






Summary of Ongoing/Existing Innovative or Alternative Technologies or Practices to Improve Water Quality

The Clean Water Budget's "Innovative or Alternative Technologies or Practices to Improve Water Quality" line-item funds "innovative or alternative technologies or practices designed to improve water quality or reduce sources of pollution to surface waters...". While this line item makes an explicit investment in research related to innovative or alternative technologies or practices, innovation is also integrated throughout many of the Clean Water Budget-supported programs/activities. Below is a summary table with examples of ongoing/existing innovative or alternative work across state agencies, supported by the Clean Water Budget. Ongoing/existing work will be taken into consideration to strategically target new investments in innovative or alternative technologies and practices. The Lake Champlain Basin Program also funds innovative or alternative clean water work in Vermont and across the Lake Champlain basin (see page 7 for more information).

Line Item	Agency	Project	Goal	Innovative/Alternative Aspect	
Water Quality Grants to Partners and Farmers	Agency of Agriculture, Food and Markets (AAFM)	Woodchip Barnyard Replacement	Provide cost effective solutions to reduce water quality impacts for small livestock producers.	The woodchip barnyard, an innovative practice from the UK, replaces existing heavy use areas with a layer of woodchips and contains drainage collection system.	
Water Quality Grants to Partners and Farmers	Agency of Agriculture, Food and Markets (AAFM)	Grassland Shallow Slot Manure Injection	Significantly reduce surface phosphorus application and nutrient loss while increasing efficiency and crop production.	The predominant practice for spreading manure on hay fields is surface application. This new technology of manure injection reduces phosphorus runoff from hay fields.	
Water Quality Farm Improvements and Retirement Projects	Vermont Housing and Conservation Board (VHCB)	Farmland Retirement Program	Retire and restore farmland whose continued operation is detrimental to water quality and provide a critical source of capital to retiring farmers.	An innovative practice of targeting retirement of farm parcels for the purpose of protecting and improving water quality.	
Implement Best Management Practices at State Forests, Parks, and Recreational Access Roads	Agency of Natural Resources (ANR) Department of Forests, Parks and Recreation (FPR)	Road Erosion Inventory	Assess hydrologically connected road segments on ANR land and develop a methodology of scoring and prioritization to efficiently and effectively implement clean water funds.	Road Erosion Inventory is the first program designed to comprehensively assess roads and includes the creation of a Survey123 application for data collection and utilizes GIS technology.	
Program and Partner Support	Agency of Natural Resource (ANR) Department of Environmental Conservation (DEC) Clean Water Initiative Program (CWIP)	Clean Water Workforce Capacity Development Initiative	To ensure that the State and its valued partners can effectively and sustainably meet the upsized demand for more clean water project design, development, implementation, and maintenance.	Direct investment in partner capacity has not been done to this level before and involves interviewing and soliciting input from partners on capacity needs before designing funding opportunities.	

Examples of Ongoing/Existing Innovative or Alternative Technologies or Practices to Improve Water Quality

The following innovative or alternative project examples are organized by Clean Water Budget line item and include a brief overview of the project goals and innovative or alternative aspects.

Clean Water Budget Line Item: **Water Quality Grants to Partners and Farmers**
Agency: **Agency of Agriculture, Food and Markets (AAFM)**
Project: **Woodchip Barnyard Replacement Project**

Goal of Project and Summary:

To provide a cost-effective solution for small livestock producers looking to improve winter management and reduce water quality impacts from winter heavy-use areas.

Innovative/Alternative Aspects of the Project:

The woodchip barnyard can replace existing heavy-use areas and contains a drainage layer overlain by woodchips. The drainage system underneath collects and diverts the effluent to a collection system. The top layer of woodchips is replaced each year and can be composted and then field applied along with the effluent collected from underneath the woodchips. This innovative practice was first introduced in Ireland and the UK in the early 2000s, used in New Zealand, and researched in West Virginia in the last ten years. University of Vermont Professor Joshua Faulkner brought this practice north from West Virginia, with the first woodchip barnyard implemented in Warren, VT in 2016.



During implementation of woodchip barnyard project in Vershire, Vermont.

Clean Water Budget Line Item: **Water Quality Grants to Partners and Farmers**
Agency: **Agency of Agriculture, Food and Markets (AAFM)**
Project: **Grassland Shallow Slot Manure Injection Project**

Goal of Project and Summary:

UVM Extension acquired, tested, and evaluated an innovative technology called Grassland Shallow Slot Manure Injection. The goal was to significantly reduce surface phosphorus application and nutrient loss while increasing efficiency and crop production. Grassland shallow slot injection is a very shallow manure injection method which causes a low level of soil disturbance. This technology decreases surface runoff and enables low disturbance manure injection on hay fields. The goals of this project were to provide farms with an opportunity to reduce impacts from manure application on hay fields, as well as to share this new opportunity with the agricultural community and raise awareness about this equipment. During the project time frame, the system was used on almost 5,000 acres, predominately in priority watersheds including East Creek and McKenzie Brook. The system continues to be operated by a Custom Manure Operator in Addison County and is available to be used on farms within their service area.

Innovative/Alternative Aspects of the Project:

The predominant practice for spreading manure on hay fields is surface application, so this new technology offered an incredible opportunity for reduction of phosphorus (P) runoff. This was a relatively new technology and expensive piece of equipment that came from Veenhuis Machines B.V. in the Netherlands. It is one of the first systems of its kind to be used in Vermont and provided a new method of manure application for Vermont farms that was not available prior to this project. Since this project, two additional systems have been supported in Vermont.



Veenhuis grassland manure injector project in Addison County, Vermont.

Clean Water Budget Line Item: **Water Quality Farm Improvements and Retirement Projects**
Agency: **Vermont Housing and Conservation Board (VHCB)**
Project: **Farmland Retirement Project**

Goal of Project and Summary:

The goal of VHCB's Farmland Retirement Program is to fund a buyout of farmland whose continued operation is especially detrimental to water quality, given the land's location, proximity to water, type of operation, etc. In particular, the Program has targeted farms with identified water quality problems that are physically or financially infeasible to remedy. This has included dairy farms with severe manure management problems that are too costly or too physically difficult to remedy and in places where this type of intense farming use is simply not appropriate. In some cases, the conservation of this land has also coincided with the need for the landowner to retire from the business of farming completely. The funds the farmer receives from the sale of the land is a critical source of capital as they transition to retirement.

With the support of the Clean Water Budget (Capital Bill dollars), VHCB has been able to direct funds to conservation partners (Vermont Department of Fish & Wildlife, The Nature Conservancy (TNC), and Vermont Land Trust (VLT)) to purchase farmland and then retire some, or all, of the land from agricultural production. To date, Clean Water Budget Capital Bill funds (a total of \$860,000) have been used to fund 3 farm retirement projects: Deering Farm (State Fiscal Year (SFY) 2021), Fitzgerald Farm (SFY 2018 and 2019), and Farrow Farm (SFY 2020). These projects have featured habitat restoration work which has included planting native vegetation along impaired waterways to reduce runoff, stabilize riverbanks, and improve water quality. In each of these projects, Vermont Department of Fish and Wildlife now owns the properties and has undertaken extensive restoration work, which has also included removing farm infrastructure to improve water quality and enhance wildlife habitat. A secondary layer of protection in the form of a conservation easement co-held by VHCB and a land trust (VLT or TNC) has ensured that the land will remain perpetually conserved.

Innovative/Alternative Aspects of the Project:

We are not aware of other state-funded conservation programs which focus on the targeted retirement of farm parcels for the purposes of protecting and improving water quality. While the core of VHCB's agricultural program remains the protection of working farmland, we are excited to have the opportunity to work with our conservation partners to protect and improve water quality in places where farming is having severe detrimental effects on water resources and habitat.



In August 2022, VHCB in collaboration with Vermont Department of Fish and Wildlife retired a former dairy farm in the Lake Memphremagog basin. The farm barn and manure pit will be removed, and riparian area restored. This includes day-lighting a stream behind the barnyard.

Clean Water Budget Line Item: **Implement Best Management Practices (BMPs) at State Forest, Parks and Recreational Access Roads**

Agency: **Agency of Natural Resources (ANR)**

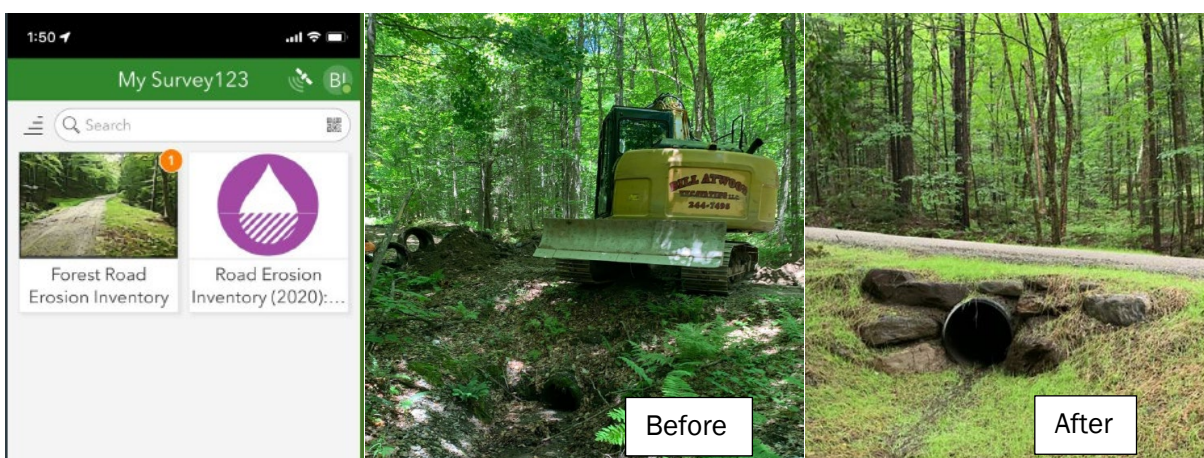
Project: **Road Erosion Inventory Project**

Goal of Project and Summary:

The goal of the project is to adapt the Municipal Roads General Permit Road Erosion Inventory to assess hydrologically connected road segments (i.e., roads most adjacent to waterways) on ANR land. The Inventory scores and prioritizes BMPs to bring road segments up to standards for water quality.

Innovative/Alternative Aspects of the Project:

ANR has never completed a comprehensive road assessment and this project created a good incentive for FPR to adapt the Municipal Roads General Permit Road Erosion Inventory to ANR land. This project included the creation of a Survey 123 App that is used for data collection and utilizes smart phone and GIS technology.



The ArcGIS Field Maps and Survey123 applications are used to manage the hydrologically connected road segments and collect segment data while in the field. This data is then used to install corrective practices, such as replacing undersized culverts with correctly sized structures.

Clean Water Budget Line Item:

Program and Partner Support

Agency:

Agency of Natural Resource (ANR)

Project:

Clean Water Workforce Capacity Development

Goal of Project and Summary:

The Department of Environmental Conservation (DEC) Clean Water Initiative Program (CWIP) has recently launched a Clean Water Workforce Capacity Development Initiative to invest in the people and organizations that help get clean water projects on the ground. Due to additional investments from the Vermont Clean Water Budget, American Rescue Plan Act (ARPA), Bipartisan Infrastructure Law (BIL), Lake Champlain Basin Program, and other opportunities, the total funding for clean water projects over the next few fiscal years is expected to be orders of magnitude greater than historical levels. Implementation of clean water projects across multiple sectors in Vermont requires expanded capacity and evolving technical expertise of a network of partners that are numerous, diverse, well-trained, well-resourced and who operate in an enabling environment with minimal roadblocks or barriers. Vermont is fortunate to have a strong group of partners assisting in these efforts, but recent feedback from these partners has identified challenges to their ongoing success.

Innovative/Alternative Aspects of the Project:

With a relatively sudden increase in federal and state funds, CWIP wants to ensure that the State and our valued partners can effectively and sustainably meet the upsized demand for more clean water project development, design, implementation, and maintenance. CWIP's Capacity Development initiative is innovative in both intent (DEC has not directly invested in partner capacity to this level before) and form (DEC is interviewing and soliciting input from the Clean Water Workforce on capacity needs *before* designing the funding opportunities so that the program reflects better Human Centered Design principles).



CWIP values its partners work and need for capacity: From a shoreland restoration project in Brighton, VT to riparian restoration work along the Lamoille River.

Summary of Lake Champlain Basin Program (LCBP) Role in Clean Water Innovation

The LCBP is a lead partner in the state’s clean water network to help identify and develop innovative or alternative technologies or practices designed to improve water quality or reduce sources of pollution to surface waters. The LCBP, through its Technical Advisory Committee (TAC), allocates federal funds to applied research efforts that support innovative or alternative approaches to achieving clean water goals, as well as maintain/improve performance of ongoing efforts in Vermont and across the Lake Champlain basin—a key component to support adaptive management. The TAC leverages the expertise of professionals from academia, management agencies, and others, including representation from the State of Vermont. The TAC presents technical information to be used for decision-making; advises about emerging management issues and prepares research or action to address those issues; and interprets monitoring program results and other technical information to help determine success or redirection of projects. The State of Vermont provides non-federal match from the Clean Water Budget to assist the LCBP in securing its federal funds, including federal funds to support the TAC’s objectives. This is important context when considering the Vermont Clean Water Budget’s complementary role in supporting/leveraging resources for innovative or alternative technologies or practices. To learn more, [visit the LCBP Technical Advisory Committee webpage](#).

For example, the LCBP TAC has funded and is overseeing a modeling study to evaluate options to control internal phosphorus loading in the Missisquoi Bay, factoring the dynamics of internal (from the Bay sediments) and external (from the land draining into the Bay) phosphorus pollution loading.

Another example, the LCBP TAC has funded and overseen the feasibility study and design of the “Jewett Brook Treatment Train.” This is an innovative approach, under development/evaluation, that could address excessive nutrient runoff, by installing a series of constructed wetlands to treat a proportion of the total flow of the Jewett Brook to remove phosphorus, and to return the treated water to the stream. This proposed concept would complement aggressive implementation of agricultural water quality improvement practices in the Jewett Brook watershed.