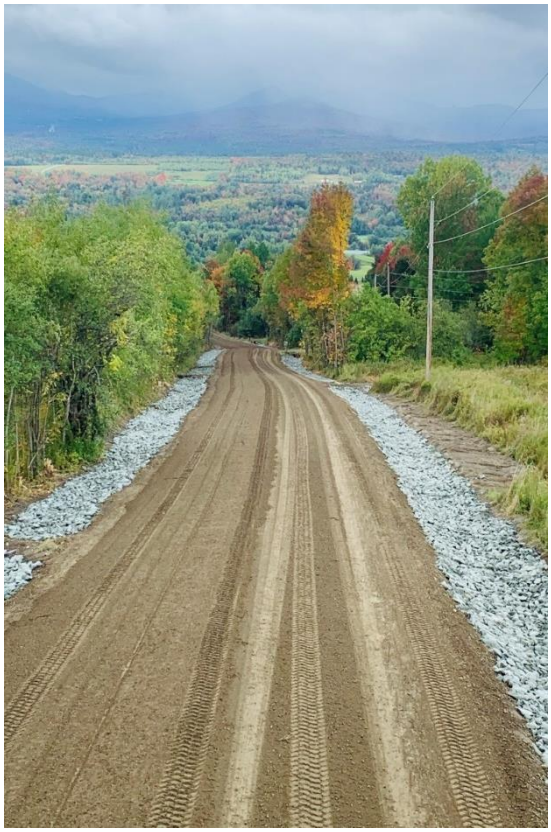
Vermont Clean Water Initiative
2023 Performance Report



Cover photo image descriptions (clockwise from top left):
Stone-lined ditch implementation in Troy, funded through Grants-in-Aid in partnership with the Town of Troy / Half-acre buffer planting along the Green River in Guilford, funded through the Capital Fund in partnership with the Connecticut River Conservancy / Lamoille River basin planted with cover crops, implemented by the Agency of Agriculture, Food & Markets with Lake Champlain Basin Program funds / Missisquoi River / French Hill block culvert removals, funded by the Clean Water Fund in partnership with the Department of Forest, Parks, and Recreation

VERMONT CLEAN WATER INITIATIVE

VERMONT

AGENCY OF ADMINISTRATION
AGENCY OF AGRICULTURE, FOOD & MARKETS
AGENCY OF COMMERCE & COMMUNITY DEVELOPMENT
AGENCY OF NATURAL RESOURCES
AGENCY OF TRANSPORTATION

VERMONT CLEAN WATER INITIATIVE 2023 PERFORMANCE REPORT

Submitted on behalf of the Vermont Agency of Administration
January 12, 2024

Relevant Reporting Requirements:	Fulfilled by:
10 V.S.A. § 1389a (a) The Report shall summarize all investments, including their cost-effectiveness, made by the Clean Water Board and other State agencies for clean water restoration over the prior fiscal year.	Chapter 2
10 V.S.A. § 1389a (b)(1) Documentation of progress or shortcomings in meeting established indicators for clean water restoration.	Chapter 3 & 4
10 V.S.A. § 1389a (b)(3) A summary of water quality problems or concerns in each watershed basin of the State, a list of water quality projects identified as necessary in each basin of the State, and how identified projects have been prioritized for implementation.	Refer to Tactical Basin Plans[1]
10 V.S.A. § 1389a (b)(4) & (d)(3) A summary of any changes to applicable federal law or policy related to the State's water quality improvement efforts, including any changes to requirements to implement total maximum daily load plans in the State; Submit to the Joint Fiscal Committee a summary of available federal funding related to or for water quality efforts in the State.	2023 Report on Federal Funding Related to Water Quality Improvement Efforts in Vermont[2]
10 V.S.A. § 1389a (b)(6) Beginning January 2024, a summary of the administration of the grant programs established under sections 925–928 of this title [Act 76 of 2019], including whether these grant programs are adequately funding implementation of the Clean Water Initiative and whether the funding limits for the Water Quality Enhancement Grants under subdivision 1389(e)(1)(D) of this title should be amended to improve State implementation of the Clean Water Initiative.	Appendix A
10 V.S.A. § 1389a (d)(2) The Secretary of Administration shall develop user-friendly issue briefs, tables, or executive summaries that make the information required under subdivision (b)(3) available to the public separately from the report required by this section.	Clean Water Interactive Dashboard[3] Executive Summary
10 V.S.A. § 1386(e) Report the status of Lake Champlain total maximum daily load implementation plan milestones, phase 2 and beyond, identified in tactical basin plan implementation tables for each basin due for a U.S. Environmental Protection Agency interim or final report card in accordance with the TMDL Accountability Framework schedule.	Chapter 3 & Appendix B & C
10 V.S.A. § 1264 (k)(1-3) Report on installation of stormwater treatment practices through operational stormwater permits, including: (1) permitted new development is achieving at least a 70 percent average phosphorus load reduction; (2) estimated total phosphorus load reduction from new development, redevelopment, and retrofit of impervious surface permitted; and (3) number and percentage of projects that implemented Tier 1, 2, or 3 stormwater treatment practices.	Appendix D

[1] To learn more about Tactical Basin Planning and view the plans for all 15 of Vermont's basins, visit: https://dec.vermont.gov/water-investment/watershed-planning

[2] 2023 Report on Federal Funding Related to Water Quality Improvement Efforts in Vermont, available at: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/2023_Vermont%20Federal%20Clean%20Water%20Funding%20Report_V.2.pdf

[3] For more ways to interact with the data presented in this report, visit the Clean Water Portal: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

ACKNOWLEDGEMENTS

This report was prepared by the Vermont Agency of Natural Resources Department of Environmental Conservation (DEC) Clean Water Initiative Program on behalf of the Vermont Secretary of Administration with assistance from partner agencies. The Clean Water Initiative Program coordinates with staff of the Vermont Agency of Administration; Vermont Agency of Agriculture, Food & Markets; Vermont Agency of Commerce and Community Development; Vermont Agency of Transportation; Vermont Fish and Wildlife Department; Vermont Department of Forests, Parks and Recreation; DEC's Water Investment Division; DEC's Watershed Management Division; Vermont Housing and Conservation Board; U.S. Department of Agriculture Natural Resources Conservation Service; and Lake Champlain Basin Program to complete this report. Vermont Agency of Digital Services supported data management and database development.

VERMONT CLEAN WATER INITIATIVE - https://dec.vermont.gov/water-investment/cwi

VERMONT CLEAN WATER INITIATIVE PARTNER AGENCIES

Agency of Administration - aoa.vermont.gov

Agency of Agriculture, Food & Markets - agriculture.vermont.gov

Agency of Commerce and Community Development - accd.vermont.gov

Agency of Natural Resources - anr.vermont.gov

Agency of Transportation - vtrans.vermont.gov

VERMONT CLEAN WATER INITIATIVE AFFILIATE and PARTNER ENTITIES

Vermont Housing and Conservation Board - vhcb.org

Lake Champlain Basin Program - lcbp.org

U.S. Department of Agriculture Natural Resources Conservation Service - usda.nrcs.gov

Report available electronically at: dec.vermont.gov/water-investment/cwi/reports

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Vermont Clean Water Initiative 2023 Performance Report Executive Summary

Vermont's waterways are important environmental and economic resources for residents and visitors. The State of Vermont funds clean water projects to protect, enhance, and restore water quality across the state. Clean water projects are regulatory or non-regulatory practices or protections that address water pollution, including excess nutrients and sediment. The Vermont Clean Water Initiative 2023 Performance Report, referred to hereafter as Report, summarizes efforts of state government, along with federal and local partners, to improve water quality across Vermont from state fiscal year (SFY) 2016 to 2023 (July 1, 2015–June 30, 2023).

Clean Water Investments

Vermont's clean water funding helps municipalities, farmers, landowners, and nonprofit organizations implement clean water projects statewide. Collectively, state and federal funding programs, as well as regulatory requirements, drive clean water implementation efforts in Vermont.

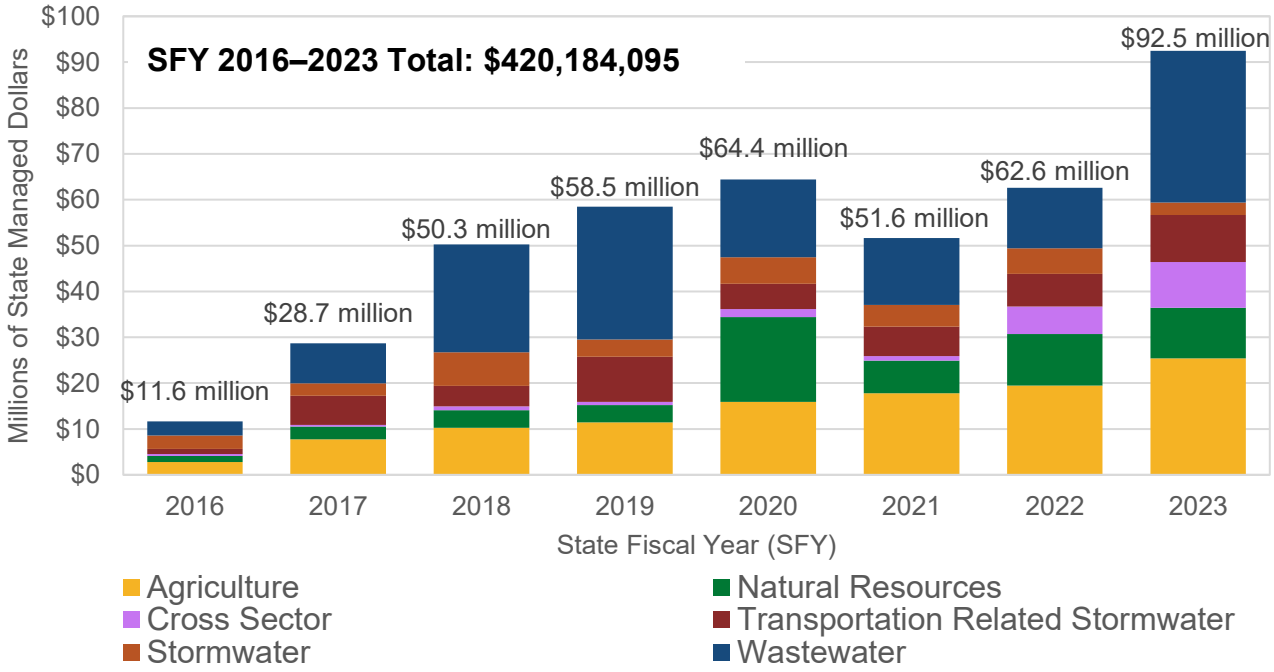

Figure ES-1: Dollars awarded by State of Vermont agencies to clean water projects statewide by land use sector, SFY 2016–2023.

The State of Vermont invested over $420 million in clean water projects through grants, contracts, and loans from SFY 2016 to SFY 2023. The amount of funding awarded to clean water projects rose significantly between 2016 and 2023. Project funding varies annually based on project readiness, award timing, and economic factors. *See Report Chapter 2 to learn more about clean water funding and investments.*

Clean Water Project Outputs

Clean water projects work to improve water quality, and also provide co-benefits for the environment and local communities, such as increasing flood resilience, improving habitat function and biodiversity, supporting carbon sequestration, improving soil health, supporting workforce development, and providing local economic stimulus. The following table highlights some of the results of state and federally funded and regulatory projects completed from SFY 2016 to 2023. *See Report Chapter 2 to learn more about clean water project outputs.*

LAND USE SECTOR	PROJECT OBJECTIVES	EXAMPLE PROJECTS	PROJECT BENEFITS	CUMULATIVE PROJECT OUTPUTS (SFY 2016–2023)
AGRICULTURE	Reduces pollution by slowing/controlling rain/snowmelt runoff and soil erosion from farm production areas and farm fields	 	• Cost-effective • Supports agricultural economy • Improves soil health	• Over **380,000** acres of agricultural conservation practices implemented • Over **5,000** structural agricultural practices implemented
STORMWATER	Reduces pollution by slowing/controlling rain/snowmelt runoff from developed lands, such as parking lots, sidewalks, and rooftops	 	• Publicly visible educational opportunity • Adds green space in residential and commercial areas	• Over **1,400** acres of existing impervious/hard surfaces treated by stormwater practices
NATURAL RESOURCES	Reduces pollution by restoring functions of "natural infrastructure" — river channels, floodplains, lakeshores, wetlands, and forests	 	• Cost-effective • Improves habitat • Enhances recreation • May improve public access	• Over **500** riparian acres (adjacent to rivers, lakes, and wetlands) actively restored through buffer plantings and lakeshore restorations • Over **2,600** riparian acres passively restored through river corridor and wetland easements
TRANSPORTATION RELATED STORMWATER	Reduces pollution by slowing/controlling rain/snowmelt runoff and erosion from roads	 	• Reduces future road maintenance costs • Improves public safety	• Over **360** municipal road miles improved through drainage and erosion control best practices
WASTEWATER	Reduces pollution by improving wastewater treatment infrastructure	 	• Protects public health and safety	• **22** wastewater treatment facility upgrades and refurbishes • **7** combined overflow abatements completed

Total Maximum Daily Load (TMDL) Progress

The 2023 Performance Report summarizes the state's progress in implementing the Lake Champlain and Lake Memphremagog phosphorus Total Maximum Daily Loads (TMDLs). TMDLs identify water pollution (e.g., phosphorus) reductions required to restore water quality. The figures below show the estimated total phosphorus load reduction (metric tons per year) achieved by clean water project implementation thus far in the Lake Champlain (left) and Lake Memphremagog (right) basins. Estimates include the results of projects implemented through state and federal funding programs and in response to regulatory requirements. *See Report Chapters 3 and 4 for more information.*

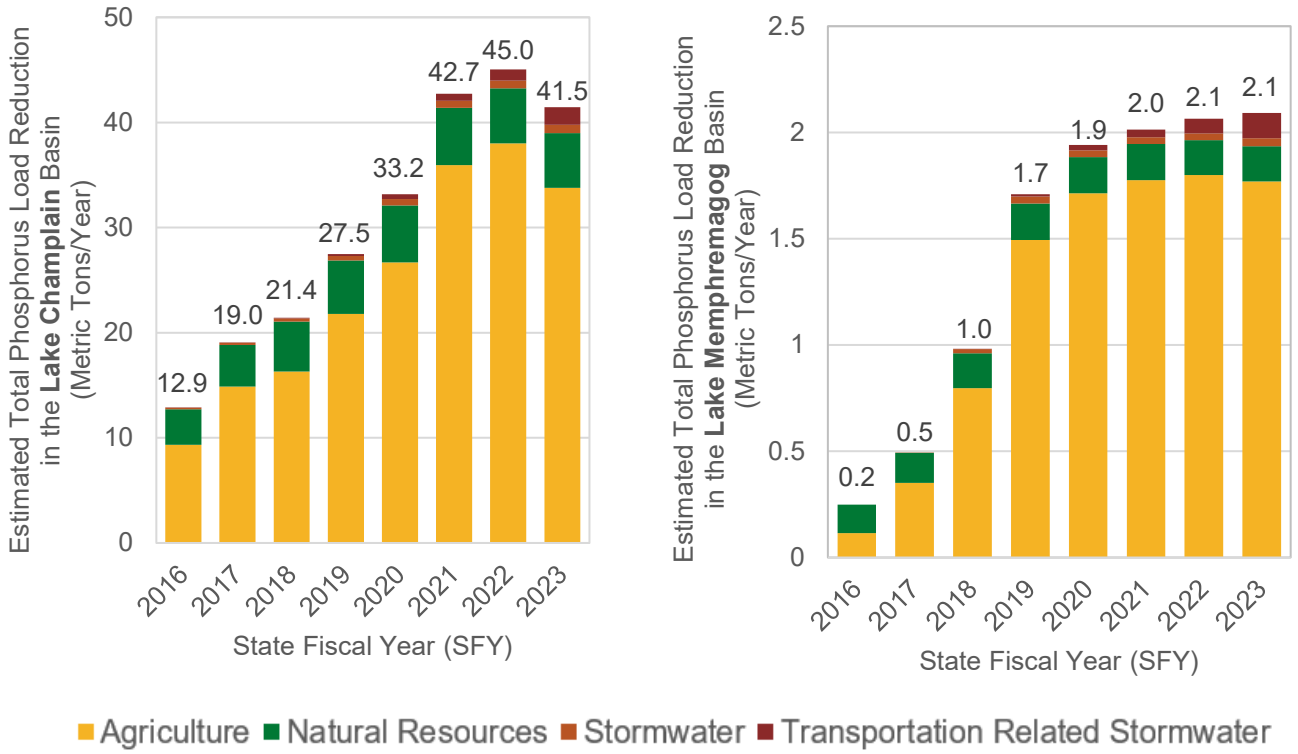

Figure ES-2: Annual estimated total phosphorus load reductions (metric tons per year) associated with reported clean water projects in the Lake Champlain (left) and Lake Memphremagog (right) basins during SFY 2016–2023 by land use sector.

Over the past eight state fiscal years, the state has made substantial progress towards reaching the water quality targets outlined in the state's large-scale phosphorus TMDLs, with 20% of the required reduction achieved to date in the Lake Champlain basin and 14% of the required reduction achieved to date in the Lake Memphremagog basin. Achieving the water quality goals outlined in the state's large-scale TMDLs is not a linear path — variance in the rate of progress is to be expected over the 20-year implementation period. The rate of progress in estimated phosphorus reductions in both the Lake Champlain and Lake Memphremagog basins has slowed in SFY 2023, however several ongoing factors are expected to accelerate the rate of progress in future years, including:

- State funding programs at the Vermont Department of Environmental Conservation have shifted to block grant structures that rely on regional partners to manage and administer funding of individual projects. The transition to regional administration of clean water funding is anticipated to empower community partners, reduce bottlenecks, and increase the impact of clean water investments.
- Vermont has received an influx in federal funding under the American Rescue Plan Act, the Bipartisan Infrastructure Law, and the Inflation Reduction Act, as well as increased Clean Water Fund revenue enacted under Act 76 of 2019. Program expansion supported by this funding will drive clean water project implementation across sectors.
- The State of Vermont has been expanding clean water regulatory, financial, and technical assistance programs since SFY 2016. Many regulatory programs are now in place that will drive meaningful progress in the agriculture and developed lands sectors.
- The State is investing to expand the capacity of the clean water workforce. Investments in our partner network to support capacity expansion are expected to increase clean water progress and reduce reporting lags.
- The State is expanding its ability to fully capture results in its tracking and reporting, such as estimating phosphorus reductions for additional project types in the natural resources sector. Enhanced tracking and reporting will provide a more complete picture of progress on the ground.

Continued effort, investment, and coordination are critical in the state's ability to reach its water quality goals. The Vermont Clean Water Initiative 2023 Performance Report serves as a useful tool to provide accountability on the state's clean water progress and to inform adaptive management. By taking an adaptive management approach, the state will continue to identify and prioritize its resources to break down barriers to project implementation and clean water progress. Clean water project implementation is an important piece of climate resilience work and clean water projects have co-benefits like increased flood resilience, improved carbon sequestration, better soil health, and improved habitat function and biodiversity. In addition to achieving water quality goals, Vermont's work to improve water quality directly supports climate adaptation and flood mitigation, which will increase the state's resilience to future climate related stressors.

Chapter 1: Introduction

Vermont's lakes, rivers, wetlands, and reservoirs are important environmental and economic resources for residents and visitors. Vermont's waterways provide safe drinking water and recreational opportunities for thousands of people and support local economies by fostering tourism. High-quality streams, lakes, and wetlands also support wildlife habitat and increase flood resilience for local communities. The State of Vermont has made it a priority to support partners' work to restore, enhance, and protect Vermont's water quality. This includes work to address priority sources of nutrient and sediment pollution. This report summarizes the efforts of the state government and its partners to improve water quality across Vermont since the passage of Act 64, Vermont's Clean Water Act, in 2015.

Protecting and Restoring Clean Water in Vermont

Vermont's waterways vary in quality — some waters are of exceptional quality and require protection, and some waters suffer from excess pollution and require restoration. Impaired waters requiring restoration are a priority to mitigate adverse impacts on ecosystems, human health, and economic activity. In Vermont, a primary water quality challenge of concern is pollution caused by excess sediment and nutrients, such as phosphorus and nitrogen, originating from the land and carried to waterways through runoff. Nonpoint source pollution results from sediment and nutrients from the land being transported to waterways by rainfall and snowmelt traveling through agricultural fields, roads, parking lots, forests, and streambanks. Nonpoint source pollution is more difficult to manage than point source pollution, which enters waterways from an easily identified and confined place, such as a discharge pipe from a wastewater treatment facility.

Figure 1: Cyanobacteria blooms in Lake Champlain.
Credit: Lake Champlain Committee

Excess phosphorus loading can lead to cyanobacteria blooms in Vermont's lakes (Figure 1).[4] Cyanobacteria, also known as blue-green algae, are a natural component of surface waters and provide important ecological services, such as photosynthesis and the transfer of nitrogen from the atmosphere to the aquatic environment through nitrogen fixation. However, cyanobacteria blooms can produce toxins that may be harmful to people, animals, and the environment. The Vermont Department of Health, Vermont Department of Environmental Conservation (DEC), and partners monitor cyanobacteria blooms around the state and notify the public when cyanobacteria blooms make it unsafe to recreate at designated monitoring locations.[5]

[4] To learn more about phosphorus, water pollution, and cyanobacteria, read this clean water plain language one-pager.

[5] Information related to public health and safety of recreating in Vermont's waterbodies is available through the Vermont Department of Health, here: https://www.healthvermont.gov/environment/tracking/cyanobacteria-blue-green-algae-tracker

Clean water restoration plans, known as Total Maximum Daily Loads (TMDLs), identify pollutant reductions required for an impaired waterbody to meet the State of Vermont's water quality standards. TMDLs set up long term pollutant reduction targets to mitigate both nonpoint source and point source pollution. Most of the State of Vermont is covered by three large-scale TMDLs that require nutrient loading reductions, as shown in Figure 2. Lake Champlain and Lake Memphremagog TMDLs target phosphorus pollution to address cyanobacteria blooms and other excess algae and aquatic plant growth. The five-state Long Island Sound TMDL targets nitrogen pollution, which causes low dissolved oxygen and dead zones in the Sound. The State of Vermont also has numerous small-scale TMDLs across the state.[6] Coordinated implementation of large-scale and small-scale TMDLs supports local and regional water quality restoration.

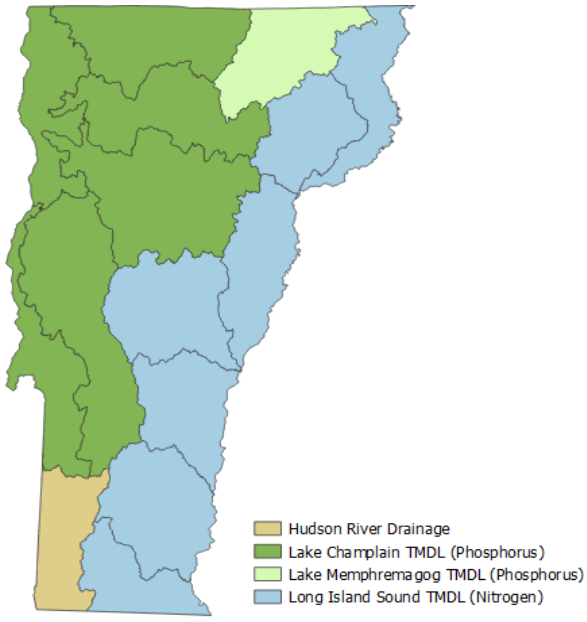

Figure 2: Vermont's large-scale TMDLs that require nutrient pollutant reductions. Tactical Planning Basins also shown.

Vermont's Clean Water Act (Act 64 of 2015)

To further the state's work to restore, enhance, and protect Vermont's water quality, and to provide reasonable assurance on the state's ability to meet nonpoint source pollution reduction targets outlined by the TMDLs, Vermont's Clean Water Act (Act 64 of 2015) was signed into law in June 2015. The Act strengthened the regulatory and financial structures available to address sources of water pollution, with a focus on sediment and nutrients (phosphorus and nitrogen). The Act established the Clean Water Fund to provide a financial mechanism to support clean water work statewide. Act 64 also initiated accountability and transparency requirements to track and report on the progress of water quality improvement efforts receiving state financial support and obligations through state regulatory requirements.

[6] For more information on TMDLs in Vermont, visit: https://dec.vermont.gov/watershed/map/tmdl

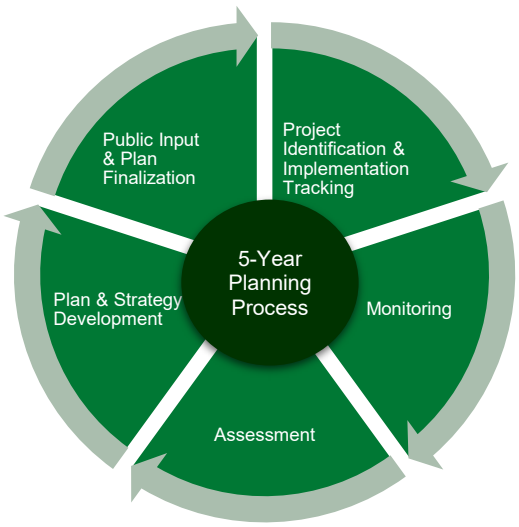

Figure 3: Five-Year Tactical Basin Planning Process

Prioritizing Clean Water Actions

The State of Vermont uses the Tactical Basin Planning process to identify and prioritize clean water projects that will provide the greatest return on investment through achievement of water quality restoration goals. Tactical Basin Plans identify and prioritize clean water projects across land use sectors (stormwater, agriculture, rivers, roads, and wastewater treatment) based on scientific monitoring data and assessment results. Tactical Basin Plans are updated on a five-year cycle following a multi-stage process illustrated in Figure 3. The results of investments presented in this report are used to identify gaps and employ adaptive management to inform future project planning and prioritization efforts. Each Tactical Basin Plan contains a list of priority projects and strategies necessary to achieve clean water goals.[7]

Clean Water Projects

Clean water projects, described in Table 1 and throughout this report, refer to regulatory or non-regulatory practices or actions that restore, enhance, and protect Vermont's water quality.[8] All land use sectors contribute to Vermont's water quality challenges and all sectors have opportunities for improvement. Clean water projects are categorized into land use sectors based on the dominant land use of the area surrounding the project. Clean water projects help to support compliance with the Vermont and federal Clean Water Acts and may help to leverage additional federal funds. Examples of some clean water projects by land use sector are provided in the table below, along with a summary of the additional benefits clean water projects provide. Clean water projects provide co-benefits for the environment and local communities, such as increasing flood resilience, improving habitat function and biodiversity, supporting carbon sequestration, improving soil health, supporting workforce development, and providing local economic stimulus.

[7] To learn more about Tactical Basin Planning in Vermont, visit: https://dec.vermont.gov/water-investment/watershed-planning

[8] Clean water project may be defined differently or more narrowly in certain contexts, such as in relation to Act 76 of 2019.

Table 1: Clean water project land use sectors, objectives, examples, and additional benefits.

LAND USE SECTOR	PROJECT OBJECTIVES	EXAMPLE PROJECTS	PROJECT BENEFITS	FEATURED FLOOD RESILIENCE BENEFITS
AGRICULTURE	Reduces pollution by slowing/controlling rain/snowmelt runoff and soil erosion from farm production areas and farm fields	 	• Cost-effective • Supports agricultural economy • Improves soil health	• Cover crops and no-till practices reduce soil erosion and runoff, improve soil health, and increase the water holding capacity of agricultural lands
STORMWATER	Reduces pollution by slowing/controlling rain/snowmelt runoff from developed lands, such as parking lots, sidewalks, and rooftops	 	• May enhance aesthetic appeal • Publicly visible educational opportunity • Adds green space in residential and commercial areas	• Projects lower the volume and speed of rain/snowmelt runoff from the landscape, which reduces flash flooding during heavy rainfall events
NATURAL RESOURCES	Reduces pollution by restoring functions of “natural infrastructure” — river channels, floodplains, lakeshores, wetlands, and forests	 	• Cost-effective • Improves habitat • Enhances recreation • May improve public access	• Floodplains and wetlands help to slow down and absorb flood waters, reducing flood hazards downstream • Natural lakeshores are more resilient to erosion during severe weather and flood events
TRANSPORTATION RELATED STORMWATER	Reduces pollution by slowing/controlling rain/snowmelt runoff and erosion from roads	 	• Reduces future road maintenance costs • Improves public safety	• Improved road drainage and erosion prevention makes our transportation networks more resilient to erosion during heavy rainfall events and flooding
WASTEWATER	Reduces pollution by improving wastewater treatment infrastructure	 	• Protects public health and safety	• Relocating infrastructure out of flood-prone areas improves community flood resilience • Improving infrastructure reduces likelihood of sewer overflows during heavy rainfall events

Report Purpose and Scope

The purpose of the *Vermont Clean Water Initiative 2023 Performance Report* is to summarize the results of the State of Vermont's clean water investments, educational opportunities, and regulatory programs from state fiscal year (SFY) 2016 through 2023 (July 1, 2015–June 30, 2023). The report also summarizes how state funding programs, federal funding programs, and regulatory requirements contribute to achieving the Lake Champlain and Lake Memphremagog TMDLs.[9] Data presented in this report are representative of the most complete available data at the close of the state fiscal year. Data reported in previous years is subject to change in future annual reports as project information becomes available.

This report fulfills state statutory and federal reporting requirements, as outlined on Page 2. The *Vermont Clean Water Initiative 2023 Performance Report* is divided into chapters based on geographic region. The purpose of each geographically focused chapter is to report progress in each of Vermont's major nutrient TMDL watersheds. Figure 4 shows a map of the geographic regions with large-scale nutrient TMDLs and corresponding chapter numbers.[10]

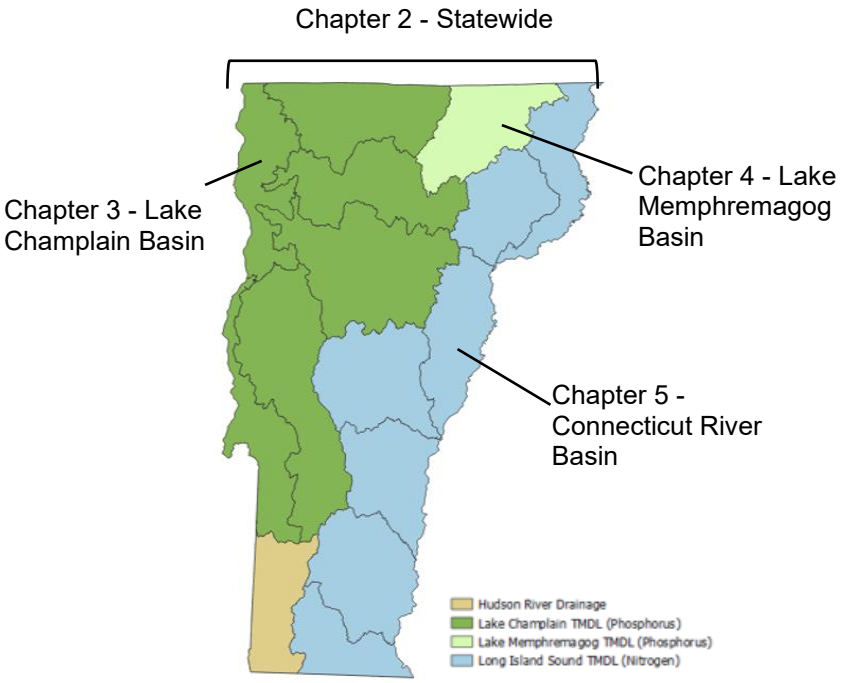

Figure 4: Geographic scope and focus of the *Vermont Clean Water Initiative 2023 Performance Report* chapters.

Collectively, state funding programs, federal funding programs, and regulatory requirements drive clean water efforts in Vermont. All three program categories work together to achieve

[9] The State of Vermont also has numerous small-scale TMDLs. For example, Lake Carmi in Franklin County also suffers from cyanobacteria blooms, thus the Phosphorus Total Maximum Daily Load for Lake Cami was established in 2009. Since Lake Carmi is located in the Lake Champlain basin, actions to reduce phosphorus pollution in Lake Carmi support both the implementation of the Lake Carmi TMDL and Lake Champlain TMDL. Implementation of large-scale and small-scale TMDLs can support both local and regional water quality priorities.

[10] Results in the Hudson River drainage basin are included in the statewide results reported in Chapter 2 and can be viewed in the Clean Water Interactive Dashboard: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

water quality goals, and in some cases are complimented by additional funding from private sources and local contributions. For example, state funds leverage federal funds, and some funding programs support the cost of regulatory compliance. The following table summarizes clean water funding programs managed by the State of Vermont that are included in this report.

Table 2: State of Vermont funding programs reported by state agencies and affiliates.

Agency or Affiliate	Clean Water Funding Programs
Agency of Administration (AoA)	Stormwater Utility Incentive Payments
Agency of Agriculture, Food & Markets (AAFM)	Agricultural Clean Water Initiative Program Best Management Practice (BMP) Program Capital Equipment Assistance Program (CEAP) Clean Water Fund Operational Funds Conservation Reserve Enhancement Program (CREP) Farm Agronomic Practice (FAP) Program Grassed Waterway and Filter Strip (GWFS) Program Pasture Surface Water Fencing (PSWF) Program Water Quality (WQ) Grants Vermont Farmer Ecosystem Services Program Vermont Phosphorus Innovation Challenge (VPIC) Vermont Pay for Performance (VPFP) Program
Agency of Commerce and Community Development (ACCD)	Better Connections Planning Grant Downtown Transportation Fund Vermont Center for Geographic Information (VCGI)
Agency of Natural Resources (ANR)	Clean Water Initiative Program Funding Programs Clean Water State Revolving Fund (CWSRF) Loans CWSRF Land Conservation Interim Financing Program Department of Forests, Parks and Recreation Fish and Wildlife Department Watershed Grants Municipal Pollution Control Grants
Agency of Transportation (VTrans)	Better Roads Program Municipal Highway Stormwater Mitigation Program Transportation Alternatives Program (TAP)
Vermont Housing and Conservation Board (VHCB)	Conservation Grants Farmland Protection Grants Water Quality Grants
Multi-Agency Programs	American Rescue Plan Act (ARPA) Programs Municipal Roads Grants-in-Aid Program

FEDERAL CLEAN WATER FUNDING

The United States Department of Agriculture Natural Resources Conservation Service (UDSA-NRCS) and the Lake Champlain Basin Program (LCBP) provide significant federal funding to support clean water projects in Vermont. The results of USDA-NRCS- and LCBP-funded clean water projects are included in this report to show TMDL progress, but funding administered directly by federal entities are not included in

statewide investments as they are outside the scope of this report, which focuses on how state administered funds are being spent.[11]

Several state regulatory programs are in place to protect, maintain, and restore water quality by establishing land use and management requirements that minimize discharges and runoff to surface waters. Regulatory requirements that are in place to protect the state's natural resources but do not have a direct link to water quality improvement are outside the scope of this report. Table 3 summarizes which regulatory programs are included in this report and what programs will be included in the future.

Table 3: Clean water regulatory program results included in this report and planned future additions.

Agency	Included in this Report	Planned Future Additions
Agency of Natural Resources[12]	Operational Stormwater Permits regulating new or redeveloped impervious surface Municipal Separate Storm Sewer System (MS4) General Permit Municipal Roads General Permit (MRGP) Wastewater National Pollutant Discharge Elimination System (NPDES) Permits	Transportation Separate Storm Sewer System (TS4) General Permit Operational Stormwater Permits regulating sites with more than three acres of existing, unpermitted impervious surface (Three-Acre General Permit)
Agency of Agriculture, Food & Markets[13]	Required Agricultural Practices (RAPs) (Phosphorus reduction data on compliance at barnyards/production areas)	RAPs (Phosphorus reduction data on compliance on croplands and pastures)

[11] Note that some LCBP funding is administered by the Vermont Department of Environmental Conservation as passthrough funding, and these dollars are included in data on statewide investments.

[12] For more information on regulatory stormwater programs, visit: https://dec.vermont.gov/watershed/stormwater. For more information on wastewater permits, visit: https://dec.vermont.gov/watershed/wastewater

[13] For more information on agricultural water quality regulations, visit: https://agriculture.vermont.gov/water-quality/regulations

Accountability Measures

Clean water investments and results are presented throughout the report using the following four accountability measures:[14]

Investment measures show how Vermont invests in clean water projects from identification and planning through design, implementation, and maintenance.

State investments are defined as dollars obligated or awarded to clean water efforts by State of Vermont agencies through a variety of funding and financing mechanisms.

Funds are assigned to state fiscal years according to agreement execution date. When a project is completed, funding is retroactively updated to reflect the final expended amount.

Education measures summarize outreach and technical assistance to support, identify, develop, and maintain clean water projects.

The State of Vermont delivers clean water education through outreach (workshops, trainings, and public/stakeholder meetings) and technical assistance (targeted, one-on-one interactions).

Hours of education provided are assigned to state fiscal years based on the date of the event.

Project output measures quantify the results of clean water projects.

Output measures are standardized across all programs to consistently summarize results of funding and regulatory efforts.

Results are assigned to a state fiscal year based on the completion date of the project and are only reported once a project is complete.

Pollutant reduction measures are estimated nutrient load reductions achieved by clean water projects.

Pollution reduction estimates are modeled at the project level based on the total pollutant load from the land being treated by a project and the average or expected pollutant reduction efficiency of the project type.[15]

Annual pollutant reductions apply throughout the expected lifespan of a project, beginning on the date the project is completed.[16]

At present, total phosphorus load reductions are tracked and reported for the Lake Champlain and Lake Memphremagog basins only.

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[14] To view available data on investment, project output, and pollution reduction measures supported by other funding and regulatory efforts, and by individual basin, please visit the Clean Water Interactive Dashboard: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

[15] Estimated pollutant reductions are presented in delivered loads, or the pollutant load reduction after accounting for estimated pollutant storage or deposition en route to the receiving waterbody. Beginning with the Vermont Clean Water Initiative 2021 Performance Report, reporting of total phosphorus load reduction was revised to be presented in terms of delivered load to increase the accuracy of reporting on progress compared to the TMDL.

[16] Additional information on the methods used to estimate pollutant reductions can be found on the Clean Water Tracking and Accounting webpage: https://dec.vermont.gov/water-investment/cwi/projects/tracking-accounting

Explore Clean Water Project Data with Online Tools

The State of Vermont coordinates across agencies to track clean water efforts in a centralized database known as the Clean Water Reporting Framework. The database is used to compile and summarize project data to produce this report. These data and many online tools are made available to the public through the Clean Water Portal.[17] The Portal's Clean Water Project Explorer allows interested parties to search for and learn details about individual state-funded clean water projects (Figure 5). The Explorer also contains potential projects identified through Tactical Basin Planning. The Portal's Clean Water Interactive Dashboard allows interested parties to view investment data, project output measures, and estimated pollutant reductions presented in this report by watershed (Figure 6).

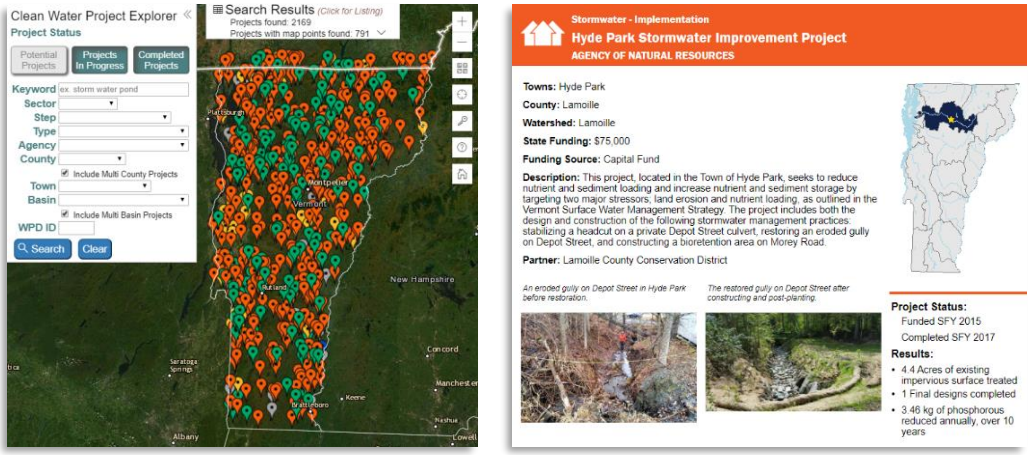


Figure 5: Sample Clean Water Project Explorer search results (left) and individual project report (right).

Figure 6: The Clean Water Interactive Dashboard homepage.

[17] The Project Explorer and Clean Water Interactive Dashboard can be accessed via the Clean Water Portal: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

Chapter 2: Statewide Clean Water Investments and Results

The State of Vermont's clean water investments are channeled through grant, loan, and assistance programs to strategically restore and safeguard the state's rivers, streams, lakes, ponds, and wetlands. These funds are used to help identify and prioritize clean water projects, as well as to design, implement, and, in some cases, maintain projects. The State of Vermont tracks outputs of state investments at the project level to quantify the impact of clean water efforts statewide. This chapter summarizes statewide investments awarded to clean water projects by State of Vermont agencies as well as project output measures achieved through completion of clean water projects funded by State of Vermont agencies.

Vermont's Clean Water Funding

The State of Vermont is committed to maintaining and improving water quality through financial and technical assistance and regulation. Vermont's clean water funding helps municipalities, farmers, landowners, and nonprofit organizations implement projects that will restore, enhance, and protect Vermont's water quality. Funds from state programs complement and leverage other funding sources to support clean water efforts statewide.

The Vermont Clean Water Board and Budget Process

The Clean Water Board was created as a result of Act 64 of 2015, Vermont's Clean Water Act, and is responsible for planning, coordinating, and financing the restoration, enhancement, and protection of Vermont's water quality. Composed of representatives from five state agencies and four members of the public, the Board recommends to the Governor an annual Clean Water Budget that is made up of Clean Water Fund, Capital Bill, and American Rescue Plan Act dollars.[18] Once the budget is recommended and approved by the Legislature, the funds are awarded to multiple state agencies and affiliates that work to address water quality challenges across land use sectors.

The American Rescue Plan Act

The American Rescue Plan Act (ARPA) is part of the federal COVID-19 response to address economic impacts due to the pandemic. The State of Vermont will receive $1.026 billion in ARPA funds to invest in broadband infrastructure, clean water, climate action, housing, and economic development to be encumbered by December 31, 2024 and expended by the end of calendar year 2026. The Vermont Agency of Natural Resources is responsible for distributing a portion of these ARPA funds to support water and wastewater infrastructure programs.[19] A subset of the ARPA funding was

[18] To learn more, visit the Clean Water Board webpage: https://dec.vermont.gov/water-investment/cwi/board

[19] Visit the ANR ARPA webpage for more information on types of water and wastewater infrastructure programs: https://anr.vermont.gov/special-topics/arpa-vermont

appropriated to the Clean Water Board and will be distributed (SFY 2022–SFY 2024) to support new and existing clean water programs across multiple state agencies.[20]

While the Clean Water Budget is a major source for funding clean water efforts statewide, many state agencies and affiliates pair Clean Water Budget dollars with other state or federal funds to complement and expand upon their clean water efforts.

[20] View approved Clean Water Budget allocations for a full list of ARPA funding distributed by the Clean Water Board on the Clean Water Board's webpage: https://dec.vermont.gov/water-investment/cwi/board

Vermont's Statewide Clean Water Investments

The State of Vermont distributes funding through agencies to a wide range of organizations to support all phases of clean water work across land use sectors. The following sections summarize statewide investments in clean water projects by land use sector, funding source, and project step over the past eight state fiscal years.[21]

Click symbol to view description of accountability measures.

State Investments by Land Use Sector

Reaching Vermont's water quality goals requires investments across all land use sectors. The following figure summarizes state clean water investments by land use sector statewide over the past eight state fiscal years, from SFY 2016 to 2023.

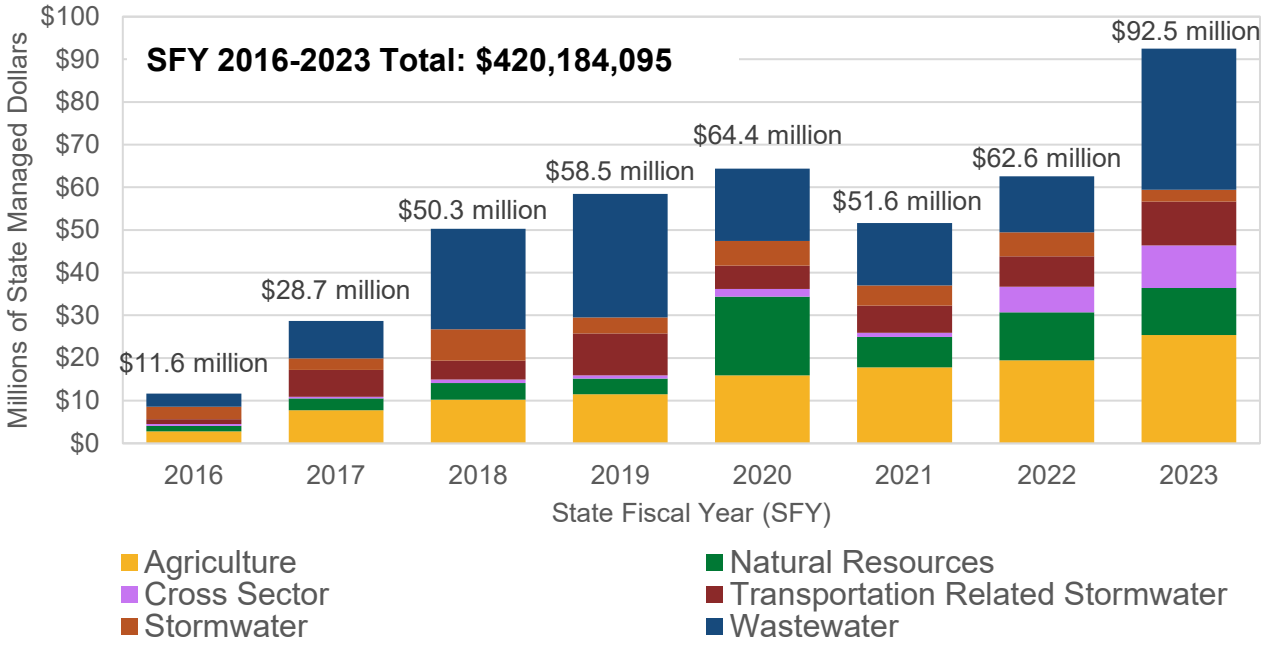


Figure 7: Total dollars awarded by State of Vermont agencies to clean water projects statewide by land use sector, SFY 2016–2023.

Explanation of Figure 7

The State of Vermont has invested over $420 million in clean water projects statewide from SFY 2016 to 2023. Annual clean water investments have increased significantly since SFY 2016, but funding awarded to projects varies from year-to-year based on project readiness and the timing of awards. In SFY 2021, COVID-19's economic impacts affected Clean Water Fund revenue sources and capacity to administer and implement projects, which led to a slight reduction in appropriation and a temporary slowdown of funding programs. Funding levels recovered in SFY 2022 and 2023, supported in part by a short-term influx of American Rescue Plan Act (ARPA) dollars.

[21] To view clean water investments by basin, visit the Clean Water Interactive Dashboard: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

Clean water funding is allocated to support work across land use sectors. Most of the cross sector funding represents block grant awards to Funding Program Administrators tasked with administering a grant program and issuing sub-grants to support clean water projects across a range of land use sectors. Once the block grants are completed, dollars will be reallocated to the appropriate sector based on the project types that were awarded funding.[22]

State Investments by Funding Source

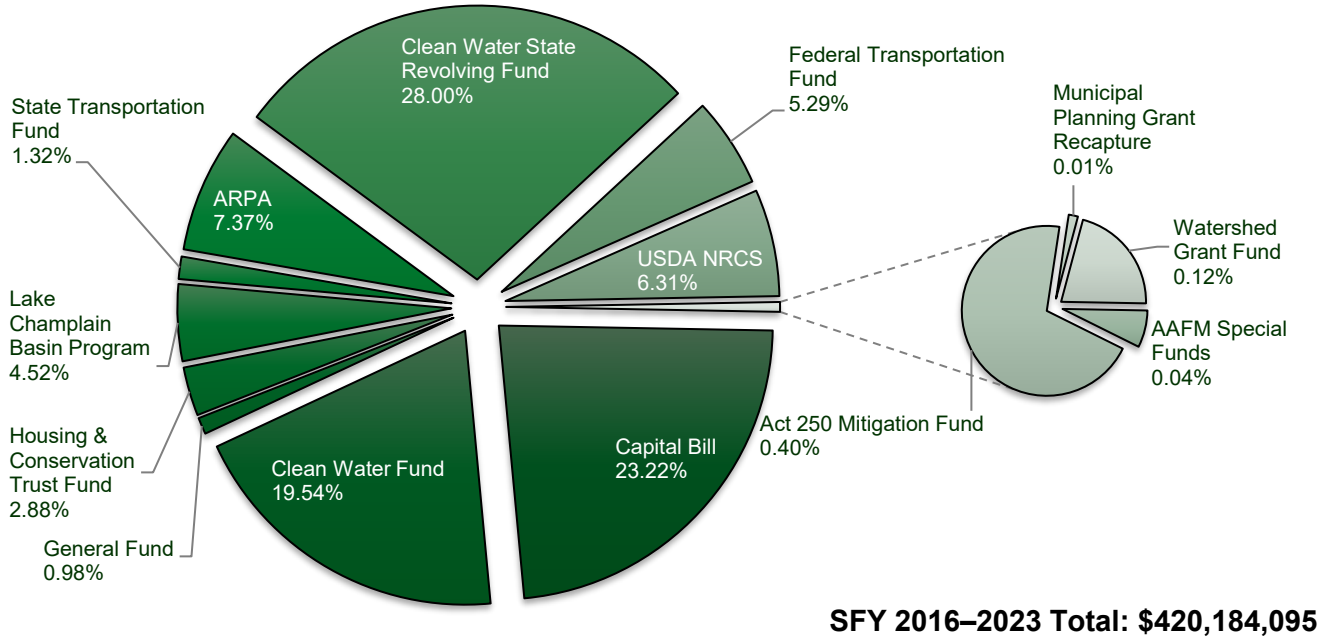


Figure 8: Proportion of dollars awarded to clean water projects through State of Vermont agencies by funding or financing source, SFY 2016–2023.[23]

Explanation of Figure 8

State agencies' clean water investments are supported by a variety of funding sources. The annual Clean Water Budget is made up of Clean Water Fund and a portion of Capital Bill dollars, comprising about one third of clean water investments. Several federal funding sources *administered by state agencies* are considered state investments, including Clean Water State Revolving Fund (CWSRF), Federal Transportation funds, some U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) funds, and some Lake Champlain Basin Program funds. Direct investments by federal agencies or other organizations are beyond the scope of this report.

[22] To learn more about current Clean Water Initiative Program funding programs, visit: https://dec.vermont.gov/water-investment/cwi/grants/opportunities

[23] Investments reported include state and federal dollars awarded to projects by state agencies, but exclude federal funds awarded directly by federal agencies and the Lake Champlain Basin Program, as the focus of this report is state funding.

Investments and Leveraged Contributions by Land Use Sector

State-funded clean water projects leverage local and federal contributions to help cover project costs and to further clean water efforts in Vermont. Loans are considered leverage as they are mostly paid back to the state for continued lending. The following figure summarizes leveraged contributions from SFY 2016 to 2023 by land use sector.

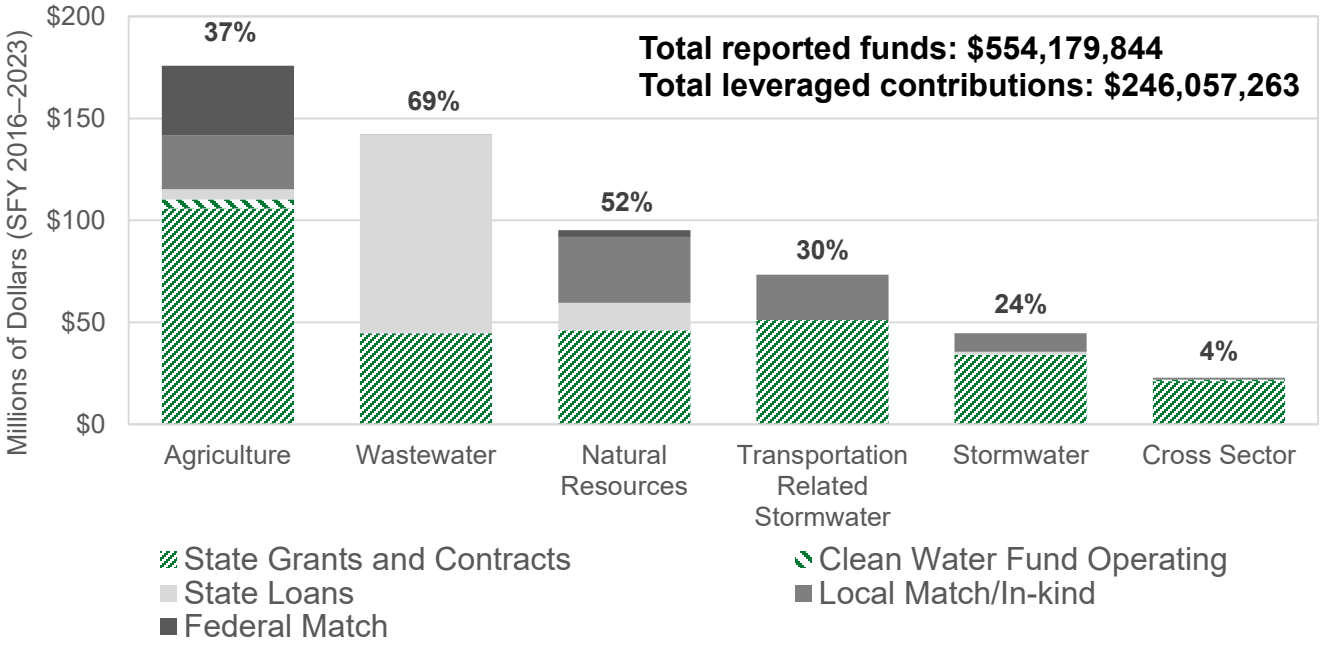


Figure 9: State investments (grants, contracts, and Clean Water Fund operating) and leveraged contributions (local match/in-kind, federal match, and state loans) reported through State of Vermont agencies by land use sector, SFY 2016–2023. Percent represents the proportion of leveraged contributions out of the total reported funds within each sector.

Explanation of Figure 9

State-funded clean water projects leverage local and federal contributions to help cover project costs and to further clean water efforts. Leveraged contributions (local match/in-kind, federal match, and state loans) since SFY 2016 total $246 million and represent 44 percent of the total $554 million in clean water funds reported SFY 2016 through SFY 2023. Most reported wastewater funds are low-interest loans made to municipalities through the Clean Water State Revolving Fund that will ultimately be paid back to the state (except for some loan subsidies). Match contributions reported here only include local match/in-kind (private contributions, municipal funds, and volunteer labor) and federal match reported through State of Vermont grants and contracts, where data is available. Clean Water Fund Operating refers to limited AAFM and ANR personnel funded through the Clean Water Fund to support implementation efforts and is not considered leveraged contribution. This report mainly focuses on passthrough funds administered by state agencies and this figure is the only funding figure that includes the Clean Water Fund Operating funding category. This category represents a fraction of the substantial staffing costs associated with clean water work. State agency investments in personnel, operating, and monitoring activities are beyond the scope of this report.

State Investments by Project Step

Making wise investments in cost-effective clean water projects requires thorough project planning, analysis, design, and implementation. In addition, operation and maintenance of existing projects is important to sustaining project function and clean water outcomes. Investing in the project development process is key to ensuring state investments will yield the greatest water quality improvement per dollar, which includes de-prioritizing lower-value or non-viable projects early in development. The following figure summarizes the percentage of funding awarded to various steps of the clean water project development process during SFY 2016 to 2023.

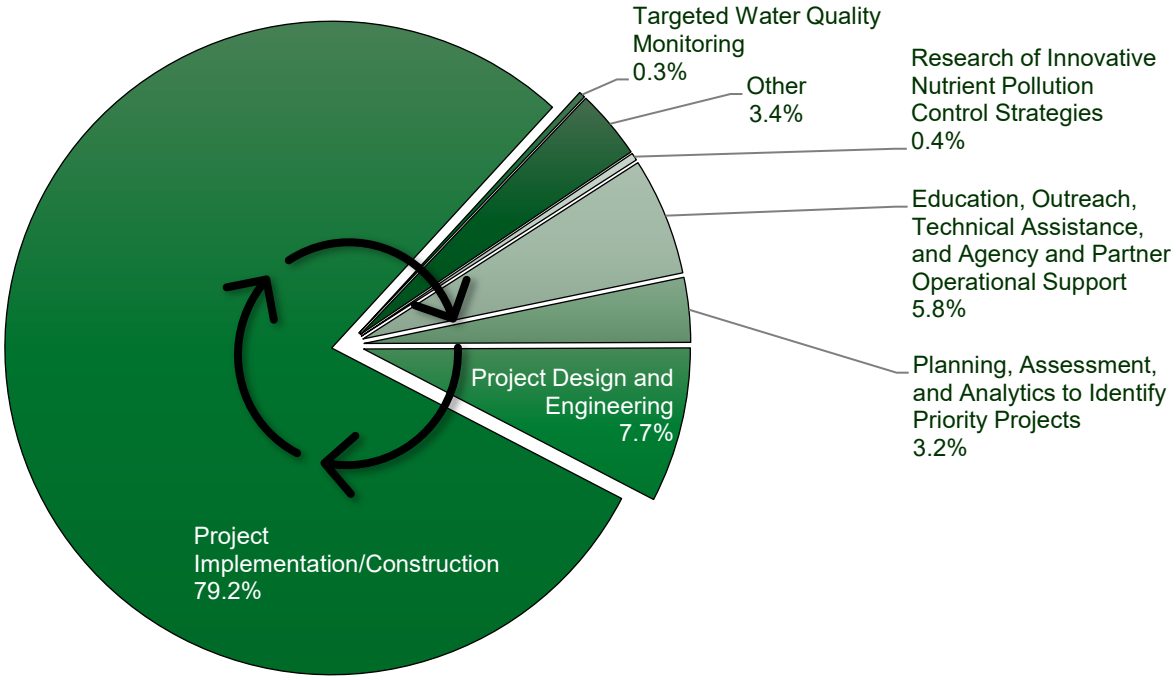


Figure 10: Percentage of dollars awarded by State of Vermont agencies to various steps of the clean water project development process, SFY 2016–2023.

Explanation of Figure 10

While the state invests in all project steps, nearly 80 percent of clean water investments are used to construct or implement clean water projects that restore, enhance, and protect Vermont's water quality. Approximately 10 percent of clean water investments are used in the planning, design, and engineering phases. Targeted water quality monitoring represents passthrough funds that are used to support focused, small watershed scale monitoring, but does not capture all water quality monitoring efforts in Vermont. The "Other" category includes agreements that do not fit squarely into one project step, including multiple block grants issued to partners who will use the money to develop, design, and implement several projects. Once those projects are completed, dollars may be reallocated to the appropriate step.

Vermont's Statewide Education, Outreach, and Technical Assistance

Click symbol to view description of accountability measures.

Reducing nutrient and sediment pollution sources requires employing sound land management practices which can necessitate changes to our cities and towns, farms, forests, and natural spaces. Education and outreach related to clean water projects and programs is critical to achieve our water quality goals. The State of Vermont delivers clean water education through outreach (workshops, trainings, and public/stakeholder meetings) and technical assistance (targeted, one-on-one interactions). Clean water education, outreach, and technical assistance aim to:

- Increase public awareness and engagement in establishing and implementing clean water priorities;
- Increase landowner acceptance of new and changing policies and willingness to adopt best management practices;
- Support regulated entities in preparing to meet new regulatory requirements in the most cost-effective manner;
- Support clean water project proponents, including regulated entities, in building expertise to develop, plan, and secure resources to implement clean water projects; and
- Increase adoption and effectiveness of best management practices to improve water quality.

Educational efforts support all land use sectors in planning and securing resources to implement clean water projects. The following section summarizes education, outreach, and technical assistance efforts by land use sector.

Clean Water Outreach by Organization

Reported outreach is provided by state reporting partners, as well as partners who receive clean water funding from state agencies to conduct outreach. The following figure summarizes the total hours of education provided by outreaching organizations from SFY 2016 to 2023.

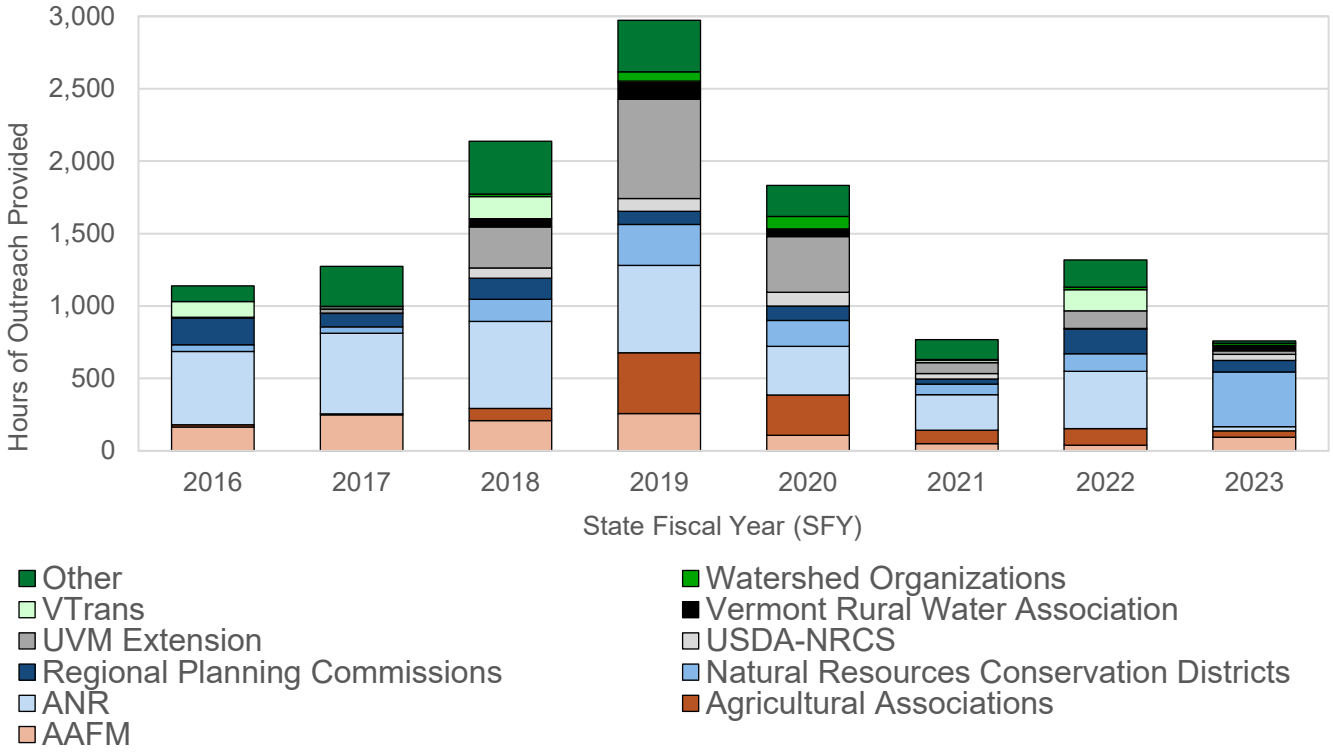


Figure 11: Total hours of education provided to participants of State of Vermont-funded clean water outreach events (workshops, trainings, and public/stakeholder meetings) by outreach organization or organization category, SFY 2016–2023.[24]

Explanation of Figure 11

In total, 3,005 outreach events have been reported, reaching over 90,799 attendees, with over 339,000 hours of education received by attendees since SFY 2016. In SFY 2020 to 2023, there was a decrease in the overall number of outreach events reported compared to previous years. This is in part related to the COVID-19 pandemic limiting in-person outreach. The need for, and the resources available to support, clean water outreach efforts fluctuate. For example, outreach efforts were critical in the development of foundational programs to drive Vermont's clean water efforts, including the initial phases of implementing the Lake Champlain TMDL and the Vermont Clean Water Act (Act 64 of 2015). More recently, outreach efforts have supported partners in the development and implementation of programs under Act 76 of 2019. As these programs move from development and launch into implementation, the need for continued education and outreach events on these topic areas may be reduced. Note, the entities responsible for reporting outreach efforts are ANR, AAFM, VTrans, and external partners conducting outreach under the scope of a state grant or contract agreement, however many events include multiple outreaching organizations. Outreach not directly conducted by state agencies and/or supported by state funding are not included in these data.

[24] For presentation purposes, the figure above includes organizations that reported more than zero hours of education between SFY 2016 and SFY 2023 grouped into the categories above. "Agricultural Associations" include both regional and statewide organizations connecting and supporting the agricultural sector. "Other" includes ECO AmeriCorps, Lake Champlain Basin Program, Lake Champlain Sea Grant, Vermont Housing and Conservation Board, Vermont League of Cities & Towns, and Federation of Vermont Lakes & Ponds.

Clean Water Outreach by Target Audience

State of Vermont outreach events reach a diverse range of audiences. The following figure summarizes the target audiences reached by State of Vermont-funded clean water outreach efforts (workshops, trainings, and public/stakeholder meetings), from SFY 2016 to 2023.

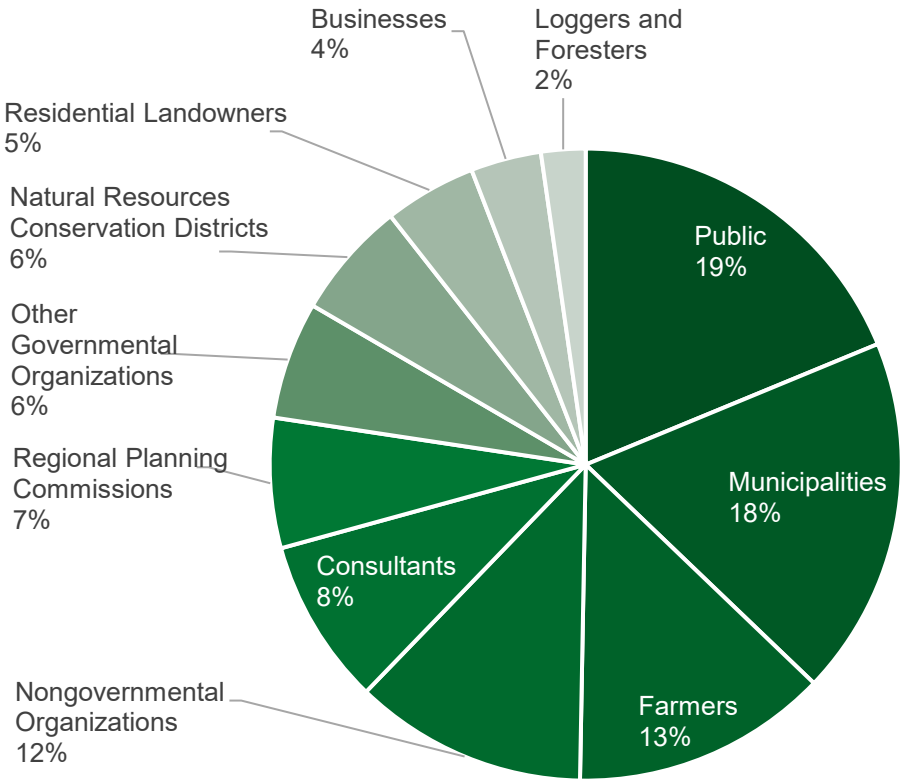


Figure 12: State of Vermont clean water outreach efforts between SFY 2016–2023 reached a total of 197,107 attendees. Percentages reflect the proportion of total attendees in each target audience.

Explanation of Figure 12

The state's outreach efforts target a wide range of different sector- and organization-based audiences. One of the state's water quality priorities is to support municipalities and farmers in addressing stormwater, wastewater, and agricultural sources of nutrient pollution, which is why these audiences represent a large proportion of the target audiences above. In addition, regional planning commissions and non-governmental organizations, such as watershed groups and natural resource conservation districts, play an important role in working with municipalities, farmers, and other landowners to secure funds to implement priority clean water projects. It is crucial to keep the public engaged to broaden support of the state's clean water efforts and bolster landowner willingness to adopt and implement voluntary, non-regulatory clean water projects.

Technical Assistance by Land Use Sector

State of Vermont agencies and partners provide technical assistance to regulated and non-regulated audiences who implement clean water projects. While not all technical assistance provided by state agencies can be tracked, the following table summarizes available data on technical assistance efforts by land use sector since SFY 2016.

Table 4: State of Vermont technical assistance efforts by sector.

Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Agricultural Technical Assistance Measures			
Number of technical assistance visits conducted by AAFM and partners to support implementation of conservation practices	1,217	5,754	
Number of farms provided technical assistance[25]	552	2,715	
Number of water quality compliance farm visits conducted by AAFM to check compliance with Required Agricultural Practices (RAPs) and Medium Farm Operation (MFO) and Large Farm Operation (LFO) Rules	251	3,143	
Developed Lands and Wastewater Technical Assistance Measures			
Approximate hours of technical assistance provided by DEC's Water Investment Division engineers on municipal stormwater and wastewater projects	5,975	38,897	
Hours of water quality municipal technical assistance provided by VTrans staff	977	8,526	

[25] Data collected for SFY2016–2018 is not complete and only reflects farms provided technical assistance from partners.

Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Natural Resources Technical Assistance Measures			
Number of logging operation site visits to provide Acceptable Management Practices (AMP) technical assistance[26]	27	126	
Square miles of forestlands covered by Use Value Appraisal (UVA) site inspections[27]	285	1,868	
Number of communities receiving Urban and Community Forestry Program technical assistance[28]	114	849	

Explanation of Table 4

In the agricultural sector, AAFM and partnering organizations have conducted over 5,700 technical assistance visits cumulatively from SFY 2016 to SFY 2023 to support implementation of agricultural conservation practices.

In the developed lands sector, DEC and VTrans staff provide technical assistance to prepare municipalities and other regulated entities to comply with water quality-related regulations. DEC Water Investment Division engineers provided over 38,800 hours of technical assistance on municipal stormwater and wastewater projects from SFY 2016 to 2023, while VTrans staff provided over 8,500 hours of water quality technical assistance to municipalities.

In the natural resources sector, projects are voluntary and not driven by regulation. Education targeting the public and landowners increases the likelihood of natural resource restoration projects moving forward. Department of Forests, Parks and Recreation (DFPR) staff conducted 126 site visits to provide technical assistance on Acceptable Management Practices at logging operations. The Vermont Urban and Community Forestry Program provided technical assistance to communities over 840 times from SFY 2016 to SFY 2023 related to planning for and managing urban trees.

[26] Data are reported by calendar year rather than state fiscal year. Given the timeline of this report, calendar year 2023 data are not yet available and calendar year 2022 data are reported. DFPR's annual statewide summary reports are available at: https://fpr.vermont.gov/forest/managing-your-woodlands/acceptable-management-practices

[27] Data are reported by calendar year rather than state fiscal year. Given the timeline of this report, calendar year 2023 data are not yet available and calendar year 2022 data are reported.

[28] Data are reported by federal fiscal year (October 1–September 30) rather than state fiscal year.

Technical assistance efforts across sectors have been impacted by the COVID-19 pandemic, limiting or altering in-person interactions, particularly evidenced by a drop in visit numbers across many technical assistance metrics in SFY 2020–2022.

Figure 13: The Vermont Urban & Community Forestry Program's, Gwen Kozlowski, and Southern Windsor County Forester, Hannah Dallas, plant one of eleven trees on public property in Windsor. With technical and financial support from the Vermont Urban & Community Forestry Program, made possible by a Sustainable Urban Forest Resilience grant from the USDA Forest Service, Windsor engaged in a two-year project to focus on its public tree canopy through planting and maintenance activities.

Statewide Results of Vermont's Clean Water Investments

Click symbol to view description of accountability measures.

Clean water projects restore, enhance, and protect water quality by addressing the sources and causes of sediment and nutrient pollution across land use sectors. The following section summarizes the results of state-funded and regulatory clean water projects completed statewide to improve the state's water quality. Some measures have been rounded to the nearest whole number for reporting purposes, but totals have been calculated using unrounded numbers.[29]

Statewide Results of Agricultural Pollution Prevention Projects

Agricultural pollution prevention projects involve the installation or application of conservation practices that reduce sources of nutrient and sediment pollution from farm production areas and agricultural fields. The following table summarizes project outputs associated with state-funded agricultural pollution prevention projects, technical assistance, and regulatory programs.

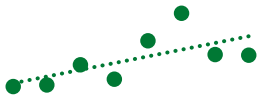
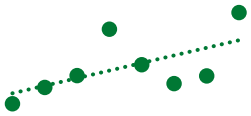
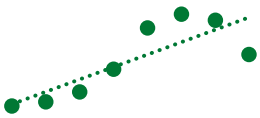
Table 5: Outputs of state-funded agricultural pollution prevention projects implemented statewide since SFY 2016.

Project Output Measures[30]	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Acres of agricultural conservation practices implemented (excluding practice types listed below)[31]	26,905	141,317	
Acres of agricultural forested and filter strip buffers installed	32	256	

[29] For a full record of project output measures by state fiscal year, visit the Clean Water Interactive Dashboard here: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

[30] Agricultural project output measures can overlap with other project output measures if multiple practices were applied on the same field. For example, 10 acres of manure injection and 10 acres of cover crop applied on the same field will amount to 20 acres of agricultural conservation practices implemented in reported project outputs. Similarly, practices implemented on the same field over multiple years will be counted for each year implemented. For example, 10 acres of cover crop implemented on the same field in 2016, 2017, and 2018 will amount to 30 acres of agricultural conservation practices implemented in reported project outputs. The total agricultural project outputs column represents the total level of effort of state funding programs, rather than the number of distinct agricultural acres addressed.

[31] Acres of agricultural conservation practices includes aeration, conservation crop rotation, cover crop, crop to hay, grassed waterways, manure injection, conservation tillage, and rotational grazing.

Project Output Measures[30]	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Acres of pasture with livestock excluded from surface water	64	345	
Number of structural agricultural practices installed in barnyard/production areas, fields, and pastures	100	749	
Acres of water quality protections within newly conserved agricultural lands	645	2,101	
Acres of agricultural land treated through innovative equipment[32]	18,160	127,520	
Project Output Measures Supported by State Technical Assistance[33]	**SFY 2023**	**Total SFY 2016–2023**	**Trend SFY 2016–2023**
Acres of agricultural conservation practices implemented with support of state-funded technical assistance	3,287	34,643	
Agricultural Regulatory Measures	**SFY 2023**	**Total SFY 2016–2023**	**Trend SFY 2016–2023**
Acres of production area inspected by AAFM for RAP compliance[34]	3,014	15,703	

[32] Examples of innovative equipment include manure injection equipment and drag lines.

[33] Agricultural conservation practices reported through technical assistance represent agricultural conservation practices implemented without direct financial assistance to farmers from state and federal programs. These practices are reported through technical assistance efforts which are funded by state programs.

[34] SFY 2016–2018 datasets are incomplete and do not fully account for all acres of production area inspected by AAFM for RAP compliance due to the initiation of this tracking mechanism.

Explanation of Table 5

The number of agricultural pollution prevention projects implemented statewide has consistently increased each year since SFY 2016. Many of the project output measures tracked in the agricultural sector show impacts of the COVID-19 pandemic on implementation rates between SFY 2021–2022. Unlike in other sectors, many clean water practices implemented in the agricultural sector have an effective life of one year and require continued implementation year-after-year to sustain results. Additionally, agricultural practices are inherently subject to weather and soil conditions for the season and thus fluctuating levels of implementation are based on farm business decisions, landowner willingness, and ability to implement.

Figure 14: Grassland Shallow Slot Manure Injection equipment is a very shallow manure injection method which causes a low level of soil disturbance. This application method significantly reduces surface phosphorus application and nutrient loss while increasing efficiency and crop production. This equipment purchase was funded through the Vermont Agency of Agriculture, Food & Markets Capital Equipment Assistance Program.

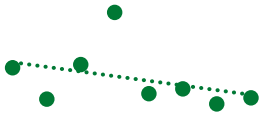
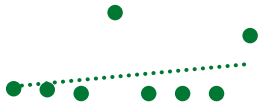
Figure 15: Before (left) and after (right) planting of trees and shrubs that will mature and become a forested riparian buffer between agricultural land and the adjacent brook which flows into the Missisquoi River. This is one section of a 32-acre buffer project supported through the Vermont Agency of Agriculture, Food & Markets Conservation Reserve Enhancement Program.

Figure 16: Before (left) and after (right) installation of a new waste storage facility and adjacent solid manure stacking site in the Otter Creek watershed supported through the Vermont Agency of Agriculture, Food & Markets Best Management Practice Program.

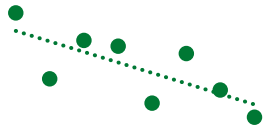
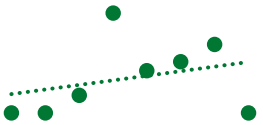
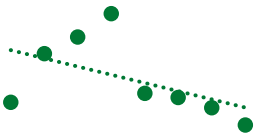
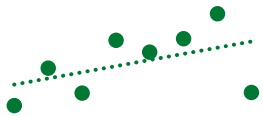
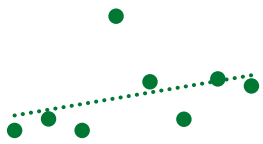
Statewide Results of Natural Resources Restoration Projects

Natural resources restoration projects involve the restoration and protection of natural infrastructure functions that prevent and abate nutrient and sediment pollution. Natural infrastructure includes floodplains, river channels, lakeshores, wetlands, and forestlands. The following table summarizes project outputs associated with state-funded natural resources restoration projects. Project development measures reflect efforts in the identification, prioritization, and design of projects. Project output measures reflect the impact of project implementation or construction.

Table 6: Outputs of state-funded natural resources restoration projects implemented statewide since SFY 2016.

Project Development Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Stream miles assessed by Stream Geomorphic Assessment, River Corridor Plan	0	282	
Number of natural resources restoration projects identified[35]	21	703	
Acres of river corridor scoped for easement	200	511	
Number of preliminary (30%) designs completed	1	59	
Number of final (100%) designs completed	4	69	

[35] Number of natural resources restoration projects identified includes projects resulting from River Corridor Plans, Stream Geomorphic Assessments, and Lake Watershed Action Plans, as well as projects identified for river corridor easement, riparian buffer planting, dam removal, and wetland restoration.

Project Output Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Acres of forested riparian buffer restored through buffer planting	1	328	
Acres of floodplain restored	10	109	
Linear feet of lakeshore restored	0	1,915	
Stream miles reconnected for restoring rivers to the least erosive condition and regaining fish passage	0	521	
Acres of wetland conserved and restored through easements	47	1,195	
Acres of riparian corridor conserved and restored through easements	26	1,469	
Acres of land conserved with natural resources protections	1,338	26,582	
Miles of forest road and trail drainage and erosion control improvements	3	20	
Number of stream crossings improved	37	94	

Explanation of Table 6

Extensive work to complete Stream Geomorphic Assessments and River Corridor Plans occurred in the early 2000s, resulting in a substantial amount of data in most watersheds across the state and a limited need to complete additional assessments in recent years. Ongoing work to develop tools and resources to streamline these processes will support targeted re-assessments in priority areas of the state. Most natural resource restoration projects reflected in this report are voluntary, and results may vary year-to-year depending on landowner willingness to participate, partner capacity, the timing of reporting, and other factors. Landowner outreach and investment in partner capacity to complete these types of projects is a crucial component to continued progress in clean water work in the natural resource sector. Annual variation in the level of project outputs reported is also partially attributable to some project types in the natural resource sector requiring multi-year planning and design work, legal agreements, and partner coordination.

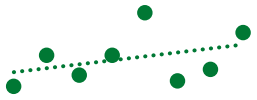
Figure 17: During (left) and after (right) removal of the Dunklee Pond dam. Removal of this 75-foot-long concrete dam reconnected 13 stream miles of the Tenney Brook, a tributary to East Creek in Rutland, Vermont. Removal of dams that are no longer actively used provides important water quality benefits — it allows river reaches to return to a natural process of evolution, reduces sediment transport to receiving waters, improves aquatic habitat, and increases flood resilience. The removal of this dam was funded by the Department of Environmental Conservation in partnership with the Vermont Natural Resources Council. The project was completed in the spring of 2022.

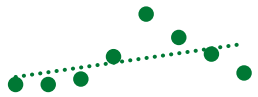
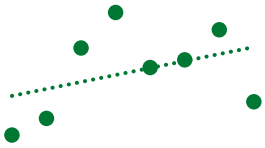
Figure 18: The Lake Champlain TMDL Phase 1 Implementation Plan highlights forests as an important area for reducing phosphorus loading to state waters, representing 75% of Vermont's total land base. Inadequate infrastructure is one cause of erosion on state forestland. Replacement of infrastructure not only reduces phosphorus loading to waterbodies, but also improves stream habitat and maintains public access for recreation and logging operations. This project included replacement of an undersized and collapsed cross drainage culvert (before, left) with an appropriately sized, aligned culvert (after, right) on a forest road in Mount Mansfield State Forest, located within the Lake Champlain basin. The project was supported by Lake Champlain Basin Program funding administered through the Department of Environmental Conservation in partnership with the Department of Forests, Parks and Recreation.

Statewide Results of Developed Lands Projects

Developed lands projects mitigate erosion and treat polluted stormwater runoff containing nutrient (phosphorus and nitrogen) and sediment pollution from impervious surfaces. Stormwater treatment practices capture and treat flow from parking lots, sidewalks, and rooftops, while transportation related stormwater projects reduce erosion and mitigate pollutants from road-related sources. The following table summarizes project outputs associated with projects reported through state funding programs and regulatory programs. Regulatory measures are reported through regulatory programs and are not necessarily tied to state funding programs. State and federal funding programs provide funding to support project design and implementation/construction for both regulatory and non-regulatory projects.

Table 7: Outputs of stormwater treatment and road erosion remediation projects implemented statewide, reported through state funding programs or regulatory programs since SFY 2016.

Non-Regulatory Project Development and Output Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Number of projects identified through Stormwater Master Plans	59	921	
Number of illicit/unauthorized discharges confirmed (to be addressed by the responsible municipality or landowner)	0	122	
Number of preliminary (30%) designs completed	3	247	
Number of final (100%) designs completed	28	151	
Acres of existing impervious surface treated by stormwater treatment practices	19	553	

Acres stabilized through use of seeding/mulching equipment per year	41	678	
Regulatory Project Development and Output Measures	**SFY 2023**	**Total SFY 2016–2023**	**Trend SFY 2016–2023**
Acres of existing impervious surface treated by stormwater treatment practices under stormwater permits	197	884	
Acres of new impervious surface treated by stormwater treatment practices under stormwater permits	164	1,013	
Hydrologically connected municipal road miles inventoried[36]	87	6,042	
Hydrologically connected municipal road miles identified as requiring water quality improvements[37]	47	2,570	
Miles of municipal road drainage and erosion control improvements supported through state funding programs	25	367	
Number of municipal road drainage and stream culverts replaced supported through state funding programs	206	994	

Explanation of Table 7

State-funded efforts have resulted in the identification and prioritization of over 900 stormwater projects through Stormwater Master Planning and the identification of more

[36] Note that state funding programs supported the implementation of required Road Erosion Inventories (REIs). REI data come directly from the MRGP database.

[37] The segment scoring methodology under the Municipal Roads General Permit was updated in March 2023. More information, including the updated scoring methods, is available here: https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees/municipal-roads-program

than 120 illicit discharges since SFY 2016. In recent years, these efforts have begun to level out as assessments have covered most areas of the state and the focus has shifted to implementation of identified projects. State-funded non-regulatory stormwater treatment practices have treated over 550 acres of existing impervious surfaces since SFY 2016.

Operational stormwater permits require treatment of runoff from new development or redevelopment of a certain size, and have historically not been funded with state dollars.[38] However, the Three-Acre Rule will compel many sites with existing impervious surfaces to obtain operational stormwater permits and treat runoff from existing impervious surfaces, known as the Three-Acre General Permit. The state is developing funding programs to support landowners subject to the Three-Acre General Permit requirements. Data on these programs will be reflected in future reports.

Municipal Separate Storm Sewer System (MS4) Permits require designated urbanized communities to manage stormwater discharges from those areas. MS4 communities can receive partial funding and/or loan financing for the implementation of MS4 projects that address existing untreated or under-treated impervious surface.

Since SFY 2016, over 1,000 acres of new and nearly 900 acres of existing impervious surface subject to regulatory requirements under MS4 and operational stormwater permits have been permitted and require treatment to the state standards.[39] See *Appendix D: Results of State Stormwater Regulations* for more information on stormwater permit outputs.

To comply with the Municipal Roads General Permit (MRGP), municipalities were required to submit initial Road Erosion Inventories (REIs) by the end of 2020. The number of hydrologically connected (adjacent to or intersecting surface waters) municipal road miles inventoried in each state fiscal year illustrates that permit compliance deadline, with the majority of road miles inventoried between SFY 2017–2021. REIs have covered over 6,000 hydrologically connected municipal road miles as of SFY 2023. Vermont has approximately 6,500 miles of roads that fall under the MRGP's jurisdiction.

Since SFY 2016, the Municipal Roads Grants-in-Aid Program and VTrans Better Roads Program have funded projects resulting in over 360 miles of municipal road drainage and erosion control improvements, and replaced nearly 1,000 municipal road drainage and stream culverts to improve road runoff for water quality.

[38] Some of the funding programs established under Act 76 of 2019, described in Appendix A, will provide funding to support regulatory permit compliance under several programs that require treatment of existing impervious surfaces, such as the Three-Acre General Permit.

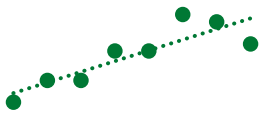
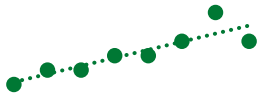
[39] Results associated with regulatory operational stormwater permits are reported at the time of permit obtainment, and permittees have five years to complete the required treatment practice(s) under the permit.

Figure 19: Phosphorus reduction on developed land is required to implement the Lake Champlain TMDL. This project contributes to that reduction by providing stormwater treatment for untreated developed lands in a Burlington neighborhood via Green Stormwater Infrastructure (GSI). The image depicts installation of a stormwater infiltration chamber, a GSI technique. Runoff can fill the large yellow structure, then seep slowly into the crushed rock base and soils below. This infrastructure reduces polluted runoff and high stormflows from developed lands that drain into combined sewer systems and contribute to combined sewer overflows. This project was funded through Lake Champlain Basin Program dollars administered by the Department of Environmental Conservation.

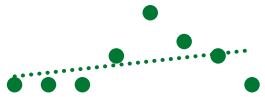
Statewide Results of Wastewater Treatment Projects

Wastewater treatment projects decrease the amount of nutrients, like phosphorus and nitrogen, and other pollutants that reach our waterways from municipal wastewater systems through treatment upgrades, combined sewer overflow (CSO) abatement, and refurbishment of aging infrastructure. Clean water projects completed in the wastewater sector are primarily compelled by regulations intended to address point sources of pollution, and some state funding programs provide financial assistance to support regulatory compliance. The following table summarizes project outputs associated with state-funded wastewater treatment projects. Project development measures reflect efforts in the identification, prioritization, and design of projects. Project output measures reflect the impact of project implementation and construction.

Table 8: Outputs of state-funded wastewater treatment projects implemented statewide since SFY 2016.

Project Development Measures	SFY 2023	Total SFY 2016–2023	Trend SFY 2016–2023
Number of preliminary (30%) designs completed	9	59	
Number of final (100%) designs completed	4	39	
Project Output Measures	**SFY 2023**	**Total SFY 2016–2023**	**Trend SFY 2016–2023**
Number of combined sewer overflow abatements completed[40]	1	7	
Number of wastewater collection systems refurbished	3	17	

[40] Combined sewer overflows (CSOs) may require multiple abatement projects to achieve water quality standards or eliminate any potential discharge from the CSOs.

Number of wastewater treatment facilities refurbished[41]	0	12	
Number of wastewater treatment facility upgrades completed[42]	0	10	

Explanation of Table 8

Clean water projects in the wastewater sector are capital intensive and can take many years to complete, resulting in variation in outputs from year to year. Some projects improve treatment within facilities, while others may provide community wastewater solutions to address failed or failing septic systems in designated village centers. State grants and low interest loans capitalized through the Vermont and U.S. Environmental Protection Agency (EPA) Clean Water State Revolving Fund (CWSRF) finance municipal wastewater improvements. Wastewater treatment facility upgrades are extremely expensive and are typically only pursued when compelled by a regulatory requirement. Functioning wastewater treatment facilities may require upgrades to expand treatment capacity, which may not be necessary if capacity is sufficient to treat anticipated inflows.

Figure 20: One of three wastewater treatment facilities operated by the City of Burlington. The city has partnered with the State of Vermont to finance several municipal wastewater treatment facility improvements and combined sewer overflow abatement projects. Financing this work has been possible in part by the low interest loans available through the Clean Water State Revolving Fund.

[41] A refurbished wastewater treatment facility refers to a facility with improvements or renovations that enable it to continue to efficiently operate.

[42] An upgraded wastewater treatment facility refers to a facility with increased treatment capacity.

Cost Effectiveness of State Clean Water Investments

The previous section of this report summarizes the results of state-funded clean water projects completed from SFY 2016 to SFY 2023. Given the significant costs of restoring and protecting water quality, the state must efficiently and effectively spend its resources. The cost effectiveness of clean water projects is expressed as state dollars invested per kilogram of estimated total phosphorus load reduction over the anticipated lifespan of the project. If projects are maintained beyond their anticipated lifespan, the cost effectiveness of the project improves. Cost effectiveness can only be calculated for project types where estimated total phosphorus load reductions and cost data are available at the project level. Local- and federal-leveraged funds associated with state-funded projects are not included in the calculation of cost effectiveness of state investments. The figure and table below summarize the cost effectiveness of state investments in reducing phosphorus pollution by sector. [43]

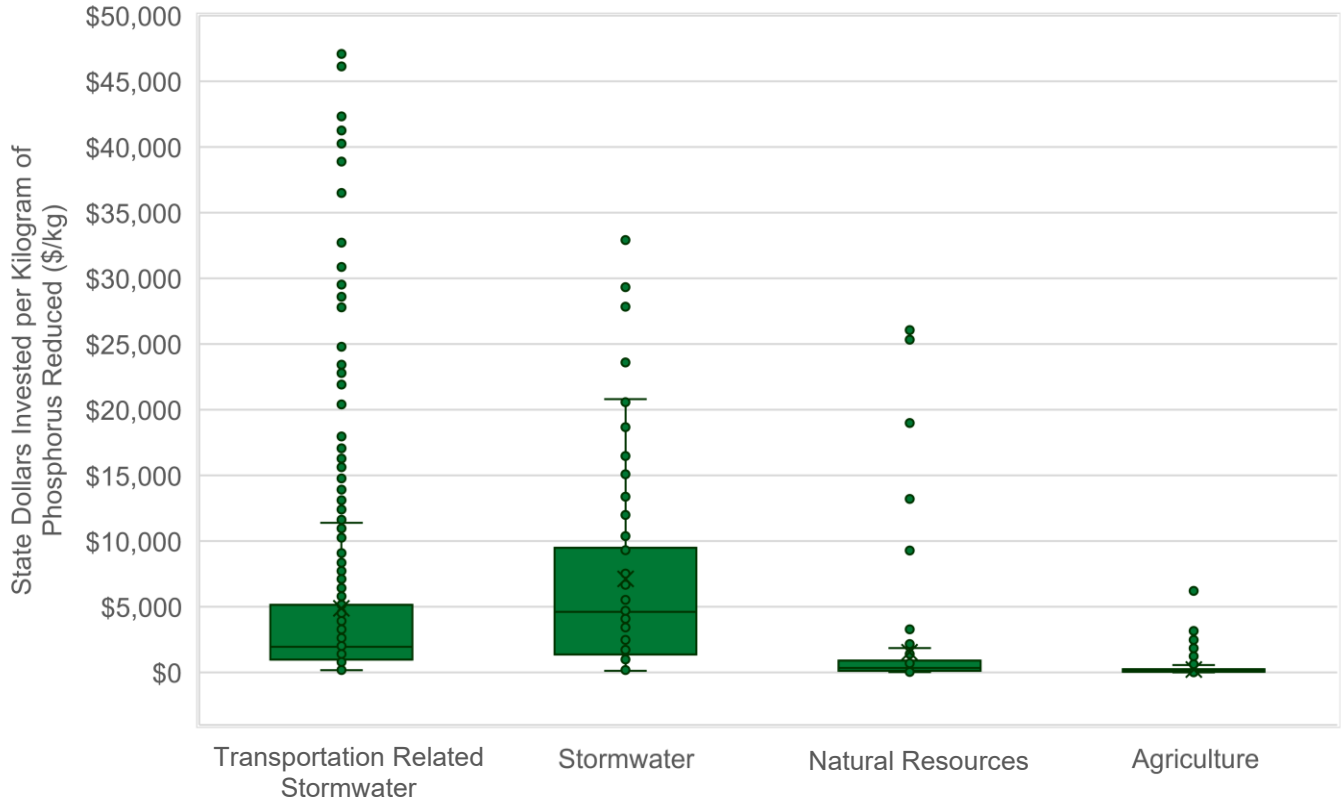


Figure 21: Dollars invested per estimated kilogram of total phosphorus load reduced over the effective lifespan of each project type, based on clean water projects funded through State of Vermont agencies completed in SFY 2016–2023.[44]

[43] Cost effectiveness data is presented in real dollars adjusted to the end of SFY 2023 for comparison purposes. Inflation adjustments were calculated based on the United States Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (CPI-U).

[44] Some projects were removed from the analysis due to project costs including work that is not directly associated with phosphorus reductions.

Table 9: Minimum, median, and maximum cost effectiveness ($/kg of phosphorus reduced) of state investments in clean water projects by project type.

Metric	Transportation Related Stormwater	Stormwater	Natural Resources	Agriculture
Minimum	$163	$128	$27	$1
Median	$1,952	$4,607	$352	$105
Maximum	$47,085	$32,918	$26,058	$6,214
Count of data points	454	80	100	8,046
Practices included in analysis	Road erosion control on hydrologically connected municipal road segments	Bioretention Infiltration trench Gravel wetland Surface infiltration Grass swale Porous pavement Wet pond Hydrodynamic swirl separator Sand filter Extended dry detention pond Gully stabilization	Riparian buffer Lakeshore restoration	Crop rotation Cover crop Conservation tillage Riparian buffer Grassed waterway Grazing management Manure injection

Explanation of Figure 21 and Table 9

Achieving Vermont's water quality goals requires action across all land use sectors. The key is to target funds to the most cost-effective projects within each land use sector. The State of Vermont employs science-based assessments to identify and prioritize projects and incorporates those prioritized actions in Tactical Basin Plans. The figure and table above show the distribution of cost effectiveness across four land use sectors where project level cost and phosphorus reduction data required to calculate cost effectiveness are available.

Clean water projects in the agricultural and natural resources sectors included in this analysis are among the most cost-effective practices in terms of dollars invested per unit of estimated phosphorus pollution reduced. In the agricultural sector, practices such as conservation tillage, cover crop, and manure injection are highly cost-effective annual practices, but must be implemented each year to sustain pollution reduction results. Forested riparian buffers are also highly cost-effective, and have a 10 to 20-year lifespan, which results in more sustained phosphorus reduction compared to annual agricultural field and pasture projects. Note that riparian buffers on agricultural lands are included

under agricultural pollution prevention practices, while buffers planted on all other land uses are considered natural resources restoration projects. The State will account for pollutant reductions in other natural resources projects, such as stream and floodplain restoration, in future years.

Stormwater and transportation infrastructure projects tend to be more expensive per unit of estimated phosphorus pollution reduced. Stormwater practices are generally engineered structural practices that can incur high construction costs, but these practices are necessary to achieve required reductions from developed lands and have relatively long lifespans, achieving phosphorus load reductions for 20 years or more, if properly maintained. The large range in the cost effectiveness of road practices may be a result of some municipalities remediating the highest priority, most complex road segments (and therefore most expensive road segments) first to comply with the Municipal Roads General Permit (MRGP). Additionally, road project cost and complexity can vary based on what practices need to be installed to bring a road segment up to MRGP standards.

Chapter 3: Clean Water Investments and TMDL Progress in the Lake Champlain Basin

Lake Champlain TMDL

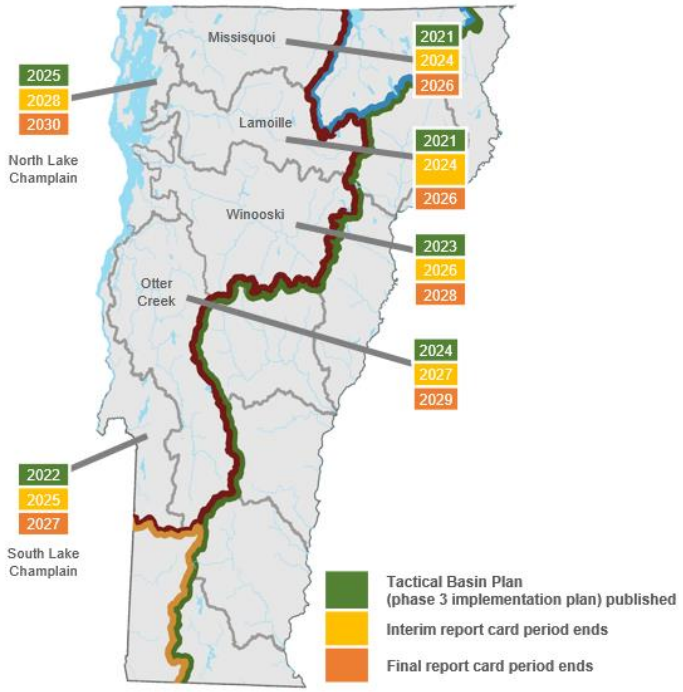


Figure 22: Lake Champlain TMDL Accountability Framework schedule by Tactical Basin Plan watershed.

Lake Champlain is one of the largest lakes in North America and its watershed drains nearly half the land area of Vermont, as well as portions of northeastern New York and southern Québec. Phosphorus levels in some portions of Lake Champlain regularly exceed Vermont's water quality standards, which contributes to cyanobacteria blooms, low dissolved oxygen concentration, impaired aquatic life, and reduced recreational use. The Lake Champlain restoration plan, *Phosphorus Total Maximum Daily Loads for Vermont Segments of Lake Champlain* (Lake Champlain TMDL), identifies phosphorus load reductions that must be achieved in all 12 segments of Lake Champlain to meet State of Vermont water quality standards.[45] Total phosphorus loading to Lake Champlain from Vermont was modeled to be 630.6 metric tons per year during the TMDL baseline period of 2001 to 2010. The TMDL states total phosphorus loading to the lake must be reduced to 418.1 metric tons per year by the end of calendar year 2036 to achieve Vermont's water quality standards, a 212.4 metric ton reduction from the baseline.

The Lake Champlain TMDL contains an Accountability Framework intended to ensure adequate progress toward reducing phosphorus pollution to Lake Champlain. The Framework sets a schedule for U.S. Environmental Protection Agency (EPA) to issue report cards on the State of Vermont's progress throughout the 20-year implementation timeframe (2016–2036). Tactical Basin Plans are updated on a five-year rotating basis and include Implementation Tables with priority actions to implement the Lake Champlain TMDL. EPA issues interim report cards halfway through the five-year planning cycle and final report cards at the end of the five-year planning cycle based on progress reports produced by DEC (Figure 22).[46] EPA uses this chapter of the *Clean Water Initiative Annual Performance Report* and its appendices to help

[45] *Phosphorus Total Maximum Daily Loads for Vermont Segments of Lake Champlain* available at: https://dec.vermont.gov/watershed/restoring/champlain

[46] Additional Lake Champlain TMDL Implementation Progress Report information available at: https://www.epa.gov/tmdl/lake-champlain-phosphorus-tmdl-commitment-clean-water

determine satisfactory progress for the Lake Champlain TMDL. Progress reports for the 2023 reporting cycle are included in Appendix B: The Northern Lake Champlain Direct Drainages (Basin 5) TMDL Implementation 2023 Progress Report and Appendix C: Winooski River (Basin 8) TMDL Implementation 2023 Progress Report.

The following sections of the report summarize the state and federal funding programs' and regulatory programs' clean water efforts in the Lake Champlain basin that are contributing to Lake Champlain TMDL progress.

Vermont's Clean Water Investments in the Lake Champlain Basin

Reaching Lake Champlain's water quality goals requires investments across all land use sectors. The following figure summarizes state investment and Lake Champlain Basin Program investments in the Lake Champlain basin from SFY 2016 to 2023.

Click symbol to view description of accountability measures.

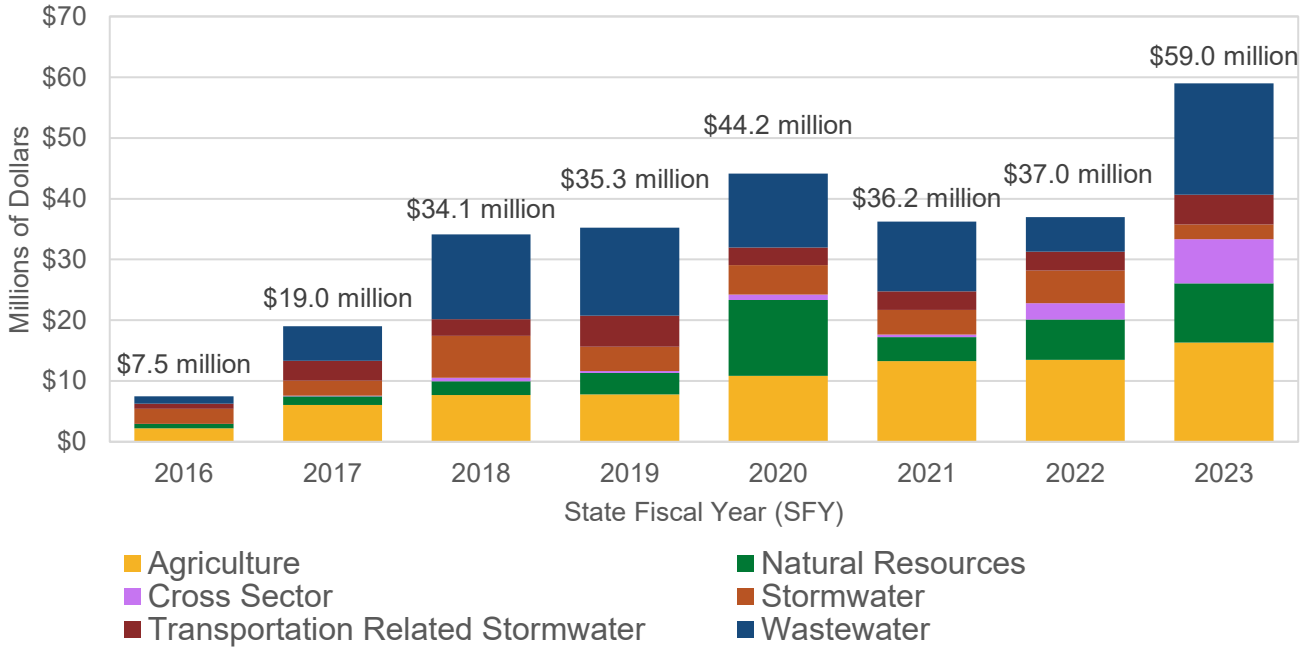


Figure 23: Total dollars awarded by State of Vermont agencies and Lake Champlain Basin Program to clean water projects in the Lake Champlain basin by land use sector, SFY 2016–2023. Note: Federal funding data administered directly by USDA-NRCS are not included in this figure.

Explanation of Figure 23

The State of Vermont and Lake Champlain Basin Program have invested over $272 million in clean water projects in the Lake Champlain basin since SFY 2016. Each year during the reporting period, between 55–70% of state funding for clean water has been directed to projects located within the Lake Champlain basin. The Lake Champlain TMDL sets substantial targets for pollution reduction, and substantial commitment and investment at the state, federal, and local level are needed to achieve Vermont's water quality goals in the basin. Cross sector funding awarded in SFY 2022 and 2023 is largely

representative of the Water Quality Restoration Formula Grants awarded to Clean Water Service Providers under Act 76. For more information on Act 76 funding programs, see Appendix A: Act 76 of 2019.

Estimated Total Phosphorus Load Reductions in Lake Champlain Basin

Click symbol to view description of accountability measures.

The State of Vermont estimates the pollutant load reductions associated with clean water projects to track progress towards achieving water quality goals. The following figure summarizes the estimated total phosphorus load reductions associated with projects implemented through state and federal funding and regulatory programs in the Lake Champlain basin from SFY 2016 to 2023 by sector.

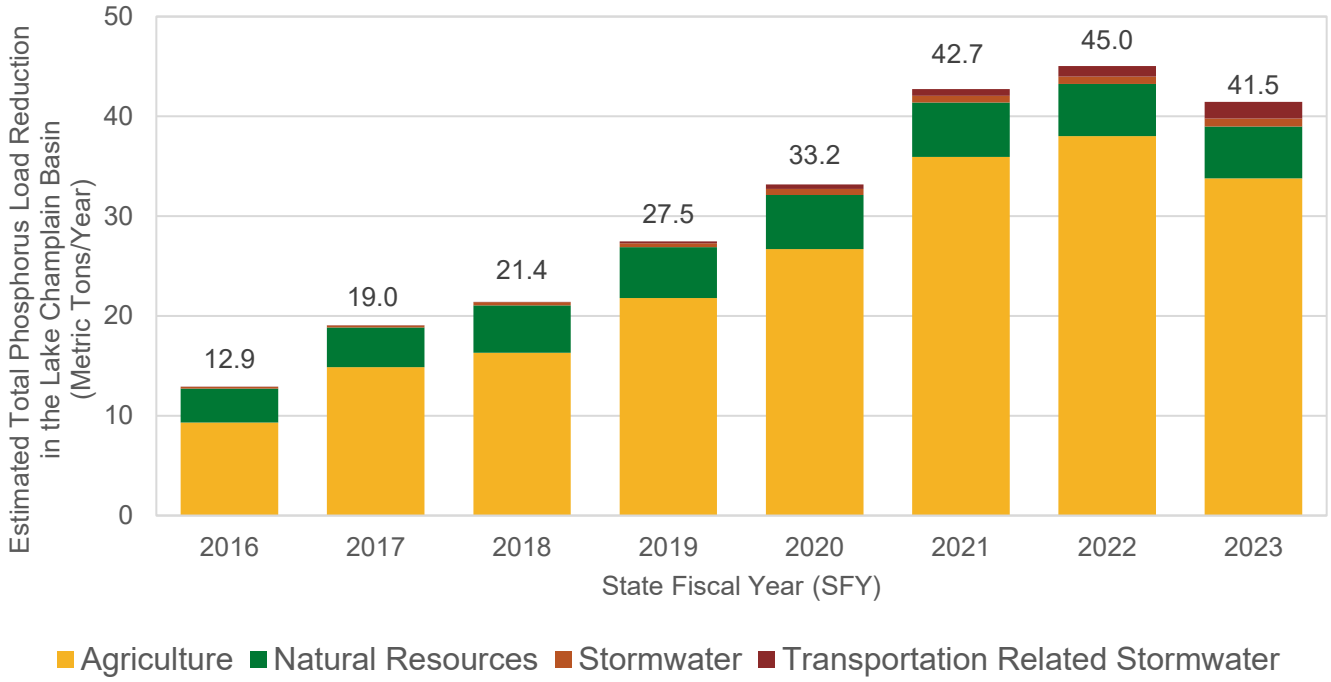


Figure 24: Annual estimated total phosphorus load reductions (metric tons per year) associated with projects implemented through state and federal funding and regulatory programs in the Lake Champlain basin in effect during SFY 2016–2023 by land use sector.[47]

Explanation of Figure 24

State funding programs, federal funding programs, and regulatory programs in the Lake Champlain basin resulted in projects that reduced an estimated 41.5 metric tons of phosphorus as of the close of SFY 2023. The State acknowledges some of the phosphorus reduction gains reported for SFY 2022 have not continued in SFY 2023. Implementation of the TMDL is not a linear path. Changing rates of progress over the 20-year implementation timeframe are to be expected and are associated with swings in

[47] Annual phosphorus load reductions are cumulative for all completed/operational projects based on start date and anticipated lifespan. Results of USDA-NRCS funded projects completed since SFY 2010 that are still in effect SFY 2016–2023 are included to represent progress since the Lake Champlain TMDL baseline period.

financial assistance levels, and the capacity of agencies and partners to administer funds, implement projects, and report outcomes. The following paragraphs provide some context to explain TMDL implementation progress by sector.

The estimated phosphorus reductions achieved to date in the agricultural sector are mostly from annual field practices, such as cover crops, reduced- or no-till, and manure injection. Most of the phosphorus reductions required in the agricultural sector are tied to croplands, meaning that annual field practices are necessary to implement the TMDL. Annual practices must be implemented every year to sustain phosphorus reductions. Implementation of annual practices is dependent on land management decisions that can be influenced by a variety of farm business factors. This year, the data suggest a slight slowdown in phosphorus reductions associated with annual practices. This is likely the result of a combination of factors, including:

- Some practices can only be implemented for a limited number of years to be eligible for cost share. Many programs are also subject to funding caps, which may limit the reported acres of practice implementation.
- Many farms implement agricultural conservation practices without the support of cost share programs. The State is limited in its ability to capture the water quality benefits of practices implemented outside cost share programs, and only some of these data are presented in this report.
- The multi-year federal Farm Bill governs much of the funding available to support agricultural practice implementation. Funds are often limited near the end of a Farm Bill cycle. The most recent Farm Bill was passed in 2018 and is set to expire at the end of calendar year 2023.
- Agricultural water quality programs have recently expanded in focus and emphasis to include holistic planning and implementation on farms, the results of which may not be fully reflected in available data.

In the natural resources sector, the increase in previously reported phosphorus reductions across all state fiscal years is largely attributable to incorporation of new phosphorus reduction accounting methods to capture the water quality benefits associated with the State of Vermont's Use Value Appraisal (UVA) Program on forestland parcels.[48] Forestland parcels that are actively enrolled in the UVA Program and have been inspected for program compliance meet Vermont's Acceptable Management Practices (AMPs), a set of forestland management criteria designed to maintain and protect water quality.[49] Newly established phosphorus accounting methods for other practices in the natural resources sector are in the process of being implemented, and will be reflected in future years of reporting. These new methods will be applied to newly completed projects, as well as applied to fill gaps for previously completed projects as data availability allows.

Estimated phosphorus reductions in the stormwater and transportation related stormwater land use sectors have been incrementally growing. This progress is associated with increased implementation of several regulatory programs designed to

[48] For details on phosphorus accounting for UVA parcels, please see the Standard Operating Procedures for Tracking & Accounting of Natural Resources Restoration Projects: https://dec.vermont.gov/water-investment/cwi/projects/tracking-accounting#SOP

[49] Phosphorus reductions are only accounting for forestland parcels that enrolled in the UVA program after the TMDL baseline periods.

reduce and mitigate stormwater pollution from developed lands and roads. Operational stormwater permits regulate stormwater discharges resulting from new development, redevelopment, and three-acre sites. Municipal Separate Storm Sewer System (MS4) permits regulate stormwater discharges in the most populous regions of the state. The Municipal Roads General Permit (MRGP) regulates stormwater related erosion on municipally owned roads. Regulatory programs are at varying stages of implementation, and continued expansion of compliance will increase estimated phosphorus reductions in future years.[50]

In the Lake Champlain basin, the change in pace of estimated annual phosphorus reduction progress seen in the data available for SFY 2022 and 2023 may be in part a reflection of the completion of relatively easy to implement projects. Now that many of the low-hanging projects have largely been implemented, identification and implementation of projects that are in some cases more complex and involved, will need to be completed to reach Vermont's water quality goals in the basin. The variability of implementation rates across years also underscores the importance of investing in program and partner capacity to broaden the reach and impact of clean water project implementation.

[50] For more information on regulatory stormwater programs in Vermont, visit: https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees

Lake Champlain TMDL Progress

Click symbol to view description of accountability measures.

Total phosphorus loading from Vermont to Lake Champlain was modeled to be 630.6 metric tons per year during the Lake Champlain TMDL baseline period of 2001 to 2010. The TMDL states net phosphorus loading to Lake Champlain must be reduced by 212.4 metric tons per year to reach a target load of 418.1 metric tons per year by the end of calendar year 2036 to achieve Vermont's water quality standards. The following figure summarizes the steady progress that has been made towards achieving the Lake Champlain TMDL since SFY 2016.

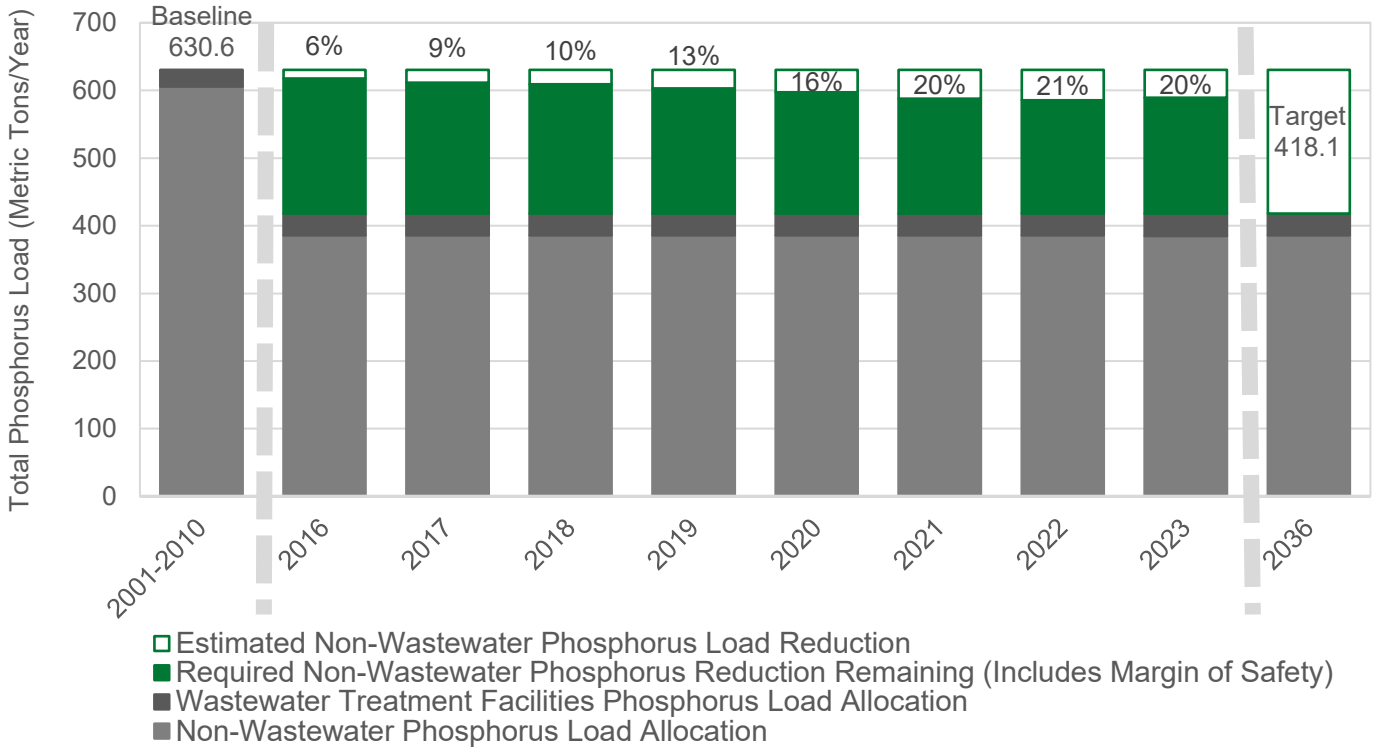


Figure 25: Estimated total phosphorus load reductions in effect during SFY 2016–2023 relative to the Lake Champlain TMDL total phosphorus baseline and target total phosphorus load in metric tons per year.

Explanation of Figure 25

The progress made toward reaching Lake Champlain's phosphorus reduction target has increased since SFY 2016, however progress has slowed in recent years (see explanation of Figure 24 for more context on rate of progress). State, federal, and regulatory clean water programs have reduced an estimated 41.5 metric tons of phosphorus loading delivered to Lake Champlain in SFY 2023, which represents approximately 20 percent of the required reduction. This result is expected to increase in the coming years for at least the following reasons:

1. An influx in federal funding under ARPA, the Bipartisan Infrastructure Law, and Inflation Reduction Act, increased Clean Water Fund revenue enacted under Act 76 of 2019, and investment in the capacity of clean water partners will drive project

implementation across sectors.[51] While many of these funding programs and capacity initiatives are underway, the results of these investments will not be fully reflected in estimated phosphorus reductions until projects are completed, which may take multiple years.

2. The State of Vermont has been building and expanding clean water regulatory, financial, and technical assistance programs since SFY 2016. Many regulatory programs are now in place that will drive phosphorus reductions from agricultural and developed lands. In some cases, the results of these regulatory programs have yet to be reflected in project-level reported data. For example, under the Three-Acre General Permit, landowners are in the process of obtaining permit coverage near term, and construction of appropriate treatment is required within five years of permit authorization.
3. The State has published methods for quantifying phosphorus reductions for agricultural, natural resources, and developed lands sector clean water practices. New methods were recently established to fill gaps in capturing the phosphorus reduction benefit of several practices, particularly in the natural resources sector. These new methods are in the process of being implemented and will be reflected in future years of reporting for newly completed projects, as well as applied to fill gaps for prior completed projects.

Lake Champlain TMDL Progress by Lake Segment Watershed

The Lake Champlain TMDL allocates total phosphorus load reduction targets by lake segment watershed, which differ slightly from the boundaries of Tactical Planning Basins. The following figure presents estimated total phosphorus load reductions in effect in SFY 2023 by lake segment watershed compared to the target reduction established by the TMDL.

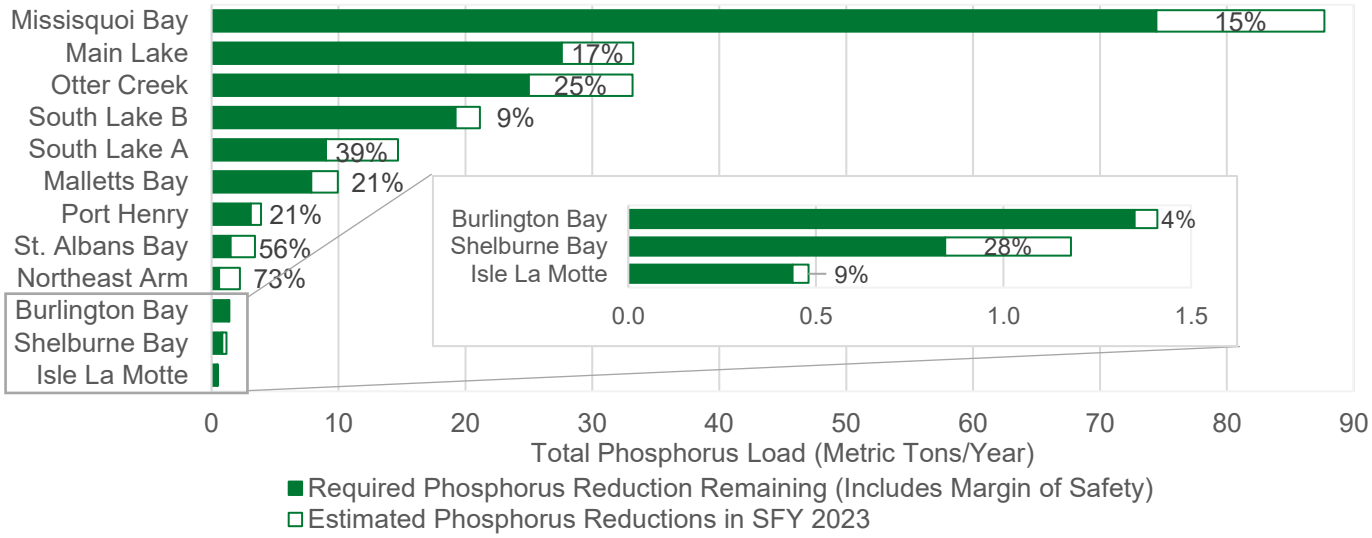


Figure 26: Estimated total phosphorus load reductions in effect during SFY 2023 by lake segment watershed compared to total phosphorus load reduction targets in metric tons per year.

[51] For more information on the Clean Water Budget, visit: https://dec.vermont.gov/water-investment/cwi/board

Percent represents the proportion of estimated total phosphorus load reductions achieved as of SFY 2023 compared to the lake segment target reduction.[52]

Explanation of Figure 26

The level of progress in phosphorus reductions relative to lake segment watershed target reductions in the Lake Champlain basin vary for the following reasons:

1. **Lake segment size and level of phosphorus reduction required varies**: The TMDL allocated phosphorus loading capacity based on each lake segment's land use and in-lake characteristics and the reduction required to meet Vermont water quality standards. The level of effort required and the magnitude of phosphorus loading ranges by lake segment.
2. **Clean water projects are targeted in priority watersheds**: Tactical Basin Plans inform where to prioritize efforts for reducing phosphorus loading to Lake Champlain. The level of progress in the Northeast Arm and St. Albans Bay lake segments is relatively high, as USDA-NRCS has targeted significant agricultural technical and financial assistance to these watersheds.
3. **New phosphorus reduction methodology**: The State has published methods for quantifying phosphorus reductions for agricultural, natural resources, and developed lands sector clean water practices. Lake segments dominated by agricultural efforts show greater progress than lake segments targeting natural resources restoration because there are currently more comprehensive systems to quantify estimated reductions for agricultural projects compared to other sectors.

[52] To view a map of the lake segment watersheds, see page 3 of the Lake Champlain TMDL, available at: https://dec.vermont.gov/watershed/restoring/champlain

Monitored Total Phosphorus Load from Vermont Wastewater Treatment Facilities in the Lake Champlain Basin

The phosphorus load allocations in the Lake Champlain TMDL are separated into wastewater wasteload allocations and non-wastewater load allocations. Tracking progress towards reaching the non-wastewater load allocation target is reflected in the previous TMDL progress figures. The wastewater wasteload allocation is tracked through *measured* water quality of effluent from the wastewater treatment facilities located within the Lake Champlain basin. The following figure shows the target wastewater wasteload allocation since the 2002 Lake Champlain TMDL and the measured total phosphorus from wastewater treatment facilities each year.

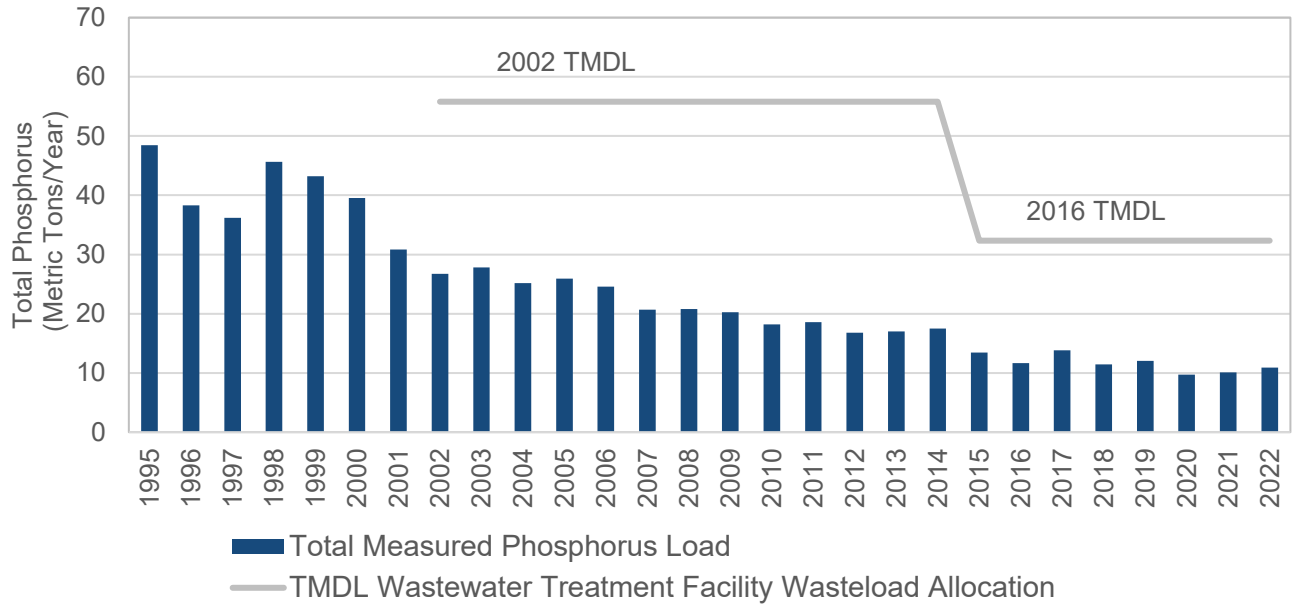


Figure 27: Measured total phosphorus load (metric tons per year) from Vermont wastewater treatment facilities draining to Lake Champlain and the Lake Champlain TMDL wastewater treatment facility wasteload allocation, calendar year 1995–2022.[53]

Explanation of Figure 27

Total average annual phosphorus loading into Lake Champlain originating from Vermont wastewater treatment facilities was approximately 24.6 metric tons per year during the Lake Champlain TMDL baseline period of 2001–2010, representing approximately four percent of total phosphorus loading to Lake Champlain from Vermont sources. During the baseline period, measured total annual phosphorus loading from wastewater treatment facilities was well below the wasteload allocation (maximum permitted phosphorus limit) of 55.8 metric tons that was established under the 2002 Lake Champlain TMDL. The updated 2016 Lake Champlain TMDL for Vermont reduced the wastewater treatment facility wasteload allocation from 55.8 to 32.3 metric tons, which is intended to achieve the overall required phosphorus load allocation while allowing for some development and growth over the TMDL implementation timeframe. Discharge monitoring indicates

[53] Total measured phosphorus load does not include loading associated with combined sewer overflow (CSO) events. Untreated CSO flows contribute an extremely small proportion of total phosphorus loading to lakes in Vermont.

Vermont wastewater treatment facilities in the Lake Champlain basin contributed approximately 10.9 metric tons of total phosphorus load to Lake Champlain in calendar year 2022, representing only 34 percent of the total wastewater treatment facility wasteload allocation under the current TMDL. These data demonstrate a consistent trend of measured total annual phosphorus load from Vermont wastewater treatment facilities, overall, well below the wasteload allocation.

Chapter 4: Clean Water Investments and TMDL Progress in the Lake Memphremagog Basin

Lake Memphremagog TMDL

Figure 28: Map of Vermont with the Lake Memphremagog, Tomifobia, and Coaticook Rivers Tactical Basin Planning region (Basin 17) highlighted in green.

Lake Memphremagog is an international waterbody with the majority of its watershed area in Vermont and a small portion in Québec. The Vermont portion of the watershed covers most of Orleans County including the three major lake tributaries: the Black, Barton, and Clyde Rivers, as well as the smaller Johns River. The Lake Memphremagog watershed is part of the larger Tactical Basin Planning region (Basin 17), which also includes the Tomifobia and Coaticook River basins that drain into Québec (Figure 28). Land use within the Vermont portion of the Lake Memphremagog watershed is largely forest or shrub with about 17 percent in agriculture, and five percent in developed lands.[54]

Phosphorus levels in the Vermont portion of Lake Memphremagog are higher than the water quality standard set for the lake. Elevated levels of phosphorus contribute to intermittent cyanobacteria blooms but also support excessive plant and algae growth that limits the quality of the lake for recreational use. The Lake Memphremagog TMDL was established in 2017 to specify the maximum amount of phosphorus that the waterbody can receive and still meet applicable water quality standards and establish targets for reducing phosphorus loading to the lake from its watershed. Total phosphorus loading to Lake Memphremagog from Vermont was modeled to be 52.7 metric tons per year during the TMDL baseline period of 2009 to 2012. The TMDL states total phosphorus loading to Lake Memphremagog must be reduced by 29 percent to 37.4 metric tons per year by 2037 to achieve Vermont's water quality standards.[55]

Tactical Basin Planning is integral to identifying priority projects to achieve water quality goals. The Lake Memphremagog, Tomifobia, and Coaticook Tactical Basin Plan (Basin 17) was updated in 2023. It provides an assessment of the health of the basin and defines ongoing and future strategies to address high-priority surface water stressors.[56] The purpose of the plan is to identify actions necessary to meet or exceed state water quality standards, and to achieve sustained ecological health and human use of surface waters. The plan sets priorities for meeting phosphorus load reduction targets for the Lake Memphremagog watershed as outlined

[54] The Lake Memphremagog TMDL can be accessed here: https://dec.vermont.gov/sites/dec/files/wsm/mapp/docs/Memph%20TMDL%20Final%20EPA%20approved.pdf

[55] Table 10, Lake Memphremagog TMDL.

[56] The 2023 Lake Memphremagog, Tomifobia, and Coaticook Tactical Basin Plan can be accessed here: https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning/basin17

in the Lake Memphremagog TMDL. The following section of the report summarizes the state investments in clean water efforts in Basin 17, which includes all the Vermont land that drains to the St. Francis River.[57]

Vermont's Clean Water Investments in the Lake Memphremagog, Tomifobia, and Coaticook Rivers Basin

Click symbol to view description of accountability measures.

Reaching Lake Memphremagog's water quality goals requires investments across all land use sectors. The following figure summarizes state clean water investments in the Lake Memphremagog, Tomifobia, and Coaticook basin from SFY 2016 to 2023. Federal funds awarded to projects directly by federal agencies are not included in this report as they are outside the scope of this report.

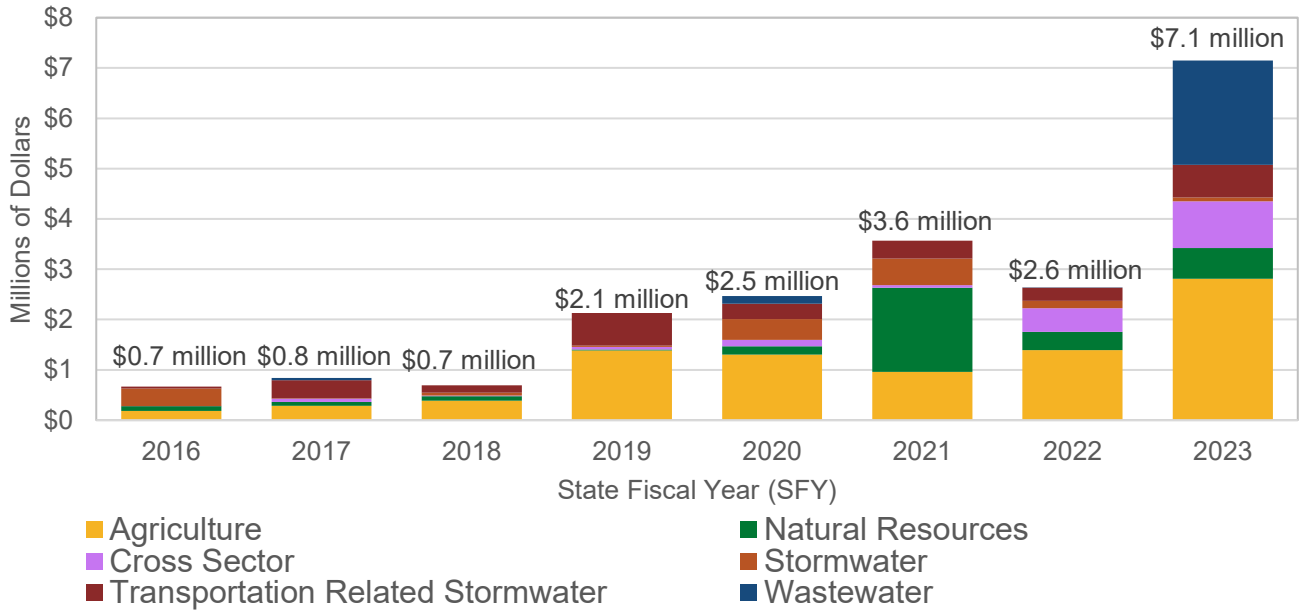


Figure 29: Total dollars awarded by State of Vermont agencies to clean water projects in the Lake Memphremagog, Tomifobia, and Coaticook Tactical Planning Basin by land use sector, SFY 2016–2023.

Explanation of Figure 29

The State of Vermont has invested over $20 million in the Lake Memphremagog, Tomifobia, and Coaticook basin since SFY 2016. From SFY 2016 to 2020, the greatest investments in the basin occurred in the developed lands and agriculture sectors. There was a large increase in natural resources funding in SFY 2021 due to the conservation of 129 acres of waterfront land at Bluffside Farm on Lake Memphremagog in Newport. This $1.4 million project was funded by a Clean Water State Revolving Fund Land Conservation Interim Financing Loan provided to Vermont Land Trust. This interim financing program provides partners with upfront access to capital to act on time-

[57] Funding presented in this chapter is representative of clean water project work across the entire Lake Memphremagog, Tomifobia, and Coaticook Rivers Tactical Planning Basin. Estimated phosphorus reductions presented in this chapter only include clean water project work that contributed to pollutant reductions in the Lake Memphremagog watershed covered by the TMDL.

sensitive conservation opportunities and affords partners time to secure funds to repay the loan over the course of five years. In SFY 2022 and 2023, the increase in cross sector funding is largely a result of funding awarded to the Clean Water Service Provider in the Lake Memphremagog basin. The large influx in state funding awarded to the wastewater sector in SFY 2023 includes over $1.7 million dollars awarded through the Clean Water State Revolving Fund to support the construction phase of a wastewater treatment facility refurbishment project serving Derby Line and located in Standstead, Québec.

Estimated Total Phosphorus Load Reductions in Lake Memphremagog Basin

Click symbol to view description of accountability measures.

The State of Vermont estimates the pollutant load reductions associated with clean water projects to track progress towards achieving water quality goals. The following figure summarizes the estimated total phosphorus load reductions associated with state, federal, and regulatory clean water projects in the Lake Memphremagog basin from SFY 2016 to 2023 by sector.[58]

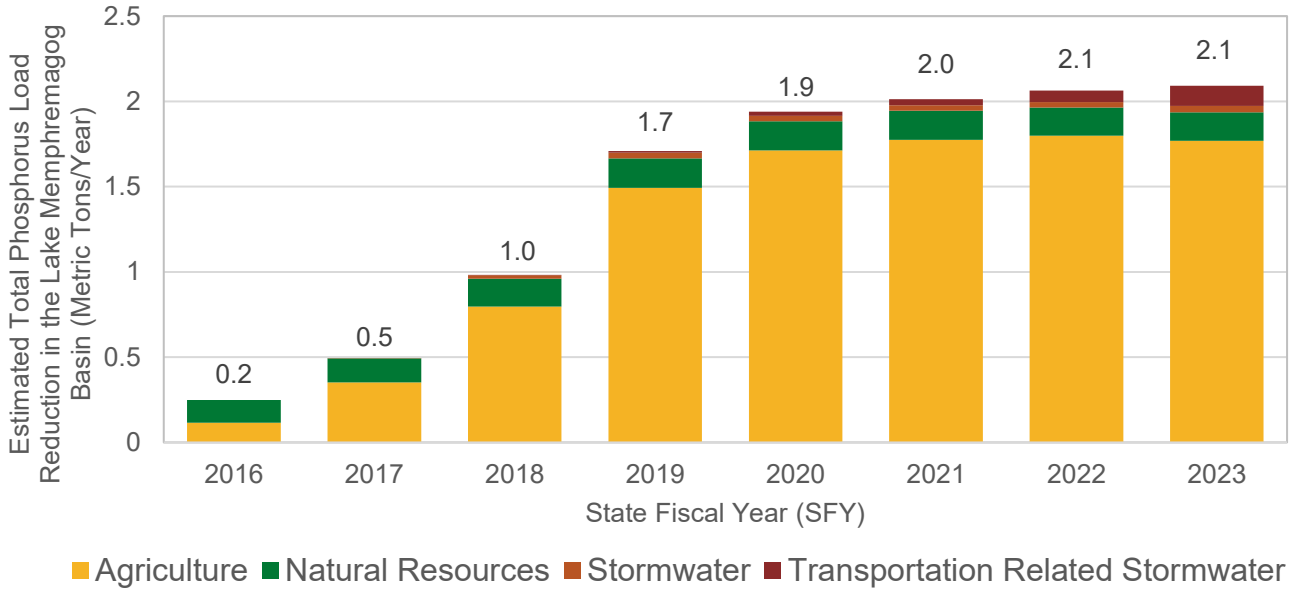


Figure 30: Annual estimated total phosphorus load reductions (metric tons per year) associated with state, federal, and regulatory clean water projects in the Lake Memphremagog basin in effect during SFY 2016–2023 by land use sector.[59]

Explanation of Figure 30

Estimated phosphorus reductions achieved by state funding programs, federal funding programs, and regulatory programs in the Lake Memphremagog basin have increased

[58] Phosphorus reductions can only be estimated for clean water projects that address pollution in the Lake Memphremagog basin that is covered by the Lake Memphremagog TMDL. Phosphorus reductions are not reported for clean water projects that treat pollution in the Tomifobia and Coaticook watersheds.

[59] Annual phosphorus load reductions are cumulative for all completed/operational projects based on start date and anticipated lifespan. Results of USDA-NRCS funded projects completed since SFY 2010 that are still in effect SFY 2016–2023 are included.

nearly twenty-fold from SFY 2016 to 2023. In recent reporting years, the pace of estimated phosphorus reduction progress has slowed. Changing rates of progress over the 20-year implementation timeframe are to be expected and are associated with swings in financial assistance levels, as well as the capacity of agencies and partners to administer funds, implement projects, and report outcomes. The following paragraphs provide some context to explain estimated phosphorus reductions reported by sector to date.

The estimated phosphorus reductions in the agricultural sector are largely from the implementation of annual field practices, such as cover crops, reduced- or no-till, and manure injection. Most of the phosphorus reductions required in the agricultural sector are tied to croplands, meaning that annual field practices are necessary to implement the TMDL. Annual practices must be implemented every year to sustain phosphorus reductions. Implementation of annual practices is dependent on land management decisions that can be influenced by a variety of farm business factors. This year, the data suggest a slight slowdown in phosphorus reductions associated with annual practices. This is likely the result of a combination of factors, including:

- Some practices can only be implemented for a limited number of years to be eligible for cost share. Many programs are also subject to funding caps, which may limit the reported acres of practice implementation.
- Many farms implement agricultural conservation practices without the support of cost share programs. The State is limited in its ability to capture the water quality benefits of practices implemented outside of cost share programs, and only some of these data are presented in this report.
- The multi-year federal Farm Bill governs much of the funding available to support agricultural practice implementation. Funds are often limited near the end of a Farm Bill cycle. The most recent Farm Bill was passed in 2018 and is set to expire at the end of calendar year 2023.
- Agricultural water quality programs have recently expanded in focus and emphasis to include holistic planning and implementation on farms, the results of which may not be fully reflected in available data.

In the natural resources sector, the increase in previously reported phosphorus reductions across all state fiscal years is largely attributable to incorporation of new phosphorus reduction accounting methods to capture the water quality benefits associated with the State of Vermont's Use Value Appraisal (UVA) Program on forestland parcels.[60] Forestland parcels that are actively enrolled in the UVA Program and have been inspected for program compliance meet Vermont's Acceptable Management Practices (AMPs), a set of forestland management criteria designed to maintain and protect water quality.[61] Newly established phosphorus accounting methods for other practices in the natural resources sector are in the process of being implemented, and will be reflected in future years of reporting. These new methods will be applied to newly

[60] For details on phosphorus accounting for UVA parcels, please see the Standard Operating Procedures for Tracking & Accounting of Natural Resources Restoration Projects: https://dec.vermont.gov/water-investment/cwi/projects/tracking-accounting#SOP

[61] Phosphorus reductions are only accounting for forestland parcels that enrolled in the UVA program after the TMDL baseline periods.

completed projects, as well as applied to fill gaps for previously completed projects as data availability allows.

Estimated phosphorus reductions in the stormwater and transportation related stormwater land use sectors are contributing an increasing proportion of total estimated phosphorus reductions in recent years. This progress can be attributed to increased implementation of several regulatory programs designed to reduce and mitigate stormwater pollution from developed lands and roads. In the stormwater sector, operational stormwater permits regulate stormwater discharges caused by new development, redevelopment, and three-acre sites. In the transportation related stormwater sector, the Municipal Roads General Permit (MRGP) regulates stormwater related erosion on municipally owned roads. Regulatory programs are at varying stages of implementation, and continued expansion of compliance will increase estimated phosphorus reductions in future years.[62]

In the Lake Memphremagog basin, it is likely that the slowing trend of estimated annual phosphorus reduction progress is in part a reflection of early adoption of easy to implement, ready to construct projects. As implementation of the TMDL continues, identification and implementation of additional projects, including in some cases more complex and involved projects, will need to be completed to continue working towards reaching Vermont's water quality goals in the basin. The variability of implementation rates across years also underscores the importance of investing in program and partner capacity to broaden the reach and impact of clean water project implementation.

[62] For more information on regulatory stormwater programs in Vermont, visit: https://dec.vermont.gov/watershed/stormwater/permit-information-applications-fees

Lake Memphremagog TMDL Progress

Click symbol to view description of accountability measures.

The Lake Memphremagog TMDL states net phosphorus loading to Lake Memphremagog must be reduced from 52.7 metric tons per year to 37.4 metric tons per year by the end of calendar year 2037 to achieve Vermont's water quality standards. The following figure summarizes progress towards achieving the Lake Memphremagog TMDL.

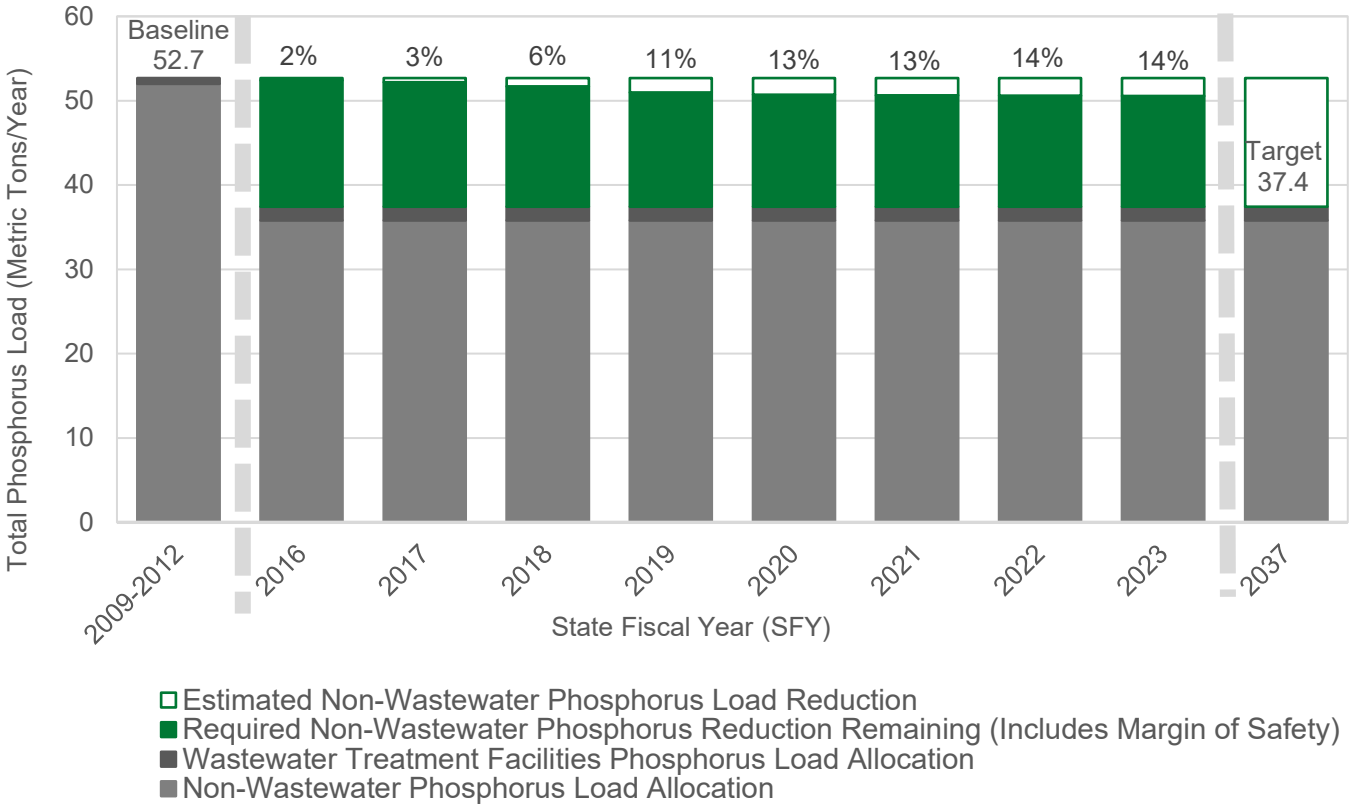


Figure 31: Estimated total phosphorus load reductions in effect during SFY 2016–2023 in the context of the Lake Memphremagog TMDL total phosphorus baseline and target total phosphorus load in metric tons per year.

Explanation of Figure 31

State and federal funding programs, and regulatory programs have reduced an estimated 2.1 metric tons of phosphorus loading to Lake Memphremagog in SFY 2023, which represents approximately 14 percent of the required reduction. Phosphorus reductions are expected to increase in the coming years for at least the following reasons:

1. An influx in federal funding under ARPA, the Bipartisan Infrastructure Law, and Inflation Reduction Act, increased Clean Water Fund revenue enacted under Act 76 of 2019, and investment in the capacity of clean water partners will drive project implementation across sectors.[63] While many of these funding programs and capacity initiatives are underway, the results of these investments will not be fully

[63] For more information on the Clean Water Budget, visit: https://dec.vermont.gov/water-investment/cwi/board

reflected in estimated phosphorus reductions until projects are completed, which may take multiple years.

2. The State of Vermont has been building and expanding clean water regulatory, financial, and technical assistance programs since SFY 2016. Many regulatory programs are now in place that will drive phosphorus reductions from agricultural and developed lands. In some cases, the results of these regulatory programs have yet to be reflected in project-level reported data. For example, under the Three-Acre General Permit, landowners are in the process of obtaining permit coverage near term, and construction of appropriate treatment is required within five years of permit authorization.
3. The State has published methods for quantifying phosphorus reductions for agricultural, natural resources, and developed lands sector clean water practices. New methods were recently established to fill gaps in capturing the phosphorus reduction benefit of several practices, particularly in the natural resources sector. These new methods are in the process of being implemented and will be reflected in future years of reporting for newly completed projects as well as applied to fill gaps for prior completed projects.

Monitored Total Phosphorus Load from Vermont Wastewater Treatment Facilities in the Lake Memphremagog Basin

The phosphorus load allocations in the Lake Memphremagog TMDL are separated into wastewater wasteload and non-wastewater load allocations. Tracking progress towards reaching the non-wastewater load allocation target is reflected in the previous TMDL progress figures. The wastewater wasteload allocation is tracked through *measured* water quality of effluent from the wastewater treatment facilities located within the Lake Memphremagog basin. The following figure shows the target wastewater wasteload allocation for the Lake Memphremagog TMDL and the measured total phosphorus from wastewater treatment facilities each year.

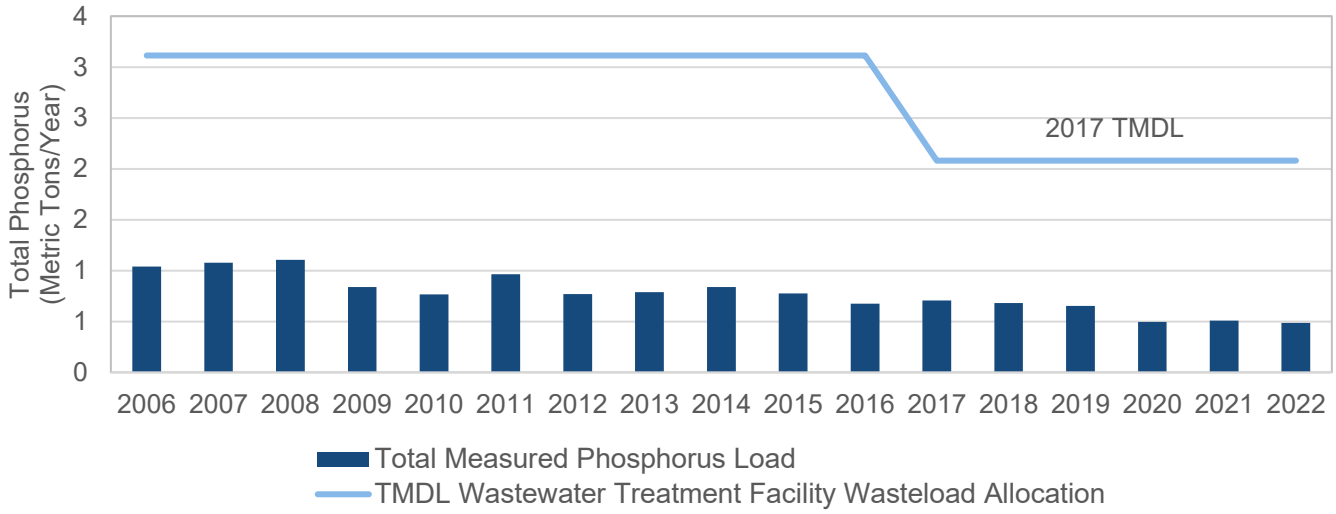


Figure 32: Measured total phosphorus load (metric tons per year) from Vermont wastewater treatment facilities draining to Lake Memphremagog and the permitted wasteload of wastewater treatment facilities in the Lake Memphremagog Basin, calendar year 2006–2022.

Explanation of Figure 32

The total average annual phosphorus loading into Lake Memphremagog originating from Vermont wastewater treatment facilities was approximately 3.1 metric tons per year during the Lake Memphremagog TMDL baseline period of 2009–2012, representing approximately four percent of total phosphorus loading to Lake Memphremagog from Vermont sources. During the baseline period, measured total annual phosphorus loading from wastewater treatment facilities was well below the permitted phosphorus limit of 3.1 metric tons. The 2017 Lake Memphremagog TMDL for Vermont reduced the wastewater treatment facility permitted wasteload to 2.08 metric tons, which is intended to achieve the overall required phosphorus load allocation while allowing for some development and growth over the TMDL implementation timeframe. Discharge monitoring indicates Vermont wastewater treatment facilities in the Lake Memphremagog basin contributed approximately 0.49 metric tons of total phosphorus load to Lake Memphremagog in calendar year 2022, representing only 23 percent of the permitted wasteload under the current TMDL. These data demonstrate a consistent trend of measured total annual phosphorus load from Vermont wastewater treatment facilities, overall, well below the wasteload allocation.

Chapter 5: Connecticut River Basin Clean Water Investments and Results

Long Island Sound TMDL

The Connecticut River is New England's longest river. It runs through four states: Vermont, New Hampshire, Massachusetts, and Connecticut. Seven Tactical Planning Basins in the eastern half of the State of Vermont drain to the Connecticut River, which eventually drains to the Long Island Sound. The Long Island Sound is a large estuary that drains a total watershed of over 16,000 square miles, including the Connecticut River as well as areas of Rhode Island and New York according to the Long Island Sound TMDL (Figure 33).[64]

The Long Island Sound is impaired due to nitrogen, which can cause cyanobacteria blooms and hypoxia (low dissolved oxygen concentrations in the water column) leading to "dead zones" that threaten marine life. To address the excess nitrogen and resulting hypoxia, the EPA approved *A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound* in 2001 to define the nitrogen reductions necessary to meet water quality standards in the Sound.

Vermont's clean water efforts to restore, protect, and enhance water quality in the Connecticut River and its tributaries are also contributing to water quality progress for Long Island Sound. The following section of the report summarizes state investments in clean water efforts in the Connecticut River basin. Currently, there are no methods in place to estimate total nitrogen load reductions to the Connecticut River basin, but these are planned to be established in the coming years.

Figure 33: Map of the Long Island Sound watershed.
Credit: New England Interstate Water Pollution Control Commission.

[64] A Total Maximum Daily Load Analysis to Achieve Water Quality Standards for Dissolved Oxygen in Long Island Sound can be accessed here: http://longislandsoundstudy.net/wp-content/uploads/2010/03/Tmdl.pdf http://longislandsoundstudy.net/wp-content/uploads/2010/03/Tmdl.pdf

Vermont's Clean Water Investments in the Connecticut River Basin

Click symbol to view description of accountability measures.

Reaching the Connecticut River basin's water quality goals requires investments across all land use sectors. The following figure summarizes state clean water investments in the Connecticut River basin from SFY 2016 to 2023. Federal funds awarded to projects directly by federal agencies are not included in this report as they are outside the scope of this report.

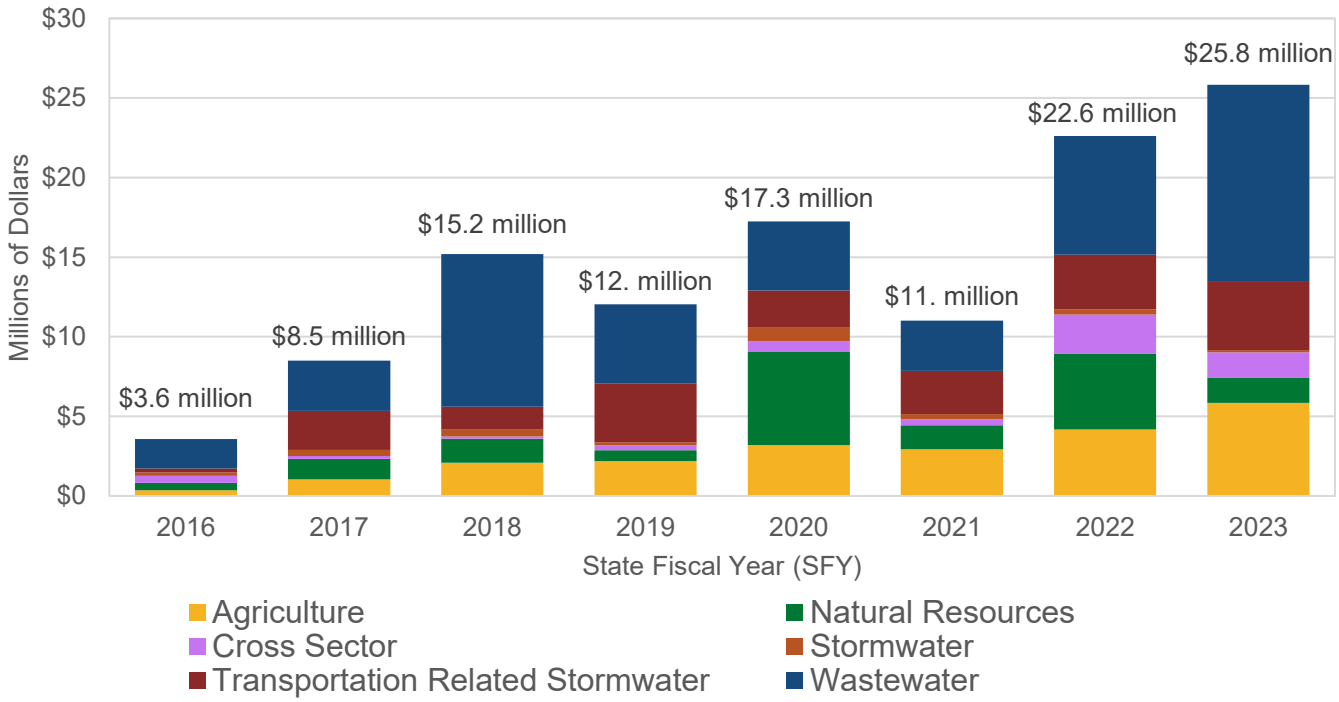


Figure 34: Total dollars awarded by State of Vermont agencies to clean water projects in the Connecticut River basin by land use sector, SFY 2016–2023.

Explanation of Figure 34

The State of Vermont has invested nearly $116 million in clean water projects in the Connecticut River basin since SFY 2016. Clean water funding in the Connecticut River basin varies from year-to-year based on project readiness and funding award rounds. Wastewater investments in SFY 2018, 2022, and 2023 included several construction phase wastewater treatment facility refurbishments and combined sewer overflow (CSO) abatement projects funded primarily through the Clean Water State Revolving Fund (CWSRF) financing and Capital Bill funds. The large increase in natural resources funding in SFY 2020 is in part reflective of a $4 million investment to conserve forestland located in the towns of Chittenden, Mendon, and Killington funded by a CWSRF Land Conservation Interim Financing Loan. This interim financing program provides partners with upfront access to capital to act on time-sensitive conservation opportunities and affords partners time to secure funds to repay the loan over the course of five years.

Future Total Nitrogen Load Reduction Tracking

Nitrogen reduction estimates cannot be reported for the Connecticut River basin, as the State of Vermont does not yet have baseline nitrogen loading rates or nitrogen reduction efficiencies for clean water projects in the Connecticut River basin. EPA-supported efforts are underway to develop consistent methods for all five states covered under the Long Island Sound TMDL to estimate nitrogen reductions for clean water projects. Vermont will set a schedule to publish methods to account for nitrogen reductions in the Connecticut River basin to comply with Vermont's Clean Water Service Delivery Act, Act 76 of 2019 (10 V.S.A. § 923) and to align with ongoing five state nitrogen tracking coordination efforts.

Chapter 6: Context and Takeaways

Water pollutants that enter Vermont's waters, including nutrient and sediment pollution, can lead to local and regional water quality issues. Excess phosphorus loading can result in potentially harmful cyanobacteria blooms in Lake Champlain, Lake Memphremagog, and inland lakes around the state. Excess nitrogen loading contributes to low dissolved oxygen and dead zones in the Long Island Sound.

Most sources of water pollution in Vermont are from nonpoint sources where rainfall and snowmelt carry pollution from the land surface into waterways. Due to the dispersed nature of nonpoint source pollution, realizing our water quality goals requires actions of various scales across all land uses to mitigate water pollution. The dispersed nature of pollution sources from the landscape also means that many external landscape-scale factors can affect the rate of progress. The success of this work also depends on the willingness of the public to adopt clean water projects and a well-supported, diverse network of partners to develop and implement projects. The following sections provide important context for interpreting results summarized in this report and the outlook for clean water progress in Vermont.

Modeled vs. Measured

The State of Vermont estimates pollutant reductions associated with clean water projects. Estimates are currently available for phosphorus reductions for projects located in the Lake Champlain and Lake Memphremagog basins, summarized in Chapters 3 and 4 of this report. These *modeled* estimates provide an incremental measure of progress at the project-level, however, many landscape-level factors influence on-the-ground water quality conditions. *Measured* water quality through monitoring is the ultimate indicator of clean water progress—whether the goal is protection of high-quality waters or the restoration of impaired waters.

The State of Vermont monitors water quality to assess the status and trends of its surface waters, posts data online, and reports the status of Vermont's waters on a biennial basis.[65] The State of Vermont also supports local monitoring initiatives through its LaRosa Partnership Program and participates in the Lake Champlain Basin Program's Long Term Monitoring Project to monitor the water quality conditions of Lake Champlain, including the status and trends of phosphorus loading.[66,67] Monitoring data and water quality status and trends are integrated into State of Vermont Tactical Basin Plans, which inform clean water funding and project implementation strategies. Tactical Basin Plans employ an adaptive management approach by considering measures of clean water project progress, water quality status and trends, and changes in land use conditions impacting water quality.

Factors Influencing Water Quality Progress

The state and federal funding programs and regulatory programs summarized in this report are designed to restore, enhance, and protect water quality, but there are many landscape-scale

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[65] Visit the Department of Environmental Conservation's Monitoring and Assessment webpage for more information, available here: https://dec.vermont.gov/watershed/map

[66] Visit the LaRosa Partnership Program webpage for more information, available here: https://dec.vermont.gov/watershed/map/monitor/larosa

[67] Visit the Lake Champlain Long Term Monitoring Project webpage for more information, available here: https://dec.vermont.gov/watershed/lakes-ponds/monitor/lake-champlain

factors beyond our control that influence progress in reaching our water quality goals. Climate change and historical pollution are two primary challenges influencing water quality progress. In addition to landscape-level factors, the success of our clean water efforts depends on the capacity of Vermont's clean water workforce to develop, implement, and maintain projects. The following sections explain how these factors influence the outputs and outcomes summarized in this report.

Climate Change

Climate change's impact on temperature and precipitation patterns affects water quality. This underscores the importance of continued assessment of water quality progress through monitoring data and consideration for external factors that may be impacting measured outcomes. Data for the past several decades show long-term shifts in temperature, precipitation, and the risks of severe weather in Vermont.[68] As climate change continues, it is important to understand the impacts on Vermont and its waters — namely climate change is increasing the frequency and intensity of storms and flooding events and increasing air and water temperatures. Above average pollutant loads resulting from flood events and high temperatures can also increase the incidence and severity of cyanobacteria blooms.

Climate Change and Cyanobacteria Blooms

Climate change is predicted to affect several key factors that regulate cyanobacteria growth — temperature, nutrient availability, and water stability. Warmer summer temperatures and shorter, warmer winters will increase the length of time that cyanobacteria can proliferate each year. The cyanobacteria monitoring program on Lake Champlain since 2003 has documented that blooms are occurring earlier in the summer and persisting later into the fall. The monitoring season now begins about two weeks earlier than it did in 2003 and recent data show blooms occurring into mid-October. Scientists in Vermont and elsewhere are noting the incidence of cyanobacteria blooms at lower than expected phosphorus concentrations, indicating that the factors noted above may contribute to the incidence of bloom condition. The State of Vermont will have little control over global factors that drive climate change-related weather patterns and precipitation. Therefore, Vermont will need to continue its focus on land-use management and control of nutrient pollution loading to surface waters to reduce the impact of cyanobacteria blooms.

Climate Change and Increased Precipitation

Climate data indicate statistically significant increase in frequency of intense storms and annual total precipitation since 1940. Water quality monitoring shows that storm events often correlate with peaks in sediment and nutrient loading to lakes. For example, phosphorus readily binds to soil, and when soil erodes into our waters, it carries phosphorus with it. Change in precipitation patterns may increase water pollution by increasing:

- Erosion of unstable road networks;
- Erosion and hazards of unstable river and streambanks;
- Erosion of lakeshores;
- Volume of runoff from agricultural fields and production areas;

[68] Vermont Climate Action Office (CAO) website: https://climatechange.vermont.gov/

- Volume of stormwater runoff from impervious surfaces, such as roads, parking lots, and rooftops; and
- Incidents of combined sewer overflows.

The summer 2023 flood events demonstrated the harms of climate-driven increased precipitation on Vermont's communities and environment. Heavy, prolonged rainfall resulted in major flooding statewide. Three to nine inches of rainfall was observed across the state over a 48-hour period in July.[69] Streams and rivers rose quickly — high waters and flood hazards led to displacement of people, infrastructure failure, property damage, crop loss, and peaks in water pollution. High flow events like this deliver significant amounts of sediment and other pollutants to waterways.[70] In the hours and days following a severe flooding event, temporary reductions in water quality and high measurements of sediment and phosphorus in waters are expected. Longer term, this type of event delivers large amounts of phosphorus laden sediments, which settle to the lake bottom and can contribute to internal phosphorus loading in subsequent years.

Climate-driven changes in precipitation patterns highlight the importance of climate adaptation and flood resilience. Clean water projects support climate adaptation and flood resilience in many ways, including projects that:

- Protect and restore natural resources, such as wetlands, floodplains, and lakeshores, to slow down, spread out, and soak up floodwaters;
- Implement agricultural field practices to improve soil health, water infiltration, and carbon sequestration;
- Manage large forestland blocks to protect biodiversity, sequester carbon, and mitigate flood related erosion;
- Use updated road, bridge, and culvert design standards that are able to withstand higher river and stream flows and more intense storms;
- Implement Stormwater Management Manual standards to emphasize the importance of infiltrating stormwater runoff from developed lands into soils; and
- Invest in wastewater infrastructure improvements to reduce flood related damage and limit the occurrence and severity of combined sewer overflow events.

It is important to consider climate change's impact on Vermont's clean water work when evaluating progress. Uncertainty in how climate change will influence pollution delivered to waterways is incorporated into pollution reduction targets articulated in large-scale nutrient TMDLs.[71] There are reasons to be hopeful that Vermont can meet its water quality goals despite climate change with sustained effort and investment. The more clean water projects implemented, the more resilient our waterways will be to extreme weather events and floods, which also protects Vermont's communities and built infrastructure from flood hazards. Realizing our water quality goals requires sustained investment and will continue to yield multiple benefits, including climate adaptation and flood resilience.

[69] National Weather Service: https://www.weather.gov/btv/The-Great-Vermont-Flood-of-10-11-July-2023-Preliminary-Meteorological-Summary

[70] Lake Champlain Basin Program: https://www.lcbp.org/our-goals/thriving-communities/flooding/2023-flooding/

[71] The Lake Champlain TMDL model simulated climate change scenarios and added a five percent margin of safety to each lake segment's loading capacity to address the likely increases in phosphorus loading from climate change, while the Lake Memphremagog model added an eight percent margin of safety.

Legacy (Historical) Pollution Sources

Clean water investments primarily address external loading, which is pollution originating from the land surface, to minimize the volume of nutrients and sediment deposited into adjacent waterways. Sediments and nutrients like phosphorus tend to accumulate at the bottom of lakes. When phosphorus in lakebed sediments moves into the water column, it is called internal loading.[72] Vermont's long history of logging and agriculture as two dominant land management approaches have resulted in a build-up of legacy phosphorus in lake systems that contributes to internal loading. As a result, in some lakes, a substantial lag time between the implementation of clean water projects and the realization of measurable water quality improvements is expected. This highlights the importance of sustained efforts to minimize additional nutrient and sediment pollution to ensure long term health of Vermont's waters. In some cases, addressing internal loading from legacy phosphorus concentrations may be needed in combination with continued work to mitigate external loading to achieve desired water quality outcomes and reduce the occurrence of cyanobacteria blooms.

Vermont's Clean Water Workforce

Vermont's work to improve water quality is led by and relies upon a network of partner organizations and project implementers who:

- Participate in clean water project planning and identification efforts;
- Host clean water projects on their property;
- Provide and/or administer clean water funding;
- Complete clean water project work, including development, design, implementation, and maintenance; and
- Report back to the state on the outcomes of projects.

[72] James, W. (2016) "Internal P Loading: A Persistent Management Problem in Lake Recovery". North American Lake Management Society. Available at: https://www.nalms.org/wp-content/uploads/2017/01/36-1-3.pdf

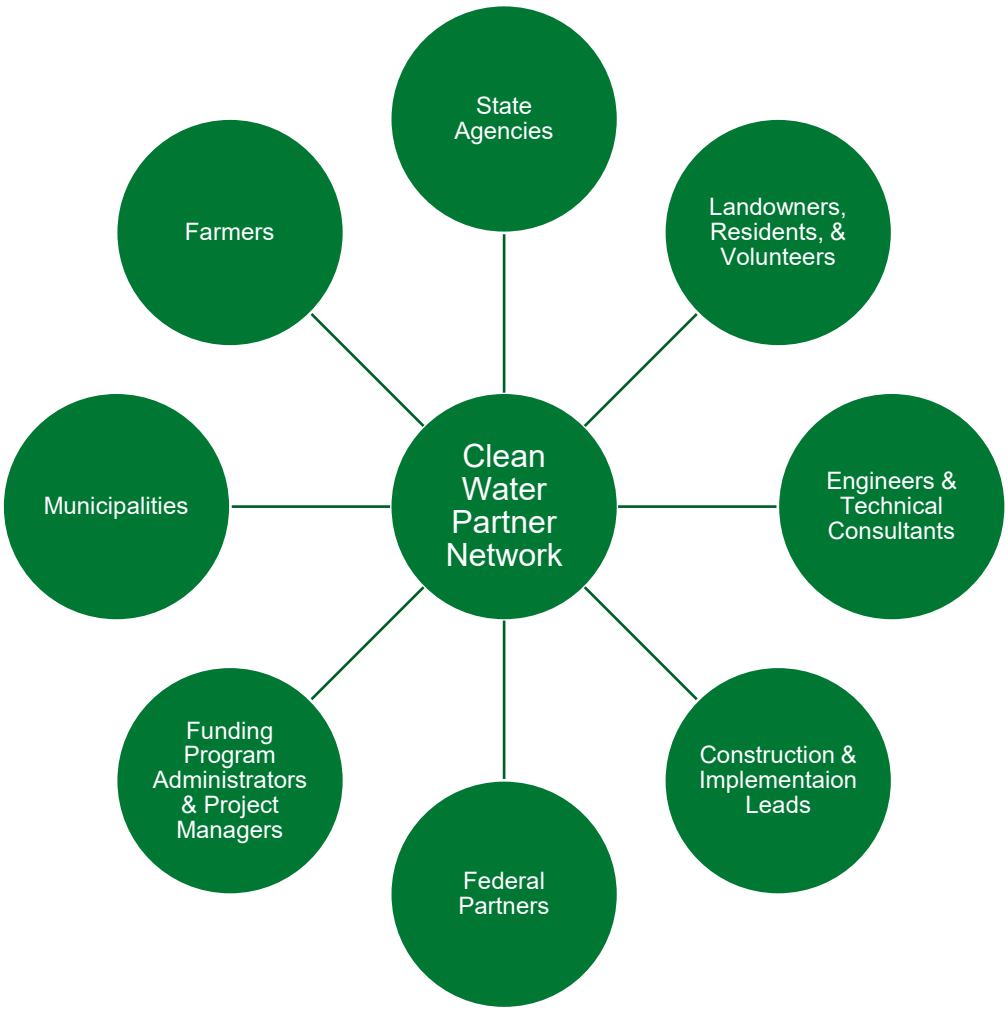

Figure 35: Clean Water Partners in Vermont

Recent unprecedented increases in state and federal funding for clean water efforts, combined with a need to increase the pace of progress to meet clean water goals, necessitates growth in the workforce's capacity. The success of the Clean Water Initiative and clean water projects across land use sectors requires the network of partners to be numerous, diverse, well-trained, and well-resourced.

For many years, the Lake Champlain Basin Program and the Vermont Agency of Agriculture, Food & Markets have invested in partner capacity focused on the clean water network, although the focus has been limited geographically, or to the agricultural sector. In 2023, the Agency of Natural Resources joined this effort by launching its own Clean Water Workforce Capacity Development Initiative. The results and impacts of these collective investments in capacity development will be reflected in future years of this report.

Outlook for Reaching Vermont's Water Quality Goals

Continued effort, investment, capacity building, and coordination are critical to the state reaching its water quality goals. The state is making a substantial investment in clean water projects that yield many additional benefits, including flood resilience and climate adaptation. Maintaining the

level of clean water investment and regulation is critical to reach our water quality goals, as it will take time for impaired waterways to recover after decades of excess pollution. Trends in reported outputs and outcomes are expected to increase in the coming years for the following reasons:

- State funding programs at DEC have shifted to block grant structures that rely on regional partners to manage and administer funding of individual projects. The transition to regional administration of clean water funding is anticipated to empower community partners, reduce bottlenecks, and increase the impact of clean water investments.
- Vermont has received an influx in federal funding under ARPA, the Bipartisan Infrastructure Law, and the Inflation Reduction Act, as well as increased Clean Water Fund revenue enacted under Act 76 of 2019. Program expansion supported by this funding will drive clean water project implementation across sectors.
- The State of Vermont has been expanding clean water regulatory, financial, and technical assistance programs since SFY 2016. Many regulatory programs are now in place that will drive meaningful progress in the agriculture and developed lands sectors.
- Throughout this report, there are areas where capacity constraints are resulting in lags in clean water investments, project work, and reported results. Indirect investments in network capacity are expected to mitigate some of these lag times and increase the rate of progress.
- The State is expanding its ability to fully capture results in its tracking and reporting, such as estimating phosphorus reductions for additional project types in the natural resources sector. Enhanced tracking and reporting will provide a more complete picture of progress on the ground.

This report serves as a useful tool to provide accountability on the state's clean water progress and to inform adaptive management. By taking an adaptive management approach, the state will continue to identify and prioritize its resources to break down barriers to project implementation and clean water progress. Clean water project implementation is an important piece of climate resilience work and clean water projects have co-benefits like increased flood resilience, improved carbon sequestration, better soil health, and improved habitat function and biodiversity. In addition to achieving water quality goals, Vermont's work to improve water quality directly supports climate adaptation and flood mitigation, which will increase the state's resilience to future climate related stressors.

Appendix A: Act 76 of 2019

Vermont's Clean Water Service Delivery Act

Act 76 of 2019 established a water quality project delivery framework to support Vermont's clean water goals and secured a new long-term funding source for the Clean Water Fund. Act 76 established four complementary grant programs intended to support implementation of the Clean Water Initiative by addressing sources of pollution through both regulatory and non-regulatory mechanisms: Water Quality Restoration Formula Grants, Water Quality Enhancement Grants, Municipal Stormwater Implementation Grants, and Developed Lands Implementation Grants.[73] Act 76 also continues support for other Clean Water Fund priorities, such as Agency of Agriculture, Food & Markets' water quality grants to partners and farmers.

The grant programs created under Act 76 began in state fiscal year (SFY) 2023 and funding associated with these programs is integrated into the statewide funding totals presented in Chapter 2. Annual funding levels for all four grant programs established under Act 76 are set by the Clean Water Board through the annual Clean Water Budget development process.[74] The following sections summarize the administration of these funding programs. Data are being collected on the funding and outcomes of these grant programs to assess adequacy of funding levels. Currently, these grant programs are adequately funding the implementation of the Clean Water Initiative factoring the recent influx of federal funds and capacity available in the network to implement this work. No change is recommended at this time to the Water Quality Enhancement Grants funding limit. The State will continue to assess the adequacy of funding and report an annual recommendation.

Water Quality Restoration Formula Grant Program

Act 76 established regional organizations called Clean Water Service Providers (CWSPs) for each Tactical Planning Basin in the Lake Champlain and Lake Memphremagog basins. CWSPs are responsible for partnering with Basin Water Quality Councils and project implementers to oversee the identification, funding, implementation, operation, and maintenance of non-regulatory clean water projects to meet non-regulatory phosphorus reduction targets with funding provided through the Water Quality Restoration Formula Grant Program.

Water Quality Restoration Formula Grants are awarded annually to each CWSP. Formula Grants funds are allocated based on the Water Quality Restoration Formula Grant Targets and Fund Allocation Methodology. The Fund Allocation Methodology considers the annual pollutant reduction allocation established for the CWSP multiplied by the standard cost for pollutant reduction, with phosphorus reduction allocations and award values scaled down to available funds.[75] The standard cost for pollution reduction is determined by project type category, and

[73] Act 76 of 2019 as enacted is available here: https://dec.vermont.gov/water-investment/statues-rules-policies/act-76/law-rule-guidance

[74] For more information on the Clean Water Board and Budget process, visit: https://dec.vermont.gov/water-investment/cwi/board

[75] To learn more about and view the Water Quality Restoration Formula Grant Targets and Fund Allocation Methodology, visit: https://dec.vermont.gov/water-investment/statues-rules-policies/act-76/resources The Methodology will be refined periodically by ANR-DEC as improved information and data become available.

includes the costs of project design and construction. Pollution reduction allocations are further downsized to make room in the awards to cover costs associated with administration, reporting, and project identification, development, inspection, verification, operation, and maintenance (O&M). O&M of clean water projects ensures installed practices continue to contribute phosphorus reductions for the duration of the project's functional life. Total Formula Grant estimated need based on phosphorus reduction targets will be further refined in future Clean Water Budget cycles, with continued collection of data on project costs related to project outputs/phosphorus reductions. ANR-DEC will continue to work with O&M partners to improve O&M cost estimates and establish quantitative budget targets in future years.

Eligible non-regulatory clean water project types that can be funded under Water Quality Restoration Formula Grants are described in the ANR-DEC Clean Water Initiative Program's (CWIP) Funding Policy.[76] This includes projects across a range of sectors including floodplain and stream restoration, buffer plantings, stormwater management improvements, wetlands restoration, and lake shoreline restoration. CWSPs and their Basin Water Quality Councils will be responsible for determining how Formula Grant funds are awarded at the project-level, within their respective basins, using state-derived Guidance.

Water Quality Restoration Formula Grants are administered by the ANR-DEC CWIP with technical project management from the ANR-DEC Watershed Planning Program (WPP).

Water Quality Enhancement Grant Program

The statutory intent of the Water Quality Enhancement Grant Program established through Act 76 is to protect high quality waters, maintain or improve water quality, restore degraded or stressed waters, create resilient watersheds and communities, and support the public's use and enjoyment of the state's waters. This is achieved in SFY 2023 through administration of a set of sub-initiatives such as: Dam Removal Design and Implementation Block Grant, Woody Riparian Buffer Block Grant, River Corridor Easements, Multi-Sector Assessments, Enhancement Development, Design & Implementation Block Grant, and Regional Conservation Partnership Program (RCPP) Wetland Incentives. Enhancement Grant Program sub-initiatives vary in structure between grants or contracts depending on the scope of work, and some funding is administered, allocated, and awarded at the project-level by a Funding Program Administrator through a block grant structure. The intent of the Water Quality Enhancement Grant Program suite of sub-initiatives is to support the life cycle of projects from identification to development through implementation.

Eligible non-regulatory clean water project types that can be funded under Water Quality Enhancement Grants are described in the ANR-DEC Clean Water Initiative Program's (CWIP) Funding Policy.[76] This includes projects across a range of sectors including floodplain and stream restoration, buffer plantings, stormwater management improvements, wetlands restoration, and lake shoreline restoration.

The Water Quality Enhancement Grants minimum funding level is 20 percent of the annual balance of the Clean Water Fund, provided that the maximum amount recommended shall not exceed $5,000,000. The SFY 2023 budget funded this grant category at the full $5,000,000 maximum.

[76] The CWIP Funding Policy is available here: https://dec.vermont.gov/water-investment/cwi/grants

Water Quality Enhancement Grants are administered by the ANR-DEC CWIP with technical project management from the ANR-DEC CWIP and the Watershed Management Division.

Developed Lands Implementation Grant Program

The Developed Lands Implementation Grant Program will provide grants or financing to support individuals required comply with stormwater regulatory requirements that are necessary to achieve water quality standards. The program will support Three-Acre General Permit obtainment and compliance through design and implementation. Initial funding to support this program is through American Rescue Plan Act (ARPA) federal funds directly appropriated to ANR-DEC from SFY 2022 through 2024 which will be encumbered and expended through December 2026. Initial administration of these funds will be through DEC's Three-Acre Permit Obtainment Assistance program, which will provide beneficiary payments to landowners to support the engineering and permitting costs associated with permit obtainment. Ultimately, a financing structure will replace ARPA programs to serve as the Developed Lands Implementation Grant Program, to be designed and administered by the ANR-DEC Water Infrastructure Finance Program.

The Developed Lands Implementation Grant Program is initially administered and managed by the ANR-DEC CWIP but will transition to the ANR-DEC Water Infrastructure Finance Program as a financing structure is developed in the future.

Municipal Stormwater Implementation Grant Program

Act 76 established the Municipal Stormwater Implementation Grant Program to provide grants to municipalities to assist with their compliance efforts under regulatory stormwater permits. 10 V.S.A § 928 states: "The Secretary shall administer a Municipal Stormwater Implementation Grant Program to provide grants to any municipality required under section 1264 of this title to obtain or seek coverage under [1] the municipal roads general permit (MRGP), [2] the municipal separate storm sewer systems (MS4) permit, [3] a permit for impervious surface of three acres or more, or a permit required by the Secretary to reduce the adverse impacts to water quality of a discharge or stormwater runoff."

The statutory intent of the Municipal Stormwater Implementation Grant Program is met through several complementary initiatives. The Vermont Agency of Transportation's (VTrans) *Municipal Roads Grants-in-Aid* and *Municipal Better Roads* programs will continue to support implementation of the Municipal Roads General Stormwater permit requirements ([1]). DEC's Municipal Separate Storm Sewer System (MS4) Community Formula Grant program will support implementation of the MS4 stormwater requirements ([2]). DEC's Green Schools Initiative, DEC's Three-Acre Public Private Partnership (P3), and DEC's Three-Acre Permit Obtainment Assistance programs will support municipalities in meeting Three-Acre General Permit stormwater requirements ([3]) .

MRGP sub-initiatives are administered and managed by VTrans. MS4 and Three-Acre Permit sub-initiatives are administered and managed by ANR-DEC CWIP.

Appendix B: The Northern Lake Champlain Direct Drainages (Basin 5) TMDL Implementation 2023 Progress Report

The Accountability Framework of the 2016 *Phosphorus Total Maximum Daily Loads (TMDL) for Vermont Segments of Lake Champlain* ensures TMDL implementation moves forward at a steady rate. A major driver of the Accountability Framework is the Vermont Department of Environmental Conservation's (DEC) development of basin-specific Tactical Basin Plans (TBP). The TBPs are developed on a five-year rotating basis and include Implementation Tables that identify priority actions needed to implement the TMDL. It is through review of the Implementation Tables, and the progress made in accomplishing the tasks that U.S. Environmental Protection Agency (EPA) tracks implementation progress in each basin. To facilitate EPA's evaluation of progress, DEC describes the status of each strategy midway through (2.5 years) and at the conclusion of the five-year planning cycle in interim and final report cards, respectively.

Appendix B is the interim report card for the 2020 Northern Lake Champlain Direct Basin. The 2.5-year reporting period began in January 2021 coincident with the publication of the 2020 Northern Lake Champlain Direct Basin[77] and goes through June 30, 2023. Data in this report align with this 2.5-year period (SFY 2021–SFY 2023) available through the Clean Water Reporting Framework (CWRF).

Due to a change in the TBP development schedule, the Watershed Planning Program will be accelerating the development of the next iteration of the Northern Lake Champlain Direct Drainages (Basin 5) TBP to be completed by the end of 2024 instead of the end of 2025. As such, the reporting period for Basin 5 during this period will be curtailed from a 5-year period to a 4-year period, which will result in the final TBP Report Card issuance concurrent with the Clean Water Initiative 2024 Performance Report. It should be noted that the subsequent Basin 5 TBP development will then progress on a 5-year cycle going forward, and the next iteration of the Basin 5 TBP will be completed by the end of 2029 instead of 2030, along with the corresponding TMDL "phase 4" content and final report card for that next 5-year reporting period.

The following sections describe progress towards completing strategies in the 2020 Northern Lake Champlain Direct TBP Implementation Table. Each strategy is organized by one of five major sectors – agriculture, developed lands, natural resources, forestry, and wastewater. Progress described for each strategy includes status (defined in Table B-1) as well as an explanation of actions taken. The explanation describes how the Agency and partners supported the strategy and resulting outcomes that together show that meaningful results were achieved. The outcomes include performance measures for Agency-supported assistance that were collected as part of the Accountability Framework (see Accountability Measures).

Phosphorus reductions for the Northern Lake Champlain basin were estimated to have met about 31 percent of the basin's total load reduction targets set by the TMDL, based on basin-

[77] The 2020 Northern Lake Champlain Direct Drainages Tactical Basin Plan available at: https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning/basin5

level data summarized in the clean water reporting framework. While this report card does not discuss trends in annual phosphorus reductions, estimated trends since SFY 2016 can be found by basin and by sector in the TMDL reduction estimates interactive online report. Trends and five-year phosphorus reduction targets will also be published and further discussed in the 2024 Basin 5 TBP's Lake Champlain TMDL Phase 3, and any gaps will be noted in the final progress report.

Basin 5 Update

The 2020 TBP strategies were evaluated and their associated actions were assigned a status condition using the rationale described in Table B-1. Of the 53 strategies identified to date, 9 have been completed, 40 are ongoing, three are in progress, and one has not been started (Figure B-1). The likelihood of completion by the final progress report was evaluated as low, medium or high for the in progress and not started strategies.

The ongoing strategies have to date achieved the expected results, but additional work is expected before the final progress report is submitted. Of the three actions that are in progress, all have a medium or high likelihood of being completed by 2024. The strategy that has not been started will most likely be replaced by another approach to meeting the same goal in the next iteration of the TBP and therefore has a low likelihood of completion as currently framed. The strategies with a high likelihood of being completed are those that have received funding and have a strong partner and local support. They are also farther along in the process. In addition, some strategies are regulatory and are required to be completed. Strategies that have a medium likelihood of completion have been initiated and may have received funding, but the end date for completion is beyond 2024. In many cases, medium likelihood strategies have support, but may lack funding or a partner to bring the project to fruition. These projects are next in line to be completed once the high likelihood actions are complete, which will free up capacity for partners that carry out the projects. Strategies with low likelihood of completion by 2024 are those that require significant funding and resources to complete. In some cases, support exists, and funding may be available, but a partner's capacity to develop the associated action(s) is lacking.

Table B-1: Status conditions assigned to strategies and actions in the TBP Implementation Table (Table B-2).

Strategy Status for Final Report Card	Description	Example(s)
Complete	A discrete action identified in a strategy with a clear end point that has been implemented. An strategy identified as ongoing in the interim report card that has been pursued and implemented throughout the TBP's 5-year period.	Provided three trainings to partners to evaluate 5 properties for Lake Wise assessments. The Municipal General Permit was implemented and all or most towns are on schedule to meet permit requirements. Five priority projects were implemented that were identified in River Corridor Plans.
Ongoing	A programmatic strategy that the state or partners expect to continue to support	Provide technical assistance to support BMP adoption
In Progress	A discrete action identified in a strategy with a clear end point that is in progress or in the queue.	A stormwater master plan that has been funded and is being implemented but is not yet completed.
Not Started	A discrete or programmatic strategy that has not been initiated	No funding is currently available to support the project.

This interim report describes a community that is well on its way to meeting permit compliance and implementing voluntary projects that will work towards meeting water quality goals.

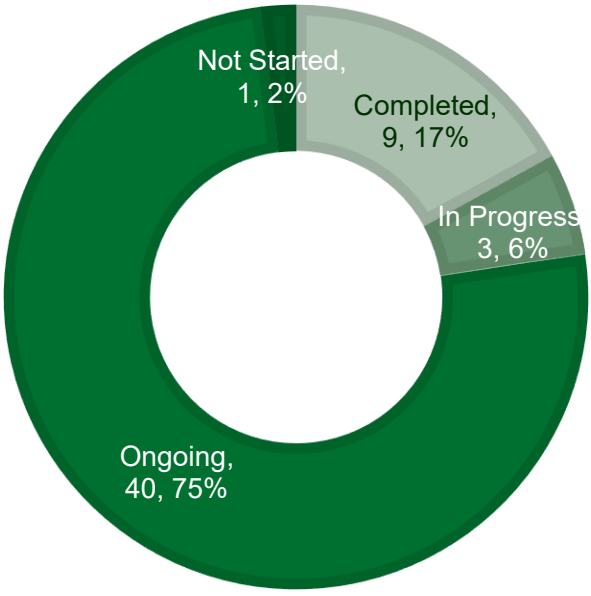

Figure B-1: Basin 5 Implementation Table action status of the 53 strategies in the 2020 TBP Implementation Table.

Most of the actions associated with regulatory programs are ongoing or complete in 2023. A majority of those were completed through Agency of Natural Resources (ANR) or Agency of Agriculture Farm and Market's (AAFM) financial support to permit holders as well as partners who distributed education, outreach, and technical assistance (Programs listed in Table 2 of the 2023 Performance Report). Regulatory compliance outcomes include increased implementation of Required Agricultural Practices and stormwater best management practices on roads. In addition, there was a steady increase in resources provided by the state to community and partners, which in turn supported a steady increase of adoption of natural resource restoration practices, and stormwater management of developed land. Available funding and advanced coordination played a critical role in allowing watershed partners and municipalities to work together to complete and pursue 17% of strategies from the 2020

Northern Lake Champlain Direct Drainages TBP to-date. The majority of the strategies (75%) are ongoing, with meaningful progress made towards completion of the strategies.

Six percent of the 53 strategies in the 2020 plan are still in progress. The narrative in Table B-2 provides additional detail in the explanation column for strategies in progress. Most projects in progress have completed the first phase of action, for example, planning or discussions towards completion of the strategy have occurred with no barriers identified towards completion.

As of SFY 2023, additional resources became available to support non-regulatory actions in the plan through the Clean Water Service Delivery Act (Act 76).[78] The act will increasingly support the delivery of clean water services and increase regional capacity to develop and implement non regulatory projects. The Chittenden County Regional Planning Commission (CCRPC) is the Northern Lake Champlain basin Clean Water Service Provider. In SFY 2023 DEC awarded CCRPC a grant for $645,340 to achieve an annual phosphorus reduction target of 41.9kg by supporting the development, implementation, and maintenance of non-regulatory clean water projects. In SFY 2024, CVRPC received $741,808 to achieve an additional 45.1kg. Additional funding and phosphorus reduction targets will be provided each year of this initial CWSP assignment term through June 30, 2028.

Basin 5 Implementation Table Status

The interim status for each strategy (Table B-2) was compiled by the Water Investment Division's Watershed Planning Program using data from the DEC, NRCDs, RPCs, and watershed partners involved in project development and implementation for the 2.5-year interim period.

The Implementation Table is not an exhaustive list of water quality strategies that lead to phosphorus reductions in a basin. A complete description of all the work that the state supports in the basin to meet water quality goals can be found in the 2021 Vermont Nonpoint Source Management Plan.[79] Additional information about progress associated with each sector can be found in Chapter 3 of the *Vermont Clean Water Initiative 2023 Performance Report,* which provides comprehensive reporting of estimated total phosphorus load reductions associated with state funding, federal funding, and regulatory programs in the Lake Champlain basin. These data are also available to the public through the Clean Water Portal's Clean Water Interactive Dashboard – an online tool that allows interested parties to examine and filter Performance Report data on investments, project outputs, estimated pollutant load reductions and project cost effectiveness. Individual projects in the basin that are included or supported by strategies are described in the Clean Water Explorer, also found through the Portal. [80]

[78] Act 76 website available here: https://dec.vermont.gov/water-investment/statues-rules-policies/act-76

[79] Vermont Nonpoint Source Management Plan 2021-2025 available here: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/Vermont%20NPS%20Management%20Plan%202021-2025.pdf

[80] Clean Water Portal can be accessed here: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

Table B-2. Basin 5 Implementation Interim Status Report includes data for just those strategies that result in phosphorus reductions and covers the time period a) SFY 2021 to SFY 2023 and b) calendar year 2021-2023, unless otherwise noted. The target date for strategy completion is December 31, 2024, the end of the time period covered by the 2020 Basin 5 plan.

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
1. Provide education, outreach, and technical assistance to farms on water quality regulations, RAPs, agricultural BMPs and cost-share programs:	Mud Creek, St. Albans Bay and Jewett Brook (critical[81]), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	See below	In addition to the information provided below, USDA NRCS Field Office staff provide this assistance to farmers, with a focus on cost-share programs to implement BMPs.	
a. Make available to farmers at least one workshop or training annually	See above	Agriculture	Complete	FCNRCD offers 4-6 workshops annually for farmers that are open to all farmers. This year they provided workshops around Soil Health, see below. GINRCD offers 2 workshops annually	
b. Provide technical assistance visits	See above	Agriculture	Ongoing	Technical Assistance by AAFM staff - conducted 88 visits and had access to the AAFM's Critical Source Area map layer, which quantifies the relative risk of erosion and runoff to surface water from agricultural fields to prioritize review of higher risk fields using the Technical Assistance by partners supported by AAFM's AgCWIP - resulted in 136 visits, covering all priority watersheds. Partners include UVM extension, FCNRCD, GINRCD and WNRCD. All of these technical assistance visits supported 19,008 acres of conservation practice implementation funded through State grants and documented 1,026 acres of farmer-funded conservation practice implementation.	

[81] The NRCS and ANR identified critical subbasins as a focus for NRCS's Lake Champlain Strategic Watershed Planning Approach.

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
c. Support partners in development and distribution of education materials	See above	Agriculture	Ongoing	Between 2021-2023, 36 water quality educational events were hosted in the Northern Lake Champlain Basin. These educational events cover topics such as water quality, soil health, agronomic practices, nutrient management planning, and nutrient management planning implementation. An example of additional support to partners to provide outreach includes FCNRCD's compilation and production of the Guide to Assistance for Agricultural Producers in Vermont with details about private, state, and federal funding and technical assistance programs available to Vermont farmers. This document is updated annually.	
2. Inspect approximately 70% of CSFOs at least once, per the 7-year inspection cycle outlined in the RAPs	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Ongoing	VAAFM is on track to inspect 100% of CSFOs, per the 7-year inspection cycle. As of the writing of this plan approximately 68% of CSFOs have received at least one inspection.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
3. Promote nutrient management: a. Expand offerings of small farm nutrient management plan (NMP) development courses and workshops, trainings for farmers, manure applicators and technical service providers	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Ongoing	Partners, primarily, the FNRCD and the WNRCD and UVM extension, provide NMP technical assistance to farms, leading to NMP adoption and implementation of plans. Most CSFO have full NMP, and AAFM and partners are focused on supporting plan implementation. UVM extension offers free classes to create plans. AAFM AgCWIP funds support the FCNRCD and the WNRCD in providing additional support to farmers and to custom manure applicators related to Nutrient Management. WNRCD and FNRCD have extended NMP outreach with the addition of additional staff since 2020. WNRCD reported writing 3 plans, updating 4 more and providing technical assistance and soil testing to over 10 farms. FCNRCD reported working with at least 4 farms, in addition to their soil health outreach (see strategy 8a). To support farms in plan implementing, AAFM and UVM Extension has provided trainings to 33 active and certified Custom Applicator businesses in Vermont, including 62 individual certified custom applicators. Applicators are required to attend 8 hours of educational training in each 5-year certification period to maintain certification. In total, NMP related course subjects that were available Statewide or Lake Champlain Region came to 14 events between 2019-2023. As Vermont is a small state, there are likely attendees from all over.	
4. Increase BMP implementation, including conversion to reduced tillage and no till crop management; cover crops; winter feedlot management and other pasture management BMPs; and grassland manure injection:	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Ongoing	Despite the expanded support described in 4a, during this time period the total acres of conservation practices have not increased, with a high of 5979 acres in 2020 to 4547 acres in 2023; however, acreage did increase for 1 specific practice noted in this strategy, manure injection. A more detailed depiction of BMP adoption trends is found in an agricultural PowerBi. that will be available in 2024. A detailed analysis and discussion will be provided in the 2024 TBP regarding trend with identification of strategies to address any negative trends.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
a. Continue and expand technical and financial assistance available through state and partner programs	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Ongoing	Regarding financial assistance, The AAFM Farm Agronomic Practices Program (FAP) and NRCS invests funds in soil-based agronomic practices to improve soil quality, increase crop production, and reduce erosion and surface runoff from agricultural fields. Annual FAP financial assistance has increased from $41,950 to $88,695 for a total of $270,00 of state funds invested in on-farm agronomic implementation with almost half ($111,180) directed to the priority St. Albans Bay watershed. Moreover, The FAP program increased cost share caps from $8,000 per grant to $10,000 per grant in SFY23. Additional support was provided through the USDA Natural Resources Conservation Service through the Regional Conservation Partnership Program (RCPP) Other partners assist farmers in securing funds, primarily NRCS with assistance from the NRCDs. UVM Extension: programs have provided a focus on winter lot management including overwintering with bed pack.	
5. Improve agricultural partner coordination and cross trainings to increase productivity and effectiveness of outreach efforts:	All, Swanton shoreline	Agriculture	Complete	Agricultural partner coordination and cross training has been enhanced with VAWQP support of the NRCDs as regional coordinators. They host agricultural partner meetings to share information and provide trainings.	
a. Hold a meeting with partners annually	All	Agriculture	Ongoing	FCNRCD is regional coordinator for the northwest region and hosts 2 meetings/year. The WNRCD is regional coordinator for the central region	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
6. Identify potential agricultural sources of E. coli and address using Bacterial TMDL as guide: a. Survey stream for locations of potential inputs and identify agricultural activity in watershed	Mud Hollow Brook, LaPlatte River	Agriculture	In Progress	WID supported discussions regarding previous TP sampling results on Mud Hollow Brook a bacterial impaired stream in 2021 and follow up by AAFM. WID will support additional discussions. Lewis Creek Association sampled in Mud Hollow Brook area with LaRosa Partnership Program (LPP) support in 2021 and 2022. Also through LPP support in 2023, the FNLC sampled mouth of stream on Maquam Shore that drained primarily agricultural land. Results suggest agricultural inputs. FNLC and FCNRCD have provided farmer with technical assistance	Medium
7. Continue the development and support of alternative conservation incentive programs to incentivize and support land stewardship for clean water through innovative approaches outside of the historical pay for practice models:	All	Agriculture	Ongoing	Since 2020, AAFM has supported the Vermont Pay-for-Phosphorus Program, which provides performance-based payments to Vermont farmers for reductions in phosphorus losses from their agricultural fields. 7 farms in Basin 5 completed Phase 1 (Data Entry) during the first two years of the Pay-for-Phosphorus Program. Supported through AAFM funds, FCNRCD works with farmers to apply to and navigate the program. In 2022, they coordinated an AAFM presentation in St. Albans about the program and progress. Additional work continues with the Vermont Payment for Ecosystem Services workgroup.	
8. Increase adoption of field agronomic practices for reducing gully and rill erosion, such as grassed waterways, strip cropping, or crop to hay conversions:	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Ongoing	Despite additional workshops, an increase in acreage under these practices are not reflected in CWRF data.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
a. Increase workshops and targeted outreach	Mud Creek, St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River, Hoisington Brook	Agriculture	Complete	Additional workshops focused on soil health have been offered and include easily accessible webinars. To help farmers adopt practices that reduce field erosion through improving soil health, UVM extension has recently begun to support a healthy soils program that has supported workshops. In partnership with the WNRCD and FCNRCD, they are coordinating a farmer soil health peer learning network in 2023-2025. To date FCNRCD reports on coordinating a 5-hour training to 53 people in Richmond, VT and expects up to 83 people to participate in one or more 2 hr webinars scheduled from December 2023 to 2024. The FNRCD currently works directly with 2 farms in the basin on soil health plan development.	
9. Assist all municipalities in developing a Road Erosion Inventory by 12/2020[82]	All	Developed lands -roads		The Municipal Stormwater Implementation Grant Program funds REI, (see description in the 2023 Performance Report). All towns are compliant in terms of both completing their required inventory (either in 2016 or 2017) and in filing Annual Reports to DEC with the help of CCRPC and NRPC. In 2023 CCRPC will commence new inventories in about 6 towns in the county. All information is tracked in the online MRGP Implementation Table Portal.	
10. Assist municipalities in meeting the Municipal Roads General Permit:	All	Developed lands -roads	Ongoing	Towns are currently addressing inventoried roads with both RPCs assisting them to obtain grant funding. For the Y23 Grants in Aid requests/awards and/or equipment awards, the following town received funds: Alburgh, Georgia, Grand Isle, Highgate, Isle La Motte, North Hero, South Hero, St. Albans City, St. Albans Town, Swanton Village, and Swanton Town. See also Strategy 9. An outcome associated with the support includes: 16 miles of hydrologically connected road were segments inventoried with 7 of those miles identified for improvements. Municipalities have improved 3 miles of road drainage.	

[82] Resource available to municipalities to address the subsequent strategies associated with stormwater management type regulations includes the Municipal Stormwater Implementation Grant Program (MSIGP). Additional description found in Appendix A of the CWIP 2023 performance report.

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
a. Towns will address at least 15% of their connected non-compliant municipal road segments' by 12/31/22.		Developed lands -roads	Ongoing	While not all towns met this by 2022, they are expected to meet by end of the 2020 TBP timeframe. As of 2023, all Basin 5 towns, but 4 had met this permit requirement, with some well beyond the 15% threshold. As an example in Chittenden county, the following non-compliant road segments per town were brought up to meet MRGP standards as follows: Charlotte-52.9%, Hinesburg-25.4%, St. George-100%, Westford-55.7%. In Franklin County, Basin 5 towns, all but 3 communities have met the requirement to date. Detailed reports on town progress are available through the MRGP Implementation Table Portal	
b. Towns will bring their Very High Priority (VHP) segments up to standards by 12/31/25 and Class 4 Very High Priority segments up to standards by 12/31/28.		Developed lands -roads	In Progress	All towns are in the process of addressing. Example of progress follows: in Chittenden County, 69 road segments were identified in 2016-2017 as VHP. Through 2022, 21 have been brought up to standard. The CCRPC will focus attention on the towns with the bulk of remaining VHP segments to be upgraded.	High
11. Provide technical assistance to road crews on culvert replacements, and installation and road maintenance BMPs:		Developed lands -roads	Ongoing	The ANR and VTrans supports the annual Roads and River workshops for municipal staff that are not basin specific. CCRPC also uses its MPO dollars to hire consultants to prepare Conceptual Designs (typically ditch work, culvert work, etc.) for discrete road segments in a few towns each year so that they can use that design when applying for or implementing grants or using their own municipal funds to complete the work.	
a. Hold one training annually		Developed lands -roads	Complete	Roads and River trainings were held multiple times and venues in 2020, 2021 and 2023	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
13. Identity priority stormwater management projects a. Support development of a Stormwater Master Plan (SWMP) for the impervious areas draining to Keeler Bay and Georgia shoreline. Also identify contributing stormwater from other land uses as well as IDDE outcomes	Keeler Bay, Georgia shoreline	Developed lands	Complete	Stormwater plans or variations were developed for all priority areas identified in the 2020 TBP as well as two other areas. LCBP funds supported GINRCD in developing a multi sector stormwater plans for Keeler Bay and the FNLC in similar type plans in on Georgia and Swanton (Maquam) Bay shoreline. FNLC received additional support from NRPC and DEC, while GINRCD received support from DEC. In 2022, LCA also reviewed stormwater projects previously identified in the McCabe's Brook watershed for prioritization and concept design. DEC supported CCRPC in developing a SWMP for Milton The MS4s conducted IDDE surveys and addressed as shown in in their annual reports.	
14. Assist municipalities in meeting the April 1, 2021 deadline for development of Phosphorus Control Plans (PCP)	MS4s, Milton	Developed lands	Complete	CCRPC, NRPC, DEC, and VTrans support the MS4 communities in developing and implementing projects from Phosphorus Control Plans and Flow Restoration Plans. Phosphorus Control Plans were completed and submitted on April 1, 2021 to DEC for the following MS4 municipalities with significant land area within Basin 5: Burlington, Colchester, Essex Junction, Shelburne, and South Burlington and St. Albans. Town of St. Albans completed their plan in April 2022. Also CCRPC and DEC supported Milton in developing a PCP, including a Stormwater Master Plan (SWMP) that was used to develop the elements of the plan, filed with State on April 1, 2021.	
15. Support implementation of priority projects, based on cost benefit of phosphorus removal, identified in SWMPs and Phosphorus Reduction Plans (PRP)	Towns with stormwater master plans, PRP or similar noted in Table 14 of the 2020 TBP	Developed lands	Ongoing	DEC's CWF policy prioritizes project funding based on phosphorus removal. The CCRPC is using its MPO funds to hire consultants to follow up on projects identified in the PCPS and do more scoping/design work on those projects. An outcome of the support addressing Strategies 13-15 include 90 projects completed, 211 acres of existing impervious and 112 acres of new impervious surface treated. Additional acres have been treated with outside of state funding sources.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
16. Encourage adoption of residential and landscaping practices by providing technical assistance and using social marketing practices	All	Developed lands	Ongoing	The Chittenden and Franklin County MS4s are supporting outreach programs (Rethink Runoff and Franklin County Stormwater Collaborative, RSEP) to encourage residential stormwater management with assistance from their RPCs, and the WNRCD and FCNRD. Both conservation districts provide technical assistance during workshops. In a separate stormwater education program called Blue BTV, the city of Burlington provides technical assistance and incentivizes the installation of small-scale residential stormwater practices by offering rebates of up to $1,000 depending on BMP type. In Blue BTV's first year (2022-2023), 60 residential site assessments were conducted resulting in 13 BMPs implemented at 12 sites. $7,000 in rebates were provided to incentivize this work. The results from a 2023 public Rethink Runoff survey will be used by the Chittenden County MS4s to gage how best to improve their outreach. Social marketing campaigns to encourage lake friendly lawn care habits are supported by the LCBP collaborative, Lawn to Lake. The campaigns include Don't P on your Lawn and Raise the Blade. In addition, the LCA and WNCRD support residential outreach campaigns that includes technical assistance to manage stormwater: Ahead of the Storm and StormSmart respectively. In 2022, LCA developed a landowner manual for property assessment and direction to existing guides using LCBP funds. In 2023, LCBP-funded discussion involving most of the above partners is expected to identify unified stormwater messaging for the Lake Champlain Basin to strengthen the impact of outreach by multiple parties.	
17. Assist landowners in managing stormwater off private roads and making progress in priority areas:	Priority HUC12s are identified in Table 19 or road erosion inventory results	Developed lands	Ongoing	In 2020, the WNRCD conducted a road erosion inventory on private roads as part of the Lake Iroquois Watershed Action Plan and provided technical assistance to address problems. In addition, LCA and WNCRD provide landowners with technical assistance to address stormwater off private roads through their residential outreach programs (see above),	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
a. Develop methods and tools to inventory private roads and pilot and complete	Priority HUC12s are identified in Table 19 or road erosion inventory results	Developed lands	Complete	The NRPC, a regional partner in this basin, has developed a private road REI that was used in Basin 6. In addition, they are developing an assessment to prioritize private roads where stormwater management would be a priority (Basin 5 CWSP formula grant funded). As a part of a Lake Watershed Action Plan, WNRCD supported development and implementation of method for Lake Iroquois roads, see above.	
b. Complete pilot inventory for private roads		Developed lands	Complete	A LCBP program grant supported, Basin 5 partner, NRPC to complete a Lake Carmi (basin 6) private road inventory completed in 2021.	
18. Assist municipalities with obtaining “Three-acre” permit coverage and making progress in priority areas	Main Lake, Shelburne Bay	Developed lands	Ongoing	The Stormwater Program has identified and notified affected three-acre site owners that they will need to apply for permit coverage by 2023. Currently, the Agency is making available grant funding in the form of rebates for individual landowners, while municipalities can access Clean Water funding and/or subsidized loans, to obtain permit coverage.	
19. Assist schools with obtaining “Three-acre” permit coverage and making progress in priority areas.	Following lake segment by 2021: Main, Burlington, Shelburne Bay	Developed lands	Ongoing	The Stormwater Program has identified and notified affected three-acre site owners that they will need to apply for permit coverage by 2023. The Agency is presently making available grant funding in the form of rebates for individual landowners, while municipalities can access Clean Water funding and/or subsidized loans, to obtain permit coverage. 71 public schools and colleges in the Lake Champlain basin are required to obtain three-acre general permit coverage. 13 schools in Basin 5 are currently enrolled in Phase 1 of the Green Schools initiative to receive technical and financial assistance for stormwater design and three-acre permit.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
20. Facilitate public private partnership to improve stormwater management of large parcels that fall under the three-acre permit by conducting a pilot project	Private lands, whose runoff contributes to public land stormwater issues	Developed lands	Complete	In 2020, DEC supported a pilot project in Chittenden and Franklin counties to pay for designs that managed stormwater originating from both public and private lands (Public Private Partnership, PPP). CCRPC is managing the PPP Final Design and Permitting grant for the Burlington Pomerleau property (Potash Brook). CCRPC is assisting the Town of Hinesburg with the management of its PPP Final Design, Permitting and Construction grant for the former Saputo cheese plant property in Hinesburg (LaPlatte River)	
21. Ensure wastewater treatment facility (WWTF) meet their TMDL allocations and optimize phosphorus reductions through facility operations by providing financial and technical assistance to municipalities	Hinesburg (high priority), Burlington, Shelburne	Wastewater	Ongoing	DEC WIFP worked with Hinesburg, Shelburne and Burlington to secure State grants and low interest loans capitalized through the Vermont and U.S. Environmental Protection Agency (EPA) Clean Water State Revolving Fund (CWSRF). These funds supported WWTF improvements including 1 upgrade and 2 refurbishments to meet permit requirements. In addition, DEC supported training of 209 people to improve operations of their WWTF.	
22. Assist communities in addressing inadequate individual onsite wastewater treatment on small, challenging sites through the planning and development of solutions, including community wastewater systems or innovative/alternative onsite systems in addition to use of WWTF:	Interested community including Colchester, Lake Iroquois, and Champlain Islands	Wastewater	See below	DEC has assisted both Colchester and South Hero to address inadequate onsite wastewater treatment systems.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
a. Continue to support Colchester's access to State Revolving Loan Funds and related funds to support the preferred solution to documented failing septic systems in Malletts Bay, which may include construction of the Malletts Bay Sewer Project.		Wastewater	Ongoing	Colchester received a CWSRF loan for phase I and II of the Malletts Bay sewer extension.	
b. Discuss support available through the ANR Village Wastewater Solutions Initiative with one priority municipality annually.	Champlain Islands	Wastewater	Ongoing	South Hero received a CWSRF loan for the preliminary design of a community wastewater system. This was preceded by a CWSRF loan supported Community Wastewater Feasibility and Preliminary Engineering Investigation Partner assistance included NRPC's support at committee meetings to garner community support, including assisting with a survey, and creating an ArcGIS storymap..	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
23. Identify river and floodplain restoration opportunities through stream geomorphic assessments (SGA):	St. Albans Bay, Jewett Brook, Lake Champlain, Malletts Bay, LaPlatte River, Hoisington Brook. When criteria developed, river segments meeting Functioning Floodplain criteria	Natural Resource	See below		
a. Update existing stream geomorphic assessments where community interest exists.		Natural Resource	Ongoing	A Basin 5 CWSP formula grant is supporting a review of existing SGA data and augmenting with information available through use of the Functioning Floodplain Initiative tool to identify potential projects in 2023.	
b. Develop a stream geomorphic assessment for Jewett Brook		Natural Resource	Not Started	A full SGA for Jewitt Brook would require support from the DEC Rivers Program; however, reduced capacity in the program has limited implementation of this strategy to date. With the development of the FFI, a more limited SGA may be suitable for identifying projects and will be considered in the 2024 tactical basin planning process.	Low
c. Develop Functioning Floodplain criteria and support training		Natural Resource	Complete	To support use of the tool in identifying priority stream restoration projects, in 2023, DEC coordinated consultant-developed materials and trainings.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
24. Support floodplain restoration, including nature-based floodplain restoration practices: a. provide trainings annually	St. Albans Bay and Jewett Brook (critical), Lake Champlain, LaPlatte River (upper), Hoisington Brook, Malletts Bay	Natural Resource	Ongoing	See FFI support. 2 acres of floodplain have been restored since 2021. In addition, the DEC River Program and WPP staff are developing criteria to support effective Stream Wood Additions. Both the CCRPC, NRPC and the FCNRCD are currently using the tool to identify priority projects. The Basin 5 CWSP Formula Grants funded the CCRPC river assessment project in 2023. On completion of the FFI guidance (strategy 23), trainings were held in 2023.	
25. Support reforestation of riparian buffers	All	Natural Resource	Ongoing	On agricultural land, 10 acres of buffer was reforested. On non-agricultural land, partners including WNRCD used CWF to support 1 acre of buffer plantings. Additional riparian buffers were planted by VLT at Philo Ridge Farms, Charlotte and along LaPlatte tributaries in Hinesburg.	
26. Support municipal efforts to increase number of geomorphologically compatible culvert and bridges:	All	Natural Resource	Ongoing	NRPC and CCRPC staff provide assistance to municipalities in the replacement of undersized culverts, including funding through VTrans Better Roads Category D grant applications for the town of, Swanton and St. Albans Town. The Rivers Program reviews all upgrade projects to ensure the structure meet current standards for geomorphic compatibility. In addition to municipal funding, the CWF has supported the improvement of 4 perennial stream crossings through culvert and/or bridge replacements.	
a. Meeting with municipalities to review opportunities and assist with funding through capital budget development	All	Natural Resource	Ongoing	The NRPC assists towns with capital budget development (see Strategy 9)	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
27. Remove nonfunctional dams that will result in ecological benefits where there is landowner interest	See Table 18 of the 2020 TBP	Natural Resource	Ongoing	The VLT with CWF support removed a dam on Crooked Creek in 2022. Partial dam removal will be funded by Basin 5 CWSPs on Potash Brook in 2024. Two dam removal opportunities are identified: McCabes Brook and Holmes Brook. VNRC supported FCNRCD in inventorying dam removal opportunities in Franklin County, although none were identified for basin 5.	
28. Provide assistance to towns to increase adoption of local protection to protect and improve surface water quality and decrease fluvial erosion	All	Natural Resource	Ongoing	Both CCRPC and NRPC have contracted with DEC to inventory/assess flood hazard regulations and potentially stream corridor regulations in all towns in anticipation of updated FEMA flood maps. In 2022, LCA gave presentations to towns in the Shelburne Bay watershed encouraging adoption of river corridor protections.	
a. Work with towns identified in Table 8 in the 2020 TBP		Natural Resource	In Progress	The NRPC and CCRPC will support this work at town request. While Georgia and Swanton are still interested in river corridor protection, other planning work has been prioritized. The NRPC was notified by Alburgh's fire chief that he has approached selectboard about update of Hazard Mitigation Plan.	Medium

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
29. Provide technical and financial assistance to landowners to address erosional features on logging roads and landings. Prioritize based on contribution of erosion features to water quality impairment using ANR assessment tools	Mill River, Malletts Creek, LaPlatte River	Natural Resource	Ongoing	ANR DFPR Chittenden and Franklin County foresters provide assistance to help landowners reduce erosion, primarily through implementing AMP. Assistance is provided during sites visit, publications and presentations. In calendar years 2020-2022, the ANR Essex District office DFPR staff performed 22 AMP-related sited visits stemming from 5 technical assistance requests and 9 submitted complaints. Only 1 complaint resulted in a water quality issue that required remediation. Additional outreach was provided by FCNRCD through an 2021 article in their newsletter that was distributed to 3900 people about the AMPs and AMP app. In addition, The ANR is in the process of assessing and prioritizing erosion issues along hydrologically connected forest roads on ANR-owned lands. This process is expected to be carried over to private lands and include an ANR's Road Erosion Inventory Ap. The Ap should become a resource for contractors and volunteers on other public and private lands by spring 2024.	
30. Increase usage of forest skidder bridges	Mill River, Malletts Creek, LaPlatte River	Natural Resource	Ongoing	When the DFPR first launched the skidder bridge construction and rental programs in 2018, both the FCNRCD and the WNRCD offered portable wooden skidder bridge rentals, but by 2021 both had discontinued the program. However, in 2023 DFPR re-launched with support from NRCDs and CWFs. In 2023, the WNRCD and the FCNRCD received new skidder bridges which will be rented at a rate of $100 per month for logging professionals Currently, WNRCD is renting out one of the bridges.	
31. Increase number of forest management plans that include Ecologically Sensitive Treatment Areas (ESTA).	All	Natural Resource	Ongoing	DFPR promotes the use of ESTA in forest management plans through county foresters and outreach materials, and some county foresters anecdotally note their increased use. However, some foresters also note that adherence to AMPs in riparian areas is viewed by some landowners as a less administratively complicated way to achieve similar forest and watershed health. In Franklin and Grand Isle counties, in 2023, 15 properties included riparian ESTAs. This is about 10%, the same percent as in 2022.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
32. Hold workshops or provide other technical assistance to sugaring operations on AMP compliance, and benefits of adopting forest management plans.	Malletts Creek, LaPlatte, Mill River	Natural Resource	Ongoing	DFPR watershed forester presented on AMPs compliance with focus towards sugaring operations at the 2023 Franklin County Sugarmakers Association Annual Meeting (25 attendees).The FCNRCD gave a talk on skidder bridge program. The DFPR watershed forester has also developed AMP guidance specific to sugaring operations. In addition, general workshops on AMPs are hosted by DFPR. At least 7 workshops with 280 forest landowners, foresters and loggers were educated on AMP compliance in central and western Vermont.	
35. Hold workshops and trainings to promote lake-friendly shoreline property maintenance	Lake Iroquois, Lake Champlain shoreline	Natural Resource	Ongoing	These types of trainings were provided at workshops initiated and coordinated by partners with DEC Lakes and Ponds contributing technical assistance: WNRCD at Lake Iroquois, and FNLC with shoreline socials in Georgia, Swanton and North Hero (135 attendees) and the GINRCD with block parties in Grand Isle (34) and North Hero (22). DEC also trained WNRCD, GINRCD and FNLC staff to become Lake Wise evaluators and to support bioengineering techniques. These partners then went on to help support 90 lake wise assessments within the basin. 35 awards, 38 recognition certificates. 60 of those assessments were done in the last two years. This increase is largely a result of the intensive outreach described above.	
36. Stabilize eroding shorelines or gullies by addressing stormwater runoff followed by use of bioengineering techniques where necessary.	Lake Iroquois, Georgia shorelines, Island shorelines and see VT Geologic Survey Land slide Inventories	Natural Resource	Ongoing	DEC promotes and holds bioengineering trainings with partners, including with the WNRCD who hosted the 2019 Summer Erosion Control Field Day in the Winooski Basin. 150 linear feet of shoreline stabilized with bioengineering techniques since 2021.	

Strategy Description	Priority Subbasin(s) or Town (s)	Sector	Status	Explanation (numbers associated with Basin 5 unless otherwise noted)	Likelihood of completion (for in progress and not started status)
37. Promote improved maintenance of on-site wastewater systems: Conduct septic socials		Natural Resource	Ongoing	WNRCD hosted a statewide conference and two septic socials reaching roughly 100 individuals. In addition, NRPC has updated the text of a regional guide to onsite wastewater.	
38. Conserve wetlands		Natural Resource	Ongoing	see below	
39. Restore wetland		Natural Resource	Ongoing	DFW has initiated a wetland restoration and acquisition initiative with EPA funding. The primary focus of this project is wetland restoration on new and existing F&W acquisitions with a goal of 40% lands restored. The FCNRCD targeted the Lake Champlain Islands in 2021 for outreach to landowners. To date 19 acres of wetlands have been restored.	
40. Support conservation easements or land purchases that protect existing condition of surface waters by protecting natural communities as well as river corridors	Specific waterbodies: Trout River, Upper LaPlatte River, including Lake Iroquois and see Table 7 in the 2020 TBP.	Natural Resource	Ongoing	2150 linear feet of riparian corridor have been conserved in the basin since 2021. As one example effort, in 2023 DEC initiated a discussion with the Town of Hinesburg to place a conservation easement on town property on LaPlatte River by the wastewater treatment facility as part of a floodplain restoration project.	
41. Provide technical support to parties interested in submitting petitions for wetlands that meet Class I criteria.	Mud Creek	Natural Resource	Ongoing	The DEC Wetlands Program has conducted wetland surveys and collected species list data for Mud Creek, a proposed candidate for Class 1 in the 2020 plan that could be used by parties in development of a petition for Class I status.	

Appendix C: Winooski River (Basin 8) TMDL Implementation 2023 Progress Report

The Accountability Framework of the 2016 *Phosphorus Total Maximum Daily Loads (TMDL) for Vermont Segments of Lake Champlain* ensures TMDL implementation moves forward at a steady rate. A major driver of the Accountability Framework is the Vermont Department of Environmental Conservation's (DEC) development of basin-specific Tactical Basin Plans (TBP). TBPs are developed on a five-year rotating basis and include Implementation Tables that identify priority actions needed to implement the TMDL. It is through review of the Implementation Tables, and the progress made in accomplishing the tasks, that U.S. Environmental Protection Agency (EPA) tracks implementation progress in each basin. To facilitate EPA's evaluation of progress, DEC describes the status of each strategy midway through (2.5 years) and at the conclusion of the five-year planning cycle in interim and final report cards, respectively.

Appendix C is the final report card for the 2018 Winooski TBP. The 5-year reporting period began coincident with the publication of the 2018 Winooski TBP and goes through June 30, 2023. Data in this appendix align with the 5-year reporting period (SFY 2019–SFY 2023) available through the Clean Water Reporting Framework (CWRF).

The following sections describe progress towards completing strategies in the 2018 Winooski TBP Implementation Table. Each strategy is organized by one of five major sectors – agriculture, developed lands, natural resources, forestry, and wastewater. Progress described for each strategy includes status (defined in Table C-1) as well as an explanation of actions taken. The explanation describes how the Agency and partners supported the strategy and resulting outcomes that together show that meaningful results were achieved. The outcomes include performance measures for Agency-supported assistance that were collected as part of the Accountability Framework (see Accountability Measures).

Phosphorus reductions for the Winooski basin were estimated to have met about 14 percent of the basin's total load reduction targets set by the TMDL, based on basin-level data summarized in the clean water reporting framework. While this report card does not discuss trends in annual phosphorus reductions, estimated trends since SFY 2016 can be found by basin and by sector in the TMDL reduction estimates interactive online report. Trends, as well future five-year phosphorus targets, are also further discussed in the 2023 Winooski Tactical Basin Plan's Lake Champlain TMDL Phase 3 content.

Basin 8 Update

The 2018 TBP strategies were evaluated, and their associated actions were assigned a status condition using the rationale described in Table C-1. To address strategies identified as ongoing in the 2023 Winooski Tactical Basin Plan, a status of complete, continued, or discontinued has been assigned to previously ongoing projects. Of the 52 strategies identified, to date 32 were completed, 17 are in progress, two are continued, and one is discontinued (Figure C-1).

Table C-1: Status conditions assigned to strategies and actions in the TBP Implementation Table (Table C-2).

Strategy Status for Final Report Card	Description	Example(s)
Complete	A discrete action identified in a strategy with a clear end point that has been implemented. A strategy identified as ongoing in the 2021 interim report card that has been pursued and implemented throughout the TBP's 5-year period.	Provided 3 trainings to partners to evaluate 5 properties for Lake Wise assessments. The Municipal General Permit was implemented and all or most towns are on schedule to meet permit requirements. Five priority projects were implemented that were identified in River Corridor Plans.
In Progress	A discrete action identified in a strategy with a clear end point that is being implemented either as described or, where needed, with revisions as described in the subsequent plan.	Stormwater master plan was funded and is being implemented but is not yet complete. An updated strategy to support water quality goals was identified during the planning process to focus on monitoring to meet water quality goals.
Continued	A discrete or programmatic strategy that was not initiated or formally pursued due to lack of interest, funding, or capacity gaps.	Strategy was carried over to the Watershed Projects Database to be implemented when there is interest and capacity. Strategy is still a high priority and carried over to the next basin plan.
Discontinued	A discrete or programmatic strategy that was removed as a strategy and is no longer a priority.	The project was superseded by a project further upstream that treated the problem effectively. The project is no longer a priority for the state program.

This report depicts a watershed community that is pursuing permit compliance and implementing voluntary practices that work towards meeting the state's water quality and phosphorus reduction goals. This is achieved through the implementation of permit programs, installation of green stormwater practices, adoption of flood resilience measures, implementation of farm agronomic practices, and application of riparian restoration and conservation projects. As described in the final status report for the 2018 Winooski TBP Implementation Table (Table C-2), most of the actions associated with regulatory programs were completed or were in progress by the interim reporting period. A majority of those were completed through Agency of Natural Resources (ANR) or Agency of Agriculture, Food and Markets (AAFM) financial support to permit holders as well as partners who distributed education, outreach, and technical assistance. Regulatory compliance outcomes include increased implementation of Required Agricultural Practices (RAPs) and agricultural best management practices (BMPs) and stormwater BMPs on roads. In addition, there was a steady increase in resources provided by the state to communities and partners supporting natural resource restoration practices and stormwater management of developed land.

Available funding and advanced coordination played a critical role in allowing watershed partners and municipalities to work together to significantly advance 94% of the strategies from the 2018 Winooski TBP (Figure C-1). Phase 3 of the TMDL in the 2023 TBP provides additional information that explains sector-level progress on meeting TMDL goals to date as well as expectations for areas of accelerated progress. This progress is an outcome of strategy implementation in the 2018 TBP. 61% of strategies were completed. Completed strategies were often related to either regulatory implementation as described above, the completion of discrete tasks, or the continued or accelerating implementation of programmatic strategies over the full five-year period. The narrative in Table C-2 provides additional detail in the explanation column. 33% of the strategies are still in progress. Those strategies in progress that were pursued and then updated as a new strategy in the 2023 Winooski TBP will be reported on during the next planning cycle. Most projects in progress have completed the first phase of action, for example, a design may have been completed for a project, but the implementation of the project will be completed in the next year. Other "In Progress" strategies are those in which slightly revised approaches to the same goal warrant continued strategy tracking in the 2023 TBP. A few lakes-related strategies were not implemented because of a lack of community capacity, but these "Continued" strategies are still a priority for follow-up if partners identify or can encourage growing interest among lake communities. Finally, one strategy was discontinued because of a lack of partner capacity and interest to pursue a specific stormwater runoff phenomenon (capturing private lands stormwater before it reaches public roads).

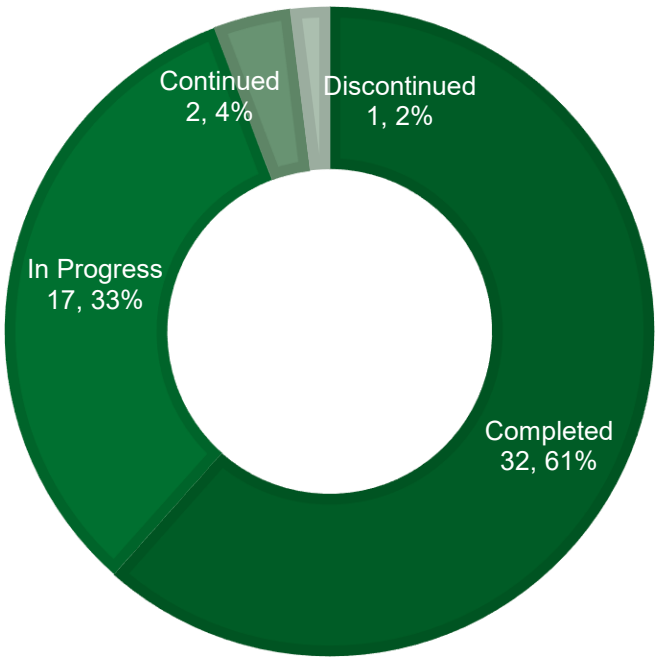

Figure C-1: Basin 8 Implementation Table action status of the 52 strategies in the 2018 TBP Implementation Table.

In the 2023 TBP, a new set of strategies are identified that represent the next phase of work associated with regulatory programs, or improved approaches that partners can take with agency resources to encourage implementation in the community. Additional accounting methodology will capture information on more restoration and protection activities on the landscape and show a more accurate representation of total phosphorus reductions achieved. In addition, the Clean Water Service Delivery Act (Act 76) will increasingly support the delivery of clean water services and increase regional capacity to develop and implement projects that fulfill actions.[83] The Central Vermont Regional Planning Commission (CVRPC) is the Winooski basin Clean Water Service Provider. In SFY 2023 DEC awarded CVRPC a grant for $1,040,947 to achieve an annual phosphorus reduction target of 69.6 kilograms by supporting the development, implementation, and maintenance of non-regulatory clean water projects. In SFY 2024, CVRPC received $1,097,230 to achieve an additional 69.6 kilograms. An explanation of DEC's expected progress based on these additional resources is included in the 2023 TBP's

[83] Act 76 website available here: https://dec.vermont.gov/water-investment/statues-rules-policies/act-76

Chapter 3 (LC TMDL Phase 3) and Chapter 4. DEC will submit the interim report for the 2023 Tactical Basin Plans in 2026 and the final report in 2028.

Basin 8 Implementation Table Status

The status for each strategy (Table C-2) was compiled by the Water Investment Division's Watershed Planning Program using data from the DEC, NRCDs, RPCs, and additional watershed partners involved in project development and implementation for the five-year planning period.

The Implementation Table is not an exhaustive list of water quality strategies that lead to phosphorus reductions in a basin. A complete description of all the work that the state supports in the basin to meet water quality goals can be found in the 2021 Vermont Nonpoint Source Management Plan.[84] Additional information about progress associated with each sector can be found in Chapter 3 of the Vermont Clean Water Initiative 2023 Performance Report which provides comprehensive reporting of estimated total phosphorus load reductions associated with state funding, federal funding, and regulatory programs in the Lake Champlain basin. These data are also available to the public through the Clean Water Portal's Clean Water Interactive Dashboard – an online tool that allows interested parties to examine and filter Performance Report data on investments, project outputs, estimated pollutant load reductions and project cost effectiveness. Individual projects in the basin that are included or supported by strategies are described in the Clean Water Explorer, also found through The Portal.[85]

[84] Vermont Nonpoint Source Management Plan 2021-2025 available here: https://dec.vermont.gov/sites/dec/files/wsm/erp/docs/Vermont%20NPS%20Management%20Plan%202021-2025.pdf

[85] Clean Water Portal can be accessed here: https://anrweb.vt.gov/DEC/cleanWaterDashboard/

Table C-2: Basin 8 Implementation Final Status Report; includes data from SFY 2019 to SFY 2023 unless otherwise noted. Any referenced tables or appendices can be found in the 2018 Winooski Tactical Basin Plan (TBP).

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Expand small farm NMP development courses and workshops, trainings for farmers, manure applicators and technical service providers	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	State and federal funds support the work of NRCDs and UVM Extension to provide NMP courses and TA to farms developing and implementing NMPs. Between calendar year 2019-2023, 18 water quality educational events were hosted in the Winooski basin. These events cover topics such as water quality, soil health, agronomic practices, nutrient management planning, and nutrient management planning implementation. Statewide, 14 outreach and education events with NMP-related course topics were hosted during this time period. In the Winooski basin, 35 farms have received NMP assistance since SFY2019, including 16 through state funding. The agricultural partner covering most of the basin, WNRCD, helped develop 12 NMPs since calendar year 2019 and has supported NMP updates for several others.
Target inspections in priority catchments/ watersheds: target implementation based upon the results	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	1 Large Farm Operation is inspected annually in the basin, 6 Medium Farm Operations are inspected at least every 3 years, and 32 Certified Small Farm Operations are inspected at least every 7 years. While inspections cannot be targeted at the catchment level because of this required rotational schedule, on-farm AAFM inspectors have access to AAFM's Critical Source Area map layer. This mapping tool quantifies the relative risk of erosion and runoff to surface water from agricultural fields, allowing inspectors to target higher risk fields during inspections.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Increase conservation practice implementation through participation in State and federal financial and technical assistance programs; and case managers	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	The AAFM Farm Agronomic Practices (FAP) Program and NRCS invest funds in soil-based agronomic practices to improve soil quality, increase crop production, and reduce erosion and surface runoff from agricultural fields. Financial assistance through the FAP program grew significantly in the basin funding between SFY2019 and SFY2021 ($20,000 à $90,000). With a $10,000 annual award limit to individual operations, the FAP program has invested $363,349 in on-farm agronomic implementation in the basin since SFY2019. Despite this increase in funding support, reported acreages of state-supported conservation practices implemented have remained relatively stable.
Increase technical assistance in priority catchments/ watersheds: work with farms, including vegetable farms, to meet RAP and adopt BMPs	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	AAFM's TA staff and AgCWIP-funded partner staff provide technical assistance on a variety of water quality topics and project areas. Since SFY2019, partners have performed 174 TA site visits, many in priority agricultural sub-watersheds. Note that AgCWIP accounts for only a portion of the technical assistance provided and does not account for all watershed partner technical assistance efforts.
Pilot the Environmental Stewardship Program to incentivize additional practice adoption	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	In 2018, AAFM began a pilot of the Vermont Environmental Stewardship Program. The pilot program was completed in 2021, and four farms, including one in the Winooski basin, were awarded Vermont Environmental Stewardship Certifications. However, capacity and resources have been focused on the launch of the Vermont Pay-for-Phosphorus Program, which provides performance-based payments to Vermont farmers for reductions in phosphorus losses from their agricultural fields. 8 farms in the Winooski basin completed Phase 1 (Data Entry) during the first two years of the Pay-for-Phosphorus Program. Additional work continues with the Vermont Payment for Ecosystem Services workgroup.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Create grassed waterways program Target funding to critical source areas in coordination with partners	Phase II priority catchments for agricultural land TBP Table 17		Agriculture	Complete	The Grassed Waterway and Filter Strip grant program is managed by AAFM and continues to be a funding opportunity for Vermont farmers to address critical source areas, erosion, and surface runoff. This program provides compensation to farmers via incentive payments for participation ($500/acre) and cost share to cover 90% of the installation costs for establishing perennially vegetated grassed waterways, filter strips, and forage and biomass seedings, and associated infrastructure, if necessary, on agricultural cropland adjacent to surface waters and ditches. However, no grassed waterways have been implemented in the Winooski basin to date.
Provide outreach to support implementation of prescribed pasture practices. Provide financial support for livestock exclusion	Phase II priority catchments for agricultural land TBP Table 17; Huntington River		Agriculture	Complete	In 2018, AAFM launched the Pasture Surface Water Fencing (PSWF) grant program providing technical and financial assistance to improve water quality and on-farm livestock exclusion from surface waters statewide. In addition to the PSWF program, AAFM supports partner technical assistance providers through the AgCWIP program. Livestock exclusion has been implemented on 69 acres in the basin since SFY2019.
Increase the availability of equipment for rental or through custom operators	Phase II priority catchments for agricultural land TBP Table 17; Huntington and Mad Rivers		Agriculture	Complete	Starting in SFY 2018, AAFM expanded the Conservation Equipment Assistance Program (CEAP) to provide opportunities for farmers, custom applicators, and non-profit organizations to receive grant funding for conservation equipment. CEAP provided funding to farmers and partners in the basin to purchase conservation equipment. Since SFY2019, CEAP invested $590,786.93 in funding to 20 farmers and partners in the Winooski Basin to purchase conservation equipment. This leveraged $36,450 in VHCB funds and $201,872.58 in farmer match contributions. To date, farms have implemented over 10,793 acres of conservation practices in the Winooski basin by acquiring conservation equipment through the program.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Develop and provide support for equine specific programing including support for installing horse manure compost bins and making pasture improvements	Mad River		Agriculture	Complete	WNRCD hosted an equine manure management on-farm tour and spoke at the annual Vermont horse council meeting to promote manure management and knowledge of the RAPs. Moving forward, WNRCD and LCCD could borrow from the Poultney-Mettowee NRCD who has developed a RAP packet for Horse Owners that it distributes to town offices, horse owners, stables, and at RAP workshops.
Provide technical and financial resources to farms below the threshold for VAAFM Small Farm Operations			Agriculture	In Progress	As of 2023 WNRCD has started reaching out to farms not regulated by the Required Agricultural Practices for potential riparian buffer planting sites. At these farms, WNRCD is sharing information on erosion control on streams that flow through their property as well as discussing temporary fencing for animals during more critical times of the year.
Complete targeted water quality sampling on 3 farms to help identify source areas			Agriculture	In Progress	WNRCD is working with the basin planner and the Lakes and Ponds Management and Protection Program to evaluate up to 12 tributary sites draining to Shelburne Pond for phosphorus and nitrogen water quality sampling under the 2024 LaRosa Partnership program. Depending on the finalized sites, up to 3 farms would be evaluated to identify watershed nutrient sources to the phosphorus-impaired lake. This sub-watershed (Muddy Brook) has the highest remaining agricultural phosphorus target in the Winooski basin.
Support the development and implementation of Phosphorus Control Plans and implementation of the Flow Restoration Plans.	Lower Winooski	MS4 entities	Developed Land - Other	Complete	CCRPC, DEC, and VTrans support the 7 MS4 communities in developing and implementing projects from Phosphorus Control Plans and Flow Restoration Plans. Phosphorus Control Plans were completed and submitted on April 1, 2021 to DEC for all MS4 municipalities with significant land area within Basin 8: Burlington, Winooski, Essex Junction, Essex, Shelburne, South Burlington and Williston. Numerous projects identified in PCPs and FRPs have been constructed. See Annual Reports filed by MS4s towns for details on constructed FRP projects.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Provide technical assistance to identify and prioritize stormwater management projects.		Waterbury, Williamstown, Stowe	Developed Land - Other	Complete	SWMPs were published for Williamstown and Stowe in 2023 and for 10 other towns in the basin in 2019 and 2021. Of the 39 towns with significant land area in the Winooski basin, 36 have had their stormwater infrastructure mapped. Moreover, 28 now have SWMPs or are MS4 communities with Phosphorus Control Plans or Flow Restoration Plans (7 municipalities). Waterbury is currently interested in developing a SWMP, and CVRPC is working with DEC to determine funding options for this work. In all, 686 potential projects were identified through Stormwater Master Planning efforts between 2019 and 2023. Not all potential projects are prioritized for further development. 299 proposed preliminary design projects are currently listed in the basin in VT's Watershed Project Database. To continue non-regulatory stormwater project prioritization and preliminary development, the Winooski basin Clean Water Service Provider (CVRPC) is tracking updates on progress for many of these proposed projects.
Support implementation of high priority projects in Stormwater Master Plans and 2015 Smugglers' Notch Parking Feasibility Study	Multiple	See TBP Appendix D	Developed Land - Other	Complete	Preliminary designs were developed for 27 stormwater projects, and final designs for 36 projects, from 2019 to 2023. Implemented projects resulted in the improved treatment of 445 acres of existing impervious surface. FWR, LCCD, WNRCD, CVRPC, WNRCD, and LCPC either have completed projects in or are currently working with 10 towns (Montpelier, Richmond, Stowe, Cambridge, Barre Town, Barre City, Bolton, Calais, Woodbury, Moretown) to advance stormwater projects through design and implementation phases.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Help municipalities control runoff from gravel and paved roads to meet the Municipal Roads General Permit: implement road assessment protocol to assist with prioritization; provide technical and financial resources to assist with implementation, including projects within 250 feet of lakes.		See top 10 prioritized road projects in town road erosion inventories as well as Phase II priority catchments for roads (TBP Tables 23 and 24)	Developed Land - Roads	Complete	All REIs are complete, and information is tracked in the online MRGP Implementation Table Portal. During SFY 2019-2023, 429 hydrologically connected road miles were inventoried and 253 hydrologically connected road miles were identified that require water quality improvements. 29 miles of municipal road drainage and erosion control improvements were made, and 103 municipal road drainage and stream culverts were replaced in the basin. Towns are using a combination of Regional Transportation Funds, VTrans Better Roads grants, DEC Grants-in-Aid funds, and their own municipal funds to implement projects to meet MRGP standards.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Support municipal stormwater ordinance adoption, include incorporation of LID and GSI practices; Implement “Three-acre” permit, including the green schools initiative to help schools meet the three-acre permit		Phase II priority catchments for developed land, TBP Table 22	Developed Land - Other	In progress	Effective July 2022, projects that expand or redevelop one half-acre (0.5 acres) or more of impervious surface are required to apply for stormwater operational permit coverage. 217 acres of new impervious surface were treated with stormwater practices between 2019 and 2023. Furthermore, the 2019 general permit for stormwater for "three-acre sites" applies to sites with three or more acres of existing or new impervious surface that lack a stormwater permit based on the 2002 Vermont Stormwater Management Manual. Approximately 340 three-acre sites totaling 2800 acres exist in the basin. The Stormwater Program has identified and notified affected three-acre site owners that they will need to apply for permit coverage by the end of 2023. The Agency is presently making available grant funding in the form of rebates for individual landowners, while municipalities can access Clean Water funding and/or subsidized loans, to obtain permit coverage. 21 public schools and colleges in the Lake Champlain basin are required to obtain three-acre general permit coverage. All but 5 schools are currently enrolled in Phase 1 of the Green Schools initiative to receive technical and financial assistance for stormwater design and three-acre permit obtainment. Towns implementing model low impact development (LID) and green stormwater infrastructure (GSI) stormwater management bylaws may further mitigate runoff from developed lands. The Green Infrastructure Collaborative is a partnership between the Lake Champlain Sea Grant Program and DEC whose assistance to towns include a model LID/GSI Stormwater Management bylaw and GSI BMP factsheets. In Chittenden County (a highly developed portion of the basin), 12 of 17 municipalities have adopted some type of stormwater bylaw by 2023.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Implement six minimum control measures required in the State TS4 permit			Developed Land - Roads	Completed	Per Part 6 of the TS4 Permit, VTrans is implementing and enforcing a 2018 SWMP, which includes six MCMs designed to reduce the discharge of pollutants from the TS4 to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the CWA. Implementation of the six MCM is ongoing. The BMPS that are being implemented by VTrans to address these six MCMs are included in Part 6.0 of the 2018 SWMP. A summary of annual reporting requirements and progress for each MCM is providing in the 2020 Annual Report Workbook.
Develop and begin implementation of a phosphorus control plan early in the next TS4 permit cycle			Developed Land - Roads	Complete	VTrans submitted the generalized PCP on April 1st, 2020. It included identification of VTrans-owned parcels, calculation of P base loads, P reduction targets for each segment of Lake Champlain as well as plans to investigate higher P source areas and develop P loading rates to help prioritize the highest source areas. A VTrans ArcGIS story map details this information more fully. On October 1st, 2020, VTrans submitted their first implementation plan, where they seek to meet approximately 25 percent of the total P reduction target in four years. There will be three subsequent four-year implementation plans that will each seek to meet approximately 25 percent of the reduction target, with the goal of fully meeting their reduction targets by 2036.
Intercept and treat runoff from agricultural and silvicultural land before it reaches VTrans right of way		Phase II priority catchments for paved roads (TBP Table 23)	Developed Land - Roads	Discontinued	Discontinued - No progress recorded toward this project.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Support brownfields restoration efforts that mitigate surface water pollution generated from these sites.		Phase II priority catchments for developed land, TBP Table 22	Developed Land - Other	Completed	DEC's Brownfields Program provides technical and financial assistance to qualified applicants who intend to redevelop a contaminated property, including a Brownfields Handbook, updated in 2023, that guides brownfield site redevelopment. Pollution assessment of adjacent surface waters and potential remediation are key considerations for all brownfields projects. The Brownfields Program also assists in the development of Area Wide Plans to develop community vision for multiple properties and targets areas for redevelopment rather than individual sites. Area Wide Plans have been developed for four municipalities in the Winooski basin (Barre City, Colchester, Northfield, and Winooski).

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Provide education on winter maintenance strategies to businesses and towns to reduce use of Chlorides.	Stevens Branch, Sunny Brook, Lower Winooski tributaries	Barre City, Montpelier, MS4 entities	Developed Land - Other & Roads	Completed	Chittenden County's Rethink Runoff program provides social media campaigns, limited advertising, and direct outreach to MS4 community residents and businesses on the proper use of, and potential use reduction strategies for, road salt. Friends of the Winooski has performed targeted outreach to major businesses in a Stevens Branch tributary (Berlin) after their LaRosa Partnership sampling data demonstrated significantly elevated chloride levels. UVM Sea Grant has supported regional webinars and local partner workshops (Mad River watershed) on winter maintenance strategies targeting businesses and municipal leaders. Since 2018, stormwater projects specifically designed to improve salt management at municipal garage sites have been identified for nine non-MS4 towns (Barre Town, Calais, Duxbury, East Montpelier, Fayston, Middlesex, Montpelier, Moretown, Warren, Washington, Woodbury) through stormwater mapping, master planning exercises, or direct partner outreach. For MS4 communities, proper management of salt in and around their facilities falls under one of the six required Minimum Control Measures of their permit: Good Housekeeping of Municipal Operations.

Support stormwater management education for private landowners, including private driveways		Phase II priority catchments for developed land, TBP Table 22	Developed Land - Other	Complete	FMR, FWR, and WNRCD collectively completed 232 residential stormwater assessments through their Storm Smart program. The program makes recommendations for simple residential stormwater management actions, including addressing storm water concerns associated with driveways. In the first phase of the program, 66 of these homesite assessments resulted in 407 recommended stormwater BMPs including 18 infiltration trenches, 14 vegetated swales, 30 driveway regrading projects, 11 riparian buffer plantings, 7 filter berms, 15 rain gardens, 7 filter berms, and 98 improved lawn care or native planting recommendations. While the same types of management actions above are still recommended, in the second phase of the Storm Smart program partners have focused their project tracking on larger identified BMPs that can be developed through various Clean Water funds. Assessments and project identification are ongoing, but so far partners have identified and prioritized 24 larger stormwater BMPs for potential development. In a separate stormwater education program called Blue BTV, the city of Burlington is incentivizing the installation of small-scale residential stormwater practices by offering rebates of up to $1,000 depending on BMP type. In Blue BTV's first year (2022-2023), 60 residential site assessments were conducted resulting in 13 BMPs implemented at 12 sites. $7,000 in rebates were provided to incentivize this work. Rethink Runoff is an ongoing awareness and public outreach campaign carried out on behalf of Chittenden County MS4 and TS4 permittees. The program offers online stormwater education materials, hosts workshops on residential stormwater topics, and manages volunteer programs for storm drain cleaning, stream clean ups, rain garden maintenance, and water quality monitoring (the Stream Team). A 2023 public Rethink Runoff survey indicates where residential stormwater management behaviors have improved, lapsed, or stayed constant over the past 20 years and hints at stormwater practices where messaging could be improved.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Implement high priority projects identified in river corridor plans	See River Corridor Plans Table 39		Rivers	Complete	15 river corridor plans have been completed in the basin, including one since the 2018 TBP (Lower Mad River). Geomorphic assessments have been completed in an additional 10 watersheds, though additional RCPs have not been developed for these systems. 560 potential projects in the Watershed Projects Database are tied directly to River Corridor Plan or Stream Geomorphic Assessment Development, while CVRPC has identified about 100 additional RCP or SGA projects that are still candidates for inclusion in the WPD. Since SFY2019, 32 acres of riparian forest buffer have been planted with state or federal funds, 18 acres of forested or filter strip buffers were installed on agricultural lands, 4 acres of floodplain have been restored, and river corridor easement, road stream crossing, and dam removal projects have been designed and implemented as described below. Most implemented projects were originally identified in River Corridor Plans, or otherwise were identified as a high priority project by the DEC watershed planner and river scientist. Note that DEC data do not track most types of private funding which may support significant natural resource restoration activity. For example, the basin's most active planting partner (FWR) implemented 38 acres of riparian buffer since 2019 according to their own records. About 20% of this work was funded by private sources. However, because of the complexity of project financing, it is difficult to explicitly parse privately funded from government-funded project acreage. In general, implementation metrics here should be considered conservative; additional work may have been done with private funds.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Replace geomorphologically and aquatic organism passage (AOP) incompatible culvert and bridges: RPCs work with municipalities to identify, add to capital budget, seek additional funding sources	Mid and Upper Winooski tributaries: Potential B(1) for fishing watersheds (TBP Table 34)		Rivers	Complete	A multi-partner AOP working group including USFWS, FWD, FWR, and WNRCD scoped about two dozen stream crossings and targeted culvert upgrade work in the Stevens Branch (Williamstown, Barre) and Winooski headwaters (Cabot, Marshfield, Plainfield) sub-watersheds. LCCD and LCPC are focusing additional outreach and project scoping in the Little River watershed, and FWR and FMR have completed one AOP project in the Mad River valley. Likewise, the state and towns replace culverts across the basin when funding is available. 37 perennial stream crossings have been improved since SFY2019. Moreover, municipalities have replaced 103 road drainage and stream culverts to improve roads-related stormwater management. The Rivers Program reviews all upgrade projects to ensure the structure meet current standards for geomorphic compatibility.
Increase River Conservation Easements: support projects which incorporate channel management and riparian buffer and provisions in areas where protection does not otherwise exist.	See River Corridor Plans TBP Table 39		Rivers	Complete	Stowe Land Trust, Vermont Land Trust, and Vermont Rivers Conservancy hold river corridor easements in the Winooski basin. Since SFY2019, they conserved an additional 82 acres of riparian corridor with state or federal funds.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Enhance the Flood Resilient Communities Program with funding and technical assistance incentives for municipalities.		Towns with interim ERAF status	Rivers	In Progress	The Agency continues to encourage municipalities to meet ERAF status through outreach on the Floody Ready website and staff interactions. State funding has also supported CCRPC, CVRPC, and LCPC technical assistance to towns working to update four aspects of town planning to achieve an elevated ERAF rating: National Flood Insurance Program enrollment, Vermont Road and Bridge Standards adoption, Local Emergency Management Plan completion, Local Hazard Mitigation Plan adoption, and River Corridor protection. Eight towns increased their ERAF ratings since the 2018 TBP and two towns adopted protective river corridor bylaws (South Burlington, Huntington). However, during the same period the ERAF rating of six municipalities declined because of lapsed LEMPs or LHMPs.
Support studies to investigate benefits of removal of dams listed in Table 9 and where landowner interest exists			Rivers	In Progress	A dam removal working group (FWR, WNRCD, LCCD, VTNRC, VFWD, USFWS, TNC, CVRPC) has developed a list of nine dams that are in various stages of project development moving toward removal and another 21 dams that partners will scope as potential future projects. Project lists were developed considering ecological and geomorphic benefits, hazard class, and possible owner buy-in. In all, these dams represent more than a quarter of the 124 remaining in-service or partially breached dams inventoried in the Winooski basin. Since the last basin plan, one dam was removed in the basin and two dams in design phases of removal were partially or fully breached by the July 2023 flood. These latter projects are transitioning to floodplain restoration projects.
Assist towns in accessing and understanding use of the Vermont Geological Survey's landslide inventory to benefit Hazard Mitigation Plan as well as preventing landslides through land conservation.	See Landslide Inventory Map, 2017	Middlesex, Plainfield, Calais, Warren, Jericho, Bolton	Rivers	In Progress	Of the six listed priority towns that have re-written their Local Hazard Mitigation Plan since the 2018 TBP (5 towns), all evaluated landslides as potential hazards in LHMP development. In one town (Plainfield), landslide hazards ranked highly relative to other threats. Some towns noted a lack of state and town-level resources to identify and address potential landslide hazards.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Support gully stabilization and remediation by addressing stormwater inputs and/or through natural channel design where possible			Rivers	In Progress	Just 105 square feet of forested gully erosion and 400 square feet of stormwater infrastructure-related gully erosion has been remediated since SFY2019. However, ANR has contracted a consultant team to identify and map critical source areas of forestland erosion and establish a method to estimate the potential for phosphorus and sediment reductions associated with forestland BMPs and AMPs. A second phase of this work will 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. These prioritization tools should accelerate the identification and implementation of more non-regulatory BMPs to address legacy forestry issues like gully erosion. However, landowner buy in is obviously important in implementing projects and has currently stalled the efforts of gully stabilization beyond the design phase for one basin partner. Through the MRGP, towns will also address road stormwater causing gullies where associated with prioritized road segments in REIs.

Remediate habitat in highly degraded areas and/or areas where extensive channel management occurred by adding woody debris	Mad and Dog River		Rivers	In Progress	In addition to its in-stream habitat benefits, strategic wood addition may have stream stability, flood attenuation, and water quality benefits where sited appropriately. While strategic wood addition has been practiced in Vermont for more than a decade, there appears to have been a recent surge of interest in this type of work in the Winooski basin and elsewhere in the state. However, stakeholders have various perspectives on SWA project identification, development, implementation, and even definitions of SWA itself. To streamline SWA understanding and accelerate good project implementation, the Vermont Fish and Wildlife Department developed an SWA guidance document in 2020 and the Rivers Program followed suit in 2021. Moreover, SWA working groups that include multiple state programs, federal program staff, and SWA practitioners are meeting regularly to discuss identification, permitting, and funding considerations of SWA. DEC also just secured technical assistance from EPA and Tetra Tech to develop a simple statewide analysis to identify stream reaches for further SWA project scoping with input from various stakeholders. In the past six months, more than six stream miles of SWA have been proposed in the Winooski basin and, after further review with the watershed planner, river scientist, and fish biologist, included in the Watershed Projects Database. Partners are currently applying to Clean Water funding programs to support this work. This work is not currently proposed for the target sub-watersheds, but one of these watersheds (Dog River) has been identified as a target geography for a Winooski in-stream and floodplain restoration working group organized by The Nature Conservancy. The Agency's understanding of the joint fish habitat and water quality benefits of this project type is still in its infancy, but there appears to be interest in scaling up this work (as well as related beaver dam analog and post-assisted log structure project types). More heavily engineered woody debris structures can be used in limited cases in larger streams to stabilize banks

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
					while providing habitat, but this work hasn't been largely implemented in the Winooski since the last basin plan.
Use community interest in salmon and/or brook trout to engage community in watershed protection actions	Mid and Upper Winooski tributaries, Mad River, Dog River, Huntington: Potential B(1) for fishing watersheds (TBP Table 34)		Rivers	Complete	CVRPC provided outreach to Northfield, Marshfield and Middlesex to gain community support for reclassification of very high quality waters, many of which support brook trout. FWR engaged FWR engaged community with education and outreach efforts, including World Fish Migration Day video series and an open restoration site day. The Vermont chapter of the Native Fishes Council is coordinating with DEC to deploy "native brook trout" or "native fish" signage at proposed upland and lowland Winooski basin sites, respectively, to encourage native fish resource recognition and voluntary actions stewarding these resources. This effort is just beginning, and no signs have been deployed as of November 2023. Since summer 2022, the MadDog Chapter of Trout Unlimited has hosted an approximately quarterly meeting to coordinate planning for the maintenance or improvement of wild trout fisheries in the Dog River sub-watershed. Attendees include Trout Unlimited volunteers and chapter leaders, municipal conservation commission members, watershed organizations, university faculty, DEC planner and assessment scientists, and FWD biologists.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Identify and remediate eroding, abandoned and retired forest roads, skid trails and log landings	Phase II priority catchments for forested land (TBP Table 16)		Forests	In Progress	The ANR is in the process of assessing and prioritizing erosion issues along hydrologically connected forest roads on ANR-owned lands. State Forest roads in the basin are primarily found in Mount Mansfield State Forest, CC Putnam State Forest, and Camels Hump State Park. ANR inventoried a significant portion of forest roads in all three major state lands in 2022 and will continue surveys in Mount Mansfield State Forest and Groton State Forest in 2023 and 2024. These inventories will identify potential road projects which can reduce sediment and phosphorus loading to surface waters in the basin. Furthermore, ANR's Road Erosion Inventory App should become a resource for contractors and volunteers on other public and private lands by spring 2024. Since SFY2019, five miles of forest road drainage and erosion control improvement was implemented in the basin.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Provide technical and financial assistance to forest landowners to meet AMP	Phase II priority catchments for forested land (TBP Table 16)		Forests	Complete	Since the last basin plan Vermont DFPR hosted at least 7 workshops with 280 forest landowners, foresters, and loggers to educate on compliance with the AMPs in central and western Vermont. Some of these workshops organized through the Logger Education to Advance Professionalism (LEAP) program incentivize logger and forester understanding of water quality concerns and AMP requirements by providing credit for classes towards professional certification. In calendars 2019-2022, the Essex and Barre District offices performed 103 AMP-related sited visits stemming from 48 technical assistance requests and 55 submitted complaints. In 25 cases a water quality issue was identified that needed to be remediated. Most of these issues were resolved through landowner education and implementation of the AMPs. Very few went to enforcement. Watershed organizations have also performed outreach and education to forest landowners. FMR's Ridge to River program supports a forestry working group that is focuses on encouraging landowners and municipalities to protect forest cover. This work helps increase forestland in the Use Value Appraisal program in which approved forest management plans are required.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Provide loggers with access to bridges to reduce floodplain encroachment and improve AOP, including renting portable skidder bridges or promote building and ownership of bridges by logging as part of their general practices. In addition, DFPR will continue renting larger temporary bridges, which provide a larger opening than the skidder bridge and can handle logging trucks.			Forests	Complete	The DFPR began providing cost-share funding for loggers and foresters to receive temporary portable skidder bridges. Statewide, the DFPR distributed 12 free wooden bridges in 2018 and administered 9 cost-share grants for bridges in 2019 and 2020. In addition, the DFPR Watershed Forester administers a rental program for 5 heavy duty steel bridges for crossing larger rivers. In the Winooski basin, with support from DFPR the WNRCD offered a portable wooden skidder bridge program but discontinued the program after the bridge failed in 2019. However, in 2023 DFPR re-launched the skidder bridge construction and rental program with support from NRCDs and using Clean Water funding. The WNRCD received two new skidder bridges which will be rented at a rate of $100 per month.
Enhance forest cover to improve watershed health by promoting the use of Ecologically Sensitive Treatment Areas for managed forest in current use.			Forests	Complete	DFPR promotes use through county foresters and outreach materials, and some county foresters anecdotally note their increased use. However, some foresters also note that adherence to AMPs in riparian areas is viewed by some landowners as a less administratively complicated way to achieve similar forest and watershed health.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Protect forestland	Winooski headwaters, North Branch, Kingsbury Branch	Berlin, Middlesex	Forests	Complete	The Vermont Use Value Appraisal program provides incentives for landowners to keep land in forest and requires development of a forest management plan that ensures protection of forest. The DFPR provides technical assistance to support protection including the Use Value Appraisal Manual which includes forest management standards and a template for a forest management plan. 132,520 forestland acres* were inspected through the Use Value Appraisal program since SFY2019 to ensure accuracy of forest management plans and to monitor implementation of any scheduled forestry activity. Moreover, an additional 3,065 acres of land were conserved with natural resource protections since SFY2019. One such action by the Berlin Pond Watershed Association, in coordination with the City of Montpelier, Town of Berlin, and Vermont Land Trust, protected an additional 33 acres of wetlands and forests within the Source Protection Area for Berlin Pond, the drinking water source for Montpelier. **Reported UVA data is representative of only the most recent inspection visit recorded and values may be incomplete for previous fiscal years*
Determine following wetlands potential as Class I wetland through collection of additional information: Shelburne Pond, Essex Alder Brook (Essex and Milton), Upper Gleason (Bolton), Kettle Pond south (Marshfield and Groton), Lanesboro Bog (Marshfield) and Mud Pond (Williston) to			Wetlands	In Progress	Assessments have occurred on all but Upper Gleason and Alder Brook (require private land access). Lanesboro Bog has been determined to be a candidate for Class I reclassification, while the others need additional study.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Prioritize restoration of wetland and floodplains on agricultural lands with highest potential for phosphorus retention and sediment attenuation.			Wetlands & Rivers	In Progress	Updated Lake Champlain wetland restoration site prioritization modeling was completed in 2018 using RCPP funds. The updated maps identify potential wetland restoration areas with the highest likelihood of P attenuation and are available on the ANR Atlas and the Wetlands Inventory Mapper. Partners such as NRCDs, NRCS, VLT, TNC and DFW are using these maps and a subset of project packets to help target wetland restoration outreach. DEC is continuing to develop a standard operating procedure with the Functioning Floodplains Initiative tool to determine the phosphorus and flood reduction potential of wetland restoration and conservation projects. 98 acres of wetlands were conserved and restored in the basin since SFY2019.
Prioritize restoration and protection of wetlands, as well as floodplain forests, and river corridors based on potential to filter out pollution.			Wetlands & Rivers	In Progress	See above. Additionally, the Functioning Floodplain Initiative tool was made publicly available as of early 2023 to allow practitioners and Agency staff to evaluate and compare the phosphorus reduction potential of individual natural resource restoration projects including easements.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Promote the Lake Wise Program.	Kingsbury Branch	Calais, East Montpelier, Woodbury, including Greenwood Lake	Lake	Complete	With support from UVM Sea Grant's Lake Education and Action Program, in 2021 FWR distributed a postcard and brochure to 250 lakeshore landowners in the Kingsbury Branch sub-watershed to promote lakeshore best management practices and invite participation in Lake Wise assessments. FWR received little feedback from this extensive effort. FWR did complete 6 Lake Wise assessments on 4 lakes in 2022. Caledonia County NRCD engaged in 2 Lake Wise Assessments on Peacham Pond resulting in a boat ramp access stormwater project currently in final design. DEC did another 5 assessments on the same pond in 2023. DEC, CVRPC, WNRCD, and FWR are exploring additional outreach strategies to reach Kingsbury Branch lakeshore landowners, despite the general lack of lake associations in this area.
Promote contractor and partner participation on the Natural Shoreland Erosion Control Certification Program	Greenwood Lake		Lake	Complete	DEC promotes and holds these trainings with partners, including the WNRCD who hosted the 2019 Summer Erosion Control Field Day in the Winooski Basin. In the Winooski basin DEC hosted three trainings to certify 60 practitioners, including many local partners. Other trainings were available outside of the basin boundaries.
Incorporate materials specific to spiny water flea into signs, greeter program. Place spiny water flea spread prevention information at all lake accesses	Kingsbury Branch	Calais, East Montpelier, Woodbury	Lake	Complete	Lake Champlain has seen the introduction of the spiney water flea. No additional spread to inland lakes or ponds in the basin has been identified. DEC and LCBP's current monitoring and outreach messages are focused on current threats, including, but not limited to zebra mussels and the spiny and fishhook water flea. Outreach about the spiny water flea includes information incorporated into posters placed at DFW access site kiosks and information provided by boat greeters who are trained by the DEC AIS Program. In the Winooski Basin, a Public Access Greeter is hired to educate boaters using the Waterbury Reservoir.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Support community's efforts to control Eurasian watermilfoil and other invasives	See TBP Table 4 for lakes altered by Eurasian watermilfoil		Lake	Continued	DEC provides financial support to community-led efforts through the AIS Grant-in-Aid program as well as technical assistance. Project awards provided funds for education and outreach, surveys, spread prevention efforts. In the Winooski basin, funds supported greeter programs at the Waterbury reservoir, Curtis Pond and Colchester Pond. However, grants have not supported active AIS management/removal in Winooski basin lakes. The AIS Grant-in-Aid program will be available for Winooski lakes AIS management as needed where community interest develops.
Grow the access greeter program at Curtis Pond to include other local lakes	Kingsbury Branch: Curtis Pond	Calais	Lake	Continued	Since 2002, the Vermont Public Access Greeter Program has expanded operation to access points at 32 lakes and ponds statewide, and those numbers are increasing annually. However, in the Winooski basin the greeter program is shrinking. Curtis and Colchester Ponds used to have greeter programs that have become inactive since the 2018 TBP. Only the Waterbury Reservoir program has continued as of 2023. As in the Lake Wise Program description above, partners will continue to assess and, where appropriate, encourage community support for lakes-related initiatives in the Kingsbury Branch.
Assist development of a cyanobacteria (blue-green algae) volunteer monitoring program and response plan			Lake	Complete	The Agency, the Vermont Department of Health and partners have worked collaboratively to develop and implement education and outreach tools as well as a monitoring program and cyanobacteria tracker website with results to help communities identify and avoid contact. Since the last basin plan, five Winooski basin lakes were monitored at least one year for Cyanobacterial blooms (Shelburne Pond, Baker Pond, Gillett Pond, Waterbury Reservoir, and Molly's Falls Reservoir).
Recruit lay monitors for collecting water quality data on high priority lakes	Kingsbury Branch: Buck, Pidgeon, Coits, Turtlehead		Lake	In Progress	By 2022, 11 lakes in the basin were being monitored by volunteers, mainly in the Kingsbury Branch. However, no lay monitors were recruited for the 4 prioritized lakes (Buck, Coits, Pidgeon, Turtlehead). An updated list of target lakes for lay monitor recruitment is provided in the Monitoring Table of the 2023 TBP.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Support community efforts to protect lake shoreland			Lake	In Progress	See Lake Wise Program update above.
Issue permits to WWTF that meet new phosphorus limits. Support municipalities pursuing phosphorus optimization, expansion projects and upgrades		See TBP Table 30	Wastewater	In Progress	Of the 16 WWTFs in the basin, all had permits expiring during or before 2018-2023 period. Of those, 13 were issued new permits. Of the three remaining facilities, in 2024 two will be issued the state's first ever integrated permit that will provide the flexibility needed for the City of Burlington to meet the requirements of the Lake Champlain TMDL. Facility-specific upgrade information for the 16 WWTFs is available in the draft 2023 Tactical Basin Plan Chapter 4: Wastewater section.
Determine the “reasonable potential” that WWTF's have to cause or contribute to downstream water quality impairment			Wastewater	In Progress	A reasonable potential analysis was completed in conjunction with permit issuance for the 13 re-permitted facilities since 2018. See the VT Wastewater NPDES Permit webpage for full reasonable potential analyses appended to each facility's issued permit. The Watershed Management Division is leveraging the LaRosa Partnership program to collected additional bracketed nutrient data upstream of WWTFs state-wide to study their contribution to nutrient loading. Moreover, a state-wide PFAS study was launched in 2022 to quantify PFAS associated with WWTFs and subsequently prioritize needed technical and financial assistance.
Provide septic system maintenance education to homeowners	Huntington River, Kingsbury Branch, Jail Branch	Calais	Wastewater	In Progress	WNRCD hosted a statewide conference and two septic socials reaching roughly 100 individuals. However, no activity on residential septic education has occurred since the 2021 interim report card.

Strategy Description	Priority Subbasin(s)	Priority Towns	Sector	Final Status	Explanation
Conduct biomonitoring and/or water quality monitoring on lakes, wetlands and streams to gain better understanding of condition and potential pollution sources, including internal phosphorus loading in lakes. In addition, monitor for pathogens at swimming areas and report to community.	Kingsbury Branch, Jail Branch, Muddy Brook	See TBP Table 11	Natural Resources	In Progress	The DEC Monitoring and Assessment Program, Lakes and Ponds Program, Wetlands Program, and Fish and Wildlife Department collectively assessed well over 100 sites, including those priorities listed here, since the 2018 TBP to assess condition and potential pollution sources (See Chapter 1 of the 2023 TBP). Volunteering monitoring by WNRCD, FMR, FWR supported through DEC LaRosa Partnership Program and the Regional Stormwater Program supported by Chittenden County MS4s supported the assessment of dozens of sites to characterize nutrient, chloride, and pathogen conditions. Pathogen sampling through the LaRosa Program was discontinued after 2019, but partners continue to monitor for nitrogen, phosphorus, and chloride where appropriate. FMR conducted their own pathogen monitoring to inform recreation decisions up to 2020, after which their Mad River Watch program was realigned to match the organization's interests and capacity.
Conduct biomonitoring and/or water quality monitoring on lakes and streams that have met "very good" or "excellent" criteria to identify candidates for reclassification		See TBP Table 11	Natural Resources	In Progress	See above. Since the 2018 TBP, one lake was added to the candidate reclassification list, seven streams were added to the aquatic biota reclassification candidate list, and four streams were added to the fisheries reclassification list.

Appendix D: Results of State Stormwater Regulations

This appendix summarizes the contributions that Operational Stormwater Permits have made toward meeting Vermont's water quality goals.

Scope of Data	
Data include:	Stormwater permit data includes new or amended operational stormwater permits issued in state fiscal year (SFY) 2018–2023. Permits authorize new, redeveloped, and existing impervious surfaces meeting regulatory thresholds. DEC tracks permit issuance, not actual construction of impervious. Actual construction and change in phosphorus load may occur one to several years behind authorization under the permit.
Data does not include:	Phosphorus load data from outside the Lake Champlain and Lake Memphremagog basins.

Table D-1. Stormwater treatment practice types installed to comply with new operational stormwater permits in SFY 2023, total of permitted practices since SFY 2018, and average estimated phosphorus removal rates.

Practice Tier	Definition and examples	Average Phosphorus Removal	Permitted in SFY 2023	Total since SFY 2018
Tier 1 practices	Infiltrating practices, impervious disconnection	>80%	80	922
Tier 2 practices	Gravel wetlands and bioretention with underdrains	60-80%	89	298
Tier 3 practices	Wet ponds, filters and dry swales not designed to infiltrate	50-60%	20	119
2002 VSMM[86] practices	Grass lined channels, non-structural credits	<50%	0	48
Total number of practices permitted			189	1,387
Average total phosphorus load removal of permitted practices[87]			71.3%	

[86] VSMM is defined as Vermont Stormwater Management Manual.

[87] Phosphorus removal efficiencies were assigned to each practice assuming that it was sized to meet the water quality volume. See Standard Operating Procedures for Tracking & Accounting of Developed Lands Regulatory Projects & Non-Regulatory Clean Water Projects for phosphorus removal efficiencies: https://dec.vermont.gov/water-investment/cwi/projects/tracking-accounting#SOP

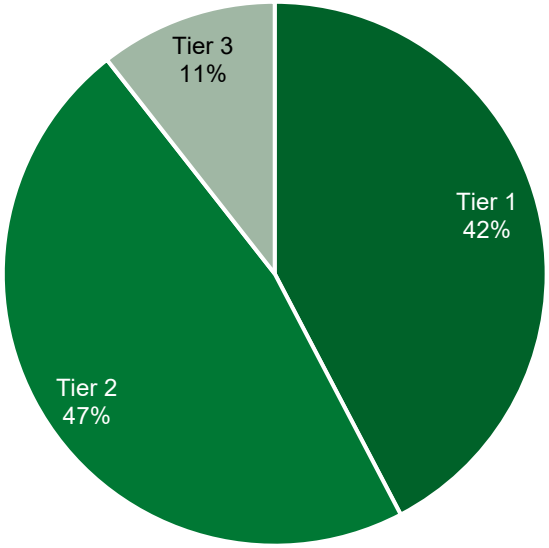

Figure D-1. Percent stormwater treatment practices by tier for new operational stormwater permits issued in SFY 2023.

Table D-2. Impervious surface area covered by operational stormwater permits issued in SFY 2023, and totals since SFY 2018, by large drainage areas.

Permitted Impervious Surface Type	SFY 2023	Total since SFY 2018
Lake Champlain		
New impervious (acres)	128.4	585.8
Redeveloped impervious (acres)	35.9	136.1
Existing impervious (acres)	60.4	163.7
Total impervious (acres)	224.7	849.7
Percent of impervious permitted	82.2%	
Lake Memphremagog		
New impervious (acres)	11.7	31.1
Redeveloped impervious (acres)	0.4	3.7
Existing impervious (acres)	0.5	2.2
Total impervious (acres)	12.6	37
Percent of impervious permitted	4.6%	
Other Drainage Areas		
New impervious (acres)	21.3	109.7
Redeveloped impervious (acres)	8.7	36.2
Existing impervious (acres)	6.1	64.6
Total impervious (acres)	36.2	169.7
Percent of impervious permitted	13.2%	

Figure D-2. Vermont's Large Scale Drainage Areas

Table D-3. Estimated change in total phosphorus load associated with operational stormwater permits in the Lake Champlain and Lake Memphremagog basins (kilograms/year), SFY 2018–2023.

Estimated Change in Total Phosphorus Load	SFY 2023	Total since SFY 2018
Lake Champlain		
Increase in phosphorus from operational permits, prior to treatment[88] (kilograms/year)	113.9	613.6
Phosphorus reduced by treatment practices (kilograms/year)	192.1	790.3
Net change in phosphorus of operational permits (kilograms/year)	**-78.2**	**-189.3**
Lake Memphremagog		
Increase in phosphorus from operational permits, prior to treatment[88] (kilograms/year)	13.8	146.5
Phosphorus reduced by treatment practices (kilograms/year)	24.2	116.6
Net change in phosphorus of operational permits (kilograms/year)	**-10.4**	**29.9**

[88] Permitted impervious and phosphorus load calculations include both new and amended permit authorizations. For amended permits, only the increased impervious acres and phosphorus load relative to the previous permit are summarized here. Phosphorus increases from new development assumed that the permitted area was forested prior to development. Redeveloped and existing impervious does not result in a phosphorus change related to change in land use.

Appendix E: Glossary of Acronyms

AAFM - Agency of Agriculture, Food & Markets

ACCD - Agency of Commerce and Community Development

AgCWIP - Agricultural Clean Water Initiative Program, in the Agency of Agriculture, Food & Markets

AIS - Aquatic Invasive Species

AMPs - Acceptable Management Practices

ANR - Agency of Natural Resources

AoA - Agency of Administration

AOP - Aquatic Organism Passage

ARPA - American Rescue Plan Act

BMPs - Best Management Practices

BTV - Burlington, Vermont

CO_2 - Carbon dioxide

CAO - Climate Action Office, in the Secretary's Office, in the Agency of Natural Resources

CCRPC - Chittenden County Regional Planning Commission

CEAP - Conservation Equipment Assistance Program

COVID-19 - Coronavirus disease

CREP - Conservation Reserve Enhancement Program

CSFO - Certified Small Farm Operation

CSO - Combined Sewer Overflow

CVRPC - Central Vermont Regional Planning Commission

CWA - Clean Water Act

CWIP - Clean Water Initiative Program, in the Water Investment Division of the Department of Environmental Conservation, in the Vermont Agency of Natural Resources

CWRF - Clean Water Reporting Framework

CWSPs - Clean Water Service Providers

CWSRF - Clean Water State Revolving Fund

DEC - Department of Environmental Conservation, in the Agency of Natural Resources

DFPR - Department of Forests, Parks and Recreation, in the Agency of Natural Resources

DFW - Department of Fish and Wildlife, in the Agency of Natural Resources

ECO - Environmental Careers and Opportunities

EPA - Environmental Protection Agency

ERAF - Emergency Relief and Assistance Fund

ESTA - Ecologically Significant Treatment Areas

FAP - Farm Agronomic Practice

FCNRCD - Franklin County Natural Resources Conservation District

FEMA - Federal Emergency Management Agency
FFI - Functioning Floodplain Initiative
FMR - Friends of the Mad River
FNLC - Friends of Northern Lake Champlain
FRP - Flow Restoration Plans
FWR - Friends of the Winooski River
GINRCD - Grand Isle Natural Resources Conservation District
GSI - Green Stormwater Infrastructure
GWFS - Grassed Waterway and Filter Strip
HUC - Hydrologic Unit Code
IDDE - Illicit Discharge Detection and Elimination
LC - Lake Champlain
LCA - Lewis Creek Association
LCBP - Lake Champlain Basin Program
LCCD - Lamoille County Conservation District
LCPC - Lamoille County Planning Commission
LEAP - Logger Education to Advance Professionalism
LEMP - Local Emergency Management Plan
LFO - Large Farm Operation
LHMP - Local Hazard Mitigation Plan
LID - Low Impact Development
LPP - LaRosa Partnership Program
MCM - Minimum Control Measures
MFO - Medium Farm Operation
MPO - Metropolitan Planning Organization
MRGP - Municipal Roads General Permit
MS4 - Municipal Separate Storm Sewer
NMP - Nutrient Management Plan
NPDES - National Pollutant Discharge Elimination System
NRCD - Natural Resources Conservation District
NRCS - Natural Resources Conservation Service
NRPC - Northwest Regional Planning Commission
O&M - Operation and Maintenance
P - Phosphorus
PCP - Phosphorus Control Plans
PFAS - Per- and polyfluoroalkyl substances
PPP - Public Private Partnership

PSWF - Pasture Surface Water Fencing

RAPs - Required Agricultural Practices

RCP - River Corridor Protection

RCPP - Regional Conservation Partnership Program

REIs - Road Erosion Inventories

RPC - Regional Planning Commission

RSEP - Regional Stormwater Education Program

SFY - State Fiscal Year

SGA - Stream Geomorphic Assessment

SWA - Strategic Wood Addition

SWMP - Stormwater Master Plan

TA - Technical Assistance

TBP - Tactical Basin Plan

TMDL - Total Maximum Daily Load

TNC - The Nature Conservancy

TP - Total Phosphorus

TS4 - Transportation Separate Storm Sewer System

USDA - United States Department of Agriculture

USDA-NRCS - United States Department of Agriculture - Natural Resources Conservation Service

UVA - Use Value Appraisal

UVM - University of Vermont

VAWQP - Vermont Agricultural Water Quality Partnership

VHCB - Vermont Housing and Conservation Board

VHP - Very High Priority

VLT - Vermont Land Trust

VPFP - Vermont Pay for Performance

VPIC - Vermont Phosphorus Innovation Challenge

VSMM - Vermont Stormwater Management Manual

VT - Vermont

VTRANS - Agency of Transportation

WNRCD - Winooski Natural Resources Conservation District

WPD - Watershed Projects Database

WPP - Watershed Planning Program, in the Water Investment Division, in the Department of Environmental Conservation, in the Agency of Natural Resources

WQ - Water Quality

WWTF - Wastewater Treatment Facility