The official public review draft will be released on October 13th. See Comment info at: https://tinyurl.com/y3vwk65z

Lamoille River Watershed Basin 7 Tactical Basin Plan

September 2021 | 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:

_____ _____

X, Commissioner Date

Department of Environmental Conservation

_____ _____

X, Secretary Date

Agency of Natural Resources

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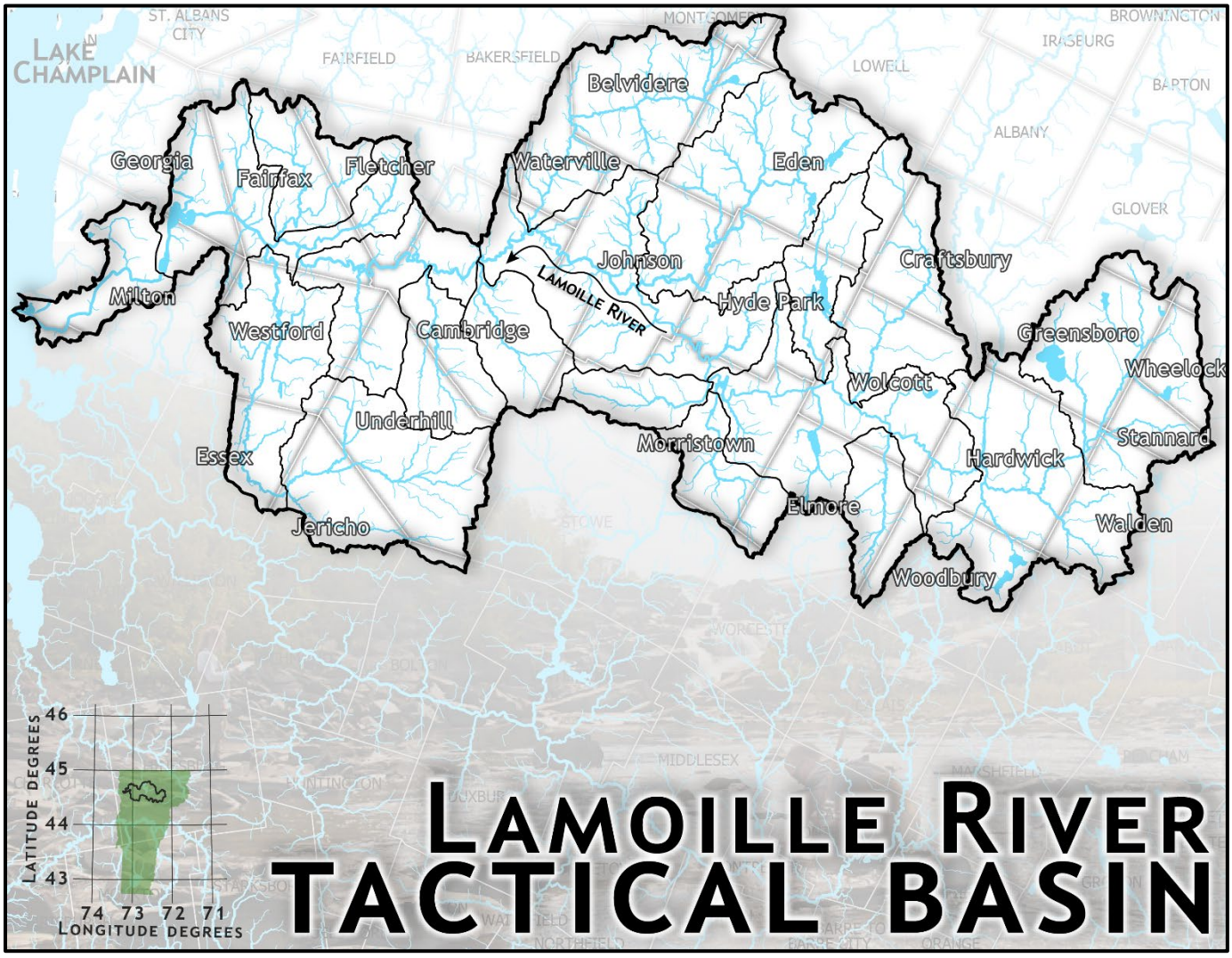
Cover Photo: Deshler Photography

Lamoille River Basin Towns

Bakersfield*	Essex	Johnson	Walden
Belvidere	Fairfax	Lowell*	Waterville
Bolton*	Fletcher	Milton	Westford
Cabot*	Georgia	Montgomery*	Wheelock
Cambridge	Glover*	Morristown	Wolcott
Colchester*	Greensboro	Sheffield*	Woodbury
Craftsbury	Hardwick	Stannard	Worcester*
Eden	Hyde Park	Stowe*	
Elmore	Jericho	Underhill	

**Only a very small area of the town is in the watershed and is covered in more detail in corresponding basin plans.*



Lamoille River Tactical Basin Plan Overview

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Executive Summary

Basin 7, the Lamoille River Watershed, covers approximately 706 square miles, and accounts for 7.5 percent of Vermont's land area. The mainstem of the Lamoille River flows 85 miles from Wheelock to Milton and drops approximately 1,200 feet in elevation. The basin occupies a major part of Lamoille County and lesser parts of Franklin, Chittenden, Orleans, Washington, and Caledonia counties. The entire watershed includes thirty-five towns and is roughly 76% forest, 13% agriculture, 6% surface waters and wetlands, and 5% developed area including roads. The Basin 7 Tactical Basin Plan (TBP) provides a detailed description of current watershed conditions and identifies water quality focused strategies to protect and restore the basin's surface waters.

The Lamoille River Tactical Basin Plan (TBP) provides a detailed description of current watershed conditions and identifies water quality focused strategies to protect and restore the basin's surface waters.

Information from monitoring events over the last five years have been incorporated in Chapters 1, 2, and 3, which cover the condition of surface waters, protection priorities, and restoration priorities, respectively. Generally, the surface waters monitored in Basin 7 meet or exceed water quality standards.

In Chapter 2, a total of nine river segments, lakes, ponds, and wetlands are priorities for protection. Of the nine waters, six river segments are reclassification candidates for fishing (5) and aquatic biota (1) and three lakes and ponds are reclassification candidates for aesthetics. No wetlands are identified as Class I candidates but six are recommended as potential candidates in Chapter 4.

Although many surface waters monitored in Basin 7 meet or exceed water quality standards, there are waters in need of restoration and continued monitoring. In Chapter 3, a total of 39 lakes, ponds, or river segments are identified for restoration. Nine river segments and three lakes are considered impaired, fourteen are considered stressed, two are impacted by aquatic exotic species, and eleven are considered altered by flow regime. Chapter 3 also includes progress reporting and target setting (or Phase 3 content) for the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL) Implementation Plan. Only the Lamoille River watershed contribution to the Mallet's Bay segment of Lake Champlain is addressed.

Chapters 4 and 5 outline sector-based strategies to meet overall protection and restoration goals, as well as strategies to achieve targets of the Lake Champlain Phosphorus TMDL, with a focus on voluntary actions to be carried out by watershed partners and the Basin's Clean Water Service Provider. This chapter includes a list of 63 geographically explicit strategies and 65 monitoring priorities 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 designation.

Focus areas and strategies for restoration and protection are summarized by land use sector in Table 1.

Table 1. Focus areas and priority strategies for restoration and protection in Basin 7.

	Focus Areas	Priority Strategies
Agriculture	Deer Brook, Stones Brook, Streeter Brook, Mill Brook, Browns River, Lower and Middle Lamoille River, Centerville Brook, Wild Branch, Beaver Meadow Brook, Perkins Meadow Brook, Porter Brook	• Form agricultural sector workgroups for priority watersheds. • Identify areas of nutrient input through AAFM inspections and landowner outreach. • Implement Nutrient Management Plans and agricultural water quality practices in high priority catchments. • Provide education and assistance to agricultural communities in priority watersheds. • Support monitoring efforts to track results of practices applied in priority watersheds. • Continue funding programs to support water quality practices in high priority watersheds.
Developed Lands - Stormwater	Lamoille mainstem, Lamoille River Tributary #4, Deer Brook, three-acre sites, Streeter Brook, Lake Elmore, Lake Eden, Lower Gihon River, Centerville Brook, Greensboro Brook, Browns River, Brewster River	• Provide technical and funding support to develop high priority projects from stormwater master plans (SWMPs) and Phosphorus Control Plans. • Provide information to municipalities on DEC standards and training opportunities for operations and maintenance of installed stormwater Best Management Practices (BMPs). • Encourage participation in the Green Schools Block Grant and support three-acre schools with funding and technical assistance for project development, implementation, and design. • Provide outreach to towns on and promote the adoption of Green Stormwater concepts. • Implement projects addressing vulnerabilities from flooding, severe rainstorms, and fluvial erosion from county and municipal All-Hazards Mitigation Plans.
Developed Lands - Roads	Basinwide with focus on Caspian Lake, Streeter Brook, Deer Brook, Lake Eden, Lake Elmore, Stannard Brook, Kate Brook	• Provide support for towns and contractors to attend Road Roundtable Forums. • Implement high priority road projects identified in Municipal Road General Permit (MRGP) road erosion inventories, lake watershed action plans, and SWMPs. • Support outreach and funding for MRGP equipment for towns. • Support training, outreach, and funding for equipment sharing programs.
Waste-water	Lamoille Mainstem	• Provide technical assistance and funding to towns interested in exploring and implementing village wastewater systems and septic replacement. • Support and ensure monitoring and permit compliance for waste management systems.
Rivers	Wild Branch, Deer Brook, North Branch Lamoille, Browns River, Seymour River, Centerville Brook, Stones Brook, Stannard Brook, Brewster River, Gihon River, Lamoille River	• Provide technical assistance to help towns implement stronger protections for surface water in their town plans and municipal regulations. • Work with towns to increase their Emergency Relief Assistance Funds (ERAF) rating. • Develop projects identified in the River Corridor Plans and by the Functioning Floodplain Initiative tool. • Scope, design, and implement high priority bridge and culvert replacements to improve aquatic organism passage, stream geomorphic compatibility, and flood resilience.
Lakes	Caspian Lake, Lake Eden, Lake Elmore, Round Pond, East Long Pond, Nichols Pond	• Develop lake watershed action plans and implement priority projects. • Maintain and build the capacity for existing aquatic invasive species programs. • Initiate stakeholder meetings to discuss fair to poor shoreland condition in target waters. • Where applicable, increase protections for high-quality lakes through reclassification.
Wetlands	Potential Class I wetlands, Browns River watershed, wetlands identified for restoration in assessments	• Provide outreach and technical assistance for Class I wetland assessment, stakeholder discussions, and petition development where there is interest. • Increase wetland acreage and function through restoration of wetlands. • Provide support to the Wetlands Program by publicizing volunteer wetland mapping workshops and training for the public.
Forests	Browns River, Lamoille River tributaries, Lake Eden, State Lands, North Branch Lamoille	• Develop forestland focused workgroups in priority watersheds to carry out strategies in the 2021 Lamoille TBP. • Implement forestry Acceptable Management Practices (AMPs) and natural resource restoration and conservation projects on state and private lands. • Maintain and increase UVA enrolled forestland among eligible parcels by providing outreach and technical assistance to private landowners, foresters, and loggers to equip them with tools to apply, enroll and manage forestland in accordance with program standards, including implementation of AMPs.

The 2016 Basin 7 plan identified 88 strategies to address protection and restoration of surface waters. Of the 88 strategies identified, 27 are complete, 21 are in progress, 17 are ongoing, 13 are awaiting action, and 10 have been discontinued (Figure 1). Eighty-five percent (65) of the priority strategies identified in the 2016 TBP are ongoing (19%), in progress (24%), complete (31%), or discontinued (11%)[1]. Of the 21 priorities "in progress", five are 75% complete, seven are 50% complete, and nine are 25% complete. The Basin 7 report card, to be included in the Vermont Clean Water Initiative 2021 Performance Report, will include a list of detailed updates for each strategy identified in the 2016 Plan. Several strategies will be carried over to this plan.

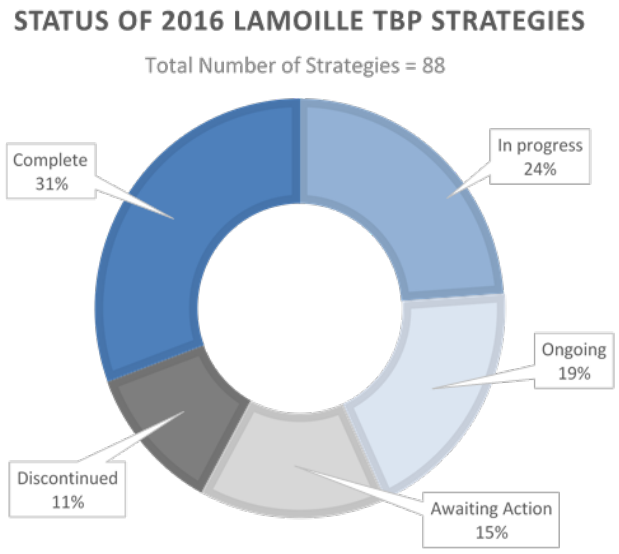


Figure 1. Status of 88 strategies from the 2016 Lamoille TBP.

While many water quality improvements are being made in Basin 7, limited staff capacity of partners, funding gaps, and lack-of-interest are primary challenges to voluntary implementation for the strategies awaiting action. In terms of the Lake Champlain Phosphorus TMDL, many programs are still in the beginning stages of implementation and tracking. New and expanded collaboration through the Clean Water Service Providers and state regulatory programs will continue to fill gaps though future iterations of the phased implementation plans. Implementing regulatory programs and continued tracking improvements are also foremost in achieving TMDL goals. In fiscal year (FY) 2022, which started July 1, 2021, the State of Vermont allocated $100 million in American Rescue Plan Act (ARPA) funds for clean water. This includes money to invest in water and sewer infrastructure to help address funding gaps and water quality needs.

The 63 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. They also serve as a location specific guide to meeting the 5-year total phosphorus reduction targets and milestones required by EPA. During the basin planning process, stakeholders expressed that unified clean water messaging, technical support and training on how to protect and maintain surface waters, and continued financial and technical support, are all critical to meet water quality goals. There was also a strong sentiment that all waters in the Lamoille River Basin should be protected regardless of their status.

[1] Discontinued = strategies that have not been initiated and are no longer being pursued. Awaiting action = strategies that have not been initiated for various reasons such as a lack of resources or local support.

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 the best and restore the rest" of Vermont's surface waters. TBPs target strategies and prioritization of resources to those actions that will have the greatest influence on surface water protection or restoration.

Figure 2. The five major policy requirements that feed into the tactical basin planning

Tactical basin planning is carried out by the Water Investment Division (WID) in collaboration with the Watershed Management Division (WSMD) and in coordination with other state agencies and watershed partners. TBPs are integral to meeting a broad array of both state and federal requirements (see Figure 2) including the U.S Environmental Protection Agency's (EPA) 9-element framework for watershed plans (Environmental Protection Agency, 2008) and state statutory obligations including those of the Vermont Clean Water Act, and Act 76 of 2019 and 10 V.S.A. § 1253.

The basin-specific water quality goals, objectives, strategies, and projects described in the TBPs aim to protect public health and safety and ensure public use and enjoyment of Vermont waters and their ecological health as set forward in the Vermont Surface Water Management Strategy (VSWMS) and the Vermont Water Quality Standards (VWQS). The TBP process (Figure 3) allows for the issuance of plans for Vermont's fifteen basins every five years.

The steps in the basin planning process are:

1. Monitor water quality.
2. Assess and analyze water quality data.
3. Identify strategies and projects to protect and restore waters identified through the monitoring and assessment process.
4. Gather and incorporate public input on the plan and finalize the plan.
5. Implement and track plan priorities as they are accomplished.

Figure 3. Steps to the basin planning process on a 5-year schedule.

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 as outlined in Figure 4.

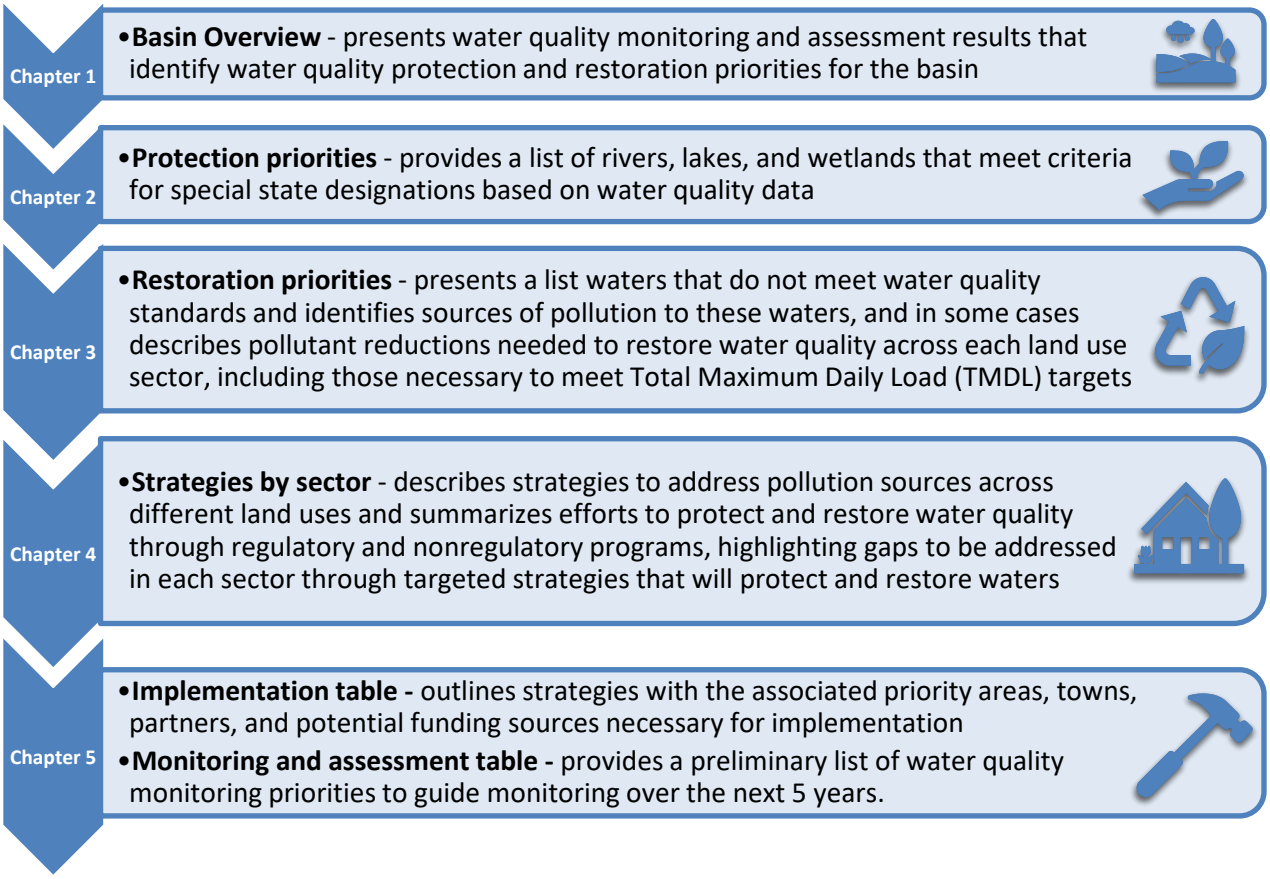


Figure 4. Key roles of the five chapters in Vermont Tactical Basin Plans.

The 2021 Lamoille River Tactical Basin Plan identifies strategies that will 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 (WPD) and the Watershed Projects Explorer. The project database and explorer are found on ANR's Clean Water Portal and are continuously updated to capture project information throughout the TBP process.

ANR's Clean Water Portal is an online platform that houses a variety of clean water tools to assist with project planning, project identification, and funding opportunities. The Clean Water Portal links to the Vermont Clean Water Initiative Program's (CWIP) Annual Performance Report. The report outlines progress in implementing clean water practices for each basin. The Clean Water Interactive Dashboard is a data visualization tool that allows users to filter and customize Vermont's clean water data presented in the CWIP Annual Performance Report.

Chapter 1 – Basin Description and Conditions

A. Basin 7 Overview

Basin 7, the Lamoille River Watershed, encompasses 706 square miles in Vermont. The entire watershed spans thirty-five towns covering five counties, a major part of Lamoille County and lesser parts of Franklin, Chittenden, Orleans, Washington, and Caledonia counties.

The Lamoille River begins its 85-mile journey in Greensboro and terminates at its confluence with Lake Champlain in Milton and Colchester. The river basin[2] comprises 18 sub-basins (Figure 5), which include the Browns River, Wild Branch, North Branch, Gihon River, Brewster River, Seymour River, Mill Brook, and many other smaller Lamoille River tributaries.

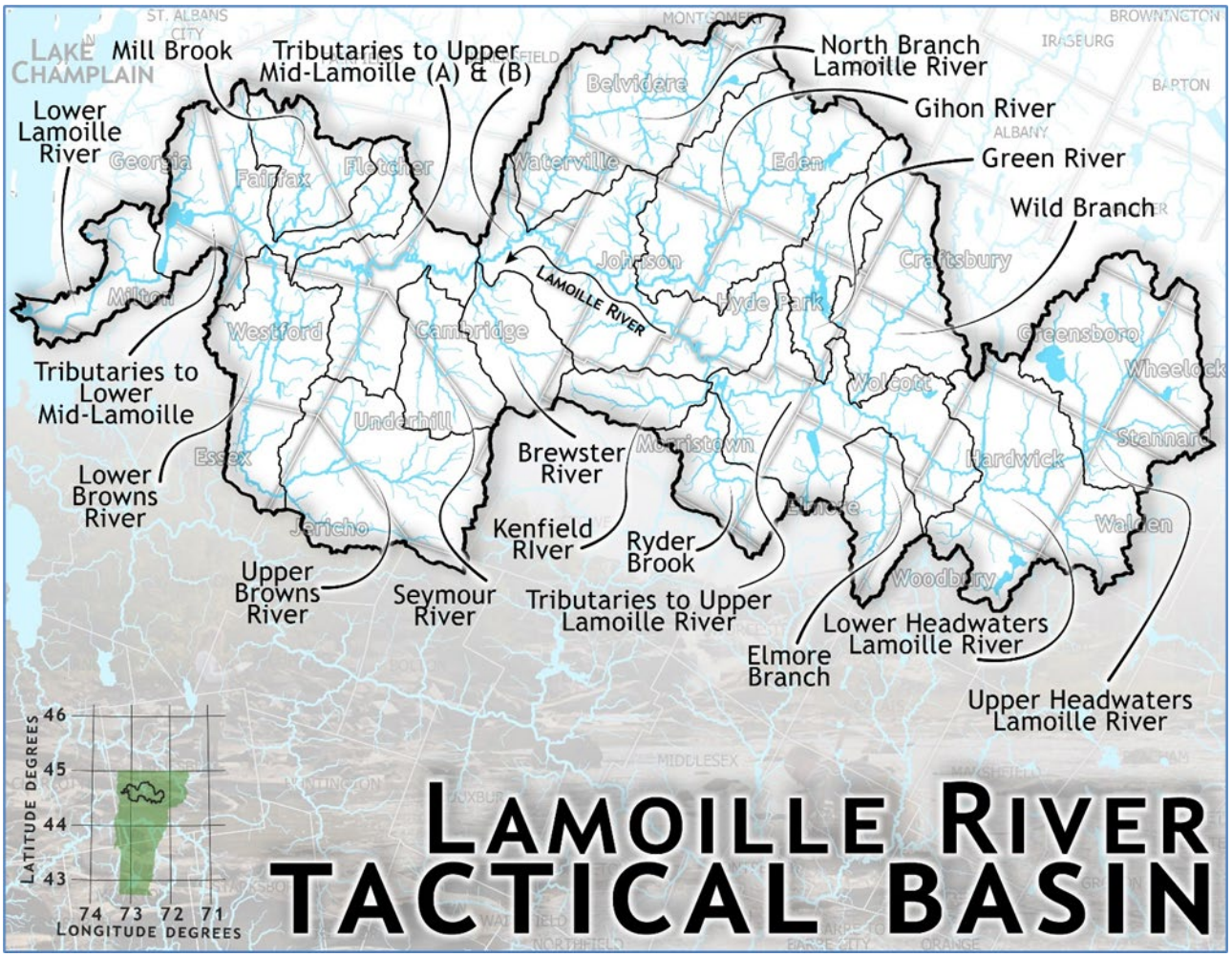


Figure 5. A map of Basin 7, also known as the Lamoille River Watershed, divided into 18 smaller river basins with town boundaries.

[2] A river basin is an area of land drained by a river and its tributaries. The terms 'basin' and 'watershed' are used interchangeably in this report. The Lamoille River Watershed is also referred to as Basin 7.

Detailed information about each of these rivers and other smaller watersheds within Basin 7 can be found in the individual basin assessment reports for Basin 7 and the 2016 Lamoille River Tactical Basin Plan.

There are a total of 24 lakes and ponds that are 20 acres or larger in the Lamoille River Basin. Caspian Lake, Arrowhead Mountain Reservoir, and Green River Reservoir are by far the largest with surface areas of 789, 760, and 554 acres, respectively. More information on lakes and their conditions can be found in Section B of this Chapter.

Land Use and Land Cover

The Lamoille Watershed is a predominantly forested landscape. Forested land covers about 76% of the basin while about 6% is wetlands and open water. Developed and agricultural land cover about 5% and 13% of the basin, respectively (Figure 6). A basin wide analysis of land use change from 2001 to 2016 showed no significant differences in any land use categories. The largest change, only around 1%, was a decrease in forest land and an increase in shrub and herbaceous land. This change may be due to logging and forest regrowth.

Large areas of properly managed forests, riparian buffers, and wetlands are principally responsible for the good water quality in the basin. Where good management practices and quality local stewardship exist on agricultural and developed lands, good water quality will too. The areas in Basin 7 that are experiencing degraded water quality trends are adjacent to:

- concentrated residential areas and road development (Deer Brook, Lamoille River Trib #4, Brewster River Trib #10, Streeter Brook, Ryder Brook, Kate Brook, Stannard Brook, Bunker Brook);
- concentrated agricultural land (Stones Brook, Halfmoon Pond, Streeter Brook, Deer Brook, Wild Branch);
- dams (Lamoille River mainstem, Hardwick Lake, Green River Reservoir, Green River, Mud Brook, Trib to Brewster River, Lake Lamoille, Elmore Pond Brook);
- industrial waste sites (Lamoille River Trib #4, Rodman Brook, Hutchins Brook and tributary); and
- high elevation locations prone to acid deposition (Lake of the Clouds, Stevensville Brook).

Most forest lands are located in the tributary headwaters of the Lamoille River, while most agricultural and developed lands are located along the mainstem of the Lamoille, with concentrated development in villages and town centers. A large portion of road networks are located along tributaries and the mainstem of the Lamoille. Large wetland complexes are found around lakes and floodplains along rivers and streams that have not been developed or drained.

Managing land use to reduce and prevent discharge of polluted runoff improves and protects water quality. Federal and state licensing are chiefly responsible for mitigating chemical, physical, and biological impacts of dam operation. The Federal Clean Air Act is largely responsible for mitigating

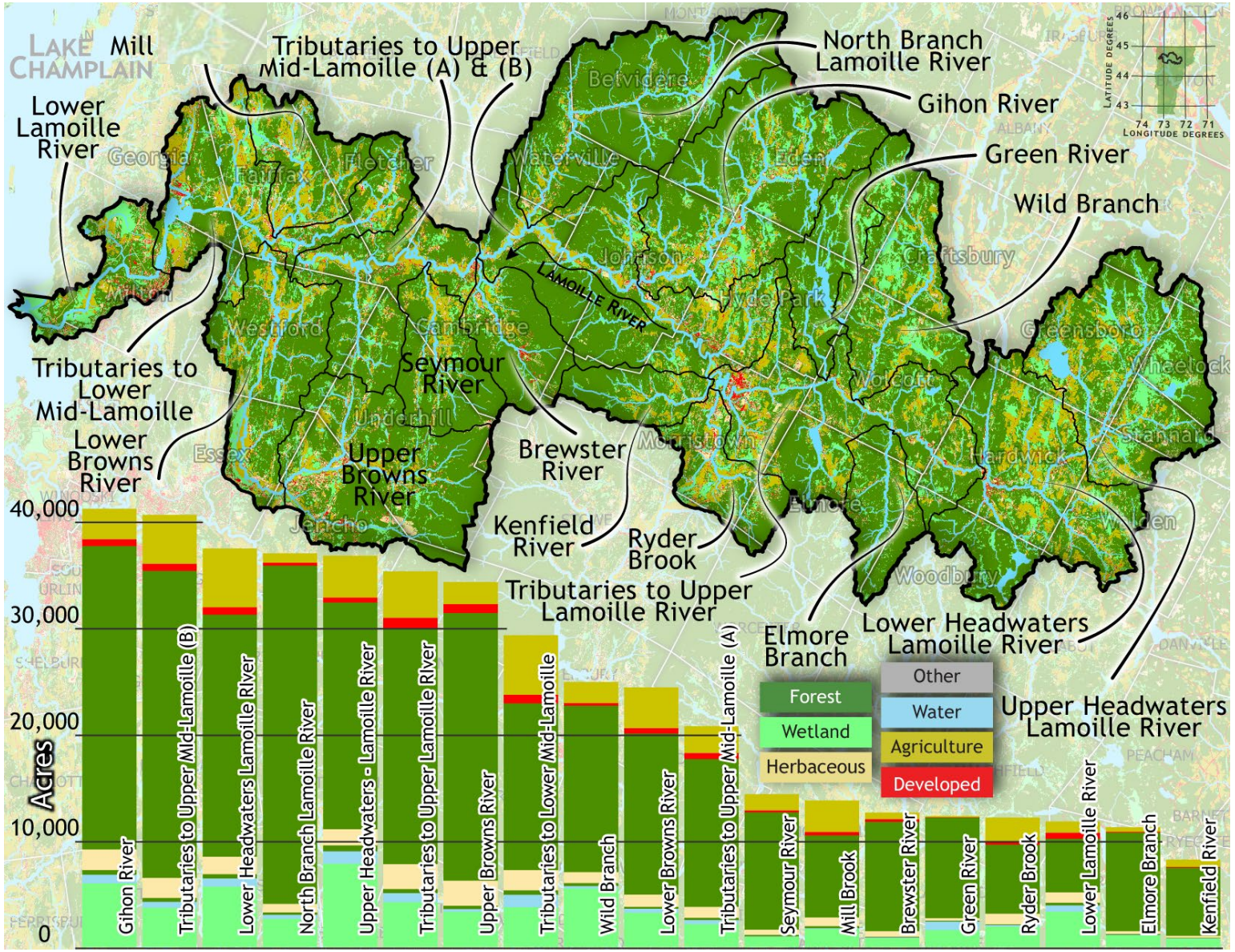


Figure 6. Map of land cover estimates by acreage for the eleven sub-basins of Basin 7. (Source: 2016 LULC data)

impacts from acid deposition. The Hazardous Waste Management Program is responsible for remediation of surface water pollution from hazardous waste sites and landfills. The Stormwater Program is responsible for managing regulated discharges from stormwater. And the Agency of Agriculture, Farm and Markets (AAFM) is responsible for regulating jurisdictional farm activities. Surface water pollution is also mitigated through the voluntary actions recommended in this plan.

Climate Change Implications for Water Resource Management

Adapting how we manage and use our surface waters in the face of climate change is one of the chief overarching challenges for Basin 7 and beyond (State of Vermont, 2021). 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 2014 Vermont Climate Assessment established state-level climate change information with implications for local surface waters. The Since 1941, Vermont average temperatures have increased 2.7° F with warming occurring twice as fast in winter (Galford, 2014). 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).

Maintaining habitat connectivity, river and lake riparian buffers, and stream equilibrium conditions will help reduce the impacts of climate change on Vermont's rivers, lakes and ponds, and wetlands.

Monitoring data also indicate changing drought conditions in the region. It is important to note these trends reflect what has been observed in the past, and in some cases these trends may or may not persist into the future. For example, many models and the information in the 2014 Vermont Climate Assessment suggest an increased frequency and severity of low-flow, drier conditions for Vermont due to predictions of longer periods between heavy rainfall events in future decades.

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. To implement these strategies, a significant investment in time by federal, state, and local stakeholders is required. These coordination efforts are ongoing. Additional information on climate change in Vermont can be found at: https://climatechange.vermont.gov.

B. Water Quality Conditions in Basin 7

There is a wide variety of water quality monitoring and assessment work that is supported by DEC and its partners which are described in detail in the Water Quality Monitoring Program Strategy. The result of this work provides a window into the condition of a basin's waters.

Several monitoring programs are active in this basin, most of which are led by programs in the WSMD. These include the Monitoring and Assessment Program (MAP) that focuses on biological monitoring of macroinvertebrate and fish communities and targeted chemistry sampling around potential pollution concerns. They also include the LaRosa Partnership Program which supports water quality monitoring, training, and the chemical analysis of water quality samples for volunteers in target areas throughout the state. The Rivers Program supports stream geomorphic assessments that evaluate geomorphic and habitat conditions of rivers. The Lakes and Ponds Management and Protection Program supports the Spring Phosphorus and Lay Monitoring Programs, which evaluate nutrient conditions and trends on lakes, as well as shoreland condition, and in-depth lake assessments in addition to surveys for aquatic invasive species. The Wetlands Program conducts chemical and biological assessments of wetlands.

In addition to the WSMD programs, a network of streamflow gages is funded and operated in partnership among DEC, Vermont Agency of Transportation (AOT), and Vermont Department of Public Safety (VDPS). The Vermont Fish and Wildlife Department (FWD) conducts fishery assessments and temperature monitoring to understand recreational fish populations and evaluates streams for strategic wood addition to restore habitat. Statewide pesticide monitoring is conducted by the Vermont Agency of Agriculture, Food, and Markets (VAAFM) with sampling sites throughout Vermont. VAAFM also runs the Ambient Surface Water Study (ASWS) to establish baseline levels of pollutants and to monitor for the presence of neonicotinoids, glyphosate, corn herbicides, and nitrate in Lake Champlain and its contributing tributaries[1]. Per- and Polyfluoroalkyl

[1] Since 2014, VAAFM has collected 646 water samples at 34 sites in agricultural use areas throughout the state.

Substances (PFAS) are monitored by the Drinking and Groundwater Protection Division, while WSMD is responsible for monitoring PFAS in surface waters. Tactical Basin Plans will include information, as reported by Vermont State agencies, as monitoring results relate to the designated uses as defined by the Vermont Water Quality Standards.

Condition of Rivers and Streams

Biological Assessment

The Watershed Management Division (WSMD) in DEC assesses the health of a waterbody using biological, chemical, and physical criteria as described in the Vermont Water Quality Monitoring Program Strategy 2011-2020 which was updated in 2015. Most of these data can be accessed through the Vermont Integrated Watershed Information System (IWIS) online data portal. The biological assessment of streams in VT is carried out by the WSMD using biological indices that measure the health of streams by looking at multiple structural and functional aspects of the macroinvertebrate and fish communities. Biomonitoring is best used for detecting aquatic life impairments and assessing their relative severity, and for recognizing streams at or near a reference level condition that may be suitable for higher levels of protection through reclassification. The ratings for the community assessments range from *Poor* - not meeting Vermont's water quality standards (VWQS) - to *Excellent* - exceeding water quality standards. The monitoring information below was collected in Basin 7 from 2016 to 2020 (Figure 7). All but two (downstream Wild Branch and Beaver Meadow Brook) of the 29 monitoring sites recommended for bioassessment in the 2016 Lamoille River TBP were sampled. These two sites will be carried over into this plan as priorities for monitoring.

Macroinvertebrate Monitoring Results

A total of 41 macroinvertebrate assessments were completed between 2016 and 2020 in Basin 7. Two sites were unable to be sampled or assessed. The results of the remaining assessments are described below. 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. These will be prioritized for the 2022 monitoring season and can be found in Chapter 5 in the Basin 7 Monitoring and Assessment Table.

Of the 41 macroinvertebrate assessments, 24 monitoring sites (58%) exhibited *Very Good* or better condition. Of these, seven were found to be *Excellent,* meaning at reference or natural condition. These streams include Smith Brook in Johnson, Green River, headwaters of Wild Branch, Tucker Brook, Wild Brook, Greensboro Brook, and Perkins Meadow Brook. Most of these waters are either headwater streams or higher up in the watershed. Streams in *Very Good* or better condition exceed the Vermont Water Quality Standards and are a priority for additional assessment and protection.

Nine macroinvertebrate assessments exhibited *Good* to *Good-Very Good* which meets B(2) criteria of the water quality standards. These waters include the Browns River, Brewster River, Rodman Brook,

Lamoille River, Elmore Branch, White Branch, Mill Brook, Streeter Brook and Rattling Brook. Streams in *Good* to *Good-Very Good* condition meet VWQS and are priorities for maintenance and protection.

Two sites exhibited *Fair-Good* condition, Gihon River, at the mouth, and Mill Brook. Sites in *Fair-Good* condition are considered indeterminant for assessing water quality condition. These sites do not fully meet VWQS, but more monitoring is required to determine status. Three sites exhibited *Fair* condition, Stones Brook (twice), Fryingpan Brook, and Deer Brook. Sites in *Fair* condition do not meet water quality standards and need to be considered for additional assessment, listing, source identification monitoring, and restoration.

Fish Monitoring Results

Twenty-five fish sampling events occurred in Basin 7 from 2016 through 2020. Six assessments were deemed *Unable to Assess*. At three of the *Unable to Assess* sites only one native species was recorded, precluding the applicability of the cold-water index of biotic integrity (IBI), which requires two or more native species. Two sites did not have applicable criteria for the stream type (large wadeable stream and wetland stream) and one sample event was performed for an EPA project using a different methodology. Of the 19 fish assessments, six exhibited fish communities in *Very Good* (5) or *Excellent* (1) condition which indicate the fish communities at these sites exceed the Vermont Water Quality Standards (VWQS). The streams include Sawmill Brook, Wild Branch, Smith Brook, Wild Brook, Haynesville Brook, and the headwaters of the Lamoille River. Streams in *Very Good* or better condition may exceed the VWQS and are a priority for additional assessment and protection.

Seven fish assessments exhibited communities in *Good* condition at North Branch Lamoille, Wilkins Brook, Sawmill Brook, Centerville Brook, Rodman Brook, Greensboro Brook, and the lower section of the Brewster River. Streams in *Good* condition meet VWQS and are priorities for maintenance and protection.

Six fish assessments exhibited communities in *Fair* (3) or *Poor* (3) condition in the Gihon River, Foote Brook, Stannard Brook, Stones Brook, and Hutchins Brook. Sites in *Fair* or *Poor* condition do not meet VWQS and need to be considered for additional assessment, listing, source identification monitoring, and restoration. Stones Brook has consistently scored poorly for both fish and macroinvertebrates and was recently added to the State 303(d) list of impaired waters.

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

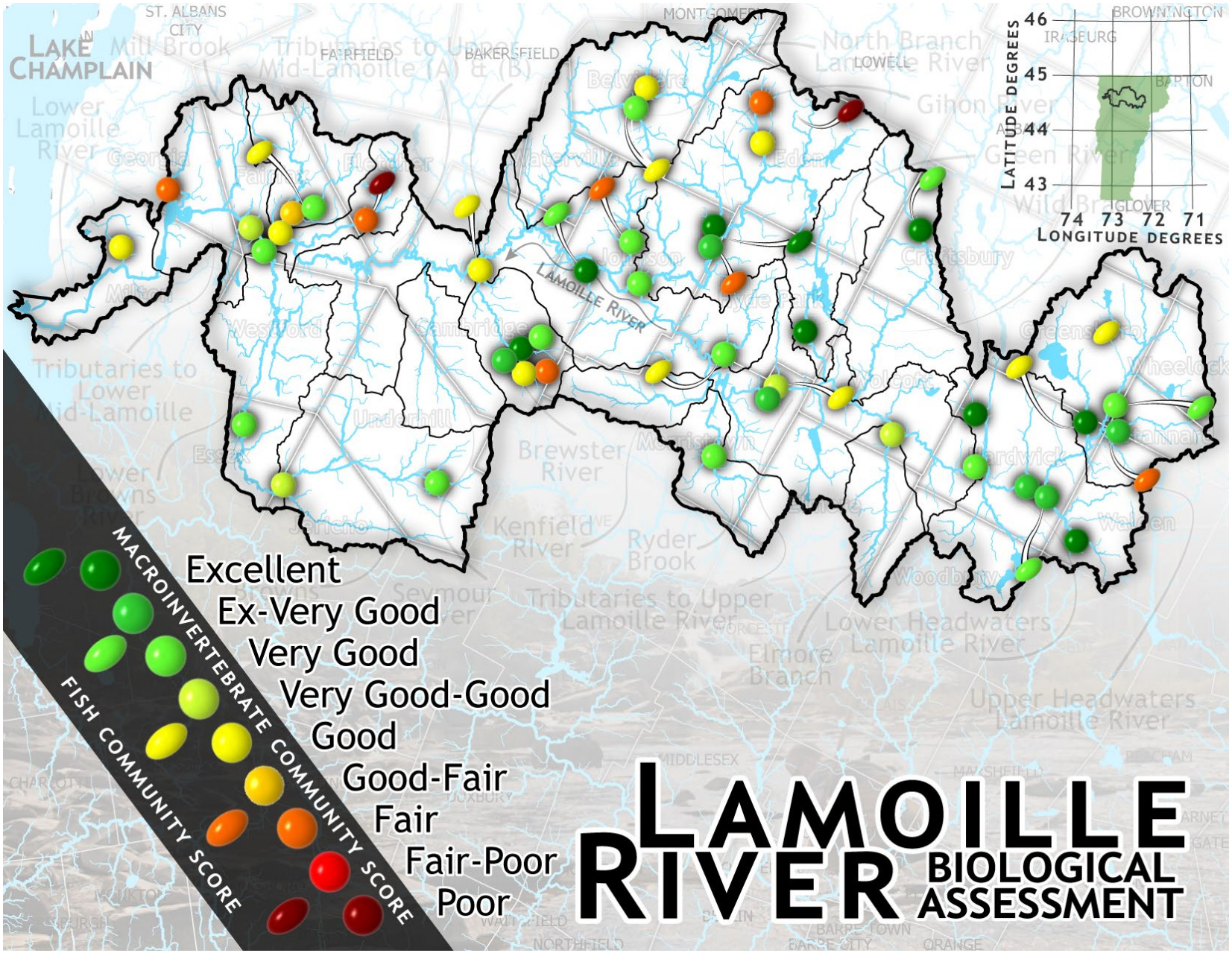


Figure 7. Map showing the results of the bioassessment monitoring from 2016-2020. Most sites sampled meet VT Water Quality Standards (2016).

Stream Geomorphic Assessment

The coverage of Phase I or Phase II Stream Geomorphic Assessments (SGAs) in Basin 7 is equally spread throughout the basin and was mainly completed on the upper and middle sections of the Lamoille River mainstem and stressed or impaired waters (Figure 8). A handful of streams on the Stressed Waters List were assessed or are scheduled to be assessed in 2021 by the Rivers Program and the Watershed Planning Program to identify obvious pollution inputs and impacts to stream geomorphology that indicate the aquatic habitat continues to be stressed. The assessment waters include Streeter Brook, Ryder Brook, Kate Brook, Stannard Brook, Tucker Brook, Bunker Brook, Haynesville Brook, Browns River, North Branch Lamoille River, and the Wild Branch. More information on the stream walk assessments is found Chapter 4 in the Rivers section of the plan.

One river, the Seymour River in Cambridge, had a Phase II Stream Geomorphic Assessment completed between 2016 and 2021. The study encompassed approximately 13 miles of stream channel within 40 reaches on the Seymour River, Settlement Brook, and numerous unnamed tributaries to the Seymour River. This stream geomorphic assessment facilitated the identification of major stressors to geomorphic stability and habitat conditions within the study area. One predominant stressor observed within the Seymour River watershed was stream channel straightening and corridor encroachment associated with the existence of roads and development. In many cases, the encroachment limited floodplain access and caused moderate to extreme channel degradation (lowering of the bed) resulting in sediment build up, channel widening, and planform adjustment (lateral movement). The study also identified major assets within the Seymour River watershed including channel spanning bedrock on the mainstem that provides vertical stability for the river and depositional areas with floodplain access that provide attenuation of sediment and floodwaters. A list of 59 potential restoration, conservation, and flood resiliency projects were developed using the stream geomorphic assessment data collected within the study area (Bear Creek Environmental, 2018).

While the majority of the assessed river segments in Basin 7 are in fair to good condition, four significant stretches of stream were rated in poor condition when the assessments were conducted for the Browns River, Brewster River, Lamoille River, and the Wild Branch. These areas (along with the segments in fair condition) are prioritized for restoration. Final SGAs for rivers in Basin 7 can be accessed at: https://anrweb.vt.gov/DEC/SGA/finalReports.aspx

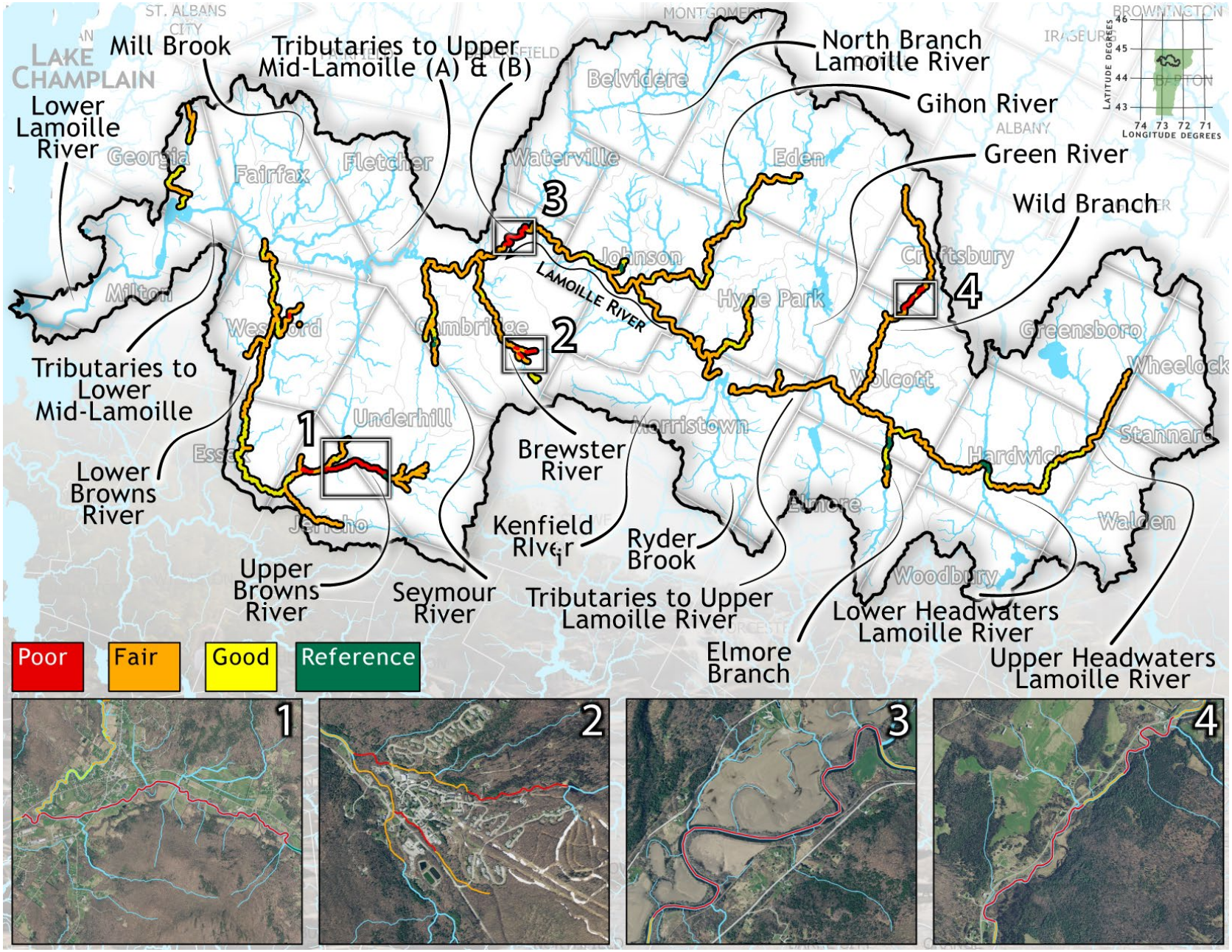


Figure 8. Map of the Lamoille Basin showing geomorphic condition of streams Phase II stream geomorphic assessments. Four areas are in poor geomorphic condition, while most are in fair condition. Very few segments attain reference condition due to historic anthropogenic impacts.

Condition of Lakes and Ponds

There are 38 lakes and ponds in Basin 7 that are ten acres or greater. Of the eight lakes in Basin 7 over 130 acres, all but one (Lake Elmore), have dams that are managed by hydroelectric facilities, The eight lakes are Caspian Lake (789 acres), Arrowhead Mountain Lake (719 acres), Green River Reservoir (593 acres), Lake Elmore (222 acres), East Long Pond (185 acres), Nichols Pond (167 acres) and Lake Lamoille (134 acres). Arrowhead Mountain Lake and Lake Lamoille are both impounded waterbodies on the Lamoille River that generate hydropower and have mixed characteristics of a river and a lake. Lake Eden (198 acres) is impounded and owned by the VT Department of Fish and Wildlife. The majority of lakes and ponds in Basin 7 are impounded by dams and should be managed in accordance with the Vermont Hydrology Policy and meet the Hydrology Criteria (§29A-304) in the 2017 VT Water Quality Standards. More information on dam location, status, purpose, and ownership can be found in Appendix A.

Lake Scorecard Assessment

Lakes in Vermont are scored on the VT Inland Lakes Scorecard (Figure 9, Table 2), which is a user-friendly interface developed by the Vermont Lakes and Ponds Management and Protection Program (VLPP). The VT Inland Lakes 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. Lake-specific water quality and chemistry data can be accessed online through the VT Lay Monitoring Program webpage.

Of the 30 lakes evaluated for shoreland condition in Basin 7, none have poor ratings and 16 waterbodies scored as fair. Of the 19 lakes monitored for water quality trends, no lakes have a poor rating, while Green River Reservoir, Lake Eden, and Caspian Lake are scored as fair. The spring phosphorus levels are significantly increasing in Green River Reservoir, summer phosphorus levels are significantly increasing in Lake Eden, and both spring and summer phosphorus are significantly increasing in Caspian Lake. One waterbody, Halfmoon Pond in Fairfax, is impaired by elevated nutrients and the watershed score is considered highly disturbed. The nutrient trend on this pond is considered stable because the nutrient levels have been elevated since monitoring began in the early 1990s.

There are three main airborne pollution types that affect lakes and ponds in Vermont: sulfur oxides, nitrogen oxides, and mercury. Mercury contamination has resulted in fish consumption advisories in nearly every lake in Vermont and those of nearby states as well, so all lakes in Basin 7 get a fair condition score for mercury except for Arrowhead Mountain Reservoir which is rated as poor and considered impaired for mercury (Figure 9, Table 2). This is due to the way reservoirs are managed for hydroelectrical production. Dramatic shifts in water level cause the release of bio-available mercury that is otherwise sequestered in the sediments and this mercury is more easily transferred up the food chain to fish and loons and other larger birds and mammals.

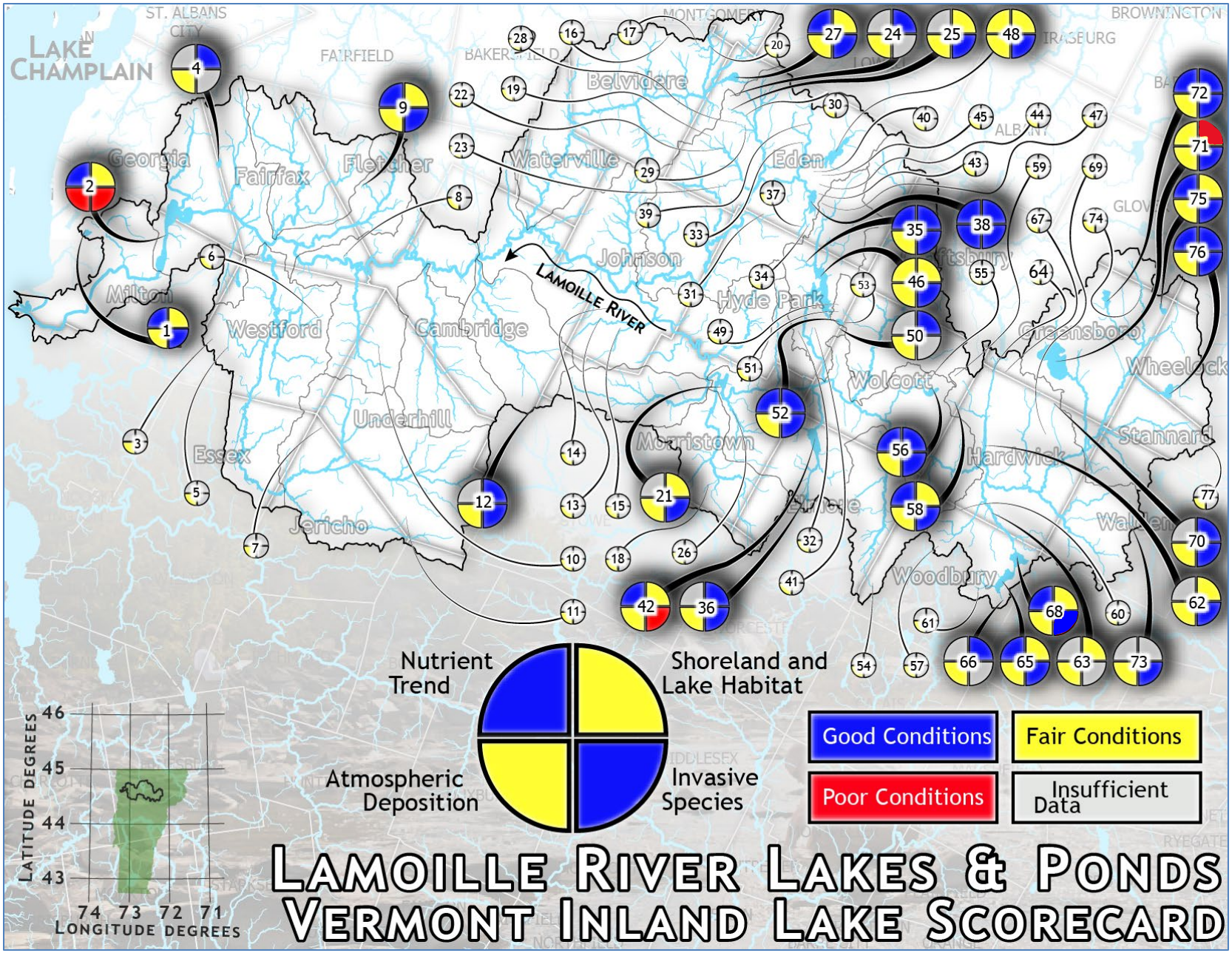


Figure 9. Map of Vermont inland lake scorecard ratings showing condition of lakes and ponds in Basin 7. Table 2 provides a key to the numbers that correspond with lakes with more than one rating.

Table 2. Table of lakes corresponding with Figure 9 showing lake scorecard ratings. Atmospheric deposition is mainly tied to mercury levels.

Map #	Lake	Shoreland Condition	Aquatic Invasive Species	Atmospheric Deposition	Water Quality (Nutrient) Trend
1	Round Pond	Fair	No AIS detected	Fair	Stable
2	Arrowhead Mountain Lake	Fair	AIS present	Poor	Stable
4	Silver Lake	Good	Insufficient Data	Fair	Insufficient Data
9	Halfmoon Pond	Fair	No AIS detected	Fair	Stable
12	Sterling Pond	Good	No AIS detected	Fair	Insufficient Data
21	Lake Lamoille	Fair	No AIS detected	Fair	Insufficient Data
24	Big Muddy Pond	Good	Insufficient Data	Fair	Insufficient Data
25	Ritterbush Pond	Fair	No AIS detected	Fair	Insufficient Data
27	Long Pond (Eden)	Fair	No AIS detected	Fair	Stable
35	Schofield Pond	Good	No AIS detected	Fair	Stable
36	Little Elmore Pond	Good	No AIS detected	Fair	Insufficient Data
38	South Pond	Fair	No AIS detected	Fair	Stable
42	Lake Elmore	Fair	AIS present	Fair	Stable
46	Green River Reservoir	Good	No AIS detected	Fair	Negative Trend
48	Lake Eden	Fair	No AIS detected	Fair	Negative Trend
50	Mud Pond (Hyde Park)	Good	Insufficient Data	Fair	Insufficient Data
52	Zack Woods Pond	Good	No AIS detected	Fair	Stable
56	Wolcott Pond	Good	No AIS detected	Fair	Stable
58	Lake Wapanacki	Fair	No AIS detected	Fair	Stable
62	Hardwick Lake	Fair	No AIS detected	Fair	Insufficient Data
63	Mackville Pond	Fair	Insufficient Data	Fair	Insufficient Data
65	East Long Pond	Fair	No AIS detected	Fair	Stable
66	Mud Pond (Woodbury)	Good	Insufficient Data	Fair	Insufficient Data
68	Nichols Pond	Fair	No AIS detected	Fair	Stable
70	Tuttle Pond	Good	No AIS detected	Fair	Insufficient Data
71	Caspian Lake	Poor	No AIS detected	Fair	Negative Trend
72	Long Pond (Greensboro)	Good	No AIS detected	Fair	Stable
73	Walden Pond	Insufficient Data	No AIS detected	Fair	Insufficient Data
75	Horse Pond	Fair	No AIS detected	Fair	Stable
76	Flagg Pond	Good	No AIS detected	Fair	Stable

Sulfur and nitrogen oxides are largely transported to Vermont from out of state air emissions. As part of the Vermont acid lake impaired Total Maximum Daily Load (TMDL) plan, the State of Vermont urged United States Environmental Protection Agency (USEPA) to enforce the Clean Air Act and its amendments to meet emission reduction targets. Vermont joined the USEPA, seven states and 13 citizen groups to sue a major emitter of air borne pollutants and won a settlement in 2007. Since then, nationwide emissions and deposition of acid forming pollutants have declined. As a result, Vermont's in-lake acid concentrations have declined, resulting in less acidic conditions. Achieving pre-industrial conditions will be unlikely, but the improvements are significant. Lakes and ponds in Basin 7 are regularly monitored for low pH (high acidity), which impacts biological communities. Lake-of-the-Clouds is the only acid-impaired waterbody in Basin 7. More information

about long term monitoring of VT's acid lakes can be found at:
https://dec.vermont.gov/watershed/map/monitor/acid-rain

Two lakes out of the 25 that have been surveyed for aquatic invasive species (AIS) - Lake Elmore and Arrowhead Mountain Lake - demonstrate poor scores. A poor score indicates that there is at least one invasive species present, regardless of its abundance or 'nuisance' level. The Lake Scorecard scoring process is described in 'How Lakes Are Scored' and a recorded webinar on the DEC Watershed Management Division YouTube channel.

Lake Champlain

Unlike other lakes in the basin, Lake Champlain is not located within the boundaries of the Lamoille basin but instead receives water from the Lamoille River and several other large watersheds. In 2021, the Lake Champlain Basin Program released the 3-year *Lake Champlain State of the Lake and Ecosystem Indicators Report*. The report describes several ongoing needs and challenges:

- The amount of nutrients delivered to the Lake from Basin 7 each year must be reduced to meet water quality goals (see Section B in Chapter 3).
- Warm weather cyanobacteria blooms continue to impact recreation in many parts of the Lake, including Mallets Bay.
- Despite several invasive species interceptions and prevention measures, the fishhook waterflea was discovered in the Lake in 2018.
- The COVID-19 pandemic limited public engagement in 2020. As a result, many outreach and interpretation programs were postponed or transitioned to virtual platforms (Lake Champlain Basin Program, 2021).

The report also asserts that the Mallets Bay segment, fed mostly by the Lamoille River, has predominantly fair status scores, except for a poor status score for "phosphorus from rivers". The Mallets Bay status for "phosphorus from Wastewater Treatment Facilities" and "invasive water chestnut coverage" is good (highest score). Compared to other lake segments, Mallets Bay scores the best where trend data is available.

Condition of Wetlands

The Vermont Wetlands Program uses its Bioassessment Project to gather data about the health of Vermont wetlands. 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 high development pressure and exhibiting habitat loss.

Wetland Bioassessment and Vermont Rapid Assessment Method

The VT Wetlands Bioassessment Project calculates the Coefficient of Conservation (CoC) at each assessed wetland. The CoC is a metric that uses the presence and abundance of plant species to evaluate wetland status. Plant species are identified either within a defined plot or within a single natural community type. Each plant has a designated score to indicate its tolerance of disturbance. These scores are averaged to determine the overall balance of disturbance-tolerant species in the wetland which can offer information on the level of disturbance in the wetland. CoC scores have been calculated from 13 Level 3 plots with an average score of 4.65, a higher-than-average score for Vermont wetlands. However, the wetlands surveyed may not be representative of the basin.

The State of Vermont also uses the Vermont Rapid Assessment Method (VRAM) to rapidly assess both wetland condition and function (Tier I Assessment). Scores can range from 4 to 100. A total of 41 VRAMs were completed since 2016 in the Lamoille Basin (Figure 10). While these are not evenly distributed through the basin, they do include assessments at several wetland types at varying elevations. Scores ranged from 30 to 97 with a mean of 67. These assessments cannot be directly used to infer wetland condition in this watershed. Wetlands with high scores tend to be higher in the watershed and often include softwood swamp and/or peatland. Wetlands which scored lower include wetlands in the Champlain Valley and immediate Lamoille River valley; shrub swamps; and wetlands where the surrounding landscape has been significantly altered by human activity.

Interested organizations and citizens can help build the dataset of wetlands in Basin 7 by conducting VRAM analysis. Individuals or groups interested in learning the VRAM protocol should contact the Wetlands Program Staff for further information.

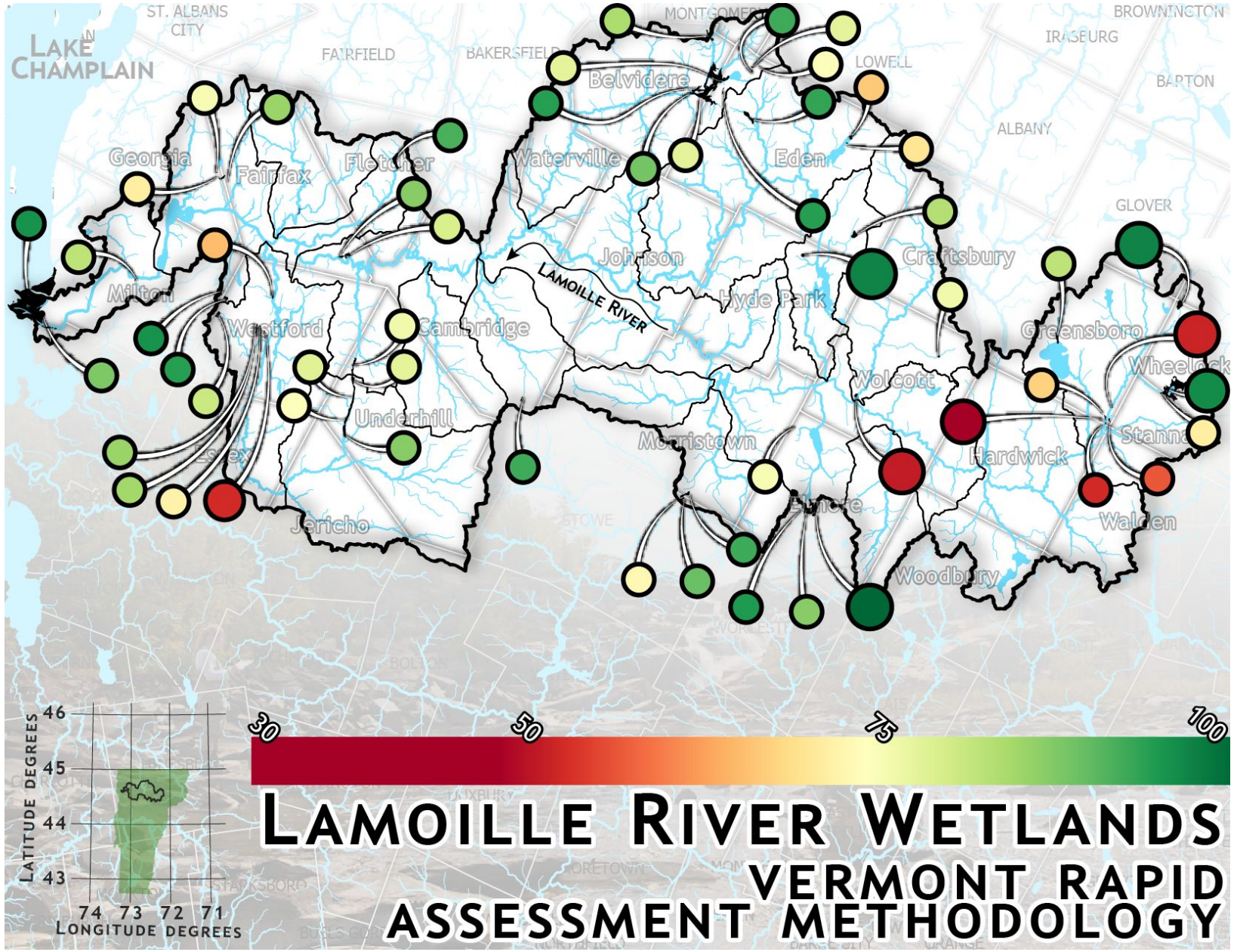


Figure 10. Map of wetland locations in the Lamoille basin with completed Tier I assessments using the Vermont Rapid Assessment Method. The scoring gradation indicates wetlands in poor (red) to excellent (green) condition. Larger dots indicate highest and lowest scores.

Condition of Fisheries

Fisheries Monitoring

Vermont Fish and Wildlife completed 44 monitoring events between 2016-2020 in 20 rivers in Basin 7. Brook Trout were the only Salmonids in sixteen of the sampled stream segments. The populations per mile ranged from roughly 66 individuals in Centerville Brook to 3,678 individuals per mile in Cooper Brook. The three trout species in Vermont are salmonids related on a family level (Salmonidae). All the salmonids, Brook Trout, Rainbow Trout, and Brook Trout are classified under a different genus. Seven of the sampled stream segments had no trout, these stream segments were found on Mill Brook, the lower reaches of the Wild Branch, Ryder Brook above the airport in Morrisville, Wilkins Brook in Fletcher, and the Lamoille River in Morrisville and Greensboro Bend. Nine stream segments had an estimated 25 pounds of fish per acre or more and populations per mile of over 1000 (qualifying for B1 fishing use). The Wild Branch showed low fish density throughout most of the stream segments sampled (8 total) with the highest densities occurring higher up in the watershed.

In 2020, a temperature survey was conducted along a portion of the Lamoille River and its tributaries to better characterize the habitat available for wild trout populations. Specifically, 21 temperature loggers were deployed in the Lamoille River and 11 tributaries between May 28 and November 16 from downstream of Kenfield Brook in Morristown to the Route 104 canoe pull-off in Cambridge. Additionally, a longitudinal temperature survey was conducted across the same extent of the Lamoille River on July 27 and July 29, 2020, to develop a relative longitudinal temperature profile of the river. Analysis of the data has not yet been completed but will be used to better inform trout management and habitat improvement projects along this portion of the Lamoille River and its tributaries. The Lamoille River from the Peterson Dam in Milton to its confluence with Lake Champlain is considered warm-water fish habitat from June 1 through September 30. The remaining sections of the Lamoille are designated as cold-water fish habitat.

Chapter 2 – Priority Areas for Surface Water Protection

The state protects lakes, wetlands, and rivers by establishing and supporting surface water management goals. In this chapter, we identify surface waters that consistently attain a higher level of quality and value based on their ability to meet certain 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. The tactical basin planning process includes reviewing ANR monitoring and assessment data to identify and document surface waters that exceed their current classification or designation.

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. In Basin 7, two lakes and seven streams have been prioritized because they meet standards for very high-quality condition (Table 3, Figure 11).

Surface Water Reclassification and Designation

Surface waters may be protected by the anti-degradation policy of the Vermont Water Quality Standards (2017) or by upward reclassification or designation through one of the following pathways:

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

These legal mechanisms guide ANR permitting processes to ensure that regulated activities on the landscape protect the condition of surface waters. The tactical basin planning process includes reviewing ANR monitoring and assessment data to identify and document surface waters that exceed their current classification or designation.

Before the Agency recommends management objectives through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management objectives for Agency consideration at any time, while the Agency typically relies on the tactical basin planning process to identify candidates for reclassification (10 V.S.A. § 1253).

Public involvement is an essential component to restoring and protecting river, wetland, and lake ecology. 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.

The Department of Environmental Conservation is developing and updating relevant procedures, forms, and guidance documents to support the petition process to reclassify streams and lakes, and to designate Outstanding Resource Waters. The Department has developed these procedures and documents for Class I wetland designations. When the public develops proposals regarding management objectives, the increased community awareness can lead to protection of uses and values by the community and individuals.

In Basin 7, three lakes and six streams have been prioritized because they meet standards for very high-quality condition (Table 3, Figure 11). Strategies for enhanced protection of waters are described in further detail in the following sections. Surface waters in need of additional monitoring to determine their potential for reclassification or designation are included in Chapter 5 in the Monitoring and Assessment Table.

Table 3. Lakes and rivers that may meet criteria for A(1) or B(1) aesthetic use, fishing use, or aquatic biota use.

Map #	Name	Use	Protection Class
1	Stevensville Brook	Fishing	B1
2	Smith Brook	Aquatic Biota	B1
3	Centerville Brook	Fishing	B1
4	Green River Below Dam	Fishing	B1
5	Lake Elmore	Aesthetics	B1
6	Lake Eden	Aesthetics	B1
7	Cooper Brook	Fishing	B1
8	Caspian Lake	Aesthetics	A1
9	Porter Brook (Greensboro)	Fishing	B1

A. Surface Water Classification

Vermont's surface water classification system establishes management goals and supporting criteria for uses in each class of water. The VWQS begin classification with two broad groups based on elevation:

- All waters above 2,500 feet altitude, National Geodetic Vertical Datum, 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 altitude, National Geodetic Vertical Datum, are designated Class B(2) for all uses, unless specifically designated as Class A(1), A(2), or B(1) for any use.

Pursuant to Act 79 of 2016, the Vermont General Assembly, recognizing the wide range of quality for Class B waters, created a new intermediary water quality class between B(2) and A(1), now called Class B(1). Act 79 also sets forth the expectation that individual uses of waters (e.g., aquatic biota

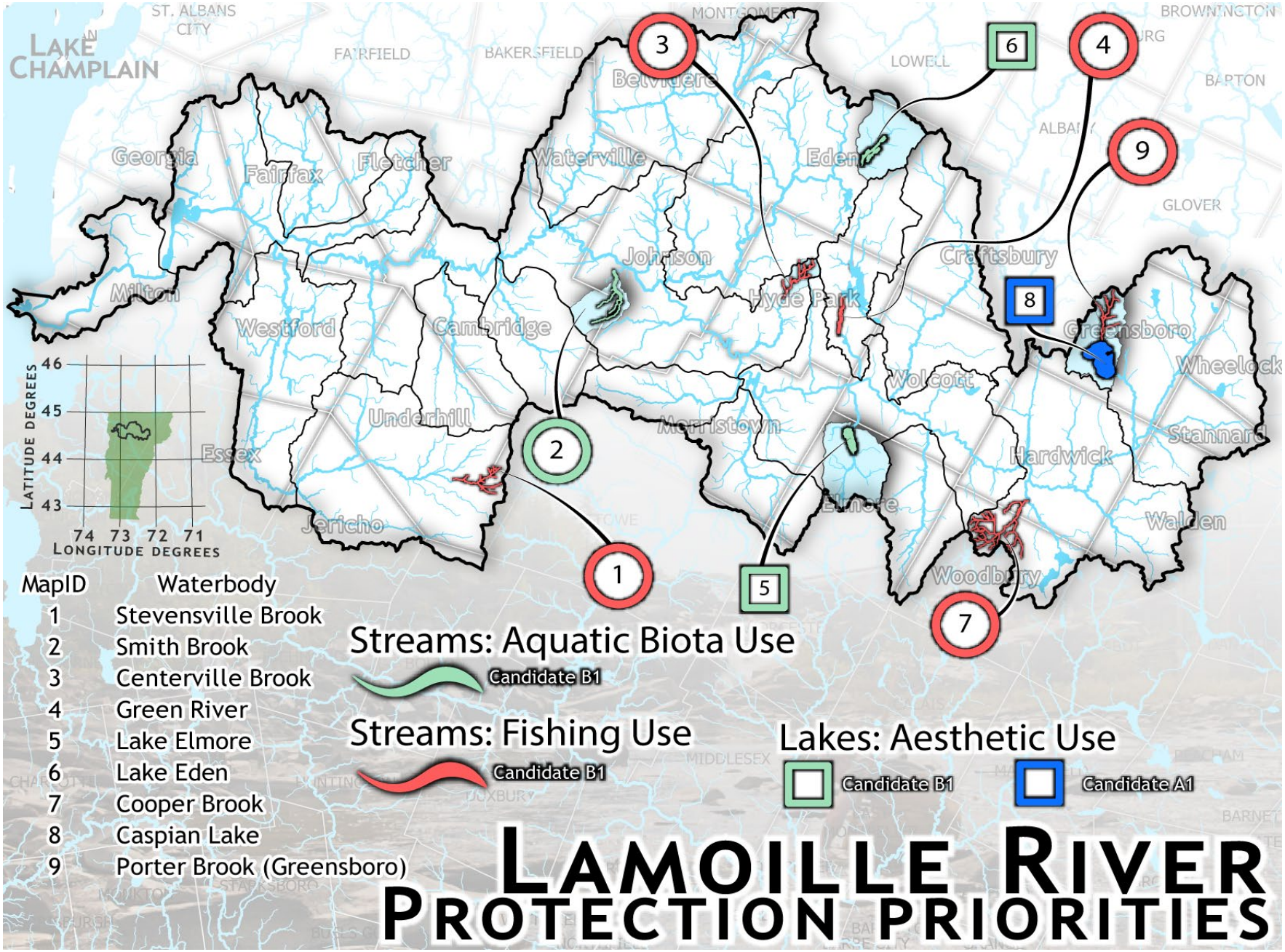


Figure 11. Map of Basin 7 priority waters for protection. Map numbers correspond with Table 3.

and wildlife, aquatic habitat, recreation, aesthetics, fishing, boating, or swimming) may be individually classified, so a specific lake or stream may have individual uses classified at different levels. Act 79 indicates that uses may be reclassified independently to Class A(1) or B(1) for individual uses if the quality of those uses are demonstrably and consistently of higher quality than Class B(2). The extent of the water being reclassified is subject to review based on documented conditions.

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. The current classification, however, does not signify that the A(1) or B(1) criteria are not met. Additional waters suitable for reclassification may be identified in the future as some waters have not been monitored. Table 4 lists the possible classes into which each use may be placed.

Table 4. A list of uses that can be placed into each water class in the Vermont Water Quality Standards.

Classification (2017)	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

A(2) Public Water Sources

Five waters are designated as A(2) public water sources in Basin 7 (Table 5). Three are actively being used, two of them are located in Johnson on Smith Brook and French Hill Brook, and one is located in Georgia on Silver Lake serving the city of St. Albans. Two are no longer being used as a public water source in Hardwick and Fairfax and could be reclassified to reflect their current condition for the designated uses (Table 5).

Table 5. Class A(2) designated public water sources in the Basin 7.

Waters	Water Source	Description	Approx. Miles/Acres
Unnamed Tributary to the Lamoille River	Village of Hardwick	**Abandoned.** Unnamed tributary to the Lamoille River and all waters in its watershed in Hardwick upstream of the water intake.	1.0 mile
Smith Brook	Village of Johnson	Smith Brook in Johnson and all waters in its watershed upstream of the water intake.	1.6 miles
French Hill Brook	Village of Johnson	French Hill Brook in Johnson and all waters in its watershed upstream of the water intake.	2.4 miles
Unnamed tributary to the Lamoille River	Village of Fairfax	**Abandoned.** Unnamed tributary to the Lamoille River and all waters in	0.1 mile

Waters	Water Source	Description	Approx. Miles/Acres
		its watershed in Fairfax upstream of the water intake.	
Silver Lake	City of St. Albans (located in Georgia)	Silver Lake and all waters in its watershed in the Towns of Georgia and Fairfax.	30 acres (lake only)

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

Based upon biomonitoring assessments conducted by the DEC WSMD, one surface water in Basin 7, Smith Brook in Johnson, consistently and demonstrably attains a higher level of quality than Class B(2), and may meet Class B(1) criteria for aquatic biota (Table 3 and Figure 11).

B(1) Waters for Recreational Fishing

Certain waters in Basin 7 support productive populations of cold-water salmonids. 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)[3]. The five streams that meet B(1) criteria for recreational fishing (§29A-306 of the VWQS) are listed in Table 3 and shown in Figure 11.

These waters shall be managed to achieve and maintain the documented quality of fishing. The five waters identified may be adjusted in the future based on new and updated surveys and as protocols are refined. Waters that meet the criteria in the VWQS for both B(1) and A(1) fishing use will be continually identified and updated. It is important to note that all waterbodies that would naturally support fish populations are protected and maintained in perpetuity.

A(1) & B(1) Waters for Aesthetics

The VWQS contains a designated use for aesthetic conditions, and DEC developed numeric nutrient criteria for lakes and ponds in relation to this use (see Table 3 on page 30 in the VWQS). One lake in the basin, Caspian Lake, meets the nutrient criteria for A(1) aesthetics while Elmore Lake and Lake Eden meet the nutrient criteria for B(1) aesthetics (Table 3, Figure 11). Both Caspian Lake and Lake Eden show increasing nutrient trends, which suggests a need for an intervention to reverse these trends. Strategies to address these trends are described in Chapters 4 and 5. Lakes that

[3] It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in any given year. The upstream and downstream extent of the stream classification should be based upon consistent or improving water quality, physical habitat quality and land use conditions. The reach should include all upstream habitats which are deemed essential to sustain water quality and physical habitat requirements necessary to support wild salmonid populations at a Very Good level.

are a priority for additional monitoring are covered in Chapter 5 in the Basin 7 Monitoring and Assessment Table.

B. Class I Wetland Designation

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

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

Impacts to Class I wetlands may only be permitted when the activity is necessary to meet a compelling public need for health or safety. The VT Wetlands Program has created a Class I website with an interactive map. This website includes the determinations for nine Class I wetlands including six wetlands that were added since 2016.

In 2016 the Sandbar Wetland Complex, in Milton and Colchester, Vermont, along the north and south sides of U.S. Route 2, was designated as a Class I wetland. No additional wetland candidates have been proposed by the Vermont Wetlands Program in the Basin 7. Six wetlands have been identified for further study for Class I wetland designation. These wetlands are described in Chapter 4. DEC supports the further study and petitioning of these wetlands and the VT Wetlands Program welcomes recommendations for Class I candidates. Those wetlands that satisfy criteria for designation may be proposed for such designation through departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

C. Outstanding Resource Waters Designation

Vermont Act 67 ("An Act Relating to Establishing a Comprehensive State Rivers Policy," 1987) provides protection to rivers and streams that have "exceptional natural, cultural, recreational, or scenic values" through the designation of Outstanding Resource Waters (ORW). ORW designation may protect exceptional waters through permit conditions, in stream alterations, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects, and other activities. Waters can be proposed for ORW designation by the ANR through rulemaking.

There are currently no waters recommended for ORW designation in Basin 7. Although no other waters have been identified as ORW candidates in this plan, there may be waters in the basin which merit this designation and for which ORW status should be pursued. In the 2016 Lamoille River TBP, two waters, Zack Woods Pond and a section of the Lamoille mainstem, were recommended for further study. Neither of these waters has been pursued for further study. The Agency will

support collaborative efforts to develop the materials, and to conduct outreach necessary to support rulemaking for ORW designation of these waters, should there be public interest. On receipt of a signed written request, the Secretary shall consider the adoption, amendment, or repeal of rules regarding ORW designation and shall take appropriate action as required under 3 V.S.A. § 806. After consideration of all relevant information, the Secretary shall determine whether to enter rulemaking to designate the waters as ORW if it finds that they have exceptional natural, recreational, cultural, or scenic values. (10 V.S.A. § 1424a).

D. Identification of Existing Uses

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 basin 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 Basin 7. 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 in Basin 7 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. The existing uses in Basin 7 of swimming, boating, fishing, and public water source are found at on the Basin 7 webpage: https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning/basin7. 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. For existing uses of waters, the level of water quality necessary to protect those existing uses shall be maintained and protected regardless of the water's classification (DEC, 2017).

Chapter 3 – Priority Areas for Surface Water Restoration

A. Stressed or Impaired 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 2019 Vermont Surface Water Assessment and Listing Methodology (Vermont Department of Environmental Conservation, 2019). Surface waters are assessed as: full support, stressed, altered, or impaired. To address Section 303(d) of the Federal Clean Water Act, the DEC develops the 303(d) List of Impaired Waters, which includes impaired lakes, ponds, rivers, and streams that do not meet VWQS.

The State also produces the Priority Waters List, which identifies other waters that do not meet water quality standards, but do not require a TMDL as other pollution control mechanisms are in place. Sections of that list include: Part B-impaired waters that have other required remediation measures in place; Part D-impaired waters with TMDLs in place; Part E-waters altered by Aquatic Invasive Species (AIS); Part F-waters altered by flow modifications; and waters that are assessed as "stressed" where stressors are present that prohibit the waters from attaining a higher water quality. These lists can be viewed on the DEC Assessment and Listing webpage. For a more detailed description of monitoring results use the Vermont Integrated Watershed Information System (IWIS) online data portal. Figure 12 and Table 6 show the known impaired (12), stressed (14), or altered (13) surface waters in Basin 7.

Updates to Listings

Based on monitoring and assessment results, three waters were removed from the Stressed Waters List in 2020 after meeting water quality standards and showing no significant signs of degradation. These waters include Tucker Brook and Haynesville Brook in Hardwick, and Elmore Branch in Elmore. Three other streams segments listed as stressed are being assessed for aquatic habitat improvements in summer 2021 by the Rivers Program. The rivers are Browns River, North Branch Lamoille, and Wild Branch, and will be reviewed during the 2022 Stressed Waters List update. Additionally, listings for the Gihon River and Ryder Brook will be revisited.

One water, Stones Brook in Fletcher, was added to the Impaired 303(d) list for failing aquatic life use assessments. The impairment is due to excessive nutrients from agricultural runoff and loss of riparian buffer vegetation. And Rodman Brook, on the Impaired 303(d) for iron, has shown an improving trend for aquatic life use and will continue to be monitored to track improvement.

A primary goal of the plan is to identify and address pollutants degrading the listed waters with strategies listed in the Chapter 5 Implementation Table. The types of strategies prescribed are based on the sector-specific practices outlined in the Vermont Surface Water Management Strategy.

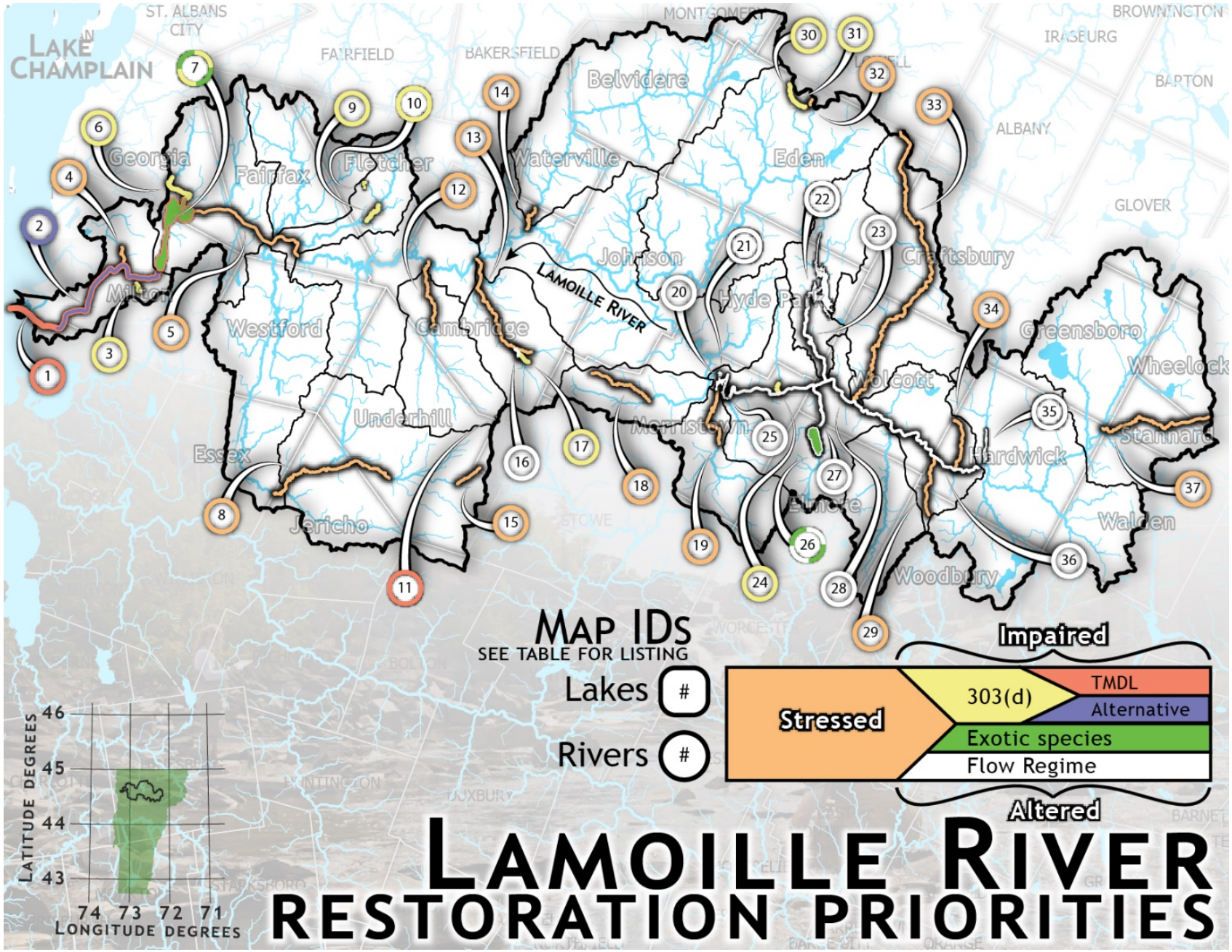


Figure 12. Map of Basin 7 priority waters for restoration. The "Map IDs" correspond with Table 6 surface water descriptions.

Table 6. Basin 7 priority waters and pollutants. This table corresponds with Figure 12 map numbers.

LISTING	MAP #	NAME	POLLUTANT(S)	PROBLEM
Impaired TMDL	1	Lamoille River, Mouth to Clarks Falls Dam (8.5 miles)	Mercury in fish tissue	Elevated levels of mercury in walleye (from historic records).
	11	Lake of the Clouds	Acid	Atmospheric deposition, critically acidified, chronic acidification
Impaired Alternative	2	Lamoille River, Route 2 to Arrowhead Mountain Lake	Low D.O.	3 dams (Clarks, Milton, and Peterson) create dissolved oxygen problems downstream
Impaired 303(d)	3	Lamoille River Trib #4, rm 0.4 to rm 0.7	Metals	Old Milton landfill (pb, zn, cu, fe) impacts macroinvertebrate community
	6	Deer Brook, Mouth to 2.5 Miles Upstream	Sediment/silt	Erosion from stormwater discharges, runoff from agricultural land, sedimentation
	7	Arrowhead Mountain Lake	Mercury	Elevated levels of mercury in walleye
	9	Stones Brook from 150-feet below Fairfax Road up to Halfmoon Brook (1 mi)	Nutrients	Agricultural runoff, loss of riparian buffer
	10	Halfmoon Pond	Phosphorus	Extremely elevated total phosphorus concentrations, agricultural influences
	17	Trib #10 to Brewster River (1 Mile)	Iron	Impacts from landfill leachate, biological community improving, monitoring to continue
	24	Rodman Brook, Mouth to rm 0.6	Iron	Impacts from landfill leachate, biological community impacted, needs follow up monitoring after restoration
	30	Hutchins Brook Tributary #4, Mouth to rm 0.3	Asbestos, sediment/silt	Asbestos mine tailings erosion, asbestos fibers, sedimentation
	31	Hutchins Brook, rm 2.0 to 3.0	Asbestos, sediment/silt	Asbestos mine tailings erosion, asbestos fibers, sedimentation
Stressed	4	Streeter Brook	Chloride, phosphorus	Needs more monitoring and further investigation
	5	Lamoille River from Fairfax Falls Dam to Arrowhead Mt Lake	Mercury in fish tissue	Elevated levels of mercury in walleye (historic records from Lake Champlain populations)
	8	Browns River, from West of Jericho-Essex Line Up 7.5 Miles	Habitat alterations, sediment/silt, temperature	Former large scale gravel mining by landowners, streambank de-stabilization
	12	Seymour River (Lowest 3.5 Miles)	Sediment, nutrients	Bank erosion, agricultural influences, channel instability
	13	Brewster River from Ski Area to Mouth	Sediment	Construction erosion, increased peak stormwater discharge, road and parking lot runoff
	14	North Branch Lamoille (Rt 109 to Mouth)	Sediment	Bank erosion, channel instability

LISTING	MAP #	NAME	POLLUTANT(S)	PROBLEM
	15	Stevensville Brook, from rm 2.0 Up to Headwaters	pH, low, habitat alterations	Acid rain inputs, frequently flooded streams
	18	Mud Brook	Iron	Iron precipitate degrading habitat, macroinvertebrates fair in 2002, no restoration since 2002 assessment
	19	Ryder Brook	Habitat alterations, sediment	Agricultural influences, residential development
	29	Kate Brook	Habitat alterations	Channelization, rip-rap, dredging
	32	Wild Branch, Mouth to Headwaters	Sediment	Re-location of channel, flood damage and repair, loss of floodplain, encroachments, bank erosion
	32	Dark Branch, rm 3.3	Asbestos, sediment	Biological community barely passing VT Water Quality Standards in 2007, possible impacts from asbestos mine
	34	Bunker Brook	Habitat alterations	Channelization, rip-rap
	37	Stannard Brook	Sediment	Floods and post flood work (1973, 95, 97), bank erosion, fish and macroinvertebrate community impacts variable
Altered Flow Regime	16	Unnamed Brook, Trib to Brewster River (1 Mile)	Artificial flow regime, insufficient flow below morse reservoir, used for domestic water	Non-support of aquatic biota for 1.0 mi (2.7 mi total length), domestic water use
	20	Lake Lamoille	Water level fluctuation by hydroelectric facility may alter aquatic habitat	Applicant appealed section 401 Water Quality certification environmental court hearing scheduled for early 2018
	20	Mid-Lamoille River, Immediately Below Cadys Falls Dam (0.3 Miles)	Artificial dewatering of falls by hydroelectric facility	Supreme court remanded issues back to environmental court, FERC license still pending
	22	Green River Reservoir	Water level fluctuation and winter drawdown alters aquatic habitat	Applicant appealed section 401 Water Quality certification; environmental court hearing scheduled for early 2018
	25	Upper Lamoille River Below Morrisville Lake Dam	Below Morrisville Dam: no flow in bypass impairs aesthetics, recreation, habitat	Supreme court remanded issues back to environmental court, FERC license still pending
	26	Lake Elmore	Water level fluctuation by hydroelectric facility may alter aquatic habitat	Applicant appealed section 401 Water Quality certification; environmental court hearing scheduled for early 2018
	27	Green River, Downstream from Reservoir 4.7 Miles	Artificial flow regime and condition by hydroelectric operations alters aquatic biota	Supreme court remanded issues back to environmental court, FERC license still pending
	27	Elmore Pond Brook-From Dam to 2.2 Miles Downstream	Artificial flow regulation & condition by dam	Supreme court remanded issues back to environmental court, FERC license still pending
	28	Upper Lamoille River Below Wolcott Dam	Wolcott Dam: artificial & poor flow regime downstream (threat)	Supreme court remanded issues back to environmental court, FERC license still pending

LISTING	MAP #	NAME	POLLUTANT(S)	PROBLEM
	35	Hardwick Lake	Water level fluctuation by hydroelectric facility alters aquatic habitat & wetlands	No longer managed for hydroelectric generation, lake drained during fall / winter for ice control
	36	Upper Lamoille River Below Hardwick Lake Dam	Hardwick Lake Dam: artificial flow regime downstream	Supreme court remanded issues back to environmental court, FERC license still pending
Altered Exotic Species	7	Arrowhead Mountain Lake	Locally abundant Eurasian water milfoil (EWM) growth	Locally abundant growth, no active management
	26	Lake Elmore	Locally abundant EWM growth.	Ongoing management plan that includes DOSH, benthic barriers, and hand-pulling

B. Basin Specific Total Maximum Daily Loads (TMDLs)

A Total Maximum Daily Load (TMDL) is the calculated maximum amount of a pollutant that a waterbody can receive and still meet Vermont Water Quality Standards. In a broader sense, a TMDL is a plan that identifies the pollutant reductions a waterbody needs to meet Vermont's Water Quality Standards and develops a means to implement those reductions. TMDLs can be calculated for reducing water pollution from specific point source discharges or for an entire watershed to determine the location and amount of needed pollution reductions. Tactical Basin Plans serve as the implantation plan to guide the implementation of actions necessary to meet TMDL reduction targets specific to each planning basin.

TMDLs for Basin 7 include:

- 2003 TMDL for 30 Acid Impaired Lakes in Vermont (Lake-of-the-Clouds)
- Northeast Regional Mercury TMDL
- Lake Champlain Phosphorus TMDL

Two TMDLs for waters in this Basin, the Acid Impaired Lakes and Mercury TMDLs are primarily focused on regional efforts to reduce atmospheric deposition and so are not described in greater detail beyond the link provided above. However, the Lake Champlain Phosphorus TMDL is described in greater detail below.

Lake Champlain Phosphorus TMDL (Phase 3 Content)

Lake Champlain is one of the largest lakes in North America and is bordered by the States of Vermont and New York and the Province of Quebec. The 8,234 square mile watershed drains nearly half the land area of Vermont (56% of the basin), as well as portions of northeastern New York (37% of the basin) and southern Quebec (seven percent of the basin). Roughly 64% of its land area is forested, 16% is agricultural, 10% is open waters, six percent developed, and four percent is wetlands.

Lake Champlain is impaired by the nutrient phosphorus, which causes cyanobacteria blooms and unpleasant odors, and leads to low dissolved oxygen concentrations, impaired aquatic life, and reduced recreational use. Phosphorus sources to the lake include agricultural runoff, streambank erosion, developed lands runoff (including roads, parking lots, lawns, athletic fields, buildings, and industrial facilities), wastewater treatment plant discharge, and runoff from forest harvesting operations and forest roads.

Total phosphorus concentrations vary greatly among the twelve Vermont lake segments that comprise Lake Champlain and its Vermont watersheds. The Malletts Bay lake segment, which Basin 7 drains to, has phosphorus levels in the low-mesotrophic range of 9-12 micrograms per liter (µg/l). Comparatively, eutrophic conditions exist in South Lake A and B, St. Albans Bay, and Missisquoi Bay, where mean phosphorus concentrations are in the range of 24-58 µg/l.

The United States Environmental Protection Agency (EPA) has established Total Maximum Daily Loads (TMDL) for all twelve Vermont lake segments to ensure that phosphorus reductions are met throughout the lake. While phosphorus concentrations vary among the segments, the interconnectedness of the segments necessitates a lake-wide approach to achieving TMDL targets set by EPA. The Lake Champlain segments have been included on Vermont's Section 303(d) list as impaired for phosphorus (United States Environmental Protection Agency, 2016) since the late 1990's and a revised TMDL plan was completed and approved by the EPA in 2016 to describe how the State will achieve the pollution reduction targets. This section, along with Chapters 4 and 5, fulfills EPAs expectations for the TMDL's Phase 3 Implementation Plan (Phase 3).

Phases 1, 2, & 3 of the Lake Champlain TMDL

The EPA approved the VT Lake Champlain Phosphorus TMDL Phase 1 Implementation Plan in September 2016. The plan addresses all major sources of phosphorus to Lake Champlain and proposed efforts from all land use sectors. Some increased efforts included enhanced regulatory oversight within state government, new requirements for municipal road and stormwater management, additional agricultural regulations, developed land stormwater management, as well as incentives for landowners to implement water quality best management practices (BMPs). The Phase 1 plan includes the state's policy commitments relating to regulatory changes and new programs that provide the foundation for longer-term success. The Vermont Clean Water Act of 2016 created the statutory authority to implement all provisions of the Phase 1 Plan, which was deemed by EPA to be completed as of September, 2020.

The Phase 2 content of the TMDL then provided a downscaling of phosphorus allocations to the tactical planning basin, and prioritized catchments for remediation based on highest modeled load reductions as well as a description of pollution tracking and accounting mechanisms. The Phase 2 content for Basin 7 was incorporated into the 2016 Lamoille Basin Tactical Plan and identified regulatory programs to address phosphorus loading and specified target areas for implementing reduction strategies from all land use sectors.

Phase 3 is incorporated as part of the 2021 Lamoille River Tactical Basin Plan and describes the progress achieved in pollutant reductions since 2016 by sector, projects sector specific target reductions for the next five years, reports on reduction requirements across all sectors within the Lamoille basin, including regulatory and non-regulatory actions, and identifies gaps in strategy implementation. This Phase 3 accounting fulfills requirements of the Lake Champlain TMDL Accountability Framework.

Malletts Bay and Lamoille Watershed Load Reductions

As described previously, Malletts Bay is one of the twelve Vermont TMDL segments where phosphorus reductions are required to restore Lake Champlain and meet Vermont's Water Quality Standards. The Lamoille watershed inputs into the Malletts Bay lake segment (Figure 13). The Malletts Bay lake segment is fed by the Lamoille River and four direct drainages. The four drainages include Indian Brook, Pond Brook, Malletts Creek, and Allen Brook, which are part of Basin 5 or the Northern Lake Champlain basin. This plan will only address loading from Basin 7.

The total phosphorus annual watershed load of Basin 7 is 70,215 kilograms (Table 7). The watershed load is different from the delivered load to Malletts Bay because only a portion of the phosphorus mobilized in Basin 7 makes it to the lake (i.e., some is captured by floodplains, some is taken up by plants, etc.). This plan uses watershed loading values. To meet the Lake Champlain Phosphorus TMDL expectations, total annual phosphorus loading into Malletts Bay from the Basin 7 is required to be decreased by 23% or by approximately 17 metric tons (17,000 kg) per year (Table 7).

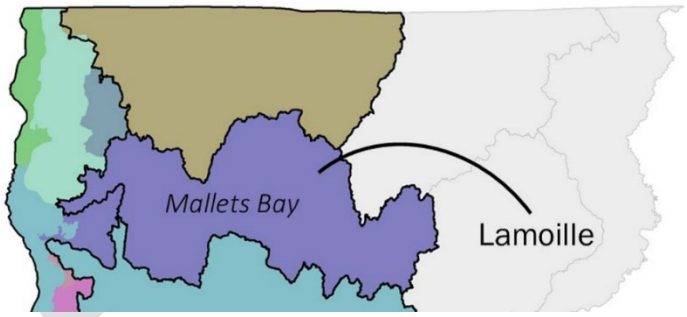


Figure 23. Map showing the extent of the Lamoille Basin (Basin 7) in relation to the Malletts Bay drainage in Vermont. The entire area draining to Malletts Bay is dark purple. The Lamoille portion is outlined in black.

In comparison, the watersheds with the highest total annual watershed loading, Otter Creek, Winooski River, and Missisquoi River, produce more than twice as much phosphorus as Basin 7. The largest reduction targets for Basin 7 are expected to come from agriculture (8,925 kg/yr), developed lands (4,499 kg/yr), and river channel erosion (3,278 kg/yr) (Table 7).

Three interactive online reports are included in this Phase 3 section to further illustrate loading and reduction estimates for the TMDL relative to Basin 7 and the agricultural sector where an ample tracking information allows for more detailed estimations. Each of these reports is provided below and within the text of the following sections.

1. *Estimated TMDL TP Loading and Reduction* online report
2. *Lamoille Basin Agricultural Phosphorus Loading & Reduction* online report
3. *Lamoille Basin Agricultural Tracking & Target Setting* online report

Sub-watershed scale phosphorus loading and reduction estimates for HUC12[4] watersheds within Basin 7 can be examined and compared with other watersheds using the *Estimated TMDL TP Loading and Reduction* online report, which displays estimates for all land use sectors and HUC12 watersheds in the Lake Champlain basin. The first page of the report summarizes estimated phosphorus loading by HUC12 watershed; the second page of the report summarizes estimated TMDL reductions by HUC12 watershed.

Table 7. Summary table of total phosphorus watershed annual loading, total annual reduction targets, and required reductions for the Basin 7 portion of the Malletts Bay segment of Lake Champlain.

Source	Category	Allocation category	Total Load (kg/yr)	Total annual reduction goal (kg/yr)	% Reduction required for basin
Agriculture	Fields/pastures	Load	26,067	7,455	28.60%
	Barnyard Production Areas	Wasteload	1,837	1,470	80.00%
Developed Lands	Stormwater & Roads				
	VTrans owned roads and developed lands	Wasteload	21,947	4,499	20.50%
	Roads MRGP				
	MS4				
	Three-Acre General Permit				
Wastewater	WWTF discharges	Wasteload	3,240	6	0.20%
	CSO discharges	Wasteload	NA	NA	NA
Rivers	All streams	Load	7,301	3,278	44.90%
Forests	All lands	Load	9,823	491	5.00%
		Total	***70,215***	***17,199***	***23.4%***

Measuring Progress Towards TMDL Targets[5]

The Clean Water Initiative Program (CWIP) has developed tracking an accounting methods to measure progress on meeting the TMDL. Tracking and accounting is still being developed and improved as the writing of this plan, but good progress is being made in the stormwater and agriculture sectors. CWIP also produces an annual report, the Vermont Clean Water Initiative Performance Report, that describes progress on statewide pollution reduction goals including basin specific progress. An interim and final report card documenting progress on the implementation table in Chapter 5 of the TBP are included in the Clean Water report appendix every five years at

[4] A hydrological unit code (HUC) is a sequence of numbers or letters that identify a hydrological feature like a river, lake, or drainage basin. HUC12 refers to the classification of the basins used to account for phosphorus loading from agricultural lands in Vermont for the Lake Champlain TMDL. An example of a HUC12 is the Brewster River in Cambridge, Vermont.

[5] The 2021 TBP reports on phosphorus reductions from July 1, 2015, to June 30, 2020. The plan illustrates these reductions using the calendar year format from 2016-2020. The 2025 5-year target is SFY2025 starting on July 1, 2020 and ending on June 30, 2025.

two and a half year increments. This section of the TBP reports on the progress made in meeting the annual reduction needed to reach the allocation for Basin 7.

Table 8 provides tracked progress for the past five years for each sector from 2016 to 2020. The annual reductions have generally increased each year for each sector. This upward trend can be more clearly observed in Figure 14. Each year in the bar chart (Figure 14) shows the percent of the final target (total TMDL reduction due in 2036) achieved. The totals are not cumulative, and the same volume of reduction must be achieved each year to maintain the 2036 target. Within the first five years, the agriculture sector is meeting 4 and 14% of their final targets and the developed lands sector is meeting five percent of their final target. The factors leading to the substantial increase in phosphorus load reductions in the agricultural sector in contrast to the minimal reductions seen in the others may include earlier regulatory compliance dates and focused efforts by partners.

See the following Forestland Sector and Wastewater Sector sections for more details on targets and progress for these sectors. The Agency expects to see increases in reductions across all sectors in Table 8 in the next five years and beyond as associated regulatory programs are implemented more comprehensively and reduction efficiency methodologies are developed and established for all clean water project types. The final section of this Phase 3 - TMDL Sector Status of Achieving Targets - provides a description of the planned improvements and progress.

Table 8. Summary table of estimated total phosphorus (TP) reductions per year for each sector by kilograms from 2016 to 2020.

Sector	Kg of TP Reduced Annually				
	2016	2017	2018	2019	2020
Field/Pastures	503	614	820	1,118	938
Barnyard Production Areas	0	5	31	58	77
Stormwater	0.6	4	11	28	37
Road	0	2.6	28	58	115
River	0.5	2.7	6	7	7
Forest	-	-	-	-	-

Five-year phosphorus load targets for 2021-2025 are shown in Table 9 for each sector as they relate to achieving the TMDL. Implementation Table strategy progress will be measured against the 5-year total phosphorus reduction (TP) targets, which are the proposed milestones for each sector. The five-year target setting is obtained by subtracting the current-year reduction estimates for each sector from the overall TMDL sector goal and dividing into five-year segments. The 2026 Lamoille River Tactical Basin Plan will report progress on achieving the target milestones suggested in this plan and address any challenges or gaps in achieving those targets in each subsequent phase of TMDL implementation, each annual Clean Water Performance Report, and attendant interim and final TBP report cards.

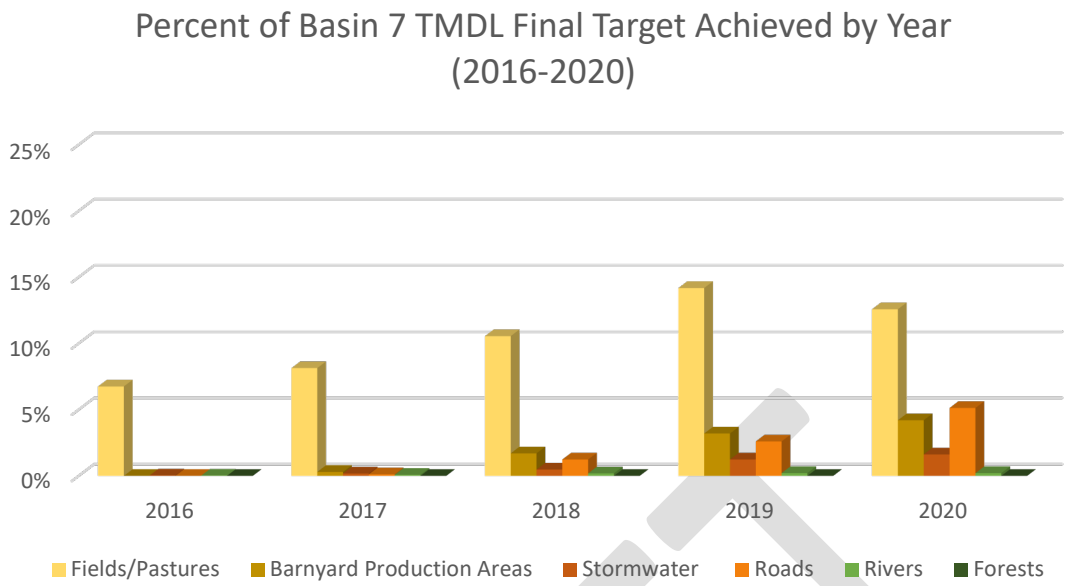


Figure 14. Bar graph showing the percent of the Basin 7 TMDL 2036 target achieved annually for each sector from 2016 to 2020.

Commitment and Strategy to Meet Targets

To meet TMDL targets, the state of Vermont has implemented initiatives that include both regulatory and non-regulatory approaches. The initiatives include the creation of the state's engagement strategy to develop, maintain, and enhance the Agency's new and current partnerships; the passage of Act 76 – the Clean Water Service Delivery Act – in 2019 to support those partnerships, as well as ensure project prioritization and funding; and finally, program advances in each sector as well as additional accounting methods to obtain an accurate reflection of phosphorus reduction through land use practices. These initiatives are described below and in detail in Chapter 4.

Table 9. Prospective five-year and estimated final year (2036) total phosphorus reduction targets (kg/yr).

Sector	2025 Target	Final Target
Fields/Pastures	2974	7,455
Barnyard Production Areas	512	1,470
Stormwater	701	4,499
Roads	663	
Rivers	1,029	3,278
Forests	154	491

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. Table 10 describes the regulatory processes that will support the attainment of annual TMDL reduction targets in each sector for Basin 7. These regulatory programs are also described below in the sector sections and in Chapter 4. Chapter 4 provides information on priority sub-basins and towns for outreach, technical and funding support, and implementation.

Table 10. Phase 3 regulatory programs to meet phosphorus reductions.

Source Sector*	Permit Program	Reporting Scale	Efficiency	TP Loading Scale	Implementation Timeline Information
Agriculture	Required Agricultural Practices (RAPs) / Large Farm Operation (LFO) & Medium Farm Operation (MFO) Rules and Permits	HUC12	SOP (to be developed in November 2021)	Implemented and tracked at HUC12 scale	Estimates completed at HUC12 scale per farm size inspection cycle. Certified Small Farm Operations (CSFOs) at least once every 7 years, MFOs at least once every 3 years, and LFOs annually.
Stormwater	Operational Three-acre General Permit	HUC12	35% reduction	Can estimate once three-acre GIS layer is finalized	Stormwater Program has list of when each parcel is due for permitting; once issued, site will have five-year period to implement.
	Municipal Separate Sewer System (MS4) General Permit	MS4 jurisdiction	SOP	Determined by MS4	Phosphorus control plans due 4/1/2021; methods due to be published by 11/2021.
Roads	Municipal Roads General Permit (MRGP)	Town, but have access to GIS road segments; should be possible to aggregate at HUC12 scale	SOP	Stormwater Program will provide estimate of total expected reduction Q1 2021	Towns must report road erosion inventories (REI) by 12/31/2020; all work to be completed by 12/31/2036; reduction timeline likely to be somewhat frontloaded due to focus on priority road segments.
	Transportation Separate Storm Sewer System (TS4) Permit	Lake Segment	TBD	TBD	Stormwater Program currently reviewing draft VTrans phosphorus control plan.
Forests	Acceptable Management Practices (AMPs)	HUC12	TBD/RFP	Completed at HUC12 scale	Assumes that lake segments with 5% forest reduction will be achieved via increased AMP compliance.

*While no river state regulatory programs have been promulgated to achieve TMDL targets, municipal River Corridor Bylaw adoption is encouraged for target towns in Chapter 4 and Chapter 5.

Act 76 Framework to Meet Non-Regulatory Targets

The 2019 Vermont Clean Water Service Delivery Act (Act 76) has provided the funding and project delivery framework to ensure essential water quality projects to achieve Vermont's clean water goals. The Act accomplishes the following four primary tasks.

Act 76 satisfies a significant milestone in the TMDL by securing long-term funding to achieve Vermont's clean water goals. The Clean Water Fund revenue will support clean water projects, which in turn will leverage other funding sources.

The Act makes it easier to prioritize and fund non-regulatory projects. Non-regulatory projects include small-scale green stormwater management practices, conservation initiatives on Vermont farms, and natural resource restoration projects such as conservation easements, wetland and floodplain restoration, and tree and shrub plantings along riparian areas. While not required, these projects are essential to achieve the water quality goals spelled out in both the Lake Champlain and Lake Memphremagog TMDLs.

The Act also provides a greater emphasis on achieving phosphorous reduction targets set for each watershed that will be supported by the establishment of Basin Water Quality Councils (BWQCs) led by regional Clean Water Service Providers (CWSPs). CWSPs are responsible for partnering with BWQCs to identify, implement, operate, and maintain non-regulatory projects to meet non-regulatory interim phosphorus reduction targets for the Lake Champlain TMDL, and for other impaired waters in Vermont as pollution budgets are established. BWQCs will be formed and operational by 2022.

Lastly, Act 76 requires formula dispersal of funds for non-regulatory projects in the Lake Champlain Basin. The formula is based on interim phosphorus reduction targets and a standard cost per unit phosphorus reduced, consistent with "pay for performance" models. CWSP interim phosphorus reduction targets are under development and will be published in 2022, as a subset of the targets presented in Table 9. The approved Clean Water Service Provider for Basin 7 is the Northwest Regional Planning Commission.

Engagement Strategy

Crucial to the development and future implementation of Phase 3 is the collaborative approach taken to engage partners. This approach focuses on impacts and projects at the local level, with the state as a committed partner in the effort. Vermont's engagement strategy, including ongoing as well as new approaches, includes three dimensions:

1. Widespread collaboration with multiple partners from multiple sectors and localities in developing, writing, and implementing Tactical Basin Plans (TBPs);
2. Strategic inclusion and engagement with different sectors and localities throughout the TMDL "Phase 3" planning process to ensure that all concerns, needs, and goals are addressed throughout the planning process; and

3. Strategic communication efforts to ensure understanding of and support for the plan among key stakeholders as well as throughout the watershed.

The engagement strategy is under development. These extensive efforts have facilitated widespread improved understanding of the requirements for Phase 3, in diverse and sustained collaboration, and in new partnerships. As a result, Phase 3 has widespread shared ownership, is well informed by those working on the ground, and enhances reasonable assurance that Vermont will achieve improvements in local water quality and the 2026 Champlain TMDL targets.

TMDL Sector Status of Achieving Targets

Agricultural Sector

Agricultural lands make up about 13% of land cover in Basin 7. Phosphorus loading from agricultural lands in Basin 7 account for approximately 4.4% of all phosphorus loading to Lake Champlain. In Basin 7, these areas will require an average reduction of 80% or 1,470 kg/yr for barnyard production areas and 28.6% or 7,455 kg/yr for fields and pastures to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 7). The annual reduction achieved for 2020 was 938 kg (12.5% of the final target) for fields and pastures and 77 kg (4.2% of the final target) for barnyard production areas. (Table 8 and Figure 14).

Sub-watershed scale phosphorus loading and reduction estimates for HUC12 watersheds within Basin 7 can be examined in the interactive *Estimated TMDL TP Loading and Reduction* online report, which displays estimates for all land use sectors and HUC12 watersheds in the Lake Champlain basin. Agricultural sectors are broken into three classes in this report: crop (or field, which is hay and cultivated crops), farm (barnyard production areas), and pasture.

Agricultural Mitigation, Tracking, and Accounting Efforts

Phosphorus loading from agricultural sources is currently being addressed by several state agencies, regulatory programs, and partner groups. These efforts include the implementation of Best Management Practices (BMPs) to reduce pollution, as well as the tracking and accounting of expected phosphorus reductions from management actions. Results from tracking and accounting efforts are used to measure progress in meeting state and federal phosphorus reduction goals. Examples of mitigation, tracking, and accounting efforts in the agricultural sector include:

- The Vermont Agency of Agriculture, Food, and Markets (VAAFM) has developed a series of Required Agricultural Practices (RAPs) to minimize agricultural impacts on water quality. These practices are expected to greatly reduce phosphorus loading from agricultural sources. Tracking and accounting efforts are being recorded in a multi-partner planning database.
- Act 76 reserves 10% of agricultural phosphorus loading for mitigation by Clean Water Service Providers (CWSPs), who are regional watershed partners with the resources to address local water quality pollution sources. Act 76 also includes provisions for CWSPs to address any required phosphorus reduction targets not met by existing regulatory programs.

- The Clean Water Initiative Program (CWIP) coordinates the funding, tracking, and reporting of clean water efforts for federal and state partners, including VAAFM and CWSPs. Tracking and accounting methods as well as standard operating procedures (SOPs) for phosphorus reduction estimation are described here.

Basin 7 Agricultural Tracking and Accounting Results

A summary of agricultural tracking and accounting work in Basin 7 is available in the *Lamoille Basin Agricultural Phosphorus Loading & Reduction* online report, which details agricultural land use, phosphorus loading estimates, BMP implementation, and estimated phosphorus reductions.

The data reporting starts in 2015, although 2016 is the start of the 20-year TMDL implementation period. Key data include:

- In 2020, over 2,200 acres of agricultural BMPs were *newly* implemented in the basin (several BMPs have multi-year lifespans and are counted in the year they are first implemented, then carried forward for the design life of the BMP); this represents a decrease from newly 3,200 implemented acres in 2019. Cover crops represent the most acreage in 2020, with over 1,500 acres.
- A little over 1,000 kg of agricultural phosphorus were estimated to have been reduced by BMP management actions in the basin in 2020. This figure is unchanged from 2019. Cover cropping was responsible for the largest reduction, followed by crop to hay conversion and riparian buffers.

Basin 7 Agricultural Target Setting

The Lake Champlain TMDL mandates reductions from agricultural sources of terrestrial phosphorus. The amount of reduction depends on the lake segment to which a watershed drains. Although reductions are reported at the basin scale, for tracking and target setting purposes these reductions were downscaled at a HUC12 scale. These HUC12-scale targets can be compared to reported reductions to assess progress, identify new strategies, and prioritize future funding and management actions. In addition, the TMDL requires reporting on the 20-year goal in five-year increments. This five-year target setting is obtained by subtracting current-year reduction estimates from the overall TMDL sector goal and dividing into five-year segments.

These data are summarized in the *Lamoille Basin Agricultural Tracking & Target Setting* online report. The first page of the report summarizes estimated reductions and target reductions by HUC-12 watershed for each TMDL year, as well as the percent of the TMDL target achieved at both a HUC-12 and basin scale. The second page of the report details a five-year target phosphorus reduction for the agricultural sector.

Key highlights:

- Basin-wide in 2020, 4.2% of the total barnyard practice reduction goal was met, and 12.5% of the field practice reduction goal was met. The TMDL mandates that 100% of this goal is met by 2036.

- Based on current year data, an annual cumulative reduction of 407 kg of phosphorus from agricultural field practices is required from 2020 to 2036 to meet the TMDL goal. The five-year reduction target for 2025 is 2,036 kg of phosphorus. This represents an increase of 1098 kg of phosphorus over what was achieved in 2020.
- Based on current year data, an annual cumulative reduction of 87 kg from barnyard practices is required from 2020 to 2036 to meet the TMDL goal. The five-year reduction target for 2025 is 512 kg of phosphorus. This represents an increase of 435 kg of phosphorus over what was achieved in 2020.

Developed Lands Sector

Developed lands make up about five percent of land cover in Basin 7. Phosphorus loading from developed lands in Basin 7 account for approximately 2.3% of all phosphorus loading to Lake Champlain. In Basin 7, these areas will require an average reduction of 20.5% or 4,499 kg/year to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 7). The annual reduction achieved for 2020 was 152 kg which is 3.4% of the final target (Table 8 and Figure 14). Based on current year data, an annual cumulative reduction of 272 kg of phosphorus from developed lands is required from 2020 to 2036 to meet the TMDL goal. The five-year reduction target for 2025 is 1,510 kg of phosphorus (Table 9). This represents an increase of 1,358 kg of phosphorus over what was achieved in 2020.

Stormwater-related phosphorus sources are identified in the Lake Champlain TMDL Phase 1 Implementation Plan and include runoff from National Pollutant Discharge Elimination System (NPDES) regulated point sources and nonpoint sources, and non-regulated small construction sites, and unregulated back roads. These are aggregated into the waste load allocation (WLA) category of developed land sources. In addition, some stormwater discharges from developed land may, in the future, become subject to NPDES permits and include the loads within the WLA consistent with EPA's guidance on stormwater management. Phosphorus loading from developed land was estimated using the SWAT model. The WLA portion of these TMDLs includes a category for developed land sources, while recognizing that this category incorporates both point sources that require NPDES permits and point and nonpoint sources that do not require such permits. An explanation of why EPA established an aggregate WLA for developed land sources can be found in the approved Phase 1 Implementation Plan (Department of Environmental Conservation, 2015).

Watershed modeling used in the Lake Champlain TMDL classifies developed lands into several land use classes, including industrial/commercial, residential, paved road, unpaved road, and private road/driveway. Several regulatory programs address TP from developed lands.

- The Three-Acre General Permit addresses runoff from parcels that include 3 or more acres of impervious surface.
- The Municipal Roads General Permit (MRGP) sets standards for town roads that minimize erosion near surface waters.
- The VTRANS TS4 Permit guides standards for state highways.

- MS4 permits help towns address stormwater runoff and subsequent impacts on local streams.

Estimated TP reductions from these regulatory programs have been calculated for the three-acre general permit, MRGP, and TS4. These estimates were subtracted, at the appropriate spatial scale, from TMDL TP reduction goals for developed lands. TP load reduction from developed lands that is not addressed by regulatory programs will be assigned to Clean Water Service Providers (CWSPs) for mitigation. Based on the most current calculations, 80% of the roads 5-year target (663 kg/yr) will be met through regulatory (MRGP and TS4) actions. However, the three-acre general permit is not expected to result in measurable reductions for the Lamoille Basin's developed lands sector within this same period.

The work of the Clean Water Service Provider (described above) will support the implementation of non-regulatory practices needed to fill the anticipated gaps between these interim five-year targets for roads and developed lands and phosphorus reduction achieved through other sector-based regulatory programs. Agency funding to support the achievement of non-regulatory targets will be established via interim targets set for the CWSPs during these next 5-years. An adaptive management approach will be used for accounting and target setting and any revisions will be documented in subsequent TBP and the Vermont Clean Water Initiative's Annual Performance Reports.

Wastewater Sector

Vermont Wastewater Treatment Facilities (WWTF) account for approximately three percent of phosphorus loading to Lake Champlain. Phosphorus loading from WWTFs in Basin 7 account for a de minimis amount of phosphorus loading to Lake Champlain. WWTFs in Vermont require an average reduction of 42.1% in the Lake Champlain basin to meet Vermont's phosphorus reduction TMDL goals.

A wasteload allocation was not assigned to the Malletts Bay lake segment. Reductions in waste load allocations are targeted only to wastewater treatment facilities (WWTFs) in those lake segment watersheds where the permitted wastewater load as of 2016 represents a significant (defined as being 10% or greater) portion of the total phosphorus load to that segment from all sources and/or where wastewater upgrades would meaningfully reduce the phosphorus reduction burden placed on non-wastewater (non-point) sources.

Therefore, WWTFs discharging to the Malletts Bay lake segment were not assigned new waste load allocations. The EPA also determined that wastewater facilities with a design flow of < 0.1 MGD will keep their permitted load as of 2016 due their minor contribution of phosphorus loading. Updates and information on permits for WWTFs in Basin 7 are found in Chapter 4.

Rivers Sector

Open water (including wetlands) makes up about six percent of land cover in Basin 7. River instability in Basin 7 accounts for approximately one percent of phosphorus loading to Lake Champlain. These areas will require an average reduction of 44.9% or 3,278 kg/year to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 7). The annual reduction achieved for 2020 was 7 kg which is 0.2% of the final target (Table 8 and Figure 14). Based on current year data, an annual cumulative reduction of 204.5 kg of phosphorus from the rivers sector is required from 2020 to 2036 to meet the TMDL goal. The five-year reduction target for 2025 is 1,029 kg of phosphorus (Table 9). This represents an increase of 1,022 kg of phosphorus over what was achieved in 2020.

Rivers sector reductions are expected to be achieved by implementing projects identified in River Corridor Plans and the Functioning Floodplain Initiative tool, and through the adoption and implementation of municipal regulations to protect river corridors.

Stream Stability Restoration through the Functioning Floodplains Initiative

Assessing stream and floodplain function supports the valuation of ecosystem services and the potential for natural resource restoration opportunities. Societal benefits such as safe swimming, fish and wildlife, public safety and property protection may be categorized under the general ecosystem services of water quality, ecological integrity, and flood resilience.

The Functioning Floodplains Initiative (FFI) was launched in 2019 to contract with a consulting team of professional practitioners and researchers. The goal of the FFI is to provide practitioners, program managers, and policymakers with the maps and data they need to protect and restore highly valued streams, wetlands, riparian areas, and floodplains in the Lake Champlain Basin.

The FFI team is developing methodology for a project credit scoring system that rewards phosphorus load reducing practices, as derived from the Lake Champlain TMDL baseload allocations, for stream instability using the Soil Water Assessment Tool (SWAT). This will result in a phosphorus crediting system that quantifies the gains made towards river system equilibrium.

There are three types of river and floodplain load reduction credit types for river instability. They are:

- Stream stability reconnection credits for projects on the reach and watershed scale
    - Looking at reductions over time (e.g., 10 lbs/year over 10 years)
    - River Corridor Easement (RCE) projects to achieve equilibrium and pollution reduction credits over time.
- Storage attenuation credits for projects that reconnect floodplains and wetlands
    - Driven by the deposit of sediment/nutrient when floodplains flood
    - Longer-term pollution reduction credits may diminish over time
- Sediment removal credits for projects that physically remove sediment when a floodplain feature is constructed, especially along incised channels (first year credit only)

The river instability baseload will be distributed to the reach scale by using TMDL sub-watersheds as the components of each HUC-12 to develop the total HUC-12 allocation. The HUC-12 load allocation then gets downscaled to the reach level using an "area weighted" reach assignment.

The FFI project team established a relationship between connectivity score and phosphorus allocation, whereby the higher the connectivity score, the more the phosphorus reduction target is achieved. This relationship demonstrates that repairing the most disconnected reaches will achieve the most phosphorus reduction. From a target-setting perspective, project implementers (under the Act 76 framework) should target those reaches where we expect to see the highest pollution reductions. This crediting system will consider "stacked" practices (e.g., protection + riparian buffers). DEC will devise how this will be quantified and reported on in our tracking and accounting systems.

Going forward, the river instability phosphorus scoring and crediting system will be based on the increments of restored and protected connectivity, with the highest project credits awarded in areas with higher baseload allocations. In other words, the size of the connectivity credit awarded to a project is commensurate with degree to which geomorphic equilibrium is restored.

Forestland Sector

Forestlands make up about 76% of land cover in Basin 7 and account for approximately 1.5% of phosphorus loading to Lake Champlain. These areas will require an average reduction of five percent or 491 kg/year to meet Vermont's Lake Champlain TMDL phosphorus reduction targets (Table 7). The Agency expects to meet forestland reduction targets through AMP compliance for Malletts Bay.

Targeting forestland best management practices (BMP) in areas contributing the highest phosphorus and sediment loads is challenging. In other sectors, such as the developed land sector, source areas are well understood and characterized by the benefit of spatial data with a high degree of accuracy. Additionally, these areas are generally accessible and have the advantage of unobscured aerial imagery to allow verification of mapped conditions. As a result, BMPs can be located to manage high loading areas on developed lands with precision. However, for the natural resource sectors (forestland and rivers), conducting higher resolution spatial data analysis is variable and other methods and analytical tools are in development to enhance project identification and prioritization.

Mapping Critical Source Areas & Identifying Legacy Erosion

As an outcome of the requirements of the Clean Water Service Delivery Act (Act 76 of 2019), and with support from the Lake Champlain Basin Program, the Agency of Natural Resources has contracted with a consultant team to identify and map critical source areas of forestland and establish a method to estimate the potential for phosphorus and sediment reductions associated with forestland BMPs the AMPs. This consultant will assist the State of Vermont in identifying forestland phosphorus and sediment reduction potential using remote sensing, a GIS-based (LiDAR) landscape analysis of erosion risk potential, and critical source area (CSA) mapping of forest roads, trails, and log landings in Vermont. These features will be prioritized based on their erosion risk potential. An

additional element of this work is to establish forestland best management practice (BMP) phosphorus and sediment accounting methods to estimate phosphorus and sediment load reductions associated with forestland BMP implementation and AMP implementation on lands in the Use Value Appraisal Program (see Chapter 4 for more information).

A second phase of this consultant work, anticipated to commence in the fall of 2021, will further assess forestlands to identify and prioritize legacy erosion associated with the critical source areas and to ground truth and calibrate the analytical and prioritization tools. The ground truthing of the landscape analysis is intended to calibrate the prioritization framework of critical source areas, as well as to develop a prioritization framework to address legacy erosion in high priority basins (i.e., South Lake Champlain and Missisquoi Bay) to achieve target load allocations for lake segments that will not meet reduction targets through Vermont AMP compliance alone.

Forestland Accounting

Until this consultant work can be completed, the calibration of the phosphorus and sediment accounting methods, to estimate phosphorus and sediment load reductions associated with forestland BMP implementation, will be in development. As such, this iteration of the Phase 3 will not include the projected forestland BMP reduction estimates or forestland BMP targets. In lieu of having specific forestland BMP implementation targets, other than AMP compliance, DEC will provide natural resource targets on the major river basin scale (i.e., HUC-08, Lamoille River Basin) that is inclusive of all natural resource restoration categories (e.g., including river corridor and floodplain restoration and protection, wetland restoration and protection, riparian and lakeshore restoration and protection, natural woody buffer establishment) as well as forestland AMP and BMP implementation.

Chapter 4 – Strategies to Address Pollution by Sector

Tactical basin plans address water quality by land use sector (Figure 15). The following sections provide specifics about protection and restoration efforts underway or recommended for each source sector to meet water quality objectives. A summary table of the strategies for each sector is found in the Executive Summary in Table 1. A detailed list of priority strategies by source sector is included in Chapter 5 in the Implementation Table Summary.

Figure 15. An illustration of the land use sector framework and practices used in Tactical Basin Planning to enhance, maintain, protect, and restore water quality.

A. Agriculture

Agricultural land use makes up approximately thirteen percent of the land cover in Basin 7 (Figure 16). One percent is cultivated crop and twelve percent is hay or pasture. The highest concentrations of agricultural land are found along the Lamoille River in the expansive river valley floodplains. The total land area used for agriculture ranges from one percent in the Green River HUC12[6] to 26 percent in the Stones Brook-Lamoille River HUC12. An analysis comparing acreage of implemented field practice conservation (FY2011-2019) to agricultural concentrations in the HUC12s (Fig. 16) showed that implementation was highest in the areas with the highest concentrations of agriculture.

Eighty-three percent of the conservation practice acreage implemented from 2011 to 2020 occurred in the top five phosphorus loading watershed. The increased prevalence of farms and agricultural activities in these sub-basins make them a priority for outreach and implementation of agronomic and farmstead practices for water quality. Focus areas for agricultural partners in Basin 7 include the top five phosphorus loading HUC12s. All but one HUC12 includes the Lamoille mainstem. The major tributaries of these priority HUC12s are the Seymour River, Browns River, Stones Brook, and tributaries to the Lamoille in Hardwick and Walden.

There are currently no permitted Large Farm Operations (LFOs) in Basin 7. However, there are eight permitted Medium Farm Operations (MFOs). MFOs are inspected once every three years by the Agency of Agriculture Food and Markets (VAAFM). These farms must comply with the Required Agricultural Practices (RAPs), MFO permitting program requirements, and Vermont's Water Quality Standards.

An estimated 25 Certified Small Farm Operations (CSFOs), that are required to certify annually with the Agency, will be inspected at least once every seven years, and need to comply with the RAPs. In Basin 7, as of the writing of this plan, 18 CSFOs have submitted certifications in accordance with the RAPs and 22% of CSFOs have received routine inspections by VAAFM.

The VAAFM estimates there are 75 Small Farm Operations (SFOs) in the Basin that do not meet the thresholds of a CSFO and are not required to receive a routine inspection by VAAFM, but still need to comply with the RAPs. Additionally, there are an estimated six areas (water quality points) in Basin 7 that indicate areas where farming historically occurred, prior farms that sold, current vegetable farms, and other characteristics that imply agricultural use current or historic. These locations, if active, may fall below the RAP thresholds.

[6] A hydrological unit code (HUC) is a sequence of numbers or letters that identify a hydrological feature like a river, lake, or drainage basin. HUC12 refers to the classification of the basins used to account for phosphorus loading from agricultural lands in Vermont for the Lake Champlain TMDL. An example of a HUC12 is the Brewster River in Cambridge, Vermont.

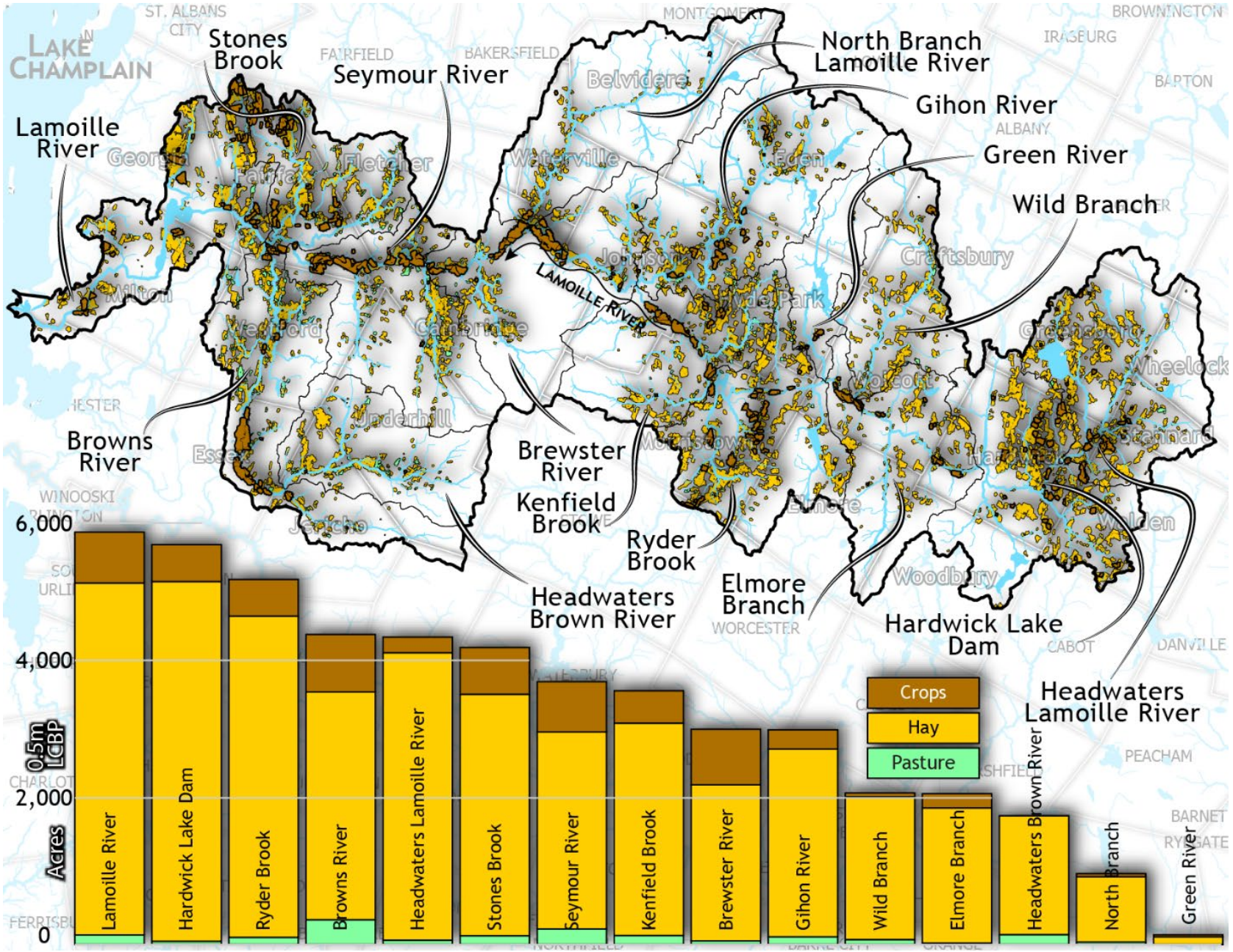


Figure 16. Map of agricultural land use aggregated by acreage of crops, hay, and pasture by HUC12 watershed.

Outreach will need to continue throughout the watershed to the remaining farms or locations to help landowners understand where they fall within the RAP farm categories and to help them understand the requirements under the RAPs. Priority watersheds for this work have been identified in Chapter 5 using current monitoring data and environmental modeling.

In March 2021, agricultural partners spanning Basin 7, including NRCS, AAFM, FWD, USFWS, NRCDs, watershed groups, and DEC staff met to discuss where work was happening and how to achieve water quality goals.

Recommendations included:

- having clearer goals and metrics developed in the tactical basin plan,
- increasing monitoring funds to track pollution and measure success of remediation actions,
- increasing outreach and farmer participation that results in more landowner willingness,
- increasing rates of repayment for services,
- building strong partnerships and increasing trust within the farming community,
- identifying the best way to connect with small farms and farms in headwater areas,
- increasing no-till in areas with continuous corn and annual flooding, and
- focusing resources and education strategically.

A list of strategies, found in the Chapter 5 Implementation Table, was developed from these recommendations. The workgroup will convene annually and focus on specific watersheds for reporting progress and building collaborative efforts.

In addition, the regional Vermont Agriculture Water Quality Partnership (VAWQP) meetings will allow for additional collaboration and reporting on basin planning efforts in the different regions. This increased collaboration will lead to effective use of time and resources and reduce redundancy in agricultural work and technical assistance in Basin 7.

VAAFM is also coordinating with agricultural partners throughout the watershed to streamline outreach to farmers where multiple resources may be available through the Multi-Partner Agricultural Conservation Practice Tracking and Planning Geospatial Database (Partner Database) launched in 2019. This coordination ensures no duplicative strategies by multiple organizations and clarifies the outreach and coordination for better farmer assistance. VAAFM provides a spectrum of assistance programs and resources (both technical and financial) that are available to farmers to improve agricultural practices that increase farm viability and protect water quality. These resources can be found at: agriculture.vermont.gov/water-quality/assistance-programs.

The USDA Natural Resources Conservation Service (NRCS) also provides a variety of assistance programs and resources for farmers to improve agricultural practices that increase farm viability, protect water quality, and improve soil health. These resources can be found at: www.nrcs.usda.gov/wps/portal/nrcs/site/vt/home/.

Additionally, in the Lamoille Basin, the Vermont Agency of Agriculture, Food & Markets, is implementing the Vermont Pay-for-Phosphorus Program, which will be accepting applications in

Fall 2021. This program is a new approach to improve land stewardship on farmland and water quality by using a performance-based payment model. The Payment-for-Phosphorus Program will accelerate agricultural water quality improvements with new funding and strategy for incentivizing and valuing farmer's agricultural land stewardship efforts. This program will help to fill gaps where funding is a barrier to voluntary actions.

From state fiscal year 2016 to 2020, over $2.7 million in state funding was dedicated to improving water quality in the agricultural sector through conservation practices, forest and grass buffers, livestock exclusion, barnyard and production practices, land conservation, equipment implementation, and technical assistance. Most of the funding went to high priority conservation practices, cover crop and heavy use area protection, identified in the 2016 Lamoille River Tactical Basin Plan.

Strategies informed by agricultural community partners include focus on coordinating conservation efforts between farmers and agricultural service providers, outreach, education, and technical assistance for increased implementation of farm and field practices, as well as supporting adoption of conservation practices through innovative equipment.

B. Developed Lands

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

All 17 stormwater strategies and actions identified in the 2016 plan were in progress or completed by release the of this plan. Municipalities, watershed groups (Friends of Northern Lake Champlain), Regional Planning Commissions (RPCs), and Natural Resource Conservation Districts (NRCDs) were successful in collaborating on the development of Stormwater Master Plans and the pursuit of the projects identified in these plans. These groups were also essential in ensuring that all the towns in the watershed were in compliance with the Municipal Roads General Permit (MRGP) in 2021. The next phase of this work is the implementation of the required and voluntary practices identified

in the plans and assessments. The required practices are explained in the regulations described below, while the highest priority voluntary practices will be carried out by municipalities with aid from the statutory watershed partners listed above.

Stormwater (Urban & Residential non-road)

This section integrates basin-specific information on stormwater-related water resource impairments, regulatory programs, stormwater master plans, Illicit Discharge Detection and Elimination (IDDE) studies, existing implementation efforts and partnerships to inform strategies to address stormwater-related water resource impairments. The tactical basin planning approach engages 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 including reductions to support the Lake Champlain Phosphorus TMDL. The section is organized around the three-acre general permit, stormwater master planning, and IDDE studies which are the primary drivers for implementation efforts in the basin.

In the last five years, stakeholders in Basin 7 have been actively participating in voluntary actions, developing Stormwater Master Plans (SWMPs) and designing and implementing priority projects identified in the SWMPs. Most towns are on track for meeting regulatory requirements and have been actively working to remediate discharges identified through IDDE studies. Those towns that are behind are getting on track and are being supported by regional partners and state Clean Water funding to meet requirements.

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

General Permit 3-9050 is a permit for stormwater runoff from impervious surfaces. It is an important component of the Vermont Clean Water Act of 2015 (Act 64) and is designed to assist in the implementation of clean-up efforts in Lake Champlain, Lake Memphremagog, and stormwater-impaired waters, while also protecting high quality surface waters statewide. This general permit covers all operational stormwater permitting, including new development, redevelopment, and permit renewal. Additionally, this general permit serves as the "Three-Acre General Permit" as required under the Vermont Clean Water Act. Parcels in the Lake Champlain watershed, including Basin 7, will need to apply for permit coverage by 2023. There are 102, three-acre-sites in the Mallet's Bay drainage covering approximately 6,184 impervious acres. The Agency anticipates grant funding and subsidized loans will be available to support engineering, design, and implementation costs associated with this general permit. Program development will for SFY 2022 be supported by an infusion of American Rescue Plan Act funds, with activities to commence fall, 2021Two programs developed to address these sites are the Public Private Partnership project and grant incentive and the Green Schools Block Grant.

Public Private Partnership

Through a pilot project, DEC is currently investigating how best to assist private landowners with permit compliance where it will also result in public entities meeting other water quality or public-interest goals. The Public Private Partnership (P3) project seeks to identify partnership opportunities with the goal of moving ten private properties that come under jurisdiction of the three-acre general permit forward to the 30% design phase. These ten can then be shared as models on how to bring a three-acre property closer to compliance with the new rule while simultaneously meeting some outcomes for public good. Designs have been developed for Jeffersonville, Johnson, and Morristown and these projects have been identified as priorities for implementation and funding in the Implementation Table in Chapter 5.

Green Schools Block Grant

The Lake Champlain Basin Program is funding a Green Schools Block Grant to have stormwater design and permitting work completed on behalf of schools in the Lake Champlain basin. Public schools and colleges in the Lake Champlain basin that are required to obtain three-acre general permit coverage (3-9050) will be able to sign up to receive technical and financial assistance for stormwater design and permit obtainment.

DEC's Green School Initiative will also partner with Lake Champlain Sea Grant to provide stormwater education and outreach to school communities. Lake Champlain Sea Grant will provide schools with watershed and stormwater lesson plans as well as training for students and teachers. In addition, Lake Champlain Sea Grant will help schools identify ways to maximize the additional benefits of green stormwater projects, such as creating pollinator habitat and outdoor classrooms. Most schools in Basin 7 have received preliminary assessments and conceptual designs as part of a town wide SWMP. The three-acre schools in Basin 7 are included in the Implementation Table in Chapter 5: Northern Vermont University, Bellows Falls Academy, Hazen Union High School (HS), Lamoille Union HS, Mt. Mansfield Union HS, Jericho Elementary, Browns River Middle School, Milton Elementary, Milton HS, Essex Elementary School, Peoples Academy and Morristown Elementary, and Westford Elementary.

Stormwater Mapping and Master Planning

Stormwater infrastructure mapping projects are completed for municipalities by the Vermont Clean Water Initiative Program to supplement any existing drainage data collected by towns and with the intention of providing a tool for planning, maintenance, and inspection of the stormwater infrastructure. Stormwater mapping reports are complete for all required (3 MS4s – Milton, Colchester, and Essex) and recommended towns (16) in Basin 7 (Table 11). The reports can be found by clicking the links in the table or at: https://dec.vermont.gov/water-investment/cwi/solutions/developed-lands/idde.

The reports and maps from each project are meant to provide an overall picture and understanding of the connectivity of the storm system on both public and private properties to raise the awareness of the need for regular maintenance. These reports identify potential priority projects in the study areas and provide information necessary to develop a stormwater master plan. The Clean Water Initiative Program will also provide stormwater discharge and suggested retrofit priorities for the impaired or stressed watersheds of Deer Brook, Streeter Brook, and the Brewster River.

Projects identified as high priority in the stormwater mapping reports and master plans may be implemented by towns with the aid of watershed partners where necessary. All towns with significant development adjacent to surface waters have developed a stormwater master plan in Basin 7 and the priority projects in those plans should be pursued. For those towns with less development, a singular project identified by a stormwater mapping report can be developed. Only one town with a stormwater mapping report (SMR), Wolcott, is identified for single-project implementation. This project should be scoped for feasibility and town support before pursuing. Stormwater mapping reports are in development for North Wolcott and Westford.

Table 11. Towns with completed SWMPs, LWAPs, and mapping reports (SMR). Click on the town to link to report.

Town Name*	Year Completed	Type	Recommendations for Implementation	# of projects implemented, pursued, or in progress	Priority Projects identified
Jericho	2017	SWMP	Implement priority projects	2	6
Underhill	2018	SWMP	Implement priority projects	1	5
Milton (MS4)	2019	SWMP	Implement priority projects	4	15
Hardwick	2017	SWMP	Implement priority projects	5	9
Johnson	2021	SWMP	Implement priority projects	2	10
Cambridge	2021	SWMP	Implement priority projects	2	10
Morristown	2020	SWMP	Implement priority projects	3	10
Hyde Park	2020	SWMP	Implement priority projects	2	10
Fairfax	2019	SWMP	Implement priority projects	0	10
Georgia	2019	SWMP	Implement priority projects	8	8
Waterville	2018	SWMP	No projects identified	0	0
Eden	2019	LWAP	Implement priority projects	3	5
Elmore	2020	LWAP	Implement priority projects	2	5
Wolcott	2015	SMR	Single project implementation	0	1
Greensboro	2019	SWMP	Implement priority projects	0	3

*Towns with mapping or plans that do not have priority projects in Basin 7 were not included. **SWMP** = Stormwater Master Plan. **LWAP** = Lake Watershed Action Plan

Illicit Discharge Detection & Elimination Studies

In 2000, the Vermont Legislature required VDEC to implement a statewide program to promote detection and elimination of improper or illegal connections and discharges. Illicit discharges are

discharges of wastewater or industrial process water into a stormwater-only drainage system. All towns in Basin 7 except Belvidere, Westford, Fletcher, Walden, Stannard, and Elmore have completed IDDE reports. The outcomes of these studies are listed in four reports:

- Detecting and Eliminating Illicit Discharges to Improve Water Quality in the Lamoille River Basin (2014)
- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2019)
- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2019)
- Advanced Illicit Discharge Investigations in the Lamoille River, Otter Creek, and Poultney River Basins Final Report (2021)

In Basin 7 most illicit discharges were identified and eliminated. Follow-up actions were identified in the reports where sources were difficult to locate, compliance was difficult, or the infrastructure was no longer in use. This plan recommends the completion of IDDE studies and mapping in Westford, follow-up on recommended actions from previous studies, and the elimination of discharges identified by new studies.

Vermont Green Infrastructure Toolkit

Many of the stormwater issues associated with developed lands can be mitigated and prevented using Low Impact Development (LID) and Green Stormwater Infrastructure (GSI) systems and practices. These emerging concepts strive to manage stormwater and pollutants by restoring and maintaining the natural hydrology of a watershed. Rather than funneling stormwater off site through pipes and infrastructure, these systems (gardens or permeable materials) focus on infiltration, evapotranspiration, and storage as close to the source as possible to capture runoff before it gets to surface waters.

The Vermont Green Infrastructure Toolkit is a project of the ten Regional Planning Commissions of the Vermont Association for Planning and Development Agencies (VAPDA) and the Vermont Agency of Natural Resources' Water Investment Division. The toolkit is a clearinghouse of information useful to Vermont municipalities to explore how to promote the adoption of Green Infrastructure policies and practices to combat the problems caused by urban, suburban and rural stormwater runoff. Outreach is recommended to support bylaw development for stormwater management of road segments receiving stormwater runoff in priority catchments in Morristown, Cambridge, Jericho, Milton, Georgia, Johnson, Wolcott, Hardwick, Hyde Park, Essex, and Fairfax. Additionally, outreach by the Regional Planning Commissions is encouraged in towns that have contemplated stormwater management, where population growth is likely, and impervious surface is moderate to high.

Roads

It is estimated that more than 75% of Vermont roads were constructed prior to any requirements for managing stormwater runoff (Vermont Agency of Natural Resources, 2012). Where road networks intersect stream networks, roads and their ditches effectively serve as an extension of the stream network. Runoff from roads can increase stormwater runoff and, in this basin unpaved roads are an important source of sediment to receiving waterbodies. Roads can also impinge on stream floodplains and be a barrier to aquatic organism passage (AOP) with undersized culverts. In Basin 7, road runoff results in sediment, phosphorus, and chloride loading to adjacent waterbodies (e.g., Deer Brook, Lake Eden, Caspian Lake, Stannard Brook, Streeter Brook, and Kate Brook).

This section integrates basin-specific information on road-related water resource impairments, regulatory programs such as the Municipal Roads General Permit (MRGP), existing implementation efforts, and partnerships to inform strategies to address road-related water resource concerns. Tactical basin planning engages local, regional, and federal partners needed to accelerate transportation-related practice implementation in the development of these strategies to meet the state's clean water goals. The following details information about regulatory programs including the Transportation Separate Storm Sewer System Permit (TS4) and the MRGP as they are the driving road water quality implementation efforts in the basin.

Municipal Roads General Permit

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

- identify sections of local roads in need of sediment and erosion control,
- rank road segments that pose the highest risks to surface waters, and
- estimate costs to remediate those sites using Best Management Practices.

REI's are required by the Municipal Roads General Permit (MRGP) as part of the Road Stormwater Management Plan. The MRGP is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. Municipalities will implement a customized, multi-year plan to stabilize their road drainage system. The plan will include bringing road drainage systems up to basic maintenance standards, and additional corrective measures to reduce erosion as necessary to meet a TMDL or other water quality restoration effort. The permit is required by the Vermont Clean Water Act (Act 64) and the Lake Champlain Phase 1 TMDL.

The implementation of the priorities identified in REI's will reduce sediment, phosphorus and other pollutants associated with stormwater-related erosion generated from unpaved municipal roads that contribute to water quality degradation. The inventories are conducted for "hydrologically-connected roads". Hydrologically connected roads are those municipal roads within 100' of or that bisect a wetland, lake, pond, perennial or intermittent stream or a municipal road that drains to one of these water resources. These road segments can be viewed using the "Municipal Road Theme" on

the ANR Natural Resource Atlas and REI results by town can be view in the MRGP Implementation Table.

Based on protocols developed by VDEC with the assistance of the Regional Planning Commissions (RPCs), all of the towns in Basin 7 have completed or plan to complete REIs by 2021 (Table 12).

Table 12. Status of towns with Road Erosion Inventories, now required by the Municipal Road General Permit. The number of non-compliant segments still needed to meet 15% target by 12/31/2022 are in ( ). Source: MRGP Implementation Table Portal accessed on 9/10/2021.

REI Status	Complete	Planned (2021)
Towns	**MS4s:** Colchester, Essex, Milton **Non-MS4s:** Belvidere (18), Cambridge, (2), Eden (28), Elmore (36), Fairfax (19), Fletcher (30), Georgia (22), Greensboro (38), Hardwick (49), Hyde Park (42), Jericho (0), Johnson, Underhill (21), Walden (34), Waterville (17), Westford (0), Wheelock (25), Wolcott (46), Woodbury (44)	Morristown, Stannard

This plan recommends that technical and financial assistance be prioritized for interested towns based on the water quality benefit of a project. Projects that "do not meet standards" and are in sub-basins with sediment impairments related to road stormwater runoff are water quality priorities. Resources available from the Clean Water Fund (e.g. Municipal Grants-in-Aid, Grants-Aid-Small Equipment grant, VTrans Better Roads grants) assist with development of designs, capital budgets, cost estimates and implementation of road projects. Completion of these projects may be counted towards meeting the requirements of the MRGP.

The MRGP requires towns to bring 15% of non-compliant roads up to MRGP standards by December 31, 2022 and report their progress to VDEC annually. For additional information see the VDEC Municipal Roads Program. Wolcott, Hyde Park, Hardwick, Elmore, Woodbury, and Greensboro are priority towns for funding because they have the highest number of non-compliant roads to be improved to reach 15% by 12/31/2022. Priority for funding road improvements should also be targeted in watersheds with stressed or impaired streams due to sedimentation, lake watersheds with increasing nutrient trends, such as Lake Eden and Caspian Lake, and priority road related projects identified in Stormwater Master Plans and Lake Watershed Actions Plans.

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 Vermont Department of Environmental Conservation's Municipal Roads General Permit (MRGP.) The Vermont Local Roads team provides assistance to municipal highway departments and town governments to improve their road networks by providing training, technical assistance, communication tools and information exchange. These programs help implement the strategies described here and listed in Chapter 5.

Transportation Separate Storm Sewer System General Permit – TS4

The Transportation Separate Storm Sewer System (TS4) General Permit 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 municipal separate storm sewer systems (MS4s); industrial activities, commonly regulated under the Multi-Sector General Permit (MSGP); and previously permitted, new, redeveloped, and expanded impervious surface, commonly regulated under State Operational Stormwater permits.

As required by the permit, VTrans has an approved Phosphorus Control Plan (PCP) that achieves on average 25% of the total reduction to Lake Champlain in each 4-year period. Projects on the VTrans roads, rights-of-way, and facilities in Basin 7 will be prioritized to include highly hydrologically connected road segments, existing road drainage deficiency, or localized erosion. The highest loading totals for paved roads in the Mallets Bay drainage are those with high hydro-connectivity with a low slope (412 kg/yr) and moderate hydro-connectivity with low a slope (242 kg/yr). The PCP meets the requirements of the Lake Champlain Phosphorus TMDL and will result in the reduction of phosphorus loading from roads, rights-of-way, and facilities under the Agency's control by over 20% within the next 20 years (by June 17, 2036).

A VTrans Lake Champlain Basin Phosphorus Control Plan Story Map outlines the agency's process towards developing the PCP and this VTrans factsheet provides additional information.

Vermont Road and Bridge Standards

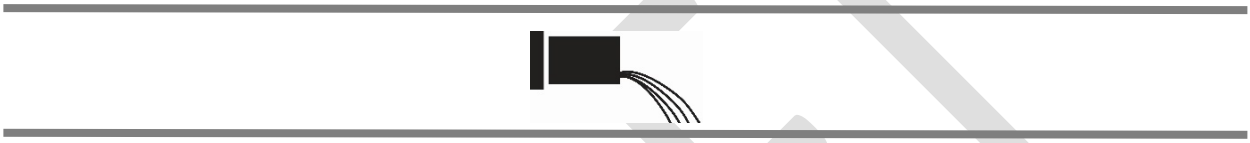
In addition to the MRGP, towns can voluntarily adopt the most current version of the Vermont Road and Bridge Standards (VRBS). These standards are administered by VTrans and go above and beyond MRGP standards. For example, municipalities may adopt MRGP standards for non-hydrologically connected roads. Towns adopting the Vermont Road and Bridge Standards may be entitled to higher cost share rates in federally declared flood event reimbursements. Stannard, Eden, Elmore, Morristown, and Waterville are priority towns identified for adoption of the VRBS.

Managing for road runoff in the upper catchments will lessen the pressure on the areas receiving larger contributions of runoff. Waters being stressed 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 because of cumulative impacts. For this reason, road BMPs for water quality are recommended basin wide and on steep slopes.

Equipment Grant and Sharing Programs

The DEC Small Equipment grant, administered by an outside grantee (Northwest RPC in SFY 2021), has smaller hydroseeders to be used by individual towns (not shared) available on the rotational basin schedule. Each year, towns in different parts of the state will be given the

opportunity to access funding to purchase equipment that can assist the municipality in implementing required MRGP practices. Match may be required. Equipment includes: hydro-seeders, hay bale shredders, rolling and plate compactors, road shoulder discs, ditch stone screener, and leaf blowers. The DEC MRGP program supports as many towns as possible buying into the regional seeder or purchasing their own. There is no longer funding for additional regional hydroseeders, but the Lamoille Country Conservation District manages a regional sharing program with towns in the Lamoille Basin. For this program to continue to be successful, funds are needed for outreach and training to get municipalities on board with using the shared equipment. A strategy for this need is found in the Implementation Table in Chapter 5.



C. Wastewater

Wastewater Treatment Facilities (WWTF)

Most municipal wastewater, originating from a combination of domestic, commercial, and industrial activities, is conveyed to centralized wastewater treatment facilities (WWTF) and treated to established standards identified in permits[7] before discharge into a receiving water. There are six municipal and one wastewater treatment facility that are subject to National Pollutant Discharge Elimination System (NPDES) discharge permits in the basin (Table 13). All these facilities were issued new permits effective on August 1, 2018, with an expiration date of June 30, 2023.

An overarching consideration for the issuance of permits in the Basin 7 planning basin is the Lake Champlain Total Maximum Daily Load (LC TMDL) for phosphorus. As of the issuance of this Plan, all Lamoille Basin Waste Treatment Facilities (WWTFs) ultimately discharging to Lake Champlain must, collectively, discharge no more than 3,240 kg of total phosphorus per day. The 2016 LC TMDL did not alter the allowable phosphorus discharge loads from WWTFs that discharge to Malletts Bay, and as such, no specific requirements for upgrade are addressed by this Plan. This does not eliminate requirements for ongoing operation and maintenance of these facilities, nor scheduled engineering performance reviews required of all WWTF in Vermont. The municipal and private wastewater discharge permits in place in the Lamoille Basin are shown in Table 13.

[7] National Pollutant Discharge Elimination System (NPDES) Permits

To meet statutory requirements, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions to determine the "reasonable potential" that WWTFs have, to cause or contribute to downstream water quality impairment. Results of these investigations are recorded as part of permit issuance documentation, which can be viewed on the Wastewater Program's discharge permit database.

Each of the public facilities received a reasonable potential determination (RPD). Based on this analysis, the Secretary determined that the available data indicated that the discharges do not cause, have a reasonable potential to cause, or contribute to instream toxic impacts or instream excursion above the water quality criteria. As such, other than the effluent limitation for phosphorus, the development of Water Quality-based Effluent Limitations (WQBELs) was not necessary.

Table 13. Basin 7 wastewater treatment facilities subject to NPDES Direct Discharge Permits. Hyperlinks in the facility column link to the discharge permit as of June 2021. MGD = Millions of gallons per day.

Facility (Permit ID)	Permit effective date	Permit expiration date	Permitted flow (MGD)	Current percent of flow design*	TMDL WLA** (kg P/yr)	Treatment type	Receiving water
Fairfax (3-1194)	8/1/2018	6/30/2023	0.078	51%	539	Aerated lagoon	Lamoille River
Jeffersonville (3-1323)	8/1/2018	6/30/2023	0.077	42%	532	Aerated lagoon	Lamoille River
Johnson (3-1149)	8/1/2018	6/30/2023	0.270	44%	224	Sequential Biological Reactor	Gihon River
Morrisville (3-1155)	8/1/2018	6/30/2023	0.550	42%	352	Sequential Batch Reactor	Lamoille River
Milton (3-1203)	8/1/2018	6/30/2023	1.000	25%	829	Sequential Batch Reactor	Lamoille River
Hardwick (3-1143)	8/1/2018	6/30/2023	0.371	44%	410	Aerated lagoon	Lamoille River
PBM Nutritionals (3-1209)	8/1/2018	6/30/2023	0.425	36%	352	Oxidation ditch, clarifier, and filtration system	Lamoille River/Arrowhead Mountain Lake

** This was calculated using the average values for the annual average flow for the time period 1/1/2016 to 1/1/2021.*

***The TMDL Waste Load Allocation (WLA) is the same as the current permitted load (kg P/yr).*

In addition, WSMD evaluated the request to waive the RPD for the PBM Nutritionals application and determined that a full determination was not necessary, due to the size of the discharge and the significant dilution available in the receiving water (Arrowhead Mountain Lake).

The next permit renewal for the Milton facility, on track for FY 2023/2024, will likely include a 20-year engineering evaluation requirement where a professional engineer will need to evaluate the facility and identify which areas (i.e. treatment process, building and grounds, or operation and maintenance) may need to be upgraded.

Septic Systems

The State of Vermont adopted, on July 1, 2007, universal 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 need to obtain a Wastewater System and Potable Water Supply Permit for activities such as:

- subdivision of land;
- construction of a new building that needs a wastewater system (often referred to as sewage disposal or a septic system) or water supply;
- repair and/or replacement of a failed[8] wastewater system or water supply; and
- when there is an existing wastewater system and/or potable water supply but there will be an increase in water or wastewater design flows due to either a modification to, or a change in use of, a connected building.

Systems installed before July 1, 2007 and systems installed or receiving increased flows after 2007 that did not receive a permit could potentially discharge into surface waters if the system was not installed correctly and is located in close proximity to a river, lake, or wetland. Failed systems that discharge pollutants into surface waters are difficult to identify without landowner permission and there is no current regulatory tool that requires inspections of pre- or post-2007 wastewater systems on a regular basis unless specified in their permit. If a citizen observes signs of a failed septic system, they should contact their Town Health Officer. There are programs that provide financial assistance to qualifying homeowners that need to upgrade their systems, but costly upgrades prevent many homeowners from upgrading their systems. The state budget for fiscal year (FY) 2022, which starts July 1, 2021, allocates American Rescue Plan Act (ARPA) funds that may benefit municipalities and residents in the basin for wastewater focused actions. This includes funding directed in part or in full to ANR for:

- Reducing sewer overflows
- Improving water and sewer infrastructure in mobile home parks and providing financial assistance to low-income homeowners with failed on-site water and wastewater systems; and,
- Developing community sewer systems in some of the more than 200 villages that currently lack such systems.

Momentum has been gaining in rural villages to explore options to deal with concerns about pollution from septic systems and growth in village centers that result in a need for centralized shared wastewater systems. A demonstration project in the town of Warren, Vermont was reported to the US Environmental Protection Agency as a different approach for managing wastewater in rural villages (Stone Environmental, Inc., 2005). Areas with concentrated development along shorelines and streambanks with systems installed before July 1, 2007, are a priority for assessment.

[8] Wastewater systems that have wastewater surfacing, backing up into the building or discharging to the waters of the State are considered failed systems.

Both the communities of Wolcott and Westford are exploring opportunities to improve wastewater infrastructure. Westford completed a preliminary engineering report in Spring 2021 and is working on the final design with hopes to receive loan funding for construction in the next five years.

Septic Socials

Concerns around failing septic systems is especially important in lakeshore communities. Many camps along lakeshores were built before July 1, 2007, and many of the camps were built for seasonal occupancy. If a lake is experiencing an increase in nutrients or *E. coli*, it is often difficult to pinpoint the exact sources. Septic systems could be a source. One way to get people informed about the health of their systems is to host a septic social. Septic socials are neighborhood gatherings where homeowners learn about the options for a well-functioning septic system and good maintenance practices, including household products that are kind to septic systems. The event provides an informal opportunity for people who may never have seen a septic system to learn about them. The host opens the gathering by talking about the importance of water quality protection. A septic system specialist discusses operation and maintenance of septic systems using the host homeowner's system as the demonstration model. Attendees are provided with brochures and other resource materials to take home. Septic socials are best for areas with old septic systems that may be having an impact on water quality. These places are often around lakes with old camps or buildings built for seasonal use that are now seeing more activity year-round. Septic socials can also be held in riverbank communities. Areas in Basin 7 that would benefit from septic socials are all the larger populated lakes including Lake Eden, Elmore Lake, and Caspian Lake, but other interested lake communities are encouraged to participate. More information about septic socials can be found at: http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/lake-wise-septic-system-socials.

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 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 enhances the ecosystem services - flood control, wildlife habitat, filtration of pollutants - these natural resources provide.

Although Agency regulatory programs protect natural resources, the following sections focus on the Agency's work to support landowner interest in natural resource restoration. Over the next five years, the agency will depend on partners to provide some of this assistance.

Rivers

Most VT rivers, in response to historic intensive channel management, floodplain and riparian corridor encroachments, and watershed land use change, 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). In Basin 7, legacy and present-day impacts, such as development within riparian corridors, channel straightening, berming, damming, removal of riparian vegetation, and construction of undersized crossing structures, have contributed to stream instability. A key consequence of these activities is the loss of the resilience and ecosystem services provided by rivers able to fully achieve dynamic equilibrium.

This section includes basin specific information on how to encourage river equilibrium by improving longitudinal, lateral, vertical, and temporal connectivity. Equilibrium is essential for good water quality, healthy aquatic habitat, and flood resilience in the basin and will help to mitigate impacts of increased runoff and streamflow described in the Climate Change section. Tactical basin planning engages local, regional, and federal partners in the development of strategies needed to accelerate practices to increase river connectivity and meet the state's clean water goals. The following details information about river corridor plans (RCP) and planting projects, strategic wood additions, Aquatic Organism Passage (AOP) restoration, and community efforts to regulate floodplain and river corridor development, which together guide project implementation in the basin to increase river connectivity.

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 Vermont River Management Program. These plans identify causes of channel instability and make recommendations for restoration. All SGAs and RCPs can be found at: anrweb.vt.gov/DEC/SGA/finalReports.aspx. Where funding, local support, and interest exists, priority projects and objectives identified in these plans should be pursued in the Brewster River, Browns River, Centerville Brook, Gihon River, Wild Branch, Seymour River watersheds and the Lamoille River mainstem.

While overall water quality in Basin 7 is satisfactory, the degraded geomorphic condition (Figure 8) of the basin's streams may impact:

1. wildlife and fish habitat (ex. riparian buffer removal that reduces shading and habitat for insects that feed fish, and channel alteration that destroys aquatic habitat).

2. public safety (ex. loss of floodplains that store floodwaters, accelerated streambank erosion which results in infrastructure damage, and channel straightening that increases flow velocity during rain events).
3. water quality (ex. higher phosphorus loading from bank soil erosion stormwater runoff from encroachment of impervious surfaces and agricultural land).

Rivers are in a constant balancing act between the energy they produce and the work that must be done to carry the water, sediment, and debris produced in their watersheds. A change in any one of these factors will cause adjustments of the other variables until the river system comes back into equilibrium (balance). These changes can be caused by natural events and by human activity. The impact of which may be seen immediately or for decades after the activity occurred.

The legacy from Tropical Storm Irene and more recent flood events will be felt for years to come. The goal of managing toward, protecting, and restoring the equilibrium condition of Vermont rivers is to resolve 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.

River Restoration and Conservation

Active river restoration activities include the reconnection of floodplains through berm removal, woody buffer plantings (trees and shrubs), and bank stabilization techniques with biological materials. In Basin 7, at lease 91 acres of river corridor has been conserved, including 11,800 linear feet of streambank, 11 acres of buffer planted, and 27 feet of gully restored. Scientific research strongly supports the value of planting trees and shrubs along stream and lake shorelines for both water quality and wildlife habitat (Figure 17). Shoreline vegetation filters and cleans dirty runoff from uphill land uses,

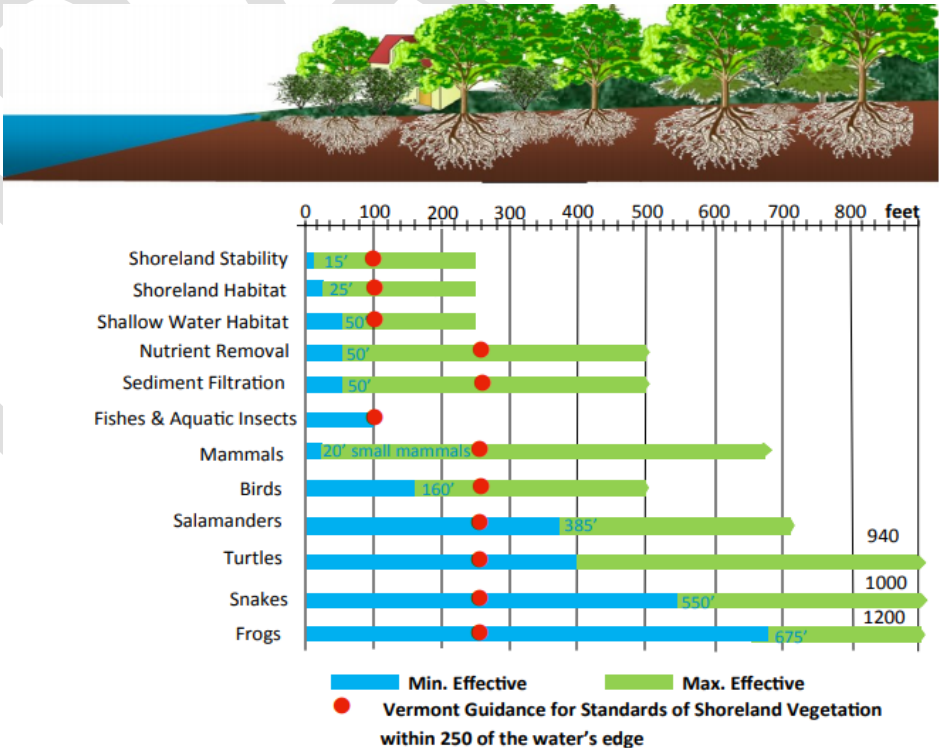


Figure 17. Recommended widths of shoreline vegetation for protection.

Source: https://dec.vermont.gov/sites/dec/files/wsm/lakes/Lakewise/docs/lp_shorewidth.pdf

provides shoreland and shallow water habitat, stabilizes banks, and increases lake and river aesthetics.

Most riparian area planting projects are coordinated and carried out by the USFWS, FWD, AAFM, and NRCDs in Basin 7. In the last five years, all FWD ownerships on the Lamoille River have been assessed for condition (22 miles on 24 parcels). Additionally, FWD contracted and worked with the Northwoods Stewardship Center on three days to plant trees which were either purchased (about 50 elm) or pulled from VFWD lands (650 trees from Wenlock and Bald Hill Wildlife Management Areas). Three floodplain and stream restoration projects were completed in Cambridge on the Brewster River, at least nine riparian buffer plantings were implemented in Cambridge, Fairfax, Jericho, Milton, Morristown, Underhill, and Wolcott. Riparian buffer plantings are encouraged basinwide especially in areas identified in River Corridor Plans where the locations have been assessed by river scientists. The Browns River is a priority area for plantings, as is the Wild Branch and the Lamoille mainstem to provide shading and habitat for aquatic species and enhance stability of riverbanks to prevent erosion. Riparian planting projects are also carried out by the Agency of Agriculture, Farm, and Markets (AAFM) and supported by the Natural Resources Conservation Service through the Conservation Reserve Easement Program.

In addition, the ANR prioritizes river reaches that are identified as high priority sediment and nutrient storage area 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 restricting channelization. River Corridor Easements protect rivers from channel management that can degrade the functions of a river corridor.

Strategic Wood Addition to Rivers and Streams

VFWD is focusing on the implementation of strategic wood additions for fishery stream health. Large woody material provides several fish habitat and fluvial benefits in streams, but it is generally lacking in many Vermont streams due to past and present river management practices to accommodate land use for logging, agriculture, and urban and residential development. Large wood has been strategically added to trout streams in the headwaters of the North Branch by The Nature Conservancy, where the goal is to improve Brook Trout habitat and fluvial functions. No strategic wood additions priorities have been identified for the Lamoille Basin, but when projects are proposed that improve both water quality and habitat and are supported by both FWD and the Rivers Program, funding should be prioritized. One reason projects are not planned for in Basin 7 is the large areas of private ownership. Strategic wood addition in these areas may begin to increase because the Natural Resources Conservation Service (NRCS) is providing funds for the practice. Training and workshops on assessment and implementation of this work will grow the knowledge base needed to increase implementation.

Dams

There are records of 63 dams of different types, sizes, and condition in Basin 7. While dams are used to generate energy and recreational opportunities such as boating, fishing, and swimming, they can

also impede a stream's ability to transport flow and sediment; cause streambank erosion and flooding problems; degrade and alter fisheries habitat; create barriers to fish movement and migration; alter downstream temperature; degrade water quality; and impede river-based recreational activity.

Of the 63 inventoried dams, 45 are in-service, four are fully breached, one is partially breached and 13 have been removed. The 46 active in-service and partially breached 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 A.

On January 18, 2018, H.554 or Act 161, the Dam Safety bill, passed the Vermont House of Representatives and received final approve on May 10th of the same year. The bill was developed collaboratively with the DEC, Vermont Natural Resources Council, Vermont Trout Unlimited, the Vermont Section of the American Society of Civil Engineers, and other partners. The bill gave the DEC rulemaking authority which will update the regulation of dams in the State.

Dam removals are pursued by private and public dam owners, often with the help from watershed groups and partners. 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. There is one dam removal being pursued in the watershed in the headwaters of the Brewster River. A second off-stream dam removal is recommended on Mud Brook in Morristown where the earthen dam creates iron leachate that runs into the stream and is impacting macroinvertebrate communities. Annual water fluctuations behind Jackson Dam in Hardwick impacts aquatic communities in Alder Brook and Hardwick Lake. An alternatives analysis to address these impacts and explore alternatives to water fluctuations, is recommended for this dam, which is also in poor condition as described in a 2019 Dam Safety Program Report.

Most other dams have a low removal potential because they are used for hydroelectric generation or recreation. Peterson Dam, a hydroelectric facility received the highest ranking for ecological impacts in a Nature Conservancy assessment of over 400 Vermont dams but is licensed until 2034 and is an active hydroelectric facility. Vermont Fish and Wildlife released a 2004 study assessing the projected habitat use with the removal of the Peterson Dam. The study found that, removal of Peterson dam would significantly increase the quantity and diversity of available habitat, citing it would restore the ecological connection between the lake and the river that certain species rely on to complete their life cycle. They determined that the dam removal would restore habitat for six endangered species, two threatened species, and six rare species (fish and mussel species) (Vermont Fish and Wildlife Department, 2001 & 2004).

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 basinwide where the removal will result in restoration of stream equilibrium and habitat, fish passage, and sediment reduction.

Stream Alteration Permits & Activities

Also related to the health of rivers and streams is the infrastructure – bridges and culverts – built to relay the flow of water under transportation corridors. Transportation corridors include state, local, and private roads, large interstates, logging roads, private driveways, and railroads. Most of this infrastructure was built before engineers and scientists fully understood the balance required for managing sediment and flow to protect stream channels (and adjacent developed lands).

The correct sizing and placement of structures plays a significant role in protecting water quality in Basin 7. Correctly sized structures prevent erosion and scouring upstream and downstream, allow for the passage of fish and wildlife, and reduce impacts from flooding. Correct placement of structures allows fish to move seasonally and to spawning territories. Without access to essential habitat, fish diversity and abundance decline.

The Rivers Program's Stream Alteration Permit Program helps to protect and restore water quality in Basin 7. If an activity will change, alter, or modify the course, current, or cross section of any watercourse within or along the boundaries of VT, that activity may be require a permit. The VDEC Rivers Program issues permits covering three general areas of activities. These three areas are:

- Activities that involve construction or excavation in rivers and streams
- Activities exempt from municipal regulation in flood hazard areas and river corridors
- Activities that involve water withdrawals, dam removal, or hydroelectric power

Approximately 89 stream alteration permits or activities were issued in Basin 7 between 3/2016 and 6/2021. Of the 89 permits issued, 53 were Next Flood activities. Next Flood activities include those practices that involve protection and stabilization activities like culvert replacement, channel stabilization, structure stabilization, and removal of debris behind stream crossing such as culverts and bridges. These generally happen after flooding events and are in response to emergency conditions. For example, 15 (28%) Next Flood activities took place early in the month of November in 2019 after the October 31, 2019 flooding event in Basin 7. Stannard, Craftsbury, and Wolcott convened permits or activities during this time period. Thirty-seven of the 53 Next Flood permits provided information on the type of activity covered by the permit; 11 projects involved bridge or culvert replacements, and 23 involved erosion stabilization to protect infrastructure such as roads, bridges, and culverts.

This plan does not provide estimates for the cost of this work, but recognizes these fixes are costly and when culverts and bridges are sized correctly and structures are built outside of floodplains and river corridors, they are more likely to weather the next storm or flood event. Most of the projects included repair or protection of manmade infrastructure, which provides support for why local zoning and bylaws to discourage new encroachments into floodplain and river corridors are important.

Oversight on culvert and bridge replacements include the implementation of standards for the correct sizing of crossing structures to handle passing high waters and debris, which should result in less damage from future flooding events. Implementation and support of Hazard Mitigation Plans basinwide, especially where water quality benefits are realized, will proactively, instead of reactively, protect infrastructure while also protecting our floodplains, rivers, and streams. Floodplain restoration and expansion will also alleviate pressure on developed areas adjacent to surface waters in villages and town centers. Reducing streambank erosion and lessening flooding extent of developed areas by increasing floodplain connectivity will reduce phosphorus loading and the introduction of other pollutants into surface waters.

Local Zoning and Bylaws

Local bylaws and municipal plan policies can provide community specific protections and guidance to maintain and enhance local water resources. Local protections also afford benefits to downstream communities and water resource users. The Regional Planning Commissions (RPCs) provide water quality protection information for each municipality in the Lamoille River Basin. The information helps to populate this section of the plan and the priority strategies related to rivers in the Chapter 5 Implementation Table. Although a community may have bylaws or town plan policies, it does not mean their resources are afforded the strongest protection. Communities may work with their RPCs to identify opportunities that provide their constituents with the highest level of natural resource protection within their means. Municipalities with high development pressure, significant impervious surface cover including roads, and significant development within proximity to water resources are a high priority for protection, as well as those areas with deficiencies related to their protective policies, zoning, or bylaws. These municipal protections provide myriad values:

- Local stormwater regulations prevent runoff of pollutants from hard surfaces into wetlands, rivers and lakes. Stormwater management also slows flow into waterbodies during some flood events. Good examples of local regulations exist for Stowe, Manchester, and South Burlington.
- Smart planning and design for development through Local Hazard Mitigation Plans (LHMP) and ERAF attainment in towns and villages saves money and lowers the risk of significant loss during flood events, while protecting water quality as an added benefit.
- Limiting development on steep slopes, ridgelines, and landslide hazard areas can protect high quality water resources and prevent excessive erosion and sedimentation to streams and lakes that impacts water quality and aquatic habitat.
- Protecting river corridors helps protect roads and structures from erosive damage, improves water quality, moderates flooding, and enhances wildlife habitat. River corridor protection, limits development close to stream and river channels to allow the channel to establish and maintain a least-erosive path through the valley lessening the need to armor channel edges.

  In recognition of historic settlement patterns, the VDEC model river corridor protection bylaw (http://bit.ly/model-regulations) provides for infill and redevelopment in designated

centers and densely developed areas provided that new development does not further encroach on the river relative to pre-existing development.

- Floodplains function in part to allow excessive water to spread out and slow down. This reduces water depth and power and allows sediment, including phosphorus, to deposit. The VDEC model bylaws use no adverse impact standards that are consistent with statewide flood resilience goals and will reduce impacts to public safety, infrastructure, and water quality from flooding.

FEMA Mapping Updates

On March 26 and 27, 2019, the Federal Emergency Management Agency (FEMA) conducted a Discovery Meeting for the Lamoille River Watershed (excluding areas in Franklin and Orleans Counties) as part of FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) program. During the meeting, stakeholders, including FEMA, state, and community officials, discussed areas of flooding concern and project goals, milestones, and products. Flooding sources considered during this meeting included major rivers such as the Lamoille River, Gihon River, and Brewster River, as well as Boardman Brook.

Field surveys related to this work commenced in spring/summer 2021 in select communities within the Lamoille River Watershed. The data obtained from the task will be incorporated in subsequent hydrology and hydraulic studies that may be used to produce an updated Flood Insurance Study (FIS) report and Flood Insurance Rate Map (FIRM) panels for Basin 7 communities.

Updated Flood Insurance Rate Maps (FIRM) will identify the high-risk flood hazard areas in the Basin that are the focus of municipal flood regulations. Most of the area will have much improved computer-model based Zone A hazard information using updated flood discharge data and one-foot contours. Some reaches will have older studies aligned with current topography. A few areas may be prioritized for updated field-based studies incorporating data from bridges and other obstructions. The effective date for the new maps is not likely until 2025 or later. Current FIRMs for communities in the Basin are posted at www.msc.fema.gov.

VDEC Hazard Area Bylaws and ERAF

VDEC River Corridor and Floodplain Protection Program has prepared model flood hazard bylaws (bit.ly/model-regulations) to assist municipalities in the development of their flood hazard regulations. These bylaws have been pre-reviewed by the Federal Emergency Management Agency (FEMA) and meet or exceed the requirements of the National Flood Insurance Program (NFIP). In addition, adoption and enforcement of Section D, River Corridors, qualifies communities for enhanced cost share under the Emergency Relief and Assistance Fund (ERAF).

ERAF provides State funding to match Federal Public Assistance after federally declared disasters. Eligible public costs are reimbursed by federal taxpayers at 75%. As of October 23, 2014, the State of Vermont contributes 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. Towns that

meet ERAF criteria protect water quality while protecting themselves financially. A summary of ERAF coverage is provided below and strategies for achieving coverage is located in the Implementation Table in Chapter 5.

- As of June 22, 2021, six towns in Basin 7, Hyde Park, Jericho, Westford, Essex, Colchester and Milton, qualified for the 17.5% contribution.
- The towns of Elmore and Hyde Park are the only towns in Basin 7 that have adopted municipal river corridor protection. Jericho, Westford, Essex, and Milton have interim protection under ERAF**.** These towns could lose their interim coverage if they do not adopt the municipal river protection. Colchester receives the 5% bonus ERAF contribution as it participates in the Community Rating System.
- All towns except Eden, Elmore, Morristown, Stannard, and Waterville have adopted the 2018 Town Road and Bridge Standards.
- All towns except Eden, Walden, Waterville, and Wheelock are participating in the National Flood Insurance Program.
- Four towns, Craftsbury, Morristown, Stannard, and Wheelock, do not have a Local Hazard Mitigation Plan.

In addition, the state budget for fiscal year (FY) 2022, which starts July 1, 2021, allocates nearly $5 million of American Rescue Plan Act (ARPA) funds for mitigating flood hazards and supporting implementation of the State Hazard Mitigation Plan. Questions regarding the model flood hazard bylaws and ERAF should be directed to the appropriate VDEC Regional Floodplain Manager: bit.ly/flood-manager.

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 activities, or the land use, on the immediate shoreland and further into the watershed. For example, the loss of native vegetation at the shoreline, the locations of roads, development pressures around the shoreline, along tributaries, and further into the watershed, and activities such as agriculture and forestry all contribute to overall lake and pond health. All of these activities impact how water moves across the landscape and ultimately enters the lake.

The recommendations below were developed based on the VT Inland Lakes Scorecard status of lakes and ponds in Basin 7 and feedback from the Lakes and Ponds Management Program. More information about the VT Inland Lakes Scorecard and Basin 7 lakes and ponds is found in Condition of Lakes and Ponds section of Chapter 1 and Priorities for Surface Water Protection in Chapter 2.

Lake Watershed Action Plans

Figure 18. Vermont Youth Conservation Corps installing a no-mow buffer and stone-lined channel to infiltrate and slow runoff from impervious surfaces on the Lake Elmore shoreline (Photo by Peter Danforth).

Lake Watershed Action Plans (LWAPs) are assessments to identify pollution sources in the lake watershed that are resulting in water quality and habitat degradation in the assessed lake. The LWAP results 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 (Figure 18). Two lakes in Basin 7 have completed LWAPs, Lake Elmore and Lake Eden, and one lake, Caspian Lake has received funding to develop a LWAP.

Lake Eden and Caspian Lake are exhibiting a significantly increasing nutrient trend. Summer total phosphorus (TP) concentrations are highly significantly increasing for Lake Eden and summer TP and spring TP concentrations are showing a significant increasing trend for Caspian Lake. Although nutrient trends are increasing in Caspian Lake and Lake Eden, their current and historical levels of TP make them candidates for A(1) and B(1) aesthetics, respectively. To reverse or stop the trend, and maintain the very high quality, the lakes are listed as high priorities for protection and restoration in this plan. Lake Elmore, which is not experiencing a poor trend is also a candidate for B(1) aesthetics.

To protect these lakes, local stakeholders are stepping up. A newly formed watershed group, the Stewards of Greensboro, have teamed up with the Orleans Natural Resource Conservation District to develop a Lake Watershed Action Plan (LWAP) for Caspian Lake. Projects identified in this plan will be a high priority for implementation to protect water quality in Caspian Lake. The group is also working on outreach efforts to develop a petition for reclassification to A(1).

Lake Associations, shoreland owners, and the towns of Eden and Elmore teamed up with the Lamoille County Conservation District to complete LWAPs for Lake Eden and Lake Elmore as

recommended in the 2016 Lamoille TBP. Several projects have been implemented that were identified in the LWAPs and additional projects are planned or in progress. The LWAPs serve to both focus on decreasing nutrient and sediment discharge into surface waters while also prioritizing habitat enhancement and restoration in riparian areas around the lakeshores. No efforts have been planned for these lakes to reclassify, but support will be provided by DEC if there is interest in exploring and pursuing reclassification.

Preventing Aquatic Invasive Species

Aquatic invasive species (AIS) have been confirmed in two lakes in Basin 7. Additional aquatic invasive species populations may exist but have not been confirmed with recent lake surveys. The two confirmed populations are found in Arrowhead Mountain Lake and Lake Elmore. Lake Elmore is involved with active removal of AIS. Lake Elmore, along with Caspian Lake and Lake Eden, which have no known invasives, has an active and successful VT Public Access Greeter Program and Vermont Invasive Patrollers (VIP) supported by DEC's Grant-in-aid funding, checking hundreds of boats annually. Greeters interact with boaters, inspect watercraft, identify any suspicious matter, collect and report data, and distribute educational material on aquatic invasive species. The Aquatic Nuisance Control (ANC) Grant-in-aid Program is offered by VDEC and provides financial assistance to municipalities and agencies of the state for aquatic invasive and nuisance species management programs. Funding for Grant-in-aid grants comes from a portion of annual revenues from motorboat registration fees and federal funds. This grant program has supported over 70 municipalities since 1994. All three lakes are a priority for continued AIS management and capacity building. To continue their work, these lake protection volunteers need a continuity plan for long-term success. Arrowhead Mountain Lake has no active VIPs or greeter program and is a priority for invasive species management.

New introductions occur mainly in waterbodies that have access for watercraft (primarily on motorboats), and the incoming boat traffic is from AIS infested waters. Five Vermont Fish and Wildlife Department (FWD) access areas are at Lake Eden, Hardwick Lake, Wolcott Pond, Arrowhead Mountain Lake, Horse Pond, and Lake Elmore, and three Vermont Forest Parks and Recreation (FPR) access areas at Lake Elmore State Park, Sandbar State Park, and Green River Reservoir State Park. While most access areas are smaller and limited to personal watercraft, such as kayaks and canoes, that pose less of a threat to potential AIS introductions, signage about AIS spread and prevention is still important. As more AIS waterbodies and threats are in proximity, and incoming boat traffic is expected to increase, continued signage at all official access sites is critical.

Protecting and Improving Shoreland Condition

Effective July 1, 2014, the Vermont Legislature passed the Shoreland Protection Act (Chapter 49A of Title 10, §1441 et seq.), which 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.

Shoreland developed prior to July 1, 2014 is not required to retroactively meet standards. Towns can also opt to delegate the permitting to their town to administer its own functionally equivalent shoreland standards, in which case a municipal permit is required. The towns of Greensboro and Elmore fall into this category.

The Lake Wise Program, an Agency of Natural Resources initiative that awards lake-friendly shoreland property, including that of state parks, town beaches, private homes and businesses, is available to lakeshore owners and Lake Associations to assess shoreland property for improvements that benefit water quality and wildlife habitat. Lakes with a fair shoreland score will benefit from implementing Lake Wise Program best management practices. More information on the program can be found at: http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise/what.

Six lakes in Basin 7 were identified as a priority for Lake Wise: Round Pond, East Long Pond, Nichols Pond, Lake Elmore, Lake Eden, and Caspian Lake. No lakes in Basin 7 have a poor shoreland habitat condition rating from the VT Lake Scorecard, but sixteen are rated fair. 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 should use the Lake Score Card Checklist of Lake Protection Actions, on the VDEC Lakes and Ponds website, as a first step to moving toward a healthier lake or pond.

Wetlands

Wetlands cover about six percent of Basin 7 and are important for safeguarding the many high quality surface waters in the basin. As recently as the 1950s, wetlands were seen as obstacles to development, agriculture, and transportation, and consequently, were systematically drained and altered. These losses and alterations compromise the important ecosystem services provided by wetlands such as sediment and nutrient attenuation, wildlife habitat, and flood water storage. While protecting remaining wetland resources is an important strategy in the basin (see Ch. 2), restoring degraded wetlands is essential to improving water quality.

This section is organized around wetland conservation and restoration and identifying sites with the greatest potential for improving water quality.

Wetland Protection

The VT Wetlands Program plays in integral role in protecting the State's surface water through wetland regulatory, protection, and monitoring activities. In Basin 7, between January 1, 2016, and December 31, 2020, approximately 82 permits were issued resulting in approximately 3.5 acres of

wetland fill or permanent alteration, and 14.8 acres of permanent buffer impact (within the 50-ft wetland buffer). Gains associated with those permits include 23.7 acres of wetland and 12.3 acres of buffer zone that include wetland and buffer restoration, conservation, and enhancement. The projects that avoid permits are an example of the VT Wetland Rules protecting wetland functions and values. The VT Wetlands Program relies on wetland mapping to help preliminarily identify the locations of regulated wetlands (Class II and Class I). Enhanced wetland mapping is being completed by basin and will eventually include the entire Lamoille River basin. Citizen scientists can help to identify wetlands for mapping in the meantime by attending trainings on mapping. Watershed partners will help to share opportunities for trainings, as they are available, as part of a strategy in the Chapter 5 Implementation Table.

Additional protection, in the form of a Class I wetland determination, can be afforded to wetlands that have been determined to be exceptional or irreplaceable in their contribution to Vermont's natural heritage, based on their functions and values. Six wetlands have been identified as candidates for Class I assessment and support for reclassification. These wetlands include: Hidden Swamp in Milton and Westford, Towne Swamp in Milton, Molly Bog and Morristown Bog Complex in Morristown, Belvidere Bog and North Branch Wetland Complex in Belvidere (Figure 19), Page Brook Wetland Complex in Glover and Sheffield, and Flagg Pond Wetland Complex in Wheelock. Because the VT Wetlands Program does not have the resources to pursue all potential Class I recommendations, this plan recommends that interested stakeholders reach out to their basin planner and VT Wetlands Program staff for technical support to research and submit Class I wetland petitions for review. Watershed partners in the basin (Regional Planning Commissions and Natural Resource Conservation Districts) are also able to provide outreach and support to municipalities and private landowners interested in reclassification efforts. This plan recommends assessing interest for reclassification in the prioritized areas.

Figure 19. The Belvidere wetlands complex includes the North Branch of the Lamoille River and the emergent and shrub wetlands that infiltrate and slow storm flows, while at the same time providing excellent habitat for fish and wildlife.

Wetland Mapping & Restoration

Wetland restoration is the process of returning a degraded wetland to an approximation of its pre-disturbance condition (Figure 20). The United States has lost over half of its wetlands through ditching and filling since European colonization 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 our remaining intact wetlands, wetland restoration is essential for rehabilitating those that have already been degraded or lost. Clean water goals for wetland restoration include assessing an area of prior converted wetland and hydric soils for restoration 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 and the Vermont Regional Conservation Project Partnership (RCPP) Wetlands Project Outreach and Development maps created by Arrowwood Environmental. Although the Lamoille River basin was not identified as one of the priority watersheds for the RCPP project, the map can be used to identify high priority areas for restoration. Field surveys are critical for ensuring accuracy as some wetlands may have been missed or misidentified. Watershed partners have been working on project development for wetland restoration along the Lamoille River, in the Browns River watershed, Wild Branch, and the Seymour River watershed.

Figure 20. Images from upper left clockwise: Location of protected area – oxbow lake and floodplain forest – on the Lamoille River; Lamoille River floodplain; after photo of buffer planted with woody vegetation; and before photo of riparian buffer.

The Vermont River Conservancy in cooperation with a private landowner was funded by a VT Ecosystem Restoration Program grant and the Vermont Community Foundation's Lake Champlain Tributaries Restoration Fund to acquire a river corridor easement to protect 23.7 acres and 1,900 feet of floodplain forest in Fairfax. In 2019, 4.2 acres of river corridor buffer was planted in wetland and upland areas to enhance wildlife and aquatic habitat and capture phosphorus during flooding and runoff events (Figure 20).

Forests

Forest lands cover approximately 74% of Basin 7 and are important for safeguarding many high-quality surface waters in the basin. Management activities take place on a portion of those lands for the benefits of maintaining healthy forest communities, improving wildlife habitat, addressing non-native invasive plants, contributing to the working landscape economy, and addressing poorly designed legacy road infrastructure. Improving management and oversight of harvesting activities can help reduce sediment, nutrients, petroleum products, and woody debris that can end up in surface waters if Acceptable Management Practices (AMPs) are not followed. Additionally providing educational outreach and technical assistance to forest landowners and land managers and providing funding to implement improvement practices will grow the practice of good stewardship and water quality protection. As the dominant land cover type in Basin 7, reducing runoff and erosion from forests is important to meeting the state's clean water goals.

This section is organized around the Vermont Department of Forests, Parks and Recreation (DFPR) Acceptable Management Practices for Logging Jobs, Vermont Voluntary Harvesting Guidelines to protect forest health and Sustainability, local skidder bridge programs, and forest land conservation efforts.

Forestry AMPs and Skidder Bridge Programs

Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont were developed and adopted as rules by the Vermont Department of Forests, Parks and Recreation (FPR) for Vermont's water quality statutes and became effective in 1987 and were subsequently revised effective August 11, 2018. The AMPs are intended and designed to prevent mud, petroleum products, and excessive woody debris (logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The AMPs are scientifically proven methods for loggers and landowners to follow for maintaining water quality and minimizing erosion. The 2018 AMP manual can be downloaded from FPR's website.

The FPR provides portable temporary bridge rental opportunities for loggers during timber harvests. These bridges reduce the occurrence of sedimentation, channeling, and any degradation of aquatic habitat, while allowing loggers to harvest timber in compliance with State AMPs. When properly installed, used, and removed, portable temporary bridges minimize stream bank and stream bed disturbance as compared with alternative devices, such as culverts or poled fords. Portable bridges are also economical because they are reusable, easy to install, and can be transported from job to job. More information on the bridge rental program is found at: https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices/temporary-bridge-rentals.

In March 2018, the FPR held a temporary skidder bridge lottery, and twelve loggers and logging companies were chosen to receive bridges that were constructed by Fontaine Millworks in East Montpelier. The FPR will also be offering workshops for building bridges throughout the state.

Specifications for building skidder bridges can be found at: https://fpr.vermont.gov/skidder-bridges. These bridges should be utilized in areas of logging basinwide with a focus on steep slopes and areas with erodible soils adjacent to surface waters.

Use Value Appraisal Program & AMPs

Compliance with Vermont's Use Value Appraisal program (UVA) requires that the AMPs be employed to the maximum practicable extent. If the AMPs are not employed on UVA enrolled forestland but no discharge occurs, it may affect UVA eligibility without presenting a water quality violation. However, if the AMPs are not employed to the maximum practicable extent 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. Almost 70% of the forestland parcels over 30 acres in size in Basin 7 employ the AMPs as a requirement of the UVA program or because of state ownership (Figure 21). This does not mean that the other forestland areas are not employing the AMPs but may be less likely to require AMPs on their property. In Basin 7, the Upper Browns River by far, has the largest area of forest lands that are not under the UVA program or managed by the state (~11,400 acres). This watershed also includes large areas in the headwaters under state ownership and management in the Mt. Mansfield State Forest and the Ethan Allen Firing Range. The Ethan Allen Firing Range is a priority for outreach for water quality management. Other watersheds that are priority for outreach and education for AMPs and the UVA program are the Lower Lamoille River, Tributaries to Lower Mid-Lamoille, and Lower Browns River. In addition to programs like the AMPs and skidder bridge rentals, County Foresters are available for consultation when questions arise about practices to protect water quality.

Forest Road Assessments and Management

The ANR has developed a process and web application for assessing and prioritizing erosion issues along hydrologically connected forest roads. The next step is a state-wide ANR forest road assessment project that will take place over the next 3 years. State Forest roads in the Lamoille Basin are found in Green River Reservoir State Park (B(1) fishing watershed), Elmore State Park (B(1) aesthetics watershed), Sandbar Wildlife Management Area and State Park (Class I Wetland), Mt. Mansfield State Forest (Stevensville Brook stressed water and Beaver Meadow Brook and Mud Brook watersheds). In 2018, FPR implemented two comprehensive forest road improvement projects (Figure 22) in Johnson in the Waterman Brook and Jacob Brook watersheds on Mt. Mansfield State Forest land. The two projects included 3,560 linear feet of forest road drainage improvements, replacement of an undersized culvert with a bridge, one stream culvert removal, and 11 cross-drain culvert removals. These projects reduced sediment transport to surface waters and improved aquatic organism passage.

It is expected that the ANR Road Erosion Inventory App, and application used to inventory and map road segments based on their condition for the Municipal Roads General Permit, will become a resource for contractors and volunteers on private land. Downloadable to smart phones and smart

screens, the app will used to assessed and priority road segments in the field. Landowners may also use to prioritize their own efforts as well as for supporting funding requests. Target areas have been identified in the Lamoille Basin for forest land road erosion inventories in the Implementation Table in Chapter 5. Basin specific forest land workgroups are also a priority for establishment in Basin 7 to coordinate activities for outreach, training, implementation, and funding in priority areas. These workgroups are planned to include staff from FPR, FWD, Natural Resource Conservation Districts (NRCDs), Regional Planning Commissions (RPCs), watershed groups, United States Fish and Wildlife Service (USFWS), and the Natural Resource Conservation Service (NRCS).

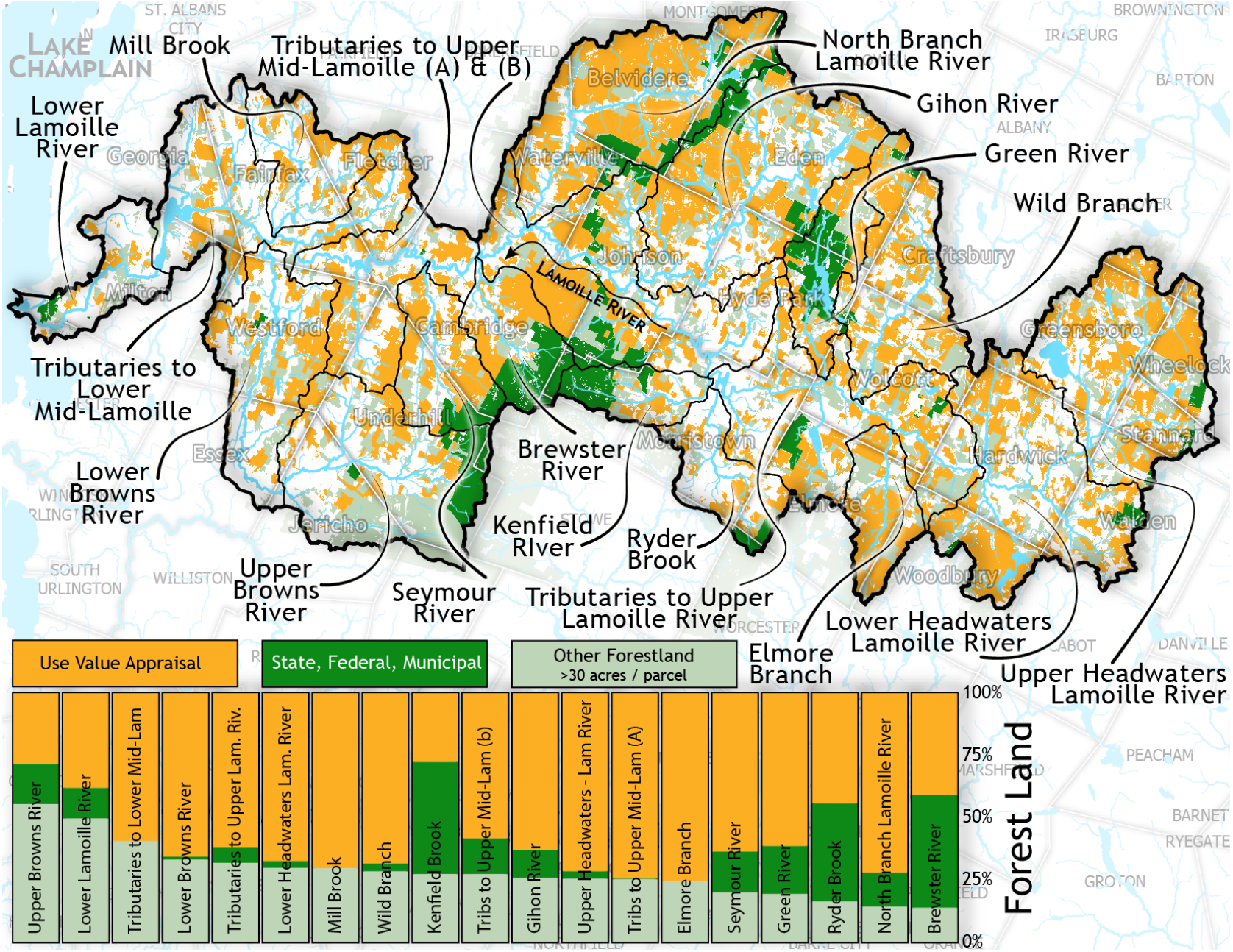


Figure 21. Map of public (dark green) and private (light green and orange) forest blocks in the Lamoille River watershed. The largest areas of private land parcels not in the Use Value Appraisal Program with over 30 acres of contiguous forest is found in the Upper Browns River watershed.

Figure 22. Upper photos left to right: eroded stream channel in Jacob Brook headwaters and stream channel restored. Lower photos left to right: undersized culvert over tributary to Waterman Brook and wooden bridge replacement over the tributary.

Chapter 5 – The Basin 7 Implementation Table

A. Progress in Basin 7

The previous Basin 7 plan was completed in 2016. A total of 88 strategies were identified in the plan. Sixty-five (or 75%) have been implemented or are in progress by ANR and its watershed partners, thirteen are awaiting action and have been carried over to this plan, and ten have been discontinued.

The Tactical Basin Plan addresses all impaired, stressed, and altered waters in the basin as well as protection needs for high quality waters. The list of strategies in the Implementation Table (Table 14) and the Monitoring and Assessment Table (Table 15) cover future assessment and monitoring needs, as well as projects that protect or remediate 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 stormwater mapping reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, Hazard Mitigation Plans, flood modeling, agricultural modeling and assessments, road erosion inventories, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

The Water Investment Division's Clean Water Initiative Program (CWIP) funds, tracks, and reports on priority projects to restore Vermont's waters, and communicates progress toward meeting water quality restoration targets outlined in the Total Maximum Daily Loads (or TMDLs). CWIP also coordinates funding, tracking, and reporting of clean water efforts for federal and state partners, including Clean Water Initiative partner state agencies – the Agencies of Agriculture, Food and Markets; Commerce and Community Development; Natural Resources; and Transportation – and the Lake Champlain Regional Conservation Partnership Program of the Natural Resources Conservation Service.

The Division's reporting on progress occurs annually for the basin regarding financial investments made and phosphorus loads addressed. A detailed report card for each of the 88 strategies from the 2016 plan will be viewable in the Appendix of the upcoming Vermont Clean Water Initiative 2021 Performance Report. Progress made in addressing the strategies in the 2021 Basin 7 Implementation Table will be reported in the next tactical basin plan scheduled for 2026 and the Vermont Clean Water Initiative 2024 and 2026 Performance Reports.

B. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in Basin 7 in coordination with the Vermont Agency of Natural Resources. 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 Caledonia County Natural Resources Conservation

District (CCNRCD), Central Vermont Regional Planning Commission (CVRPC), Chittenden County Regional Planning Commission (CCPRC), Friends of Green River Reservoir (FGRR), Franklin County NRCD (FCNRCD), Friends of Northern Lake Champlain (FNLC), Lamoille County Conservation District (LCCD), Lamoille County Planning Commission (LCPC), Lamoille Paddlers Trail Association (LPTA), Natural Resource Conservation Service (NRCS), Northeastern Vermont Development Association (NVDA), Northwest RPC, Orleans County NRCD, Stewards of Greensboro, Winooski NRCD, UVM Extension Service, US Fish and Wildlife Service (USFWS), Vermont Agency of Agriculture, Food and Markets (VAAFM), Vermont Agency of Transportation (VTrans), Vermont Land Trust (VLT), Vermont River Conservancy (VRC), lake associations, and municipal groups are active in:

- providing outreach and education to local stakeholders, private landowners, and municipalities.
- developing 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 numerous water quality monitoring programs in rivers).

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

C. Basin 7 Implementation Table

Table 14, the Implementation Table (IT), provides a list of 63 priority strategies created with the intention to be used as the go-to guide in the first step toward watershed action. The IT also provides specificity for where each strategy should be focused by identifying priority subbasins and towns. A list of related individual project entries is found in the online Watershed Projects Database (WPD). The 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 in the table is expected to be implemented and reported upon in subsequent phases of TMDL implementation plans and attendant interim and final TBP report cards included in annual Clean Water Performance Reports.

In relation to the Lake Champlain Phosphorus TMDL, IT strategy progress will be measured against the 5-year total phosphorus reduction (TP) targets for each sector, outlined in Chapter 3. These reduction targets are addressed through both the regulatory programs described in Chapter 3 and the prospective reductions assigned to Act 76 Clean Water Service Providers and guided by the IT strategies. The

effectiveness of those strategies and related implementation efforts will be measured according to TP reductions estimated for each sector. Clean water project tracking and accounting carried out by CWIP will estimate the mass of pollutants reduced from projects supporting IT strategies that will help monitor progress towards achieving those strategies and the 5-year target milestones. Progress achieved through outreach, technical assistance, and project funding will inform DEC's gap analysis related to each subsequent phase of TMDL implementation, each annual Clean Water Performance Report, and attendant interim and final TBP report cards.

As projects are developed, priority for CWIP funding will be given to those projects that achieve the highest water quality benefits. Additionally, projects that provide cumulative benefits (i.e., flood resiliency, water quality improvement, water resource protection, aquatic organism passage) will receive additional consideration for prioritization. For these priorities to be achieved, partners and stakeholders must help to carry out the strategies identified in the basin plan.

Table 14. Implementation strategies for the Basin 7 Tactical Basin Plan. See List of Acronyms on page 82.

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
STRATEGIES TO ADDRESS RUNOFF FROM AGRICULTURAL LANDS				
1. Identify projects with significant sources of nutrient input in priority sub-basins through Critical Source Area (CSA) maps, AAFM inspections to help achieve RAP compliance, and landowner outreach.	Lamoille Mainstem, Centerville Brook, Lower Gihon, Wild Branch, Seymour River, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Johnson, Hyde Park, Wolcott, Eden, Craftsbury, Cambridge, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	NRCDs, NRCS, AAFM, FNLC, DEC	Project Development Block Grants, AAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, DEC RCPP
2. Implement projects that address significant sources of nutrient input in priority sub-basins with a focus on cover cropping, manure injection, and agricultural production-area BMP projects for preventing manure and feed runoff to surface waters that will help to achieve RAP compliance and agriculture phosphorus reduction targets.	Lamoille Mainstem, Centerville Brook, Lower Gihon, Wild Branch, Seymour River, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Johnson, Hyde Park, Wolcott, Eden, Craftsbury, Cambridge, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	NRCDs, NRCS, AAFM, FNLC, DEC, VHCB	Design and Implementation Block Grant, River Corridor Easement Block Grant, AAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, DEC RCPP, VHCB
3. Implement Nutrient Management Plan recommendations in priority sub-basins.	Lamoille Mainstem, Centerville Brook, Lower Gihon, Wild Branch, Seymour River, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Johnson, Hyde Park, Wolcott, Eden, Craftsbury, Cambridge, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	NRCDs, NRCS, AAFM, FNLC, DEC	AAFM Water Quality Grants, NRCS Funding, USFWS Funding, LCBP, DEC RCPP
4. Form and convene agricultural sector workgroups for priority sub-basins to carry out and track strategies identified in the 2021 Lamoille Tactical Basin Plan.	Lamoille Mainstem, Centerville Brook, Lower Gihon, Wild Branch, Seymour River, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Streeter Brook, Browns River	Georgia, Fairfax, Milton, Fletcher, Jericho, Underhill, Cambridge, Johnson, Hyde Park, Wolcott, Hardwick, Craftsbury, Eden	NRCDs, NRCS, AAFM, FNLC, USFWS, FWD	TBP Support Grant, VAWQP funding

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
5. Provide education, outreach, and technical assistance to agricultural communities in priority sub-basins.	Lamoille Mainstem, Centerville Brook, Lower Gihon, Wild Branch, Seymour River, Beaver Meadow Brook, Deer Brook, Stones Brook, Mill Brook, Browns River	Hardwick, Johnson, Hyde Park, Wolcott, Eden, Craftsbury, Cambridge, Underhill, Jericho, Essex, Westford, Fletcher, Fairfax, Milton	NRCDs, NRCS, AAFM, FNLC	AAFM Water Quality Grants
6. Continue funding to support the AAFM Farm Agronomic Practices (FAP) Program, Conservation Reserve Easement Program (CREP), Grazing Technical Assistance (TA), and NRCS investments in soil-based agronomic practices to improve soil health, increase crop production, and reduce erosion and surface runoff from agricultural fields and to support the agriculture phosphorus reduction targets in fields and pastures.	Basinwide	All towns	UVM Extension Service, NRCS, AAFM, DEC	AAFM Water Quality Grants, NRCS Funding, DEC RCPP
7. Support monitoring efforts to identify water quality issues related to agricultural land use and track results of practices implemented to address issues.	Deer Brook, Stones Brook, Streeter Brook, Mill Brook, Browns River, Lower and Middle Lamoille River, Centerville Brook, Wild Branch, Beaver Meadow Brook, Perkins Meadow Brook, Porter Brook	Georgia, Fairfax, Milton, Fletcher, Jericho, Underhill, Cambridge, Johnson, Hyde Park, Wolcott, Hardwick, Craftsbury, Eden, Walden, Hardwick	FCNRCD, WNRCD, LCCD, CCNRCD, DEC - MAP	LaRosa Partnership Program, Lakes Lay Monitoring Program, DEC

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
STRATEGIES TO ADDRESS RUNOFF FROM DEVELOPED LANDS - STORMWATER				
8. Support, provide technical assistance to, and encourage local town and residential efforts to reduce stormwater runoff on private properties using initiatives such as Raise the Blade, Lawn to Meadow, Lake Wise, Rethink Runoff, or other established programs and techniques.	Lamoille Mainstem, Centerville Brook, Greensboro Brook	Hyde Park, Morristown, Hardwick, Greensboro, Milton, Essex	Hyde Park Energy Commission, Lake Champlain Sea Grant Program, Conservation Commissions, CCNRCD, Stewards of Greensboro, Municipalities, NVDA, Rethink Runoff	Lake Champlain Sea Grant, TBP Support Grant
9. Provide technical and funding support to develop high priority projects from recently completed stormwater master plans and Phosphorus Control Plans with a focus on priority subbasins and NRCS Type A soils.	Lamoille mainstem, Centerville Brook, Ryder Brook, Lower Gihon River, Streeter Brook, Lamoille Tributary #4, Browns River	Hyde Park, Morrisville, Johnson, Cambridge, Fairfax, Underhill, Jericho, Hardwick, Milton, Essex	LCPC, CCRPC, NRPC, CCNRCD, LCCD, private landowners, Municipalities	Project Development Block Grant
10. Encourage participation in the Green Schools Block Grant and support three-acre schools (primary and secondary schools) with funding and technical assistance for project development, implementation, and design, to achieve compliance with the three-acre rule.	Basin Target schools: Northern Vermont University, Bellows Falls Academy, Hazen Union High School (HS), Lamoille Union HS, Mt. Mansfield Union HS, Jericho Elementary, Browns River Middle School, Milton Elementary/Middle, Milton HS, Essex Elementary School, Peoples Academy and Morristown Elementary, and Westford Elementary	Johnson, Hardwick, Fairfax, Morristown, Jericho, Underhill, Milton, Essex, Westford	CCNRCD, LCCD, WNRCD, NRPC, LCPC, CCRPC	LCBP Green Schools Initiative
11. Complete implementation of the Deer Brook Gully Stabilization and Stormwater Mitigation Project.	Deer Brook - mouth to 2.5 miles upstream	Georgia	FNLC, NRPC, VTRANS, private landowners	Lake Champlain Basin Program

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
12. Support the development of stormwater retrofits in priority sub-basins.	Streeter Brook, Deer Brook	Milton, Georgia, Fairfax	DEC - CWIP, Municipalities	Clean Water Funding
13. Complete IDDE studies and mapping in Basin 7, follow-up on recommended actions from previous studies, and eliminate discharges identified by new studies.	Basinwide	Cambridge, Westford, North Wolcott, Hyde Park, Morristown	DEC - CWIP, Municipalities	IDDE Clean Water Funds
14. Provide technical support for an alternatives analysis for town garage relocation and support recommendations that improve water quality.	Lake Elmore	Elmore	LCPC, FPR, Town of Elmore, DEC - Rivers, DEC - Lakes	Project Development Block Grant, Design-Implementation Block Grant, VTrans Stormwater Program Grant
15. Identify and develop priority stormwater projects from stormwater mapping reports.	Segments receiving stormwater runoff in priority catchments	Wolcott	LCPC, LCCD, DEC – CWIP, Wolcott	Project Development Block Grant, Design-Implementation Block Grant
16. Provide information and funding to municipalities and watershed partners on DEC standards and training opportunities for operations and maintenance of installed stormwater BMPs.	Basinwide	All towns with DEC funded stormwater practices	RPCs, NRCDs, Municipalities	DEC - CWIP, Lake Champlain Sea Grant
17. Provide outreach to towns on the Green Stormwater Infrastructure toolkit to consider changes to bylaws and municipal regulations in growth centers.	Lamoille mainstem	Morristown, Cambridge, Jericho, Milton, Georgia, Johnson, Wolcott, Hardwick, Hyde Park, Essex, Fairfax	LCPC, CCRPC, NRPC, NVDA, WNRCD, Municipalities	TBP Support Grant
18. Provide technical support and funding for the implementation of Private Public Partnership projects to achieve compliance with the three-acre rule.	Lamoille mainstem, Centerville Brook, Ryder Brook, Lower Gihon River, Streeter Brook, Lamoille Tributary #4, Browns River, Brewster River	Johnson, Morristown, Cambridge, Milton, Essex, and future P3 communities	LCPC, LCCD, DEC, CCRPC	TBD, ARPA

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
19. Implement projects addressing vulnerabilities from flooding and fluvial erosion from county and municipal All-Hazards Mitigation Plans where water quality improvements are present.	Basinwide	Milton, Colchester, Westford, Jericho, Underhill, Essex, Belvidere, Eden, Elmore, Jeffersonville, Hyde Park, Morristown, Johnson, Waterville, Wolcott	LCPC, CCRPC, Municipalities	Municipal Planning Grants, FEMA
20. Support town to evaluate the town sand storage area for a stormwater management project.	Stannard Brook - all connected surface waters	Stannard	Stannard Town, CCNRCD, NVDA	VTrans Municipal Roads Grant-in-Aid, Project Development Block Grant, Design/Implementation Block Grant
STRATEGIES TO ADDRESS RUNOFF FROM DEVELOPED LANDS - ROADS				
21. Provide general support and technical assistance to towns for MRGP compliance.	Basinwide	All towns	RPCs, NRCDs, DEC, VTrans, Municipalities	TBP Support Grant, DEC - CWIP, Capacity Development Grants
22. Support Regional Hydroseeder and Vactor sharing programs through training, outreach, and funding.	Middle Lamoille	All towns	RPCs, NRCDs, VTrans, DEC-CWIP, Municipalities	DEC - CWIP, Capacity Development Grants
23. Support outreach and funding for MRGP equipment for towns.	Basinwide	All towns	RPCs, NRCDs, VTrans, DEC-CWIP, Municipalities	DEC - CWIP, Capacity Development Grants, Grants-Aid-Small Equipment Grant
24. Implement high priority road projects identified in MRGP road erosion inventories, lake watershed action plans, and stormwater master plans basinwide with a focus on priority subbasins and very steep slopes, to achieve compliance with the MRGP and meet phosphorus reduction targets for the roads sector.	Caspian Lake, Streeter Brook, Deer Brook, Stannard Brook, Lake Eden, Lake Elmore, Kate Brook	Greensboro, Milton, Georgia, Fairfax, Stannard, Eden, Elmore, Hardwick, Hyde Park Wolcott, Woodbury	LCPC, CCRPC, NRPC, NVDA, CCNRCD, LCCD, CVRPC, Municipalities	VTrans Municipal Roads Grant-In-Aid Program, VTrans Better Roads, Regional Transportation Funds, Design-Implementation Block Grant
25. Provide outreach and support to towns and contractors to attend Road Roundtable Forums.	Basinwide	All towns	RPCs, DEC - Stormwater, NRCDs, Municipalities	DEC - Stormwater, TBP Support Grant

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
26. Support towns to adopt the Vermont Road and Bridge Standards to increase ERAF rating.	Basinwide	Stannard, Eden, Elmore, Morristown, Waterville	LCPC, NVDA, Municipalities	TBP Support Grant
STRATEGIES TO ADDRESS WASTEWATER				
27. Provide information on the ANR Village Wastewater Solutions to any communities that have inadequate individual onsite wastewater treatment on small, challenging sites, and funding for planning and implementation of priority projects that are identified and have community support.	Village centers along the Lamoille mainstem	Cambridge, Craftsbury, Elmore, Georgia, Greensboro, Jericho, North Hyde Park, Westford, Wolcott, North Wolcott	DEC - Water Investment Division, LCPC, NVDA, CCRPC, Municipalities	CWSRF, USDA Community Facilities Program, Northern Borders Grant, TBP Support Grant
28. Support relocation of septic systems and/or floodproofing of on-site septic systems.	Village centers along the Lamoille mainstem	Cambridge, Hyde Park	DEC - Engineering & Facilities, LCPC, Municipalities	CWSRF, USDA Community Facilities Program, Northern Borders Grant, TBP Support Grant
29. Support upgrades to public wastewater treatment facilities.	Upper Lamoille River, Lower Mid-Lamoille River	Hardwick, Fairfax	Municipalities, WID	CWSRF, USDA RD
30. Provide support and materials to lake communities to host Septic Socials.	Lake Eden, Lake Elmore, Caspian Lake	Eden, Elmore, Greensboro	Lake Associations, DEC Lakes, DEC - Wastewater	Watershed Planning Grant
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - RIVERS				
31. Support municipal adoption of flood hazard by-law.	Upper and Middle Lamoille Waters	Wheelock, Walden, Eden, Waterville	NVDA, LCPC, Municipalities	TBP Support Grant, Municipal Planning Grants
32. Conduct a study to identify correct conservation flow levels through appropriate state regulatory processes and Hardwick Electric.	Lamoille River	Hardwick, Wolcott	DEC - Rivers, Hardwick, Hardwick Electric	LCBP, Clean Water Fund
33. Support the development of and provide technical assistance for an alternatives analysis study for	Hardwick Lake and Lamoille River	Hardwick	DEC - Rivers, DEC - Dam Safety, Hardwick, Hardwick	LCBP, Clean Water Fund

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
Jackson Dam.			Electric, CCNRCD	
34. Support towns to adopt river corridor protection or strengthen existing river protection by-laws, setbacks, and zoning by providing technical assistance and outreach.	Brewster River, Seymour River, Gihon River, Browns River, Lamoille Mainstem, Mill Brook, Stones Brook, Deer Brook, Stannard Brook	Stannard, Eden, Johnson, Cambridge, Georgia, Westford, Underhill, Fairfax	RPCs, DEC - Rivers, Municipalities	TBP Support Grant, Municipal Planning Grants
35. Work with towns to consider joining the NFIP as part of an effort to increase ERAF rating.	Lamoille Basin	Wheelock, Walden, Eden, Waterville	LCPC, NVDA, Municipalities	TBP Support Grant, Municipal Planning Grants
36. Support recreational access to the Lamoille River through the establishment and maintenance of stable access areas, portage trails and river campsites.	Lamoille River	Multiple	LPTA, Municipalities	TBD
37. Work with towns to add approved RPC flood resiliency section to town plan.	Upper Lamoille waters	Stannard, Walden	NVDA, Municipalities	TBP Support Grant
38. Support the removal of the streamside earthen dam on Mud Brook.	Mud Brook	Morristown	DEC - Rivers, FPR, Morristown, DEC - MAP, NRCD	
39. Develop projects identified in the FWD Riparian Lands Assessment report.	Upper Lamoille River, Greensboro Brook, Stannard Brook	Elmore, Greensboro, Hardwick, Stannard, Wolcott	FWD, CCNRCD, Stewards of Greensboro, OCNRCD, VRC, VLT, LCPC	Project Development Block Grant, TBP Support Grant
40. Implement priority projects from the Lamoille River Flood Study to reduce ice jams and improve flood resiliency and water quality.	Middle Lamoille River	Cambridge, Johnson, Wolcott	Municipalities, LCPC	VTrans Water Quality Grants, FEMA grants, Design-Implementation Block Grants

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
41. Scope, design, and implement high priority bridge and culvert replacements to improve aquatic organism passage, stream geomorphic compatibility, and flood resilience as identified in statewide and local assessments (e.g., river corridor plans, culvert inventories, hazard mitigation plans).	Basin wide with a focus on streams stressed or impaired by encroachment and channel erosion.	All towns, State Lands	VFPR, USFWS, Trout Unlimited, VFWD, Municipalities, private landowners, NRCDs, RPCs	VTrans Municipal Roads Grant-In-Aid Program, VTrans Better Roads, Regional Transportation Funds, Design-Implementation Block Grant, VT Stream Restoration and Protection Program RCPP Grant, National Fish Passage Program, National Fish Habitat Partnership
42. Develop and implement priority projects and actions identified in the River Corridor Plans and supported by the Functioning Floodplain Initiative tool.	RCPs: Brewster River, Browns River, Centerville Brook, Gihon River, Wild Branch, Seymour Brook, Settlement Brook, Lamoille River. FFI: Basinwide	Cambridge, Hyde Park, Eden, Johnson, Morristown, Wolcott, Craftsbury, Westford, Jericho, Underhill, Essex	CCNRCD, LCCD, WNRCD, NRPC, LCPC, CCRPC, Municipalities	Project Development Block Grant, River Corridor Easement Block Grant
43. Continue maintenance of existing erosional control features and if necessary, implement additional remediation measures needed at the Lowell and Eden asbestos mine.	Lowell asbestos mine- Hutchins Brook, Hutchins Brook Trib 4, Dark Branch	Eden	DEC - Hazardous Waste, DEC - MAP	
44. Provide outreach to towns to develop petitions for reclassification of A(2) waters where they are no longer used as a public water source.	Unnamed tributaries to the Lamoille River	Hardwick, Fairfax	NVDA, NRPC, DEC – MAP, Municipalities	604B, TBP Support Grant
45. Provide outreach to towns to develop petitions for reclassification of waters for B(1) for fishing and aquatic biota use.	Stevensville Brook, Smith Brook, Centerville Brook, Green River, Cooper Brook, Porter Brook	Underhill, Johnson, Cambridge, Hyde Park, Woodbury, Hardwick, Greensboro	CCRPC, LCPC, LCCD, WNRCD, CVRPC, CCNRCD, NVDA, Municipalities	604B, TBP Support Grant

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - LAKES				
46. Initiate stakeholder meeting to discuss lay monitoring and Lake Wise on target lakes with fair to poor shoreland scores.	Round Pond, East Long Pond, Nichols Pond	Milton, Woodbury	WNRCD, CCRPC, CVRPC, DEC - Lakes, Municipalities, private landowners, FWD	TBP Support Grant
47. Identify and coordinate stakeholders to work with VDEC to develop an invasive species management plan for the waterbody.	Arrowhead Mountain Lake	Georgia, Milton	WNRCD, FCNRCD, FWD, DEC - Lakes	TBP Support Grant
48. Initiate stakeholder meetings to discuss feasibility and logistics for lay monitoring for sentinel lake sites.	Long Pond	Greensboro	Stewards of Greensboro, DEC - Lakes	TBP Support Grant
49. Maintain and build the capacity for the Greeter & VIP Program to monitor and manage aquatic invasive species.	Lake Eden, Lake Elmore, Caspian Lake	Eden, Elmore, Greensboro	DEC - Lakes, Lake Associations, NRCDs	Aquatic Nuisance Control Grant-In-Aid Program
50. Develop Lake Watershed Action Plan (LWAP) and provide outreach to the community on the plan and proposed actions, including installation of riparian buffers on lake tributaries.	Caspian Lake	Greensboro	OCNRCD, Stewards of Greensboro, DEC - Lakes, Municipality	LWAP Development Funds

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
51. Support A(1) designation for aesthetics on lakes.	Caspian Lake	Greensboro	DEC - Lakes, Stewards of Greensboro Watershed, Greensboro Association, Municipality	VTDEC Lakes and Ponds Program
52. Maintain AIS signage at lake access areas.	Hardwick Lake, Horse Pond, Long Pond, Nichols Pond, Lake Eden, Green River Reservoir, Long Pond, Wolcott Pond	Hardwick, Greensboro, Woodbury, Eden, Hyde Park, Belvidere, Wolcott	DEC - Lakes, FWD, Lake Associations	Aquatic Nuisance Control Grant-In-Aid Program
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - WETLANDS				
53. Provide outreach and technical assistance for Class I wetland assessment, stakeholder discussions, and petition development where there is interest.	Hidden Swamp, Towne Swamp, Flagg Pond Wetland Complex, Page Brook Wetland Complex, Molly Bog & Morristown Bog Complex, Belvidere Bog and North Branch Wetland Complex	Milton, Westford, Wheelock, Glover, Sheffield, Morristown, Belvidere	DEC - Wetlands, Municipalities, NVDA, CCRPC	TBP Support Grant
54. Provide support to the Wetlands Program for publicizing volunteer wetland mapping workshops and training for the public to aid in the eventual updated wetland mapping for the Lamoille River basin.	Basinwide wetlands	All towns	RPCs, NRCDs, DEC – Wetlands, Municipalities	TBP Support Grant

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
55. Increase wetland acreage and function through restoration of previously drained and degraded wetlands identified in assessments - River Corridor Plans and Wetland Restoration Assessments - and field surveys.	Basinwide	All towns	NRCDs, DEC - Wetlands, DEC - Rivers, DEC RCPP, VLT, VRC	NRCS WRE, Clean Water Funds, Project Development Block Grant, Design - Implementation Block Grant, DEC RCPP.
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION - FORESTS				
56. Maintain and increase UVA enrolled forestland among eligible parcels by providing outreach and technical assistance to private landowners and foresters to equip them with tools to apply, enroll and manage their land in accordance with program standards, including implementation of AMPs.	Upper Browns River, Lower Lamoille River, Tributaries to Lower Mid-Lamoille, Lower Browns River	Underhill, Jericho, Milton, Fairfax, Fletcher	FCNRCD, WNRCD, NRPC, CCRPC, FPR	TBP Support Grant
57. Develop a workgroup for forestland collaborative efforts in priority watersheds to carry out strategies in the 2021 Lamoille TBP.	Upper Browns River, Lower Lamoille River, Tributaries to Lower Mid-Lamoille, Lower Browns River, Headwaters North Branch Lamoille, Headwaters Lake Eden	Underhill, Jericho, Milton, Fairfax, Fletcher, Eden, Belvidere	FCNRCD, WNRCD, NRPC, CCRPC, LCCD, LCPC, FPR, NRCS, FWD, USFWS	TBP Support Grant
58. Provide basinwide outreach through towns on information on temporary skidder bridges and forestry AMPs.	Basinwide	All Towns	RPCs, Municipalities	TBP Support Grant

Strategy Description	Priority Subbasin(s)	Priority Towns	Partners	Funding
59. Implement forestry AMPs on high priority state lands through ANR road inventory, prioritization, and implementation.	Stevensville Brook (Mt. Mansfield State Forest), Lake Elmore (Elmore State Park), Beaver Meadow Brook and Mud Brook (Mt Mansfield State Forest), Sandbar wetland complex (Sandbar State Park and Wildlife Management Area), Green River (Green River Reservoir State Park)	Underhill, Elmore, Morristown, Hyde Park, Eden, Milton	FPR, DEC	Clean Water Funds
60. Provide focused outreach to forestland managers on the use of the ANR Road Erosion Inventory App in target watersheds.	Headwaters North Branch Lamoille, Headwaters Lake Eden	Eden, Belvidere	LCCD, LCPC, FPR	TBP Support Grant
61. Identify headwaters and sensitive surface waters in large forest blocks for protection through conservation easement and land acquisition.	Basinwide	Belvidere, Waterville, Lowell, Eden, Johnson, Hyde Park, Underhill, Jericho, Elmore, Wheelock, Stannard, Walden, Woodbury	WNRCD, CCRPC, LCCD, LCPC, NVDA, FPR, CVRPC	TBP Planning Grants
62. Implement forest land conservation practices and land conservation projects.	Basinwide	All towns	NRCS, ANR	EQIP, Vermont Housing and Conservation Trust Fund, Forest Legacy Program
STRATEGIES TO SUPPORT NATURAL RESOURCE PROTECTION AND RESTORATION – SURFACE WATERS				
63. Support monitoring efforts on priority surface waters as identified in the 2021 Lamoille TBP Monitoring & Assessment Table.	see monitoring & assessment table	see monitoring & assessment table	DEC - Lakes, MAP, Wetlands, Rivers; Volunteer Monitors, LaRosa Partnership Program, FCNRCD, LCCD, WNRCD, CCNRCD	LaRosa Partnership Program, Lakes Lay Monitoring Program, DEC

D. Basin 7 Monitoring and Assessment Table

Table 15, the Monitoring and Assessment Table, provides a preliminary list of 65 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 both the ANR and its partners, which are also listed in Chapter 2. Common goals for monitoring efforts across programs include identifying water quality conditions as well as pollution sources and tracking improvements over time. Table 15 includes more sites than there is capacity to sample and as a result, will be further prioritized before monitoring occurs in 2022.

Table 15. Basin 7 priorities for monitoring and assessment. Monitoring on private lands requires landowner permission.

Waterbody	Project Description	Location	Partner(s)	Purpose
Lakes and Ponds				
1. Little Elmore Pond	Establish Lay Monitor.	Elmore	DEC - Lakes, Lay Monitoring Program	Gather data and evidence for reclassification.
2. Long Pond	Establish Lay Monitor.	Greensboro	DEC - Lakes, Lay Monitoring Program, Stewards of Greensboro	Initiate stakeholder meeting to discuss lay monitoring. Gather data and evidence for reclassification.
3. Caspian Lake	Volunteer monitor major tributaries for phosphorus, chloride, and nitrogen.	Greensboro	DEC - Lakes, LaRosa Partnership Program, Stewards of Greensboro	To establish baseline nutrient and chloride levels for the major tributaries to Caspian Lake and identify sources of pollution.
4. Schofield Pond	Establish Lay Monitor.	Hyde Park	DEC - Lakes, Lay Monitoring Program, FPR, FGRR	Gather data and evidence for reclassification.
5. Zack Woods Pond	Establish Lay Monitor.	Hyde Park, Wolcott	DEC - Lakes, Lay Monitoring Program, FPR, FGRR	Gather data and evidence for reclassification or ORW.
6. Identified Lakes and Ponds	Complete AIS survey.	Multiple	DEC - Lakes	Generate AIS status of lakes and ponds with no data.

Waterbody	Project Description	Location	Partner(s)	Purpose
Rivers and Streams				
7. Basin Brook	Biological and chemical monitoring.	Belvidere, Johnson	DEC - MAP	Determine reclassification status for aquatic biota.
8. Beaver Brook	Biological and chemical monitoring.	Westford	DEC - MAP	Data gap. Moderate sized watershed with no data.
9. Beaver Meadow Brook	Biological and chemical monitoring.	Johnson, Morristown	DEC - MAP	Data gap. Large sized watershed with no data.
10. Bell Brook	Biological and chemical monitoring.	Johnson	DEC - MAP	Data gap. Moderate sized watershed with no data.
11. Brewster River	Above school and below dam.	Cambridge	DEC - MAP	Additional monitoring will help to define the stressed segment.
12. Browns River	Biological and chemical monitoring. (RM 20.4 and between RM 11.4 and 18.5).	Westford, Jericho	DEC - MAP	Determine current condition of aquatic biota.
13. Browns River Headwaters	Biological and chemical monitoring.	Underhill	DEC - MAP	Determine reclassification status for aquatic biota.
14. Calavale Brook	Biological and chemical monitoring.	Belvidere	DEC - MAP	Determine reclassification status for aquatic biota.
15. Cooper Brook	Biological and chemical monitoring.	Hardwick	DEC - MAP	Data gap. Moderate sized watershed with no data.
16. The Creek	Biological and chemical monitoring.	Underhill	DEC - MAP	Needs follow up monitoring to determine status, possibly sampling at a new location.
17. Deer Brook	Monitor biology and chemistry above and below gully on Deer Brook - in 2021 and 2023 - add a conductivity logger if possible - try to match up with LaRosa monitoring (RM 1.8 & 2.1).	Georgia	DEC - MAP	Identify stressors and track results of stormwater BMPs.
18. Deer Brook	Volunteer monitoring of mainstem for phosphorus, chloride, and nitrogen.	Georgia	DEC - MAP, LaRosa Partnership Program, FCNRCD, FNLC	Establish baseline nutrient and chloride levels for the mainstem, identify sources of pollution causing the impairment, and track results of BMPs.
19. Elmore Branch	Biological and chemical monitoring.	Elmore	DEC - MAP	Determine reclassification status for aquatic biota. Determine if erosion in the headwaters is causing impacts to biology.
20. Elmore Pond Brook	Biological and chemical monitoring.	Elmore	DEC - MAP	Data gap. Moderate sized watershed with no data.

Waterbody	Project Description	Location	Partner(s)	Purpose
21. Foote Brook	Biological and chemical monitoring.	Johnson	DEC - MAP	Determine current condition of fish community.
22. Gihon River	Biological and chemical monitoring (RM 0.1 & 7.4).	Johnson	DEC - MAP	Determine current condition of fish community at 7.4 and find a site further upstream from the confluence for a more representative sample to better understand condition.
23. Gihon River	Biological and chemical monitoring (RM 10.3).	Johnson	DEC - MAP	Determine reclassification status for aquatic biota.
24. Green River	Biological and chemical monitoring.	Hyde Park, Morristown	DEC - MAP	Determine reclassification status for aquatic biota.
25. Greensboro Brook	Biological and chemical monitoring.	Greensboro	DEC - MAP	Determine reclassification status for aquatic biota with focus on fish.
26. Haynesville Brook (includes Perkins Meadow Brook)	Biological and chemical monitoring.	Hardwick	DEC - MAP	Determine reclassification status for aquatic biota.
27. Hutchins Brook	Monitor at previous site where macroinvertebrate data was lost.	Belvidere	DEC - MAP	Impaired segment needs updated information.
28. Kenfield Brook	Monitor fish community.	Morristown	DEC - MAP	Determine reclassification status for aquatic biota with focus on fish.
29. Lamoille River Headwaters	Biological and chemical monitoring (RM 70.5).	Greensboro, Wheelock, Glover, Sheffield	DEC - MAP	Determine reclassification status for aquatic biota. Watershed includes Flagg Brook, Edson Brook, Sawmill Brook, Paine Brook, Withers Brook, Mud Pond Brook, Page Brook, Morrison Brook.
30. Lamoille River Trib #4	Monitor for biological condition and chemical concentration above and below landfill (RM 0.1 & 0.5).	Milton	DEC - MAP	Gather data to understand current status and identify watershed sources of pollution.
31. Lee River	Biological and chemical monitoring just downstream of Camp Ethan Allen Training Site.	Jericho	DEC - MAP	Determine reclassification status for aquatic biota.
32. Mill Brook	Biological and chemical monitoring (RM 0.6 & 3.0) and volunteer monitoring for water chemistry.	Fairfax	DEC - MAP, LaRosa Partnership Program, FCNRCD	Determine if waterbody is stressed.
33. Morgan Brook & Tributary	Biological and chemical monitoring.	Westford	DEC - MAP	Determine if waterbody is stressed.
34. North Branch Lamoille	Below Basin Brook.	Belvidere	DEC - MAP	Determine reclassification status for aquatic biota
35. North Branch, Browns	Assess geomorphic condition of	Cambridge,	DEC - Rivers	Determine condition of stream geomorphology.

Waterbody	Project Description	Location	Partner(s)	Purpose
River, Wild Branch, Kate Brook	streams stressed aquatic habitat use.	Underhill, Wolcott, Hardwick		
36. Porter Brook	Biological and chemical monitoring.	Hardwick	DEC - MAP	Determine reclassification status for aquatic biota.
37. Randolph Stream (unnamed)	Biological and chemical monitoring.	Morristown	DEC - MAP	Data gap. Moderate sized watershed with no data.
38. Rodman Brook	Monitor for biological condition and chemical concentration below landfill leachate.	Morristown	DEC - MAP	Temporary repairs have been done to the landfill washout, and erosion controls installed. A major regrading of the landfill surface is required, but funding remains an issue. Monitoring will provide current condition status since the temporary repairs.
39. Ryder Brook	Biological (fish) and chemical monitoring.	Morristown	DEC - MAP	Determine if waters should be taken off the stressed list.
40. Sawmill Brook	Biological and chemical monitoring.	Greensboro, Glover	DEC - MAP	Gather data and evidence for reclassification.
41. Settlement Brook	Biological and chemical monitoring.	Cambridge	DEC - MAP	Data gap. Moderate sized watershed with no data.
42. Seymour River	Monitor biological condition and chemical concentrations.	Cambridge	DEC - MAP, LaRosa Partnership Program, FCNRCD	Establish baseline nutrient levels at confluence to determine if the mapped high loading catchment information is accurate. Determine biological condition.
43. Stannard Brook	Biological and chemical monitoring.	Stannard	DEC - MAP	Determine extent of stressed segment.
44. Stevensville Brook	Biological and chemical monitoring.	Underhill	DEC - MAP	Determine if waters should be taken off the stressed list.
45. Stones Brook	Monitor mainstem and Halfmoon Pond tributary for phosphorus, chloride, and nitrogen.	Fairfax	DEC - MAP, LaRosa Partnership Program, FCNRCD	Establish baseline nutrient and chloride levels for the mainstem and tributary, and identify sources of pollution causing the impairment, and track results of BMPs.
46. Streeter Brook	Biological and chemical monitoring and volunteer monitoring for water chemistry.	Milton	DEC - MAP, LaRosa Partnership Program, WRNRCD	Determine extent of stressed segment. Identify source of pollution.
47. Tamarack Brook	Biological and chemical monitoring.	Wolcott	DEC - MAP	Data gap. Moderate sized watershed with no data.

Waterbody	Project Description	Location	Partner(s)	Purpose
48. Tributary to Brewster River	Monitor for biological condition and chemical concentration below impaired segment.	Cambridge	DEC - MAP	Evaluate iron impairment.
49. Tucker Brook	Biological and chemical monitoring.	Hardwick	DEC - MAP	Gather data and evidence for reclassification. Determine if waters should be taken off the stressed list.
50. Waterman Brook	Biological and chemical monitoring.	Johnson	DEC - MAP	Determine reclassification status for aquatic biota.
51. Wild Branch	Biological and chemical monitoring. (RM 11.2 and lower reaches)	Wolcott, Eden	DEC - MAP	Data gap. Large sized watershed with minimal data. Determine reclassification status for aquatic biota. Sample lower reaches.
52. Wild Brook	Biological and chemical monitoring.	Eden	DEC - MAP	Determine reclassification status for aquatic biota.
Wetlands				
53. Lower Lamoille River Oxbow	Wetland assessment, VRAM.	Milton	DEC - Wetlands	Assessment for Class I wetland considerations.
54. West Milton Road Wetland	Wetland assessment, VRAM.	Milton	DEC - Wetlands	Data gap. Large wetland contiguous to Lamoille River.
55. Mill Brook Swamp	Wetland assessment, VRAM.	Fairfax	DEC - Wetlands	Data gap. Large wetland contiguous to Mill Brook.
56. Stones Brook Wetlands - Upper headwaters (North Road) and Lower (Fairfax-Fletcher Road)	Wetland assessment, VRAM.	Fairfax, Fletcher	DEC - Wetlands	Data gap. Riparian wetland contiguous to Stones Brook.
57. Cilley Hill Wetlands	Wetland assessment, VRAM.	Jericho	DEC - Wetlands	Data gap. Riparian wetland contiguous to Browns River just upstream of dam.
58. North Branch Wetlands (between Route 109 and Route 15)	Wetland assessment, VRAM.	Cambridge	DEC - Wetlands	Data gap. Riparian wetland containing many oxbows contiguous to Lamoille River. Evaluate value for conservation.
59. Lake Elmore Wetlands (southern end of lake)	Wetland assessment, VRAM.	Elmore	DEC - Wetlands	Data gap. Large wetland contiguous with Lake Elmore. RTE species.
60. Bear Swamp	Wetland assessment, VRAM.	Wolcott	DEC - Wetlands	Assessment for Class I wetland considerations. Contiguous with Tamarack Brook.
61. Collinsville Road Wetlands	Wetland assessment, VRAM.	Craftsbury	DEC - Wetlands	Data gap. Headwater wetland of the Wild Branch.
62. Alder Brook Wetland Complex	Wetland assessment, VRAM.	Hardwick	DEC - Wetlands	Data gap. Wetland complex upstream of Hardwick Lake. Consider impacts of flow alteration.

Waterbody	Project Description	Location	Partner(s)	Purpose
63. Greensboro Brook Wetlands	Wetland assessment, VRAM.	Greensboro	DEC - Wetlands	Data gap. Riparian wetland contiguous to Greensboro Brook.
64. Cemetery Brook Wetlands	Wetland assessment, VRAM.	Greensboro	DEC - Wetlands	Data gap. Riparian wetland contiguous to Cemetery Brook and Caspian Lake.
65. Route 16 Wetland (northwest of intersection between Route 15 and Route 16)	Wetland assessment, VRAM.	Hardwick	DEC - Wetlands	Data gap. Riparian wetland contiguous to Lamoille River and Haynesville Brook.

List of Acronyms

604(b)	Federal Clean Water Act, Section 604b
ACWIP	Agricultural Clean Water Initiative Grant Program
AIS	Aquatic Invasive Species
AMPs	Acceptable Management Practices (for logging)
ANC	Aquatic Nuisance Control grant
ANR	Vermont Agency of Natural Resources
AOP	Aquatic Organism Passage
AOT	Vermont Agency of Transportation
BASS	Biomonitoring and Aquatic Studies Section
BMP	Best Management Practices
BR	Better Roads
CCNRCD	Caledonia County Natural Resources Conservation District
CCRPC	Chittenden County Regional Planning Commission
CEAP	Capital Equipment Assistance Program
CREP	Conservation Reserve Enhancement Program
CWI	Clean Water Initiative Grant Funding
CWIP	Clean Water Initiative Program
CWSRF	Clean Water State Revolving Fund
CVRPC	Central Vermont Regional Planning Commission
DEC	Department of Environmental Conservation
RPC	Regional Planning Commission
EBTJV	Eastern Brook Trout Joint Venture
EQIP	Environmental Quality Incentive Program
ERP	Ecosystem Restoration Program
FAP	Farm Agronomic Practices
FNLC	Friends of Northern Lake Champlain
FPR	Vermont Department of Forests, Parks and Recreation
FWD	Vermont Fish and Wildlife Department
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
IDDE	Illicit Discharge Detection (and) Elimination
LULC	Land Use Land Cover
LCCD	Lamoille County Conservation District
LCPC	Lamoille County Planning Commission
LFO	Large farm Operation
MAB	Municipal Assistance Bureau
MAP	Monitoring and Assessment and Program
MFO	Medium Farm Operation
MPG	Municipal Planning Grant
MRGP	Municipal Roads General Permit
NFIP	National Flood Insurance Program
NFWF	National Fish and Wildlife Foundation
NMP	Nutrient Management Plan
NPS	Non-point source pollution
NRCD	Natural Resources Conservation District
NRCS	Natural Resources Conservation Service
NRPC	Northwest Regional Planning Commission
NVDA	Northeast Vermont Development Association
OCNRCD	Orleans County Natural Resources Conservation District
ORW	Outstanding Resource Water
RAP	Required Agricultural Practices
RPC	Regional Planning Commission
RCPP	Regional Conservation Partnership Program
RMP	River Management Program
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SWMP	Stormwater Master Plan
TBP	Tactical Basin Plan
TBPSG	Tactical Basin Planning Support Grants
TMDL	Total Maximum Daily Load
TU	Trout Unlimited
TNC	The Nature Conservancy

TS4	Transportation Separate Storm Sewer System General Permit
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
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 Service
VAAFM	Vermont Agency of Agriculture, Food, and Markets
VACD	Vermont Association of Conservation Districts
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VHCB	Vermont Housing and Conservation Board
VIP	Vermont Invasive Patrollers
VRAM	Vermont Rapid Assessment Method
VRC	Vermont River Conservancy
VTrans	Vermont Agency of Transportation
VWQS	Vermont Water Quality Standards
VYCC	Vermont Youth Conservation Corp
WISPr	Water Infrastructure Sponsorship Program
WNRCD	Winooski Natural Resources Conservation District
WRE	Wetland Reserve Easement Program

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Appendix A. Dams in Basin 7

Table A1. List of dams in Basin 7. These dams are either in service, partially breached, breached, or removed. Source: Vermont Dam Inventory (accessed: 01/28/2021)

MapID	Dam Name	Purpose	Status	MapID	Dam Name	Purpose	Status
5	Silver Lake	Water Supply	In Service	**38**	Simonds	NA	In Service
6	Silver Lake South Dike	Water Supply	In Service	**53**	Hardwick Lake	Recreation	In Service
7	Silver Lake North Dike	Water Supply	In Service	**54**	Winter	Recreation	In Service
9	Fairfax Falls	Hydroelectric	In Service	**56**	Mackville Pond	Recreation	In Service
11	Ferguson	Recreation	In Service	**63**	Anderson	NA	In Service
12	Stone's Brook	NA	In Service	**44**	Lake Elmore	Hydroelectric, Recreation	In Service
1	Peterson	Hydroelectric	In Service	**10**	Cilley Hill	NA	In Service
2	Milton	Hydroelectric	In Service	**48**	Travelstead	Recreation	In Service
3	Clarks Falls	Hydroelectric, Recreation	In Service	**51**	Shadow Pond	Recreation	In Service
16	Bryan	NA	In Service	**58**	East Long Pond	Recreation, Other	In Service
17	Rood	Recreation	In Service	**59**	Nichols	Recreation, Other	In Service
18	Edwards Snowmaking	Recreation	In Service	**42**	South Pond	Recreation	In Service
20	Smugglers Notch Snow Pond Diversion	Recreation	In Service	**45**	Lake Eden	Recreation	In Service
21	Smugglers Notch Village	Water Supply	In Service	**23**	Laraway	NA	Breached
22	Smugglers Notch Snow Pond	NA	In Service	**49**	Wolcott-1	NA	Breached
60	Caspian Lake	Recreation	In Service	**37**	Boardman Mill	NA	Breached
61	Greensboro-2	NA	In Service	**57**	Hardwick-4	NA	Breached
62	McGrath	Recreation	In Service	**19**	Morses Mill	NA	Breached (Partial)
27	Johnson State Lower	Recreation	In Service	**4**	Georgia - 3	NA	Removed
47	Wolcott	Hydroelectric	In Service	**14**	Grist Mill Hill	NA	Removed
50	Wolcott Pond	Recreation	In Service	**15**	Bingham Falls	NA	Removed
52	Wapanacki Lake	Recreation	In Service	**26**	Johnson Woolen Mill	NA	Removed
31	Lamoille Union High School	Fire Protection or Small Farm Pond	In Service	**28**	Johnson State Upper Dam	NA	Removed
32	Hyde Park	Hydroelectric	In Service	**29**	Johnson Village	NA	Removed

MapID	Dam Name	Purpose	Status	MapID	Dam Name	Purpose	Status
39	Hill	Recreation	In Service	**30**	East Johnson	NA	Removed
41	Green River Reservoir	Hydroelectric, Recreation	In Service	**13**	Stevensville Brook Dam	NA	Removed
43	Beaver Lake	Recreation	In Service	**36**	North Hyde Park	NA	Removed
46	Green River Reservoir Dike	Hydroelectric	In Service	**40**	Garfield	NA	Removed
24	Ransom	NA	In Service	**35**	Wards Pond	NA	Removed
25	Bryan	Recreation	In Service	**55**	Hardwick	NA	Removed
33	Cadys Falls	Hydroelectric	In Service	**8**	Jericho - 1	NA	Removed
34	Morrisville	Hydroelectric	In Service				

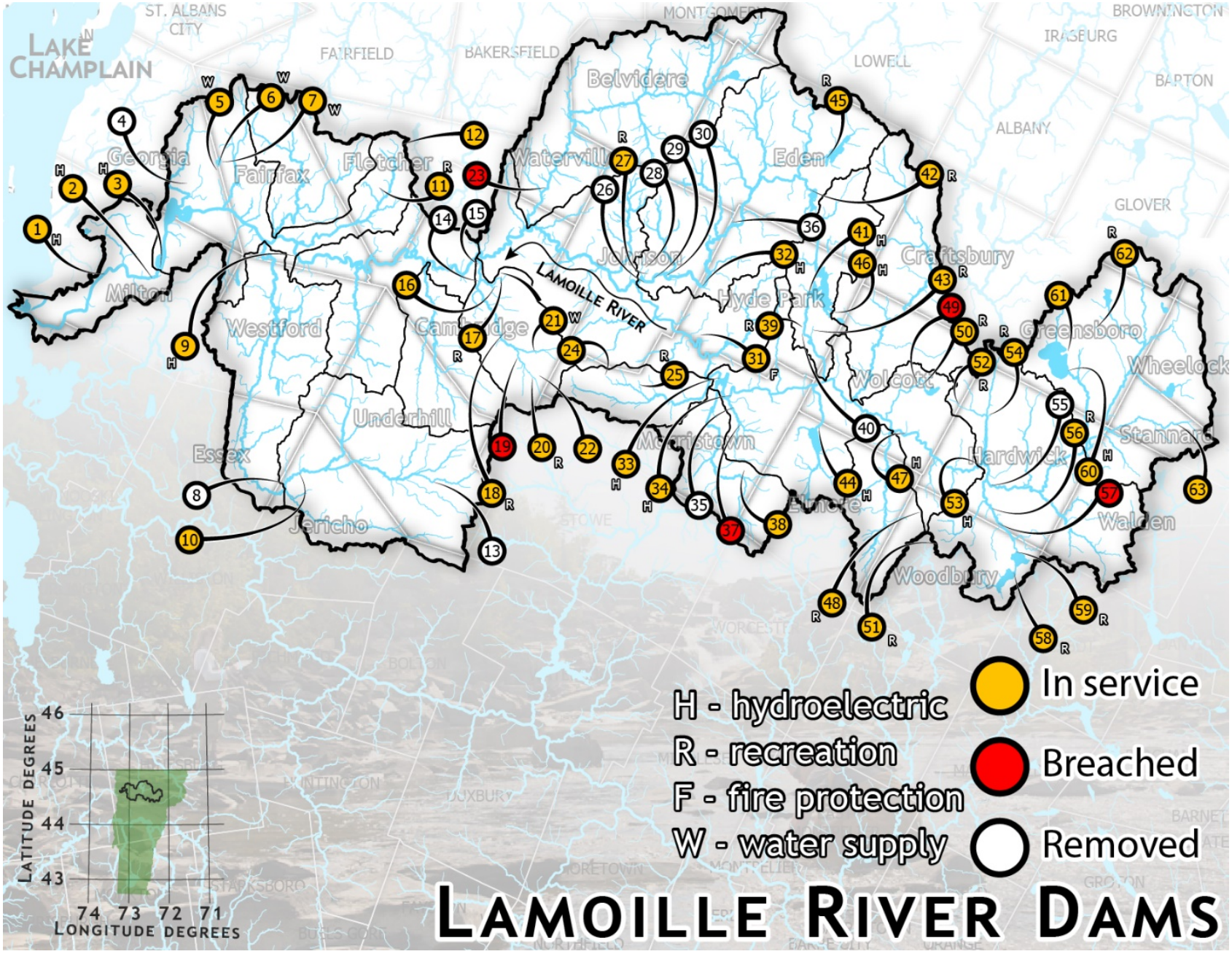

Figure A1. Map of dam records in Basin 7. Map #'s in table A1 correlate with the numbers in this map. Source: Vermont Dam Inventory (accessed: 8/18/2020)