Wilmington	Removed	---
Wilmington Reservoir	Deerfield River-OS	Wilmington	Removed	---

` Appendix C. Fisheries Assessment

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:

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).

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.

The reservoirs experience significant drawdowns in the winter which can impact littoral habitats and the ability of fish to access tributaries during the spawning season. Water level management is dictated by the FERC licenses.

- ***Lakes and Ponds***

The basin also includes several other popular lakes and ponds including Sherman Reservoir, Lake Raponda, Lake Sadawga, South Pond, and Weatherhead Hollow. 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. Other largemouth bass fisheries in the Basin include Lake Sadawga, and Weatherhead Hollow (Table 2). Of note is that American eel a Species of Greatest Conservation Need (SGCN) was observed in Weatherhead Hollow during electrofishing surveys conducted in 2019.

Lakes and ponds in the Basin are influenced by shoreline encroachments including residential development which limits woody vegetative riparian habitats. Lack of vegetated shorelines can impact water quality, temperatures, and reduce the amount of downed wood which provided valuable cover for fishes.

- ***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 is monitored annually for stream temperatures and trout populations (Figure 5). The West Branch Deerfield is monitored annually for stream temperatures and trout populations (Figures 6-8). This site indicates that stream temperatures and trout populations remain relatively stable and at good abundances (Figures 6-8; Table 3). Streams that have relatively high (~1000 fish/mile) trout abundances (based on data from 2000-2023) included Bond Brook, Cold Brook, Deerfield mainstem (i.e. Harriman bypass), Fall River, Haystack Brook, Lamb Brook, Oak Brook, and Scooter Brook, and West Branch Deerfield (Table 3). It should be noted that trout abundances are highly variable and can be influenced by several factors,

with stream temperatures being the most profound. Small headwater streams are impacted by habitat fragmentation due to dams and undersized culverts, and encroachments to riparian and flood plain habitats.

- ***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.

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). The North Branch Deerfield has very low numbers of trout even in the upper reaches numbers remain at moderate levels (Table 4). Warm stream temperatures likely limit the production of trout in this stream.

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.

Riparian habitats along the North Branch Deerfield and tributaries are influenced by road placement, residential and commercial development, and agriculture. Efforts to improve the functionality of riparian habitats along these waterbodies will reduce stream temperatures, provide bank stabilization, improve physical habitat structure, and mitigate the impacts of flood and drought.

Tributaries to the Connecticut River include the Broad Brook, Green River, and Whetstone. All three of these streams are sampled annually to monitor trout populations concurrently with stream temperatures (Figures 9-16). 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 Whetstone. Similar to other streams in the Basin, these tributaries are also influenced by road placement, and residential development which encroaches on floodplain and riparian habitats. Barriers such as dams and undersized culverts reduce aquatic connectivity.

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 two year brook trout along Somerset Road to provide a Trophy fishery, and with yearling rainbow trout along Rte 9. 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.

Threats:

Climate Change

There is a myriad of factors that climate change is influencing including increased temperatures, changes in precipitation rates, snowpack and soil moisture; changes in the number of freezing days; new diseases and invasive species; flooding, lack of flooding; movement of species and their habitats, and changes in predator-prey and plant-pollinator relationships.

- *Temperatures*

  For trout, the number one threat is increasing water temperatures. Trout are very sensitive to warm water temperatures and the observed increases in air temperatures will result in warmer stream temperatures. This will affect the available habitat that trout can occupy.

- *Floods*

  Flooding and high flow events are natural occurrences that trout and other aquatic riverine species have adapted to and will recover from. Flooding can cause short-term impacts to fish populations due to direct mortality from trauma, stranding, displacement, gill damage and secondary infections. However, floods can also improve habitat conditions by the creation

of new pools from scouring, new gravel bars from deposition, recruitment of instream wood which provides valuable cover and channel roughness, nutrient releases which increase productivity and food supply, and groundwater recharge which provides cold base flows. Instream habitat features such as downed wood, braided channels, and large boulders provide cover and velocity refuge for fish during high flow events. Unfortunately, climate change is resulting in an increase in the frequency, magnitude and duration of these events, coupled with increases in stream temperatures, will undoubtedly add stress to these populations.

Post- flood recovery responses can degrade aquatic habitat for decades. Evidence of channelization and berming that occurred after the 1927 flood are still evident today. More recently, Tropical storm Irene occurred in August of 2011 and resulted in the deposition of over six inches of rain in the central and south-eastern portion of Vermont. Similarly, in July of 2023, flooding devastated portions of Vermont including the Deerfield watershed. 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, post-flood recovery work often resulted in the widening, deepening and straightening of stream channels. In-stream wood was removed, stream banks were bermed and rip-rapped 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. While the July 2023 flood was less severe in the Deerfield watershed, and the response more controlled, many of the same techniques that degrade ecological function were applied (e.g., removal of wood and gravel bars, berming, rip-rapping, and channelization). How humans respond to the increases in the frequency, duration, and magnitude of flood events will largely influence the health of these systems moving forward.

- *Drought*
    - Drought and the lack of water can also stress fish populations. Trout need cold well-oxygenated water to survive. Climate change is increasing the duration, frequency, and magnitude of drought events which results in the reduction in the quality and distribution of habitats for certain species such as trout. Regulation of water withdrawals is necessary to ensure that climate related increases in drought events are mitigated for by conserving enough water for aquatic species such as trout during drought events.
-

Invasive Species

A variety of non-native fish species and harmful pathogens are present in Vermont or surrounding states. Invasive species, which generally exhibit a competitive edge under warmer conditions, could further spread due to climate change. Preventing future introductions of these exotic species and pathogens will allow healthy fisheries to continue.

Sedimentation

Excess sediment that enters waterbodies from poor land use practices can degrade water quality and interrupt physical and ecological processes. Encroachments to river channels and floodplain habitats due to rip-rapping, berming etc. can exacerbate bank erosion in adjacent reaches increasing sedimentation in streams. Nutrient and sediment loading into rivers increases siltation and algae production and can limit the capacity of the waterway to support macroinvertebrates, fish, freshwater mussels, and other aquatic organisms (WAP 2015). Suspended sediments can cause direct mortality to fish, respiratory impairment, gill abrasion and lead to vulnerability to disease. Deposited sediments can degrade spawning habitat by embedding substrates and can suffocate incubating embryos. Post-flood instream construction often results in discharges and when work occurs during the spawning period can reduce the viability of offspring.

Physical habitat alteration (channelization, removal of wood, removal of gravel bars, on-stream ponds)

It has been well-studied that the loss of aquatic habitat diversity and complexity is directly linked to decreased diversity and abundance of fish and macroinvertebrate populations (Lau et. al 2006). Trout require diverse, complex and messy-looking habitats to fulfill their life-history requirements. Channelization, removal of instream habitat features, loss of functioning riparian and floodplain habitats, and instream impoundments degrade riverine habitats and reduce habitat complexity. Instream impoundments disrupt the physical, chemical, and biological processes within and downstream of the waters that they impound. Instream impoundments increase water temperatures, decrease stream velocities, accumulate sediments, disrupt sediment and nutrient supply to downstream reaches, block fish passage, and favor species introductions. Private ornamental ponds are numerous throughout the Basin (and state) and efforts to educate landowners on the impacts that instream impoundments have on cold-water habitats should be prioritized.

Flow alteration

As described above, stream flows are altered in the Basin due to hydropower, water withdrawals for snowmaking and agriculture, and pond construction. Water withdrawals in small streams during drought conditions even at the diminimus level can dry up a stream. Flows are regulated via the DEC streamflow protection program and efforts to understand water withdrawals under climate change scenarios are underway.

Habitat Fragmentation- (culverts, dams)

Dams and undersized culverts block the movement of fish, other organisms and in some cases wildlife. 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.

Berming and channelization can also reduce the ability of a stream channel to access to floodplain habitats. Lateral connectivity is also important to maintain healthy functioning waterbodies.

In sum, trout production can be influenced by many factors including food availability, water chemistry, temperature and available habitat. Trout production appears to be influenced throughout the region due to water chemistry, stream temperatures, and in certain areas may be further impacted by flow alterations, lack of riparian and floodplain habitats, post-flood alterations, and onstream impoundments within the system. Tributary streams provide greater trout abundances and stocking supplements catchable sized trout to support a moderate recreational fishery. Efforts to improve river stewardship, aquatic passage, riparian habitats, flow regimes (during the FERC relicensing process), and floodplain access are management tools that could be applied to the Deerfield watershed, and tributaries to the Connecticut River.

Management Recommendations:

1. **Conduct Outreach and education to promote river and lake stewardship.**

- Private landowners can have a profound impact on the health of streams and lakes. Important stream habitat characteristics include connectivity, mid-channel and point gravel bars, instream woody features, robust riparian habitats, and access to floodplain habitats. These features can be impacted by human activities through clearing of riparian habitats, channelization, removal of instream gravel and woody features, berming, eliminating floodplain connectivity, armoring of stream banks, and construction of instream impoundments. Providing outreach and education to private landowners on the river and lake stewardship should be prioritized.

2. **Implement climate change adaptation strategies.**

As discussed above, climate change and associated changes in temperature and hydrology are increasing the magnitude, frequency and duration of flood and drought events. Climate change adaptation strategies include providing robust riparian corridors, access to floodplain habitats, longitudinal connectivity, and natural flow regimes. Improving post-flood recovery efforts will also help mitigate the impacts of climate change.

- *Protect and restore riparian habitats*: 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 habitats. Providing robust riparian habitats along streams and lakes will help mitigate the impacts of climate change.

- *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. Since climate change is altering stream flow and temperatures, allowing fish to seek the best habitat during periods of drought and flood will help mitigate the impacts of climate change.

- *Improve post-flood recovery efforts:* Large floods often damage road infrastructure, stream crossings and improved property that occur within or near a stream's floodplain. Post-flood recovery efforts are necessary to protect life and property but often result in techniques that depart from stream equilibrium, exacerbate bank erosion, and reduce habitat complexity. Berming, instream channelization, and removal of instream cover including boulders, wood, and gravel bars, inevitably impact aquatic biota. Applying techniques that protect life and property while maintaining stream equilibrium and habitat structure should be prioritized during these post-flood recovery efforts.

- *Promote the natural flow regime***:** Climate change is altering hydrology by increasing the duration, frequency and magnitude of flood and drought events. On-stream ponds, water withdrawals and hydroelectric operations all influence the natural flow regime and have the potential to exacerbate climate change stressors. Onstream ponds increase stream temperatures, alter riverine habitats and intensify flood events. Removal of on-stream impoundments would help mitigate climate change by establishing free flowing rivers with cooler temperatures. Water withdrawals for snow-making, agricultural or other human uses can impact the availability of aquatic habitats under climate change scenarios. 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. Efforts to improve the natural flow regime in the Basin would help mitigate the impacts of climate change.

- *Help stop the spread of exotic species and pathogens:* Climate change will likely favor a variety of non-native fish species and harmful pathogens. Preventing future introductions of these exotic species and pathogens will allow healthy fisheries to continue.

- *Improve water quality.* Maintaining clear, cold, and well-oxygenated water is an important habitat requirement for trout. Intense development on steep mountainsides can result in unstable conditions and mass failures during flood events, as evidenced by Okemo Mountain in July 2023. These large runoff events cause sediment discharges and as discussed above, poor land use practices can cause excessive sedimentation degrading the health of aquatic habitats. Treatment of stormwater runoff and providing forested landscapes will help maintain clear, cold and well-oxygenated water. The removal of on-stream impoundments and providing robust riparian corridors will also help improve water quality conditions in the Basin.

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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				
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	X		
Creek chub	*Semotilus atromaculatus*	X	X	X	X	X	X	X	
Fallfish	*Semotilus corporalis*	X	X	X			X		

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Common name	Scientific name	Deerfield River	Green River	North River	Fall River	Broad Brook	Crosby Brook	Whetstone \Brook	Newton Brook
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 catostomus*	X				X		X	
Mimic shiner	*Notropis volucellus*	X	X						
Pumpkinseed	*Lepomis gibbosus*	X		X	X			X	
Rainbow smelt	*Osmerus mordax*	X	X						
Rainbow trout*	*Oncorynchus mykiss*	X	X	X		X	X		
Rock bass	*Ambloplites rupestris*	X					X		

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Common name	Scientific name	Deerfield River	Green River	North River	Fall River	Broad Brook	Crosby Brook	Whetstone \Brook	Newton Brook
Slimy sculpin	*Cottus cognatus*	X	X	X	X	X	X	X	
Smallmouth bass	*Micropterus dolomieui*	X							
Tessellated darter	*Etheostoma olmstedi*			X			X		
White sucker	*Catostomus commersoni*	X	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 Reservoir	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 killifish	*Fundulus diaphinus*											X	
Blacknose dace	*Rhinichthys atratulus*											X	X
Bluegill	*Lepomis macrochirus*						X						X
Brook trout*	*Salvelinus fontinalis*		X	X	X	X			X			X	X
Brown bullhead	*Ameiurus nebulosus*	X	X	X	X	X	X	X	X	X	X	X	X
Brown trout	*Salmo trutta*								X		X	X	
Chain pickerel	*Esox niger*	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 Reservoir	Red Mill Pond	Searsburg Reservoir	Lake Raponda	Lake Sadawga	Harriman Reservoir	Howe Pond	Sherman Reservoir	South Pond	Weatherhead Hollow Pond	
Common shiner	*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					
Largemouth bass	*Micropterus salmoides*						X	X					X	
Longnose dace	*Rhinichthys cataractae*													

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 Reservoir	Red Mill Pond	Searsburg Reservoir	Lake Raponda	Lake Sadawga	Harriman Reservoir	Howe Pond	Sherman Reservoir	South Pond	Weatherhead Hollow Pond	
Longnose sucker	*Catostomus 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 smelt	*Osmerus mordax*								X		X	X		
Rainbow trout*	*Oncorynchus mykiss*		X				X		X		X	X		
Rock bass	*Ambloplites rupestris*	X	X				X	X	X		X			
Slimy sculpin	*Cottus cognatus*													

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 Reservoir	Red Mill Pond	Searsburg Reservoir	Lake Raponda	Lake Sadawga	Harriman Reservoir	Howe Pond	Sherman Reservoir	South Pond	Weatherhead Hollow Pond	
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	
Yellow perch	*Perca flavescens*	X	X			X	X	X	X	X	X	X	X	

Table 3. Total species and size classes (brook and brown trout) per mile from data collected 2000-2023.

				Number of Trout/Mile			
Stream	**Site**	**Latitude**	**Longitude**	**Mean**	**Max**	**Min**	**Number of survey events**
Mainstem Deerfield	HarrimanBypass1255	42.78085	-72.92709	10465	21892	3944	5
Mainstem Deerfield	HarrimanBypass1273	42.78369	-72.92881	7140	9982	2120	4
Mainstem Deerfield	HarrimanBypass1289	42.78975	-72.92513	4883	7659	929	4
West Branch Deerfield	WestBranchDeerfield1815	42.84606	-72.98991	3276	3276	3276	1
Scooter Brook	Scooter295	42.75475	-72.51793	2627	3826	1427	2
Lamb Brook	Lamb1750	42.81532	-72.97273	2520	2805	2234	2
Bond Brook	Bond1870	42.8832	-72.95616	1978	2010	1945	2
Mainstem Deerfield	HarrimanBypass1316	42.7901	-72.91959	1792	3174	915	4
Oak Brook	Oak0.1	42.92532	-72.88763	1754	1754	1754	1
Fall River	Fall454	42.73107	-72.57052	1698	1698	1698	1
Unnamed tributary	Unnamed2000	42.84744	-72.98901	1638	1835	1441	2
Cold Brook	Cold3.4	42.92286	-72.88507	1310	1478	1142	2
Haystack Brook	Haystack0.1	42.91695	-72.88335	1213	1516	660	3

West Branch Deerfield	WestBranchDeerfield1575	42.79434	-72.96606	1023	1916	513	5

Table 4. Total species and size classes (brook and brown trout) per mile from data collected 2000-2023.

				Number of Trout/Mile			
Stream	**Site**	**Latitude**	**Longitude**	**Mean**	**Max**	**Min**	**Number of survey events**
Broad Brook	Broad459	42.80123	-72.59892	824	3311	17	12
Broad Brook	Broad535	42.80909	-72.61041	502	502	502	1
Green River	Green1200	42.81143	-72.72057	397	397	397	1
Green River	Green757	42.78883	-72.66795	241	457	43	8
Green River	Green560	42.74174	-72.67294	44	44	44	1
Green River	Green833	42.79685	-72.6707	96	96	96	1
North Branch Deerfield	NorthBranchDeerfield1928	42.96886	-72.89243	598	598	598	1

North Branch Deerfield	NorthBranchDeerfield1600	42.92376	-72.84469	11	11	11	1
North Branch Deerfield	NorthBranchDeerfield1745	42.94755	-72.86834	20	20	20	1
North Branch Deerfield	NorthBranchDeerfield1837	42.95428	-72.88273	77	77	77	1
Whetstone Brook	Whetstone241	42.85102	-72.55866	171	171	171	1
Whetstone Brook	Whetstone328	42.84876	-72.57842	844	2999	184	11
Whetstone Brook	Whetstone500	42.86702	-72.61507	117	117	117	1
Whetstone Brook	Whetstone525	42.86606	-72.6212	109	109	109	1

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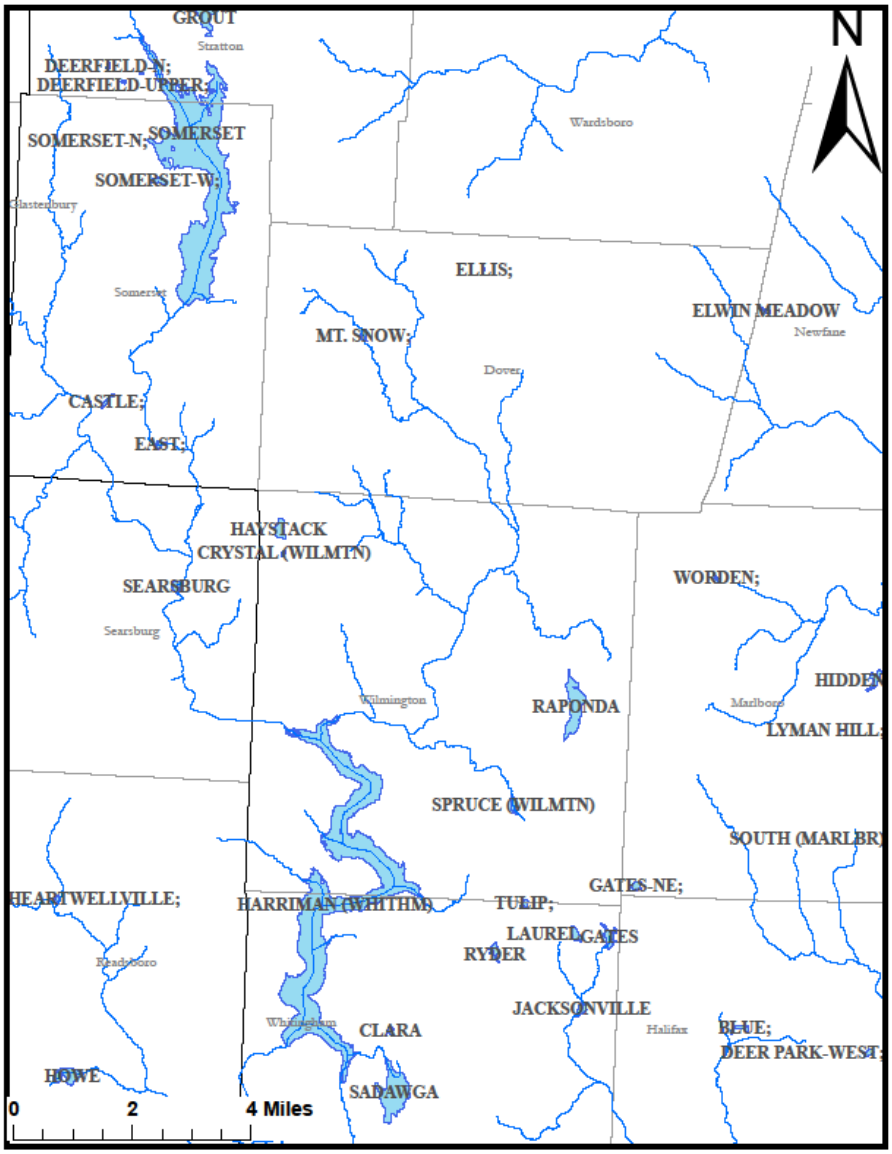

Figure 1. Somerset and Harriman Reservoirs located in Somerset, Wilmington and Whitingham VT

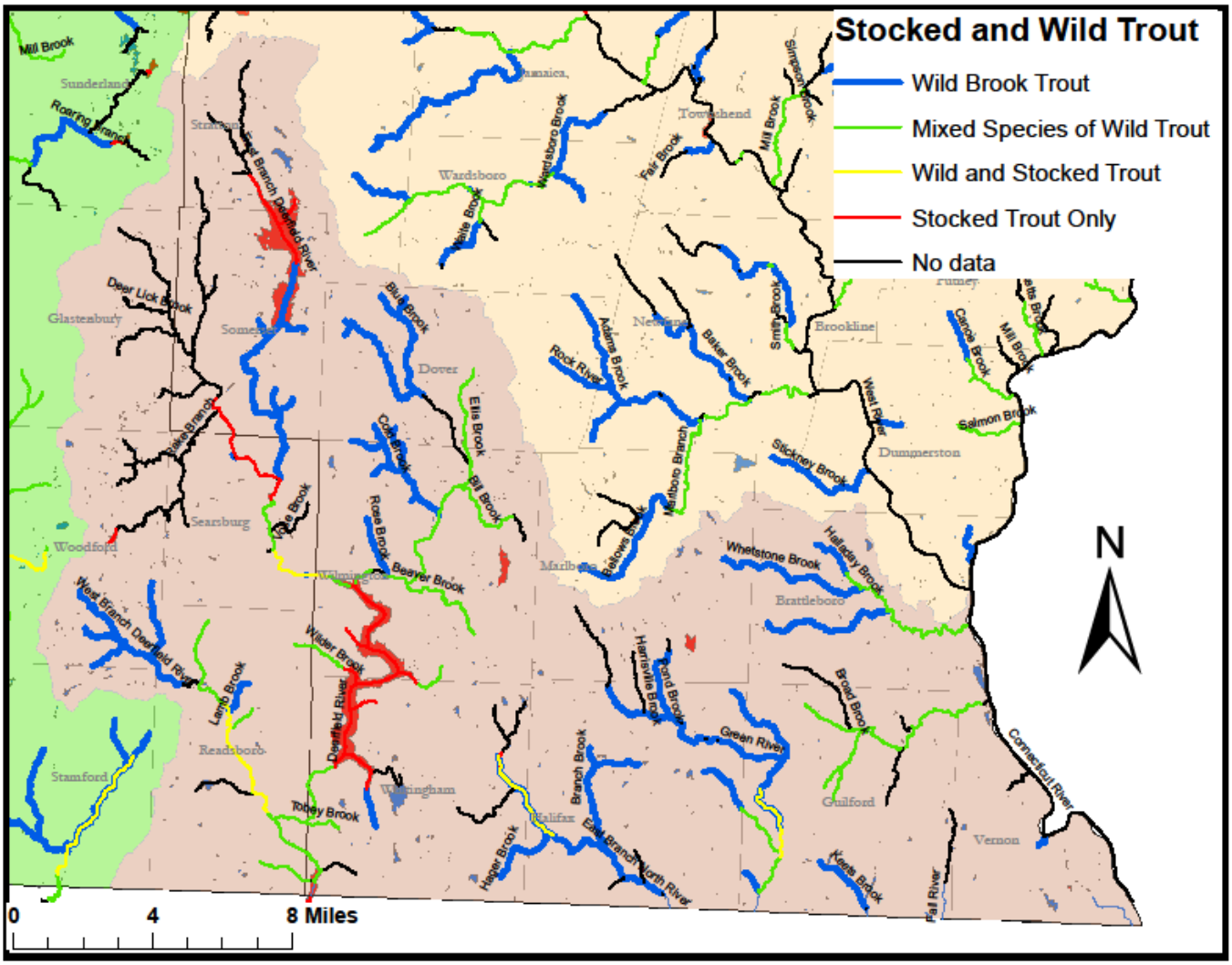

Figure 2. Streams providing habitat for trout within the Deerfield watershed.

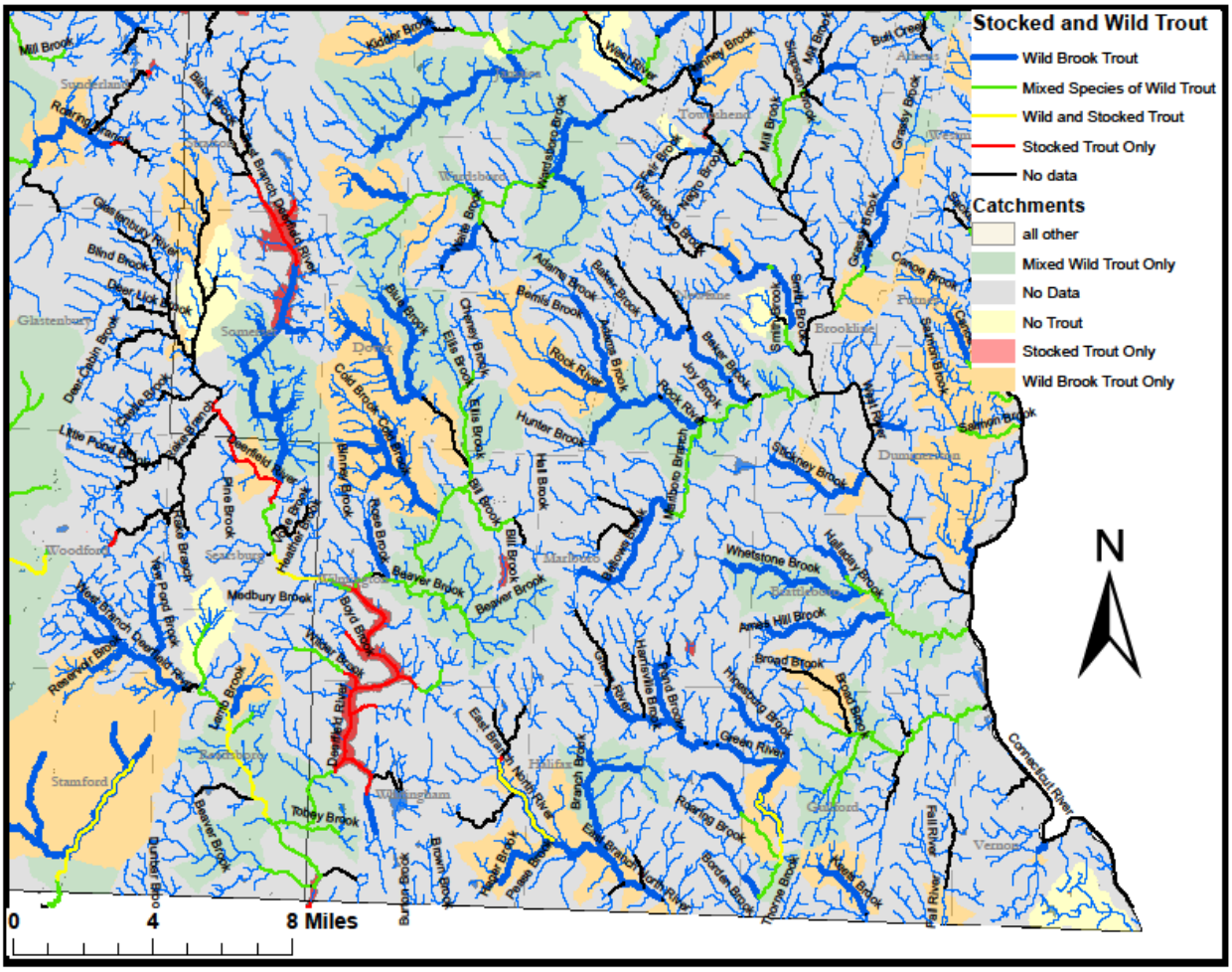

Figure 3. Catchments providing habitat for wild trout.

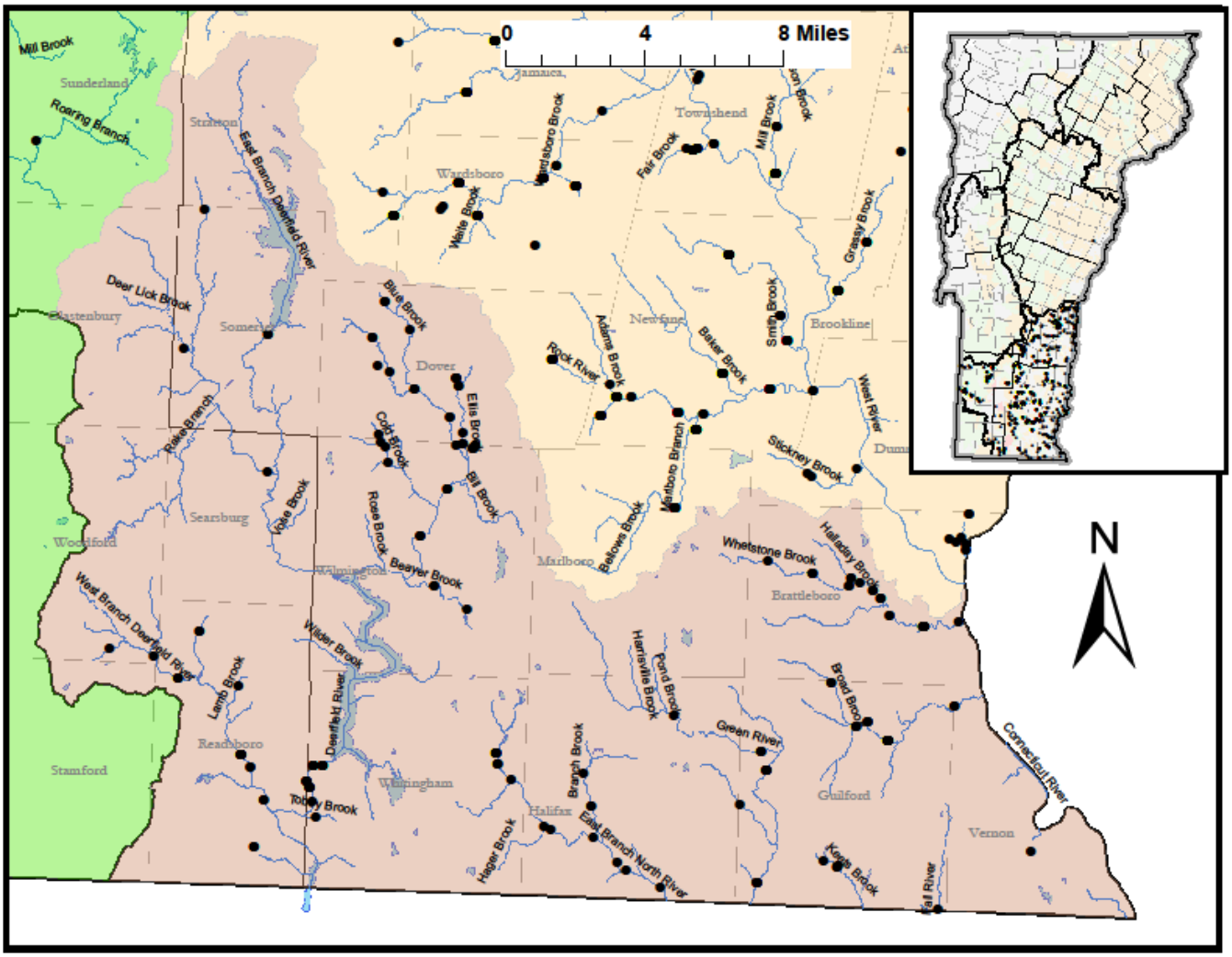

Figure 4. Trout population sample sites throughout the basin.

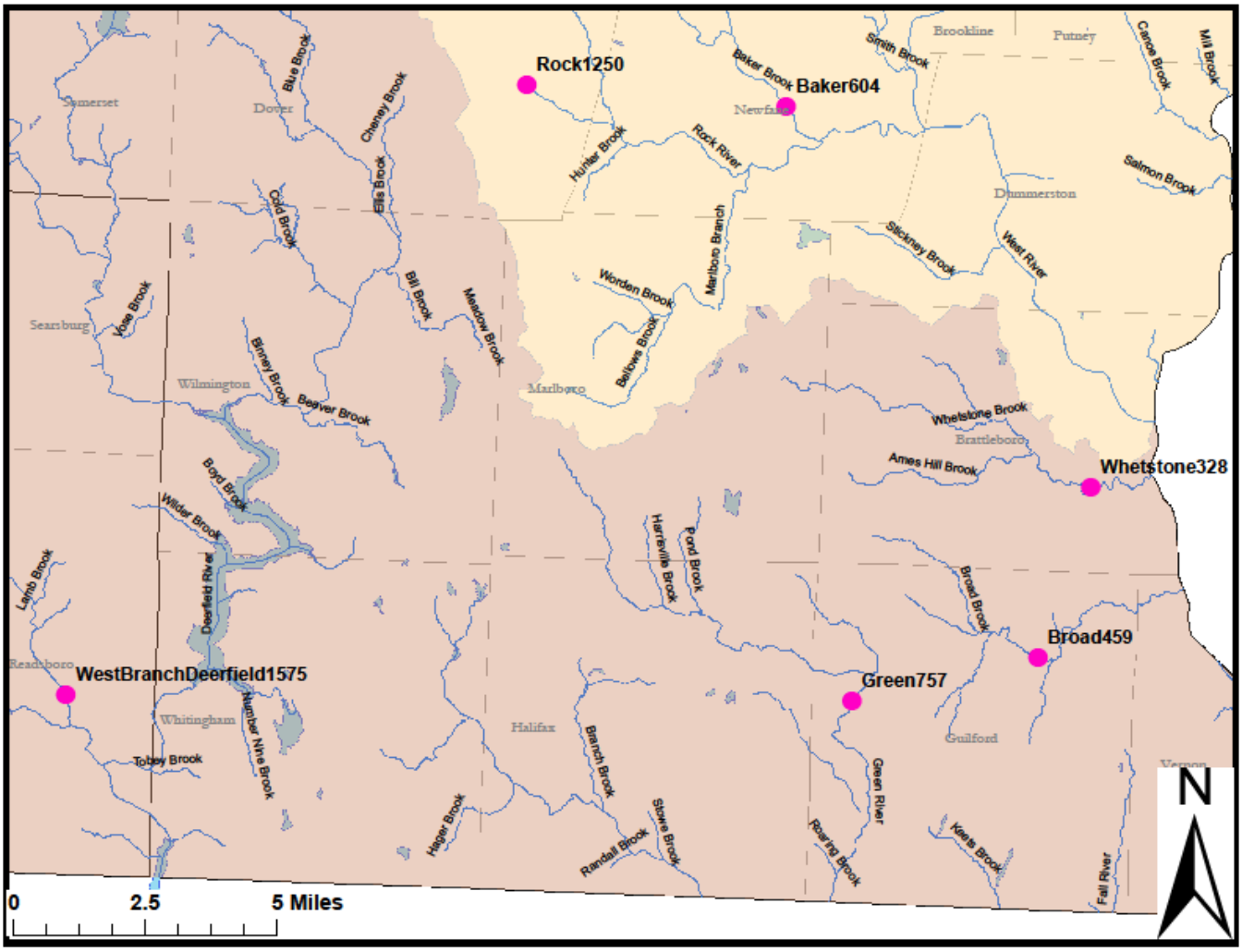

Figure 5. Sites monitored annually for stream temperatures and trout populations.

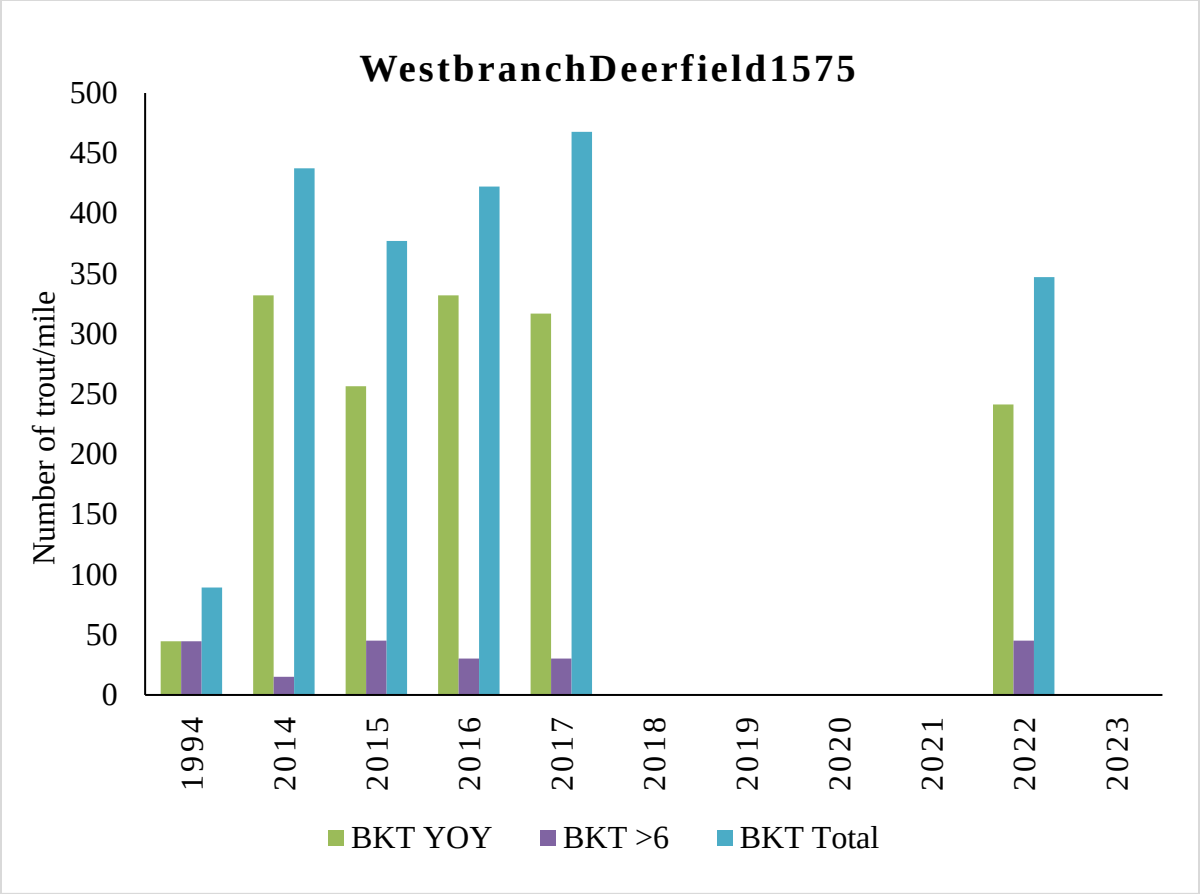

Figure 6. Number of brook trout per mile 1994-2023. No sampling 2018-2021, 2023.

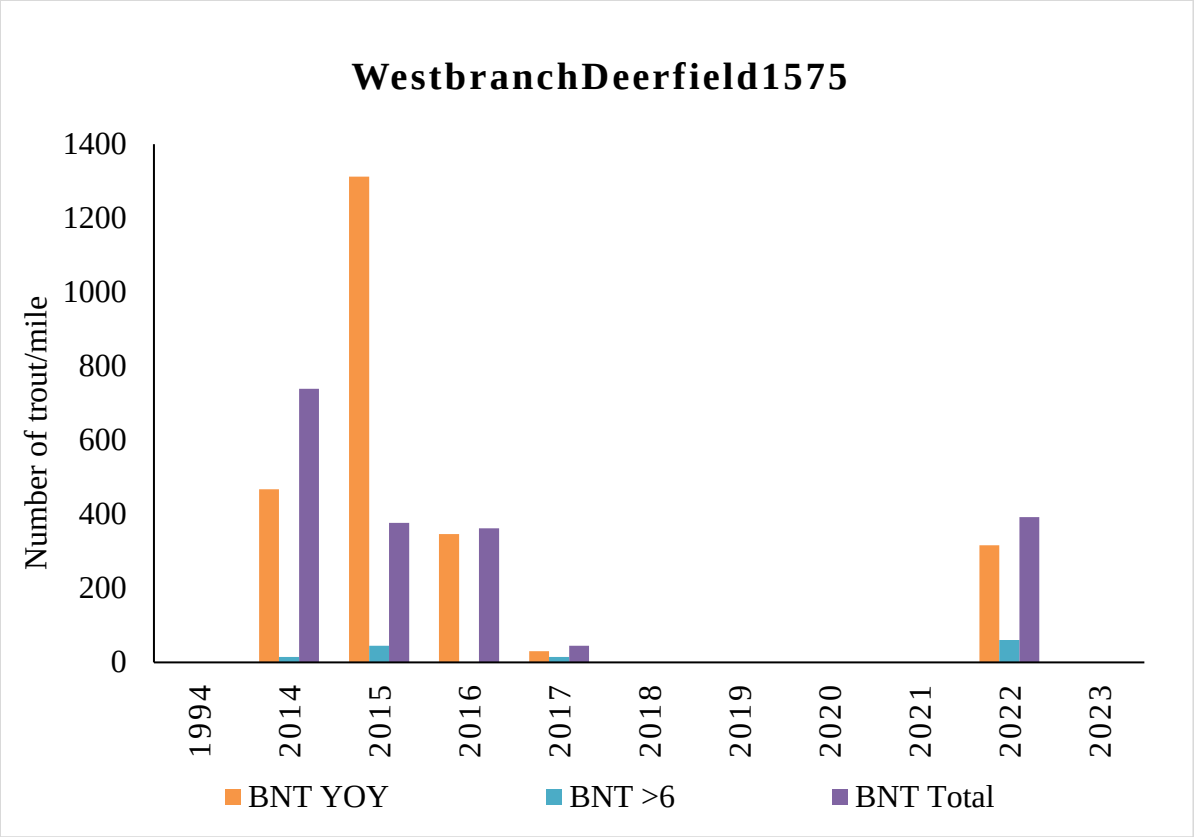

Figure 7. Number of brown trout per mile 1994-2023. No sampling 2018-2021, 2023.

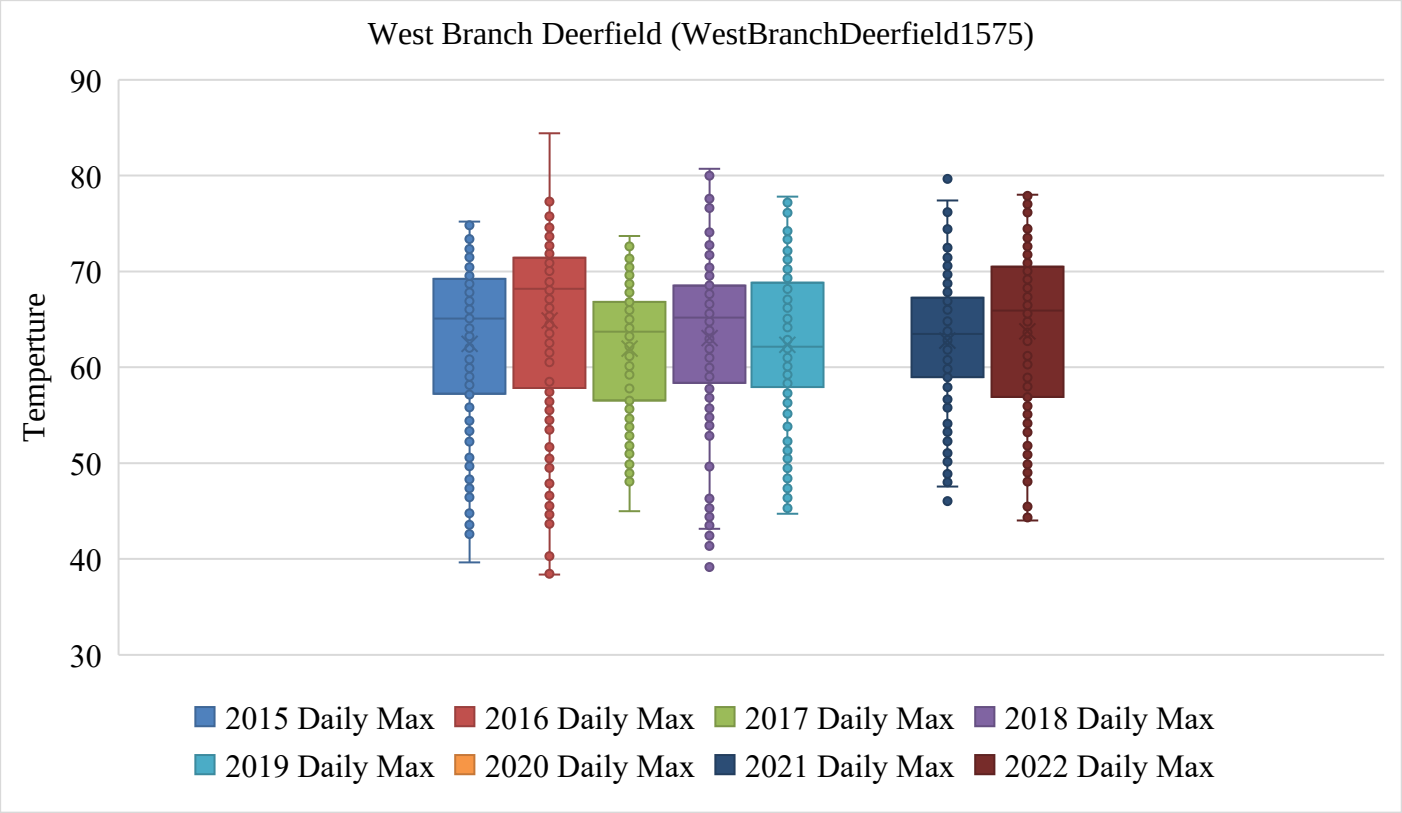

Figure 8. Daily Maximum stream temperatures recorded 2015-2022.

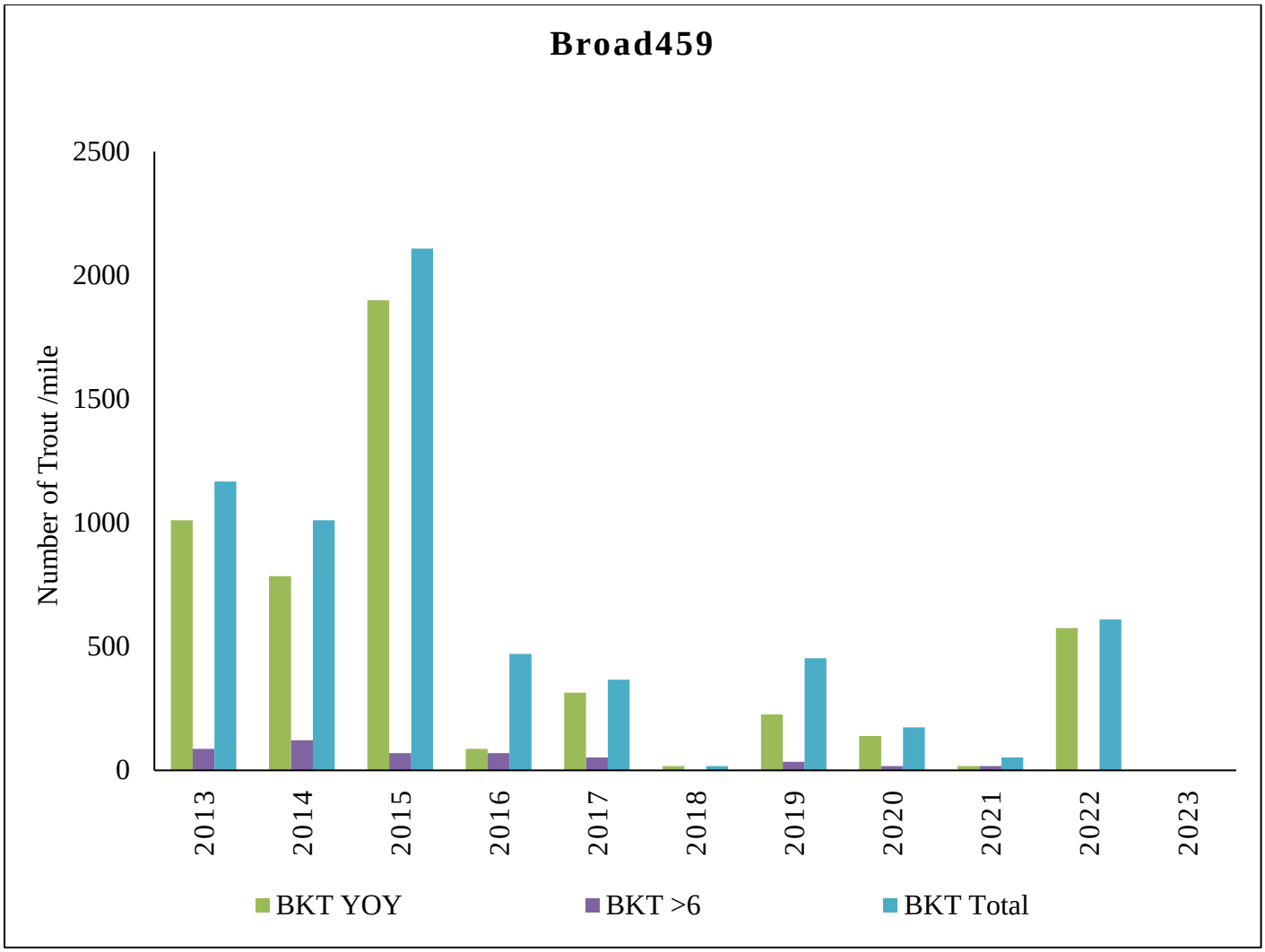

Figure 9. Number of brook trout per mile 2013-2023.

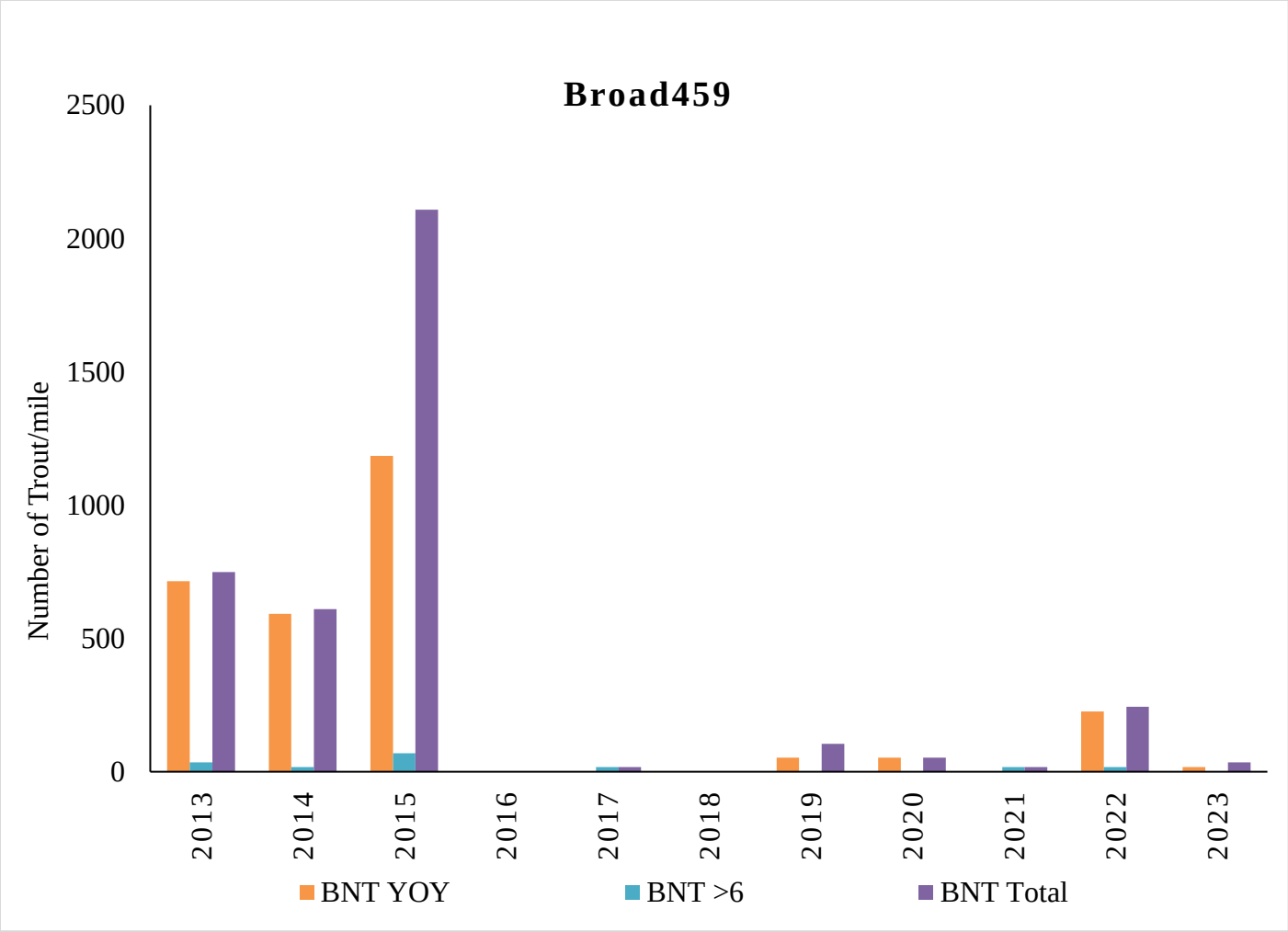

Figure 10. Number of brown trout per mile 2013-2023.

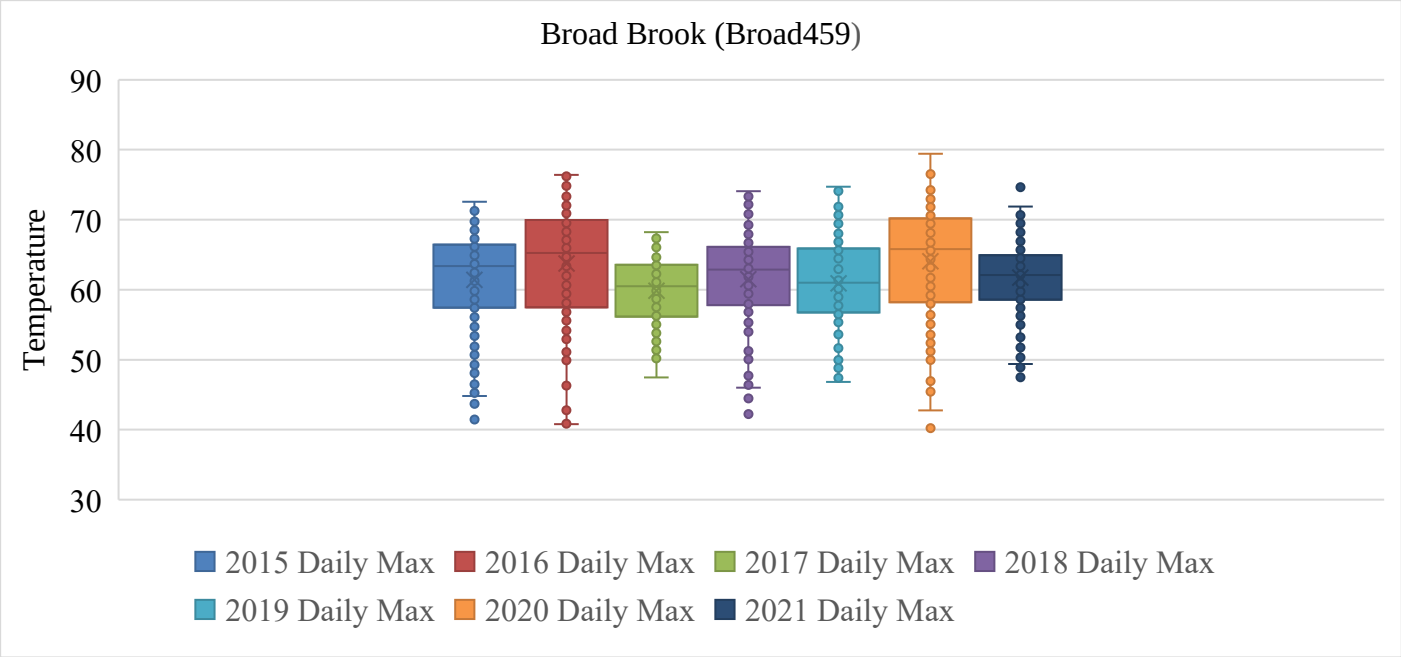

Figure 11. Daily Maximum stream temperatures 2015-2021.

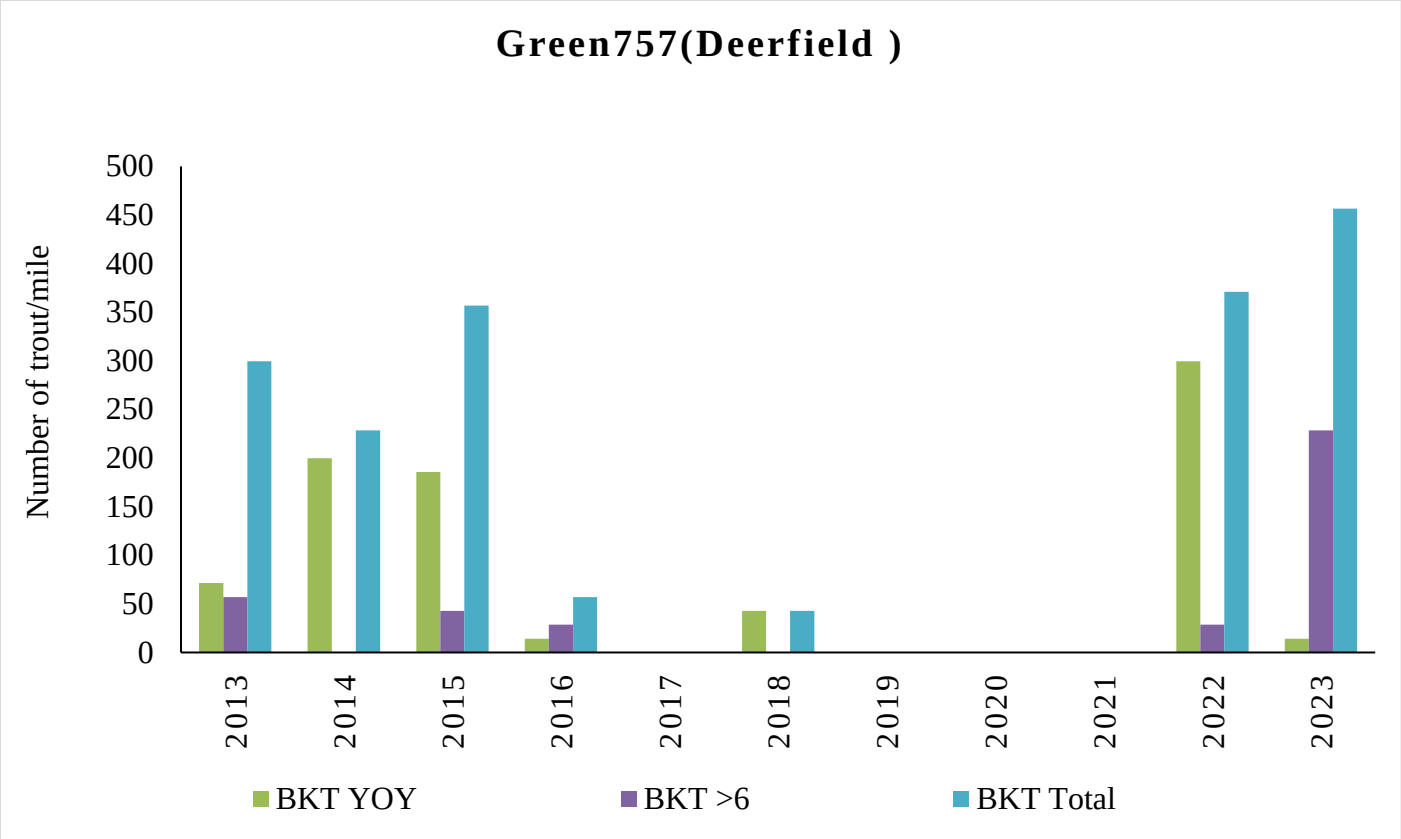

Figure 12. Number of brook trout per mile 2013-2023.

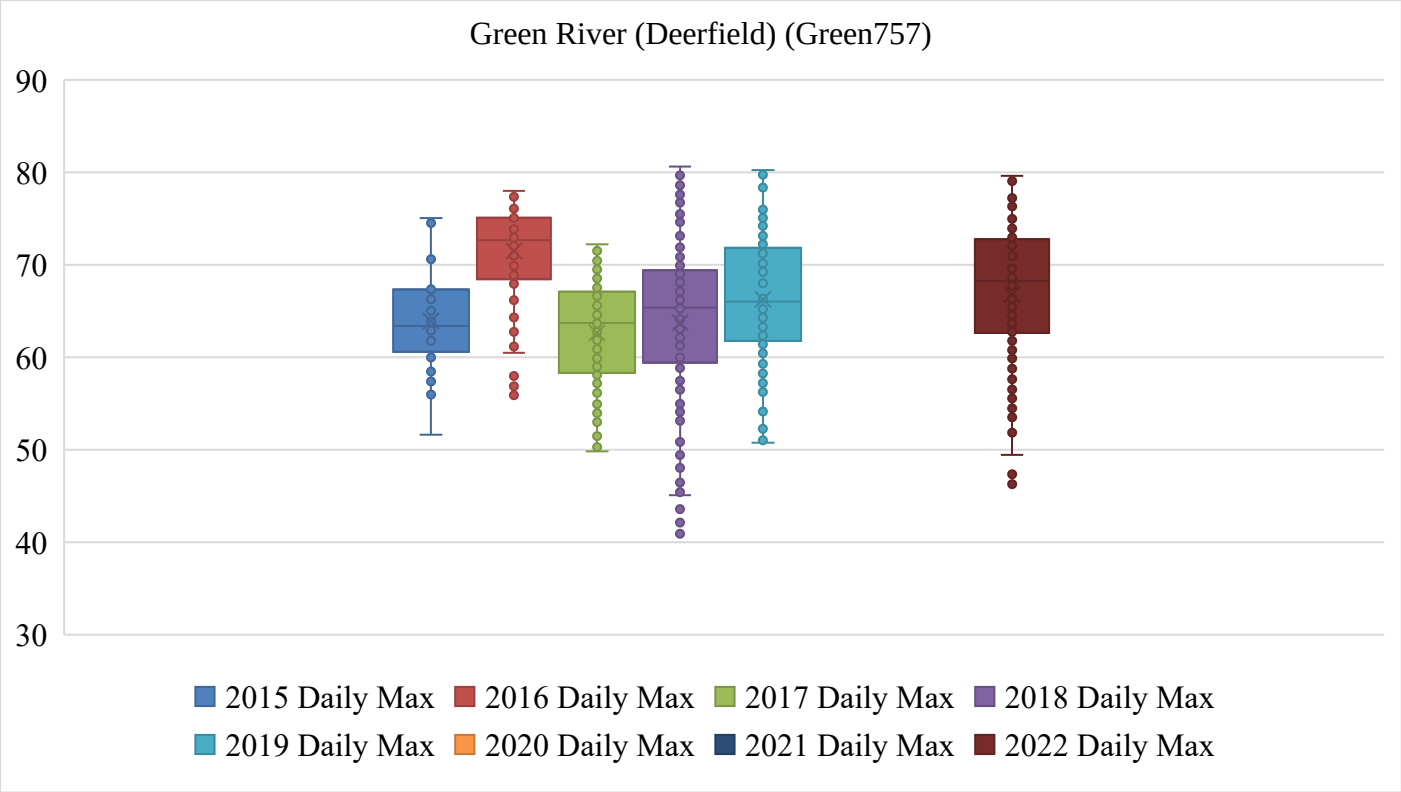

Figure 13. Daily Maximum stream temperatures 2015-2022.

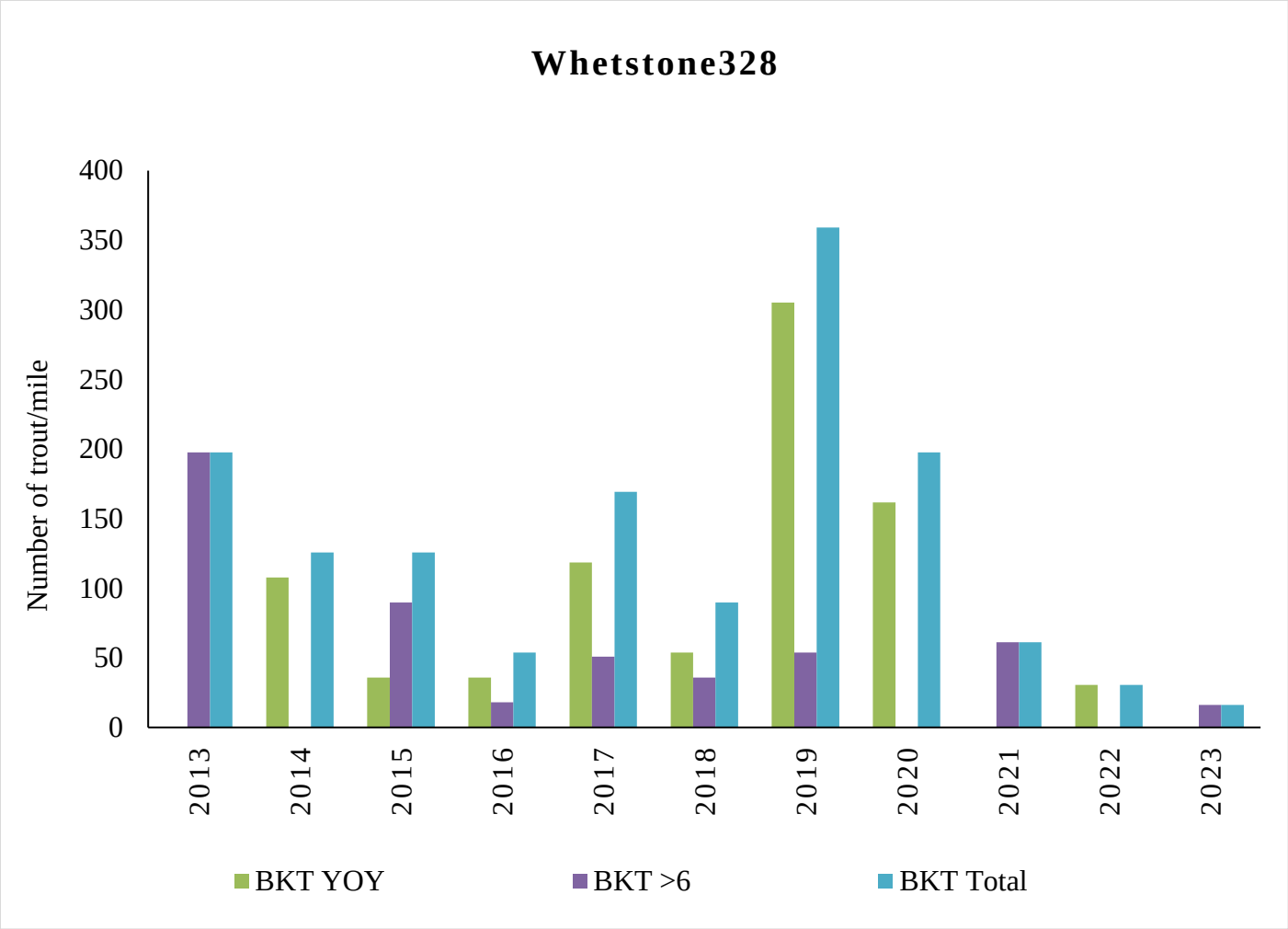

Figure 14. Number of brook trout per mile 2013-2023.

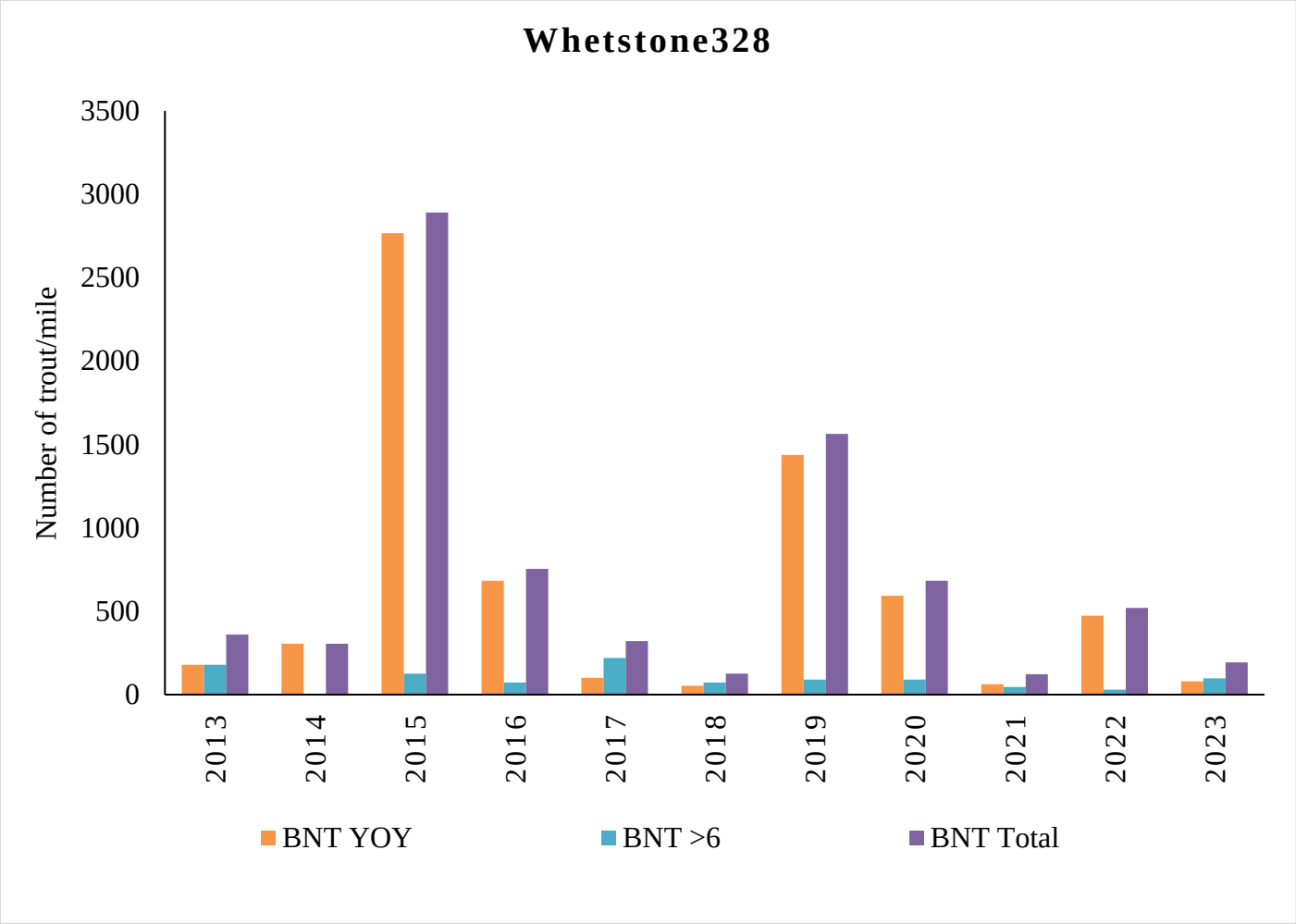

Figure 15. Number of brown trout per mile 2013-2023.

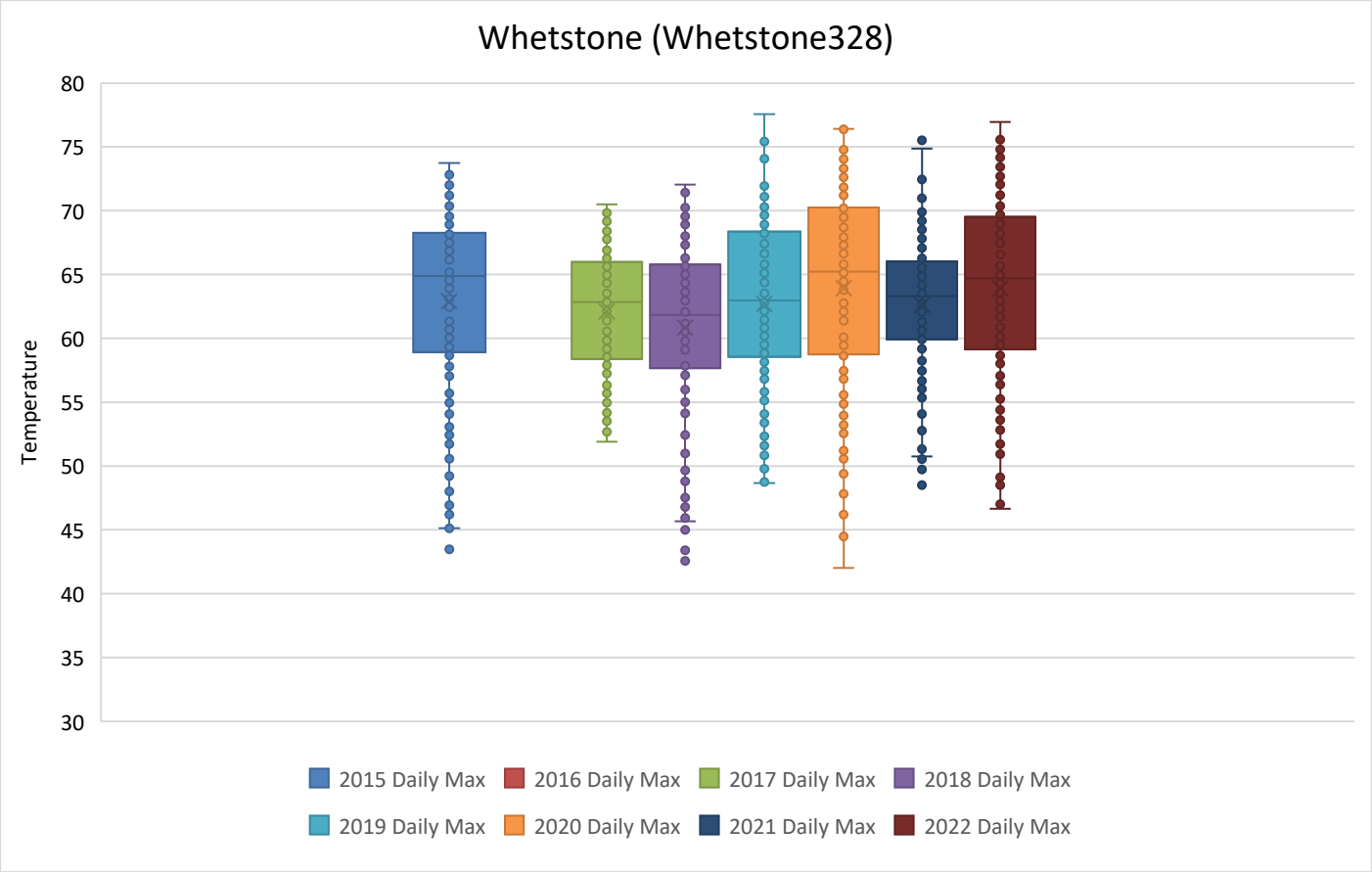

Figure 16. Daily Maximum stream temperatures 2015-2022

Appendix D. Municipal Planning and Water Resources Matrix

Table D.1.

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	Yes
Dover	Yes	Yes	Yes	Yes	No	12.5	Yes	Yes	Phase 1 complete	No
Dummerston	Yes	Yes	Yes	Yes	No	12.5	Yes	Yes	Yes	No
Glastenbury	No	Yes	No	Yes	No	7.5	No	No	No	No
Guilford	Yes	Yes	Yes	Yes	No	12.5	Yes	Yes	Yes	No
Halifax	Yes	Yes	No	Yes	Interim	7.5	Yes	No	No	No
Marlboro	Yes	Yes	No	Yes	Yes	7.5	No	Yes	Yes	No
Readsboro	Yes	Yes	Yes	No	Interim	7.5	No	Yes	Phase 1 complete	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	Partial
Sunderland	Yes	Yes	Yes	Expired	Yes	7.5	Yes	No	No	Yes
Vernon	Yes	Yes	Yes	Yes	Interim	17.5	Yes	Yes	Yes	No
Wardsboro	Yes	Yes	Yes	No	No	7.5	No	Yes	Yes	No
Whitingham	Yes	Yes	Yes	Yes	No	12.5	Yes	Yes	Phase 1 complete	No

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?*
Jacksonville Village			Yes	Yes	No	12.5				
Wilmington	Yes	Yes	Yes	Yes	No	12.5	Yes	Yes	Phase 1 complete	Underway
Woodford	Yes	No	No	Expired	No	7.5	Yes	No	No	No

Appendix E. Regional Plan Conformance

Appendix F. Responsiveness Summary of Public Comments