

1/18

PROGRESS REPORT ON
RIVER BASIN WATER QUALITY MANAGEMENT PLANNING
(TACTICAL BASIN PLANNING)

DURING 2017

10 VSA § 1253(d)

Submitted to the

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NATURAL RESOURCES AND ENERGY
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DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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Section 1) Introduction and Summary

In 2017, the Vermont Agency of Natural Resources, Department of Environmental Conservation (DEC, or Department) and its federal, state, municipal, regional and local watershed partners continued to be engaged in tactical basin planning process in all of Vermont's planning basins. The goal of the process is to develop tactical water quality watershed management plans for each of 15 planning basins that are built within a two-year timeframe, are revisited every five years, and for which implementation tables of priority actions are continually updated. Tactical basin planning is carried out for the Department by the Watershed Management Division (Division). The Monitoring, Assessment and Planning Program (MAPP) bears primary responsibility for implementing the basin planning process, and fostering effective partnerships, particularly with the Agency of Agriculture, the Natural Resource Conservation Service, Regional Planning Commissions, and the Conservation Districts of the Natural Resources Conservation Council.

The overall goal for each tactical basin water quality management plan is to establish and carry out strategies that will protect, maintain, enhance or restore the surface waters of the basin by directing regulatory, technical assistance, and funding to highest-priority sub-watershed areas. This report is prepared in fulfillment of 10 VSA §1253(d)(1), which states:

“The Secretary shall prepare and maintain an overall surface water management plan to assure that the State water quality standards are met in all State waters. The surface water management plan shall include a schedule for updating the basin plans. (...) On or before January 15 of each year, the Secretary shall report to the House Committees on Agriculture and Forest Products, on Natural Resources and Energy, and on Fish, Wildlife and Water Resources, and to the Senate Committees on Agriculture and on Natural Resources and Energy regarding the progress made and difficulties encountered in revising basin plans. The report shall include a summary of basin planning activities in the previous calendar year, a schedule for the production of basin plans in the subsequent calendar year, and a summary of actions to be taken over the subsequent three years.”

Basin plans and the basin planning process are required by Vermont Statute in 10 V.S.A. 1253(d), Section 29A-103(e) of the Vermont Water Quality Standards, and the U.S. EPA 40 Code of Federal Regulations Part 130, Section 130.6 – Water Quality Management Plans. The surface water management plan described by 10 V.S.A. 1253(d), called the Vermont Surface Water Management Strategy, or “SWMS,” was updated in 2016 to incorporate several new regulatory authorities conferred to the Vermont pursuant to the Vermont Clean Water Act (Act 64 of 2015). The SWMS was also amended to incorporate by reference the allocations of the Lake Champlain Phosphorus TMDL, as required by 40 Code of Federal Regulations Part 130, Section 130.7(d)(2). Lastly, the SWMS was updated to incorporate the water quality commitments embedded in the September 2016 Lake Champlain Phase I Implementation Plan and the Vermont Clean Water Act. The complete SWMS may be found at <http://dec.vermont.gov/watershed/map/strategy>.

During 2017, substantial progress was achieved in basin planning. In addition to the public review, responsiveness revisions, and approval by ANR Secretary Julie Moore of the tactical basin plans listed below, the Department continued to modernize and evolve the tactical planning process to meet the challenges of the Lake Champlain TMDL, including the addition of the Phase II content to Champlain Basin Plans, as well as the approval of the phosphorus TMDL for Lake Memphremagog. This evolution, is described in section two of this report, and comprises the Department's statement of ‘progress and difficulties.’ The summary of expected basin plan production over the coming year and three-year projection of actions is found in section three. Section four provides an overview of basin specific highlights.

Basin plans that were approved or issued for comment during the reporting period include:

Lake Memphremagog, Tomifobia and Coaticook Tactical Basin Plan November 2017

South Lake Champlain Tactical Basin Plan December 2017

Northern Lake Champlain Tactical Basin Plan Update December 2017

Black and Ottauquechee Tactical Basin Plan Public Review Draft January 2018

Section 2) Tactical Basin Planning Process – Progress in 2017.

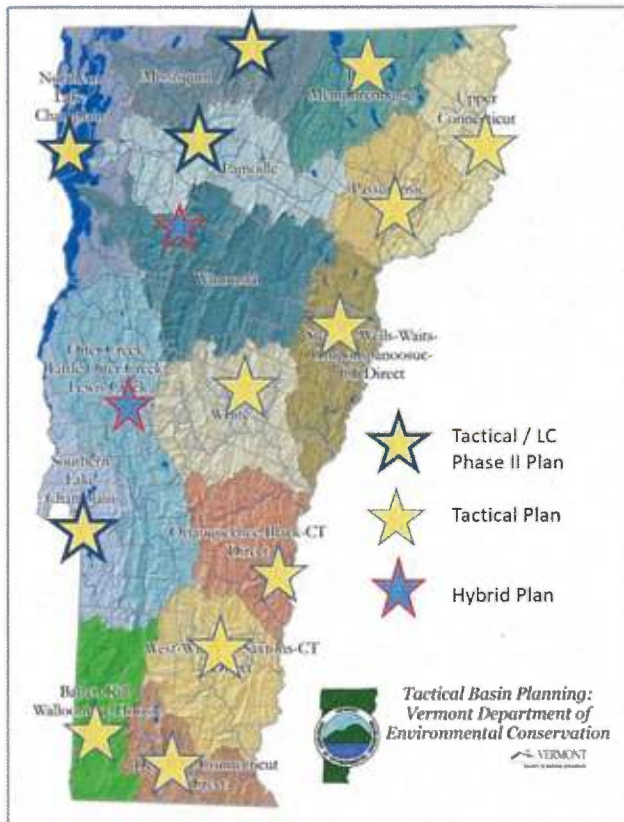


Figure 1. Vermont's 15 Tactical Planning Basins, and the status of each basin plan.

Tactical Basin Plans integrate watershed modeling, water quality monitoring, sector-specific pollution source assessments, water quality modeling, and stakeholder input to document geographically-explicit actions necessary to protect, maintain, enhance, and restore surface waters. These efforts are implemented through a combination of federal and state funding sources, partner support, internal agency support, and for certain protection efforts, the public rulemaking process.

In 2017, MAPP supported tactical planning across all basins in Vermont. Figure 1 indicates the current basin plan type that is available within each of Vermont's 15 planning basins. Tactical basin plans are considered the modern standard, which present precise, geographically-explicit implementation tables identifying those projects necessary to protect, maintain, enhance, and restore surface waters. In Lake Champlain watersheds, two tactical plans were recently updated to incorporate the "Phase II" content to support the Lake Champlain Phosphorus TMDLs issued by USEPA (see below in this report). There are no longer basins that feature traditional basin plans, and only two basins remain that are covered by hybrid traditional-tactical plans. Prior year Legislative Reports discuss the differences between the old traditional basin plans, the ~ 2010-2012 hybrid plans, and modern tactical basin plans.

Table 1 (below) provides an indication of the planning status for each Vermont basin for the reporting period, with a more detailed view of activities in each planning basin provided in Section four. Below, we describe the results of business process improvement efforts which the Division led, using Lean business process improvement approaches, to further modernize the tactical planning process, and to align planning and funding activities. In addition, new modeling capabilities that have been developed using resources conferred by Act 64 and other partners are also described. The required plan production schedule is shown below and in Section 3 of this report.

Table 1. Overall Status of Basin Planning as of 1/1/2018.

Basin	Year of most recent plan issuance	Planning phase for 2018
Basin 1 Battenkill, Walloomsac, Hoosic	2016	Monitoring, Implementation
“South Lake” Champlain (Basin 2 and 4 Poultney, Mettowee, Lower Champlain Direct)	2017	Approved December 2017, includes Lake Champlain TMDL Phase II Implementation Plan
Basin 3 Otter, Little Otter, Lewis	2012	Plan Update to commence in 2018 Lake Champlain Phase II Implementation Plan to be developed during 2018
Northern Lake Champlain (Basin 5 Upper LC, LaPlatte, Malletts Bay, St. Albans Bay, Rock, Pike)	2017 Update (TMDL Phase II)	Implementation Lake Champlain Phase II Implementation Plan incorporated in 2017 update. Approved 12/2017
Basin 6 Missisquoi	2016	Monitoring, Implementation
Basin 7 Lamoille	2016	Monitoring, Implementation
Basin 8 Winooski	2012	Plan Revision Underway Lake Champlain Phase II Implementation Plan to be developed during 2018
Basin 9 White	2013	Plan Revision Underway
Basin 10 (13) Ottauquechee, Black	2012	Planning Public Draft anticipated in Winter, 2018
Basin 11 & 13 Williams, West, Saxton’s, Lower CT,	2016	Implementation
Basin 12 & 13 Deerfield, Lower CT, Mill	2014	Implementation, Plan Update to commence in 2018
Basin 14 Stevens, Wells, Waits, Ompompanoosuc	2015	Implementation
Basin 15 / 16 – Northern CT River Watersheds	2014	Plan Revision Underway
Basin 17 Memphremagog, Coaticook, Tomifobia	2017	Lake Memphremagog phosphorus TMDL and new Tactical Plan in approved – November 2017

Lean – Improvements in Tactical Basin Planning for the Identification and Prioritization of Water Quality Improvement Projects Leading to the Integration of Clean Water Initiative (CWI) Funding for Enhanced and Restored Waters

In December 2017, the MAPP and CWIP Programs convened a LEAN event to examine the process by which projects are identified and prioritized through the tactical planning process, and then the process by which those which are proposed for funding through the Clean Water Initiative’s Ecosystem Restoration Program. The outcome of Lean business process improvement analysis was the identification and development of standardized criteria and stepwise methodology for the identification and prioritization of prospective water quality improvement projects. The subsequent Lean business process improvement plan focused on five major outcomes:

- 1) Standardize the process by which tactical plans identify priority water quality improvement projects based on a consistent approach to analyzing water quality monitoring data, and sector-specific assessment reports.
- 2) Development of a standardized process through which projects are ranked and prioritized based on relevant water quality and environmental benefits, including co-benefits and cost efficiencies.
- 3) Revisions to the [Watershed Projects Database](#) system to effectively convey priority water quality improvement projects, attendant benefits and co-benefits, and the project status towards implementation.
- 4) Refinement of a process by which prospective projects are evaluated for readiness and funding priority based on readily defined criteria, and a sequence of planned project lifecycle stages. These are referred to in the graphic below where standardized criteria are applied at different levels;
- 5) Align grant allocation mechanisms of Ecosystem Restoration and related Clean Water Initiative (CWI) grants issued by DEC with the stage-gate criteria to ensure that high-priority projects within the Watershed Projects Database are funded and implemented per an identified implementation schedule, and according to approved TMDLs and the Vermont Clean Water Act.



Substantial progress was made towards these efforts during 2017. The process of standardizing tactical basin plans was further refined and complemented by new water quality modeling analyses that are described subsequently in this report. The Watershed Projects Database, which was simply a vision in 2015, has been completed, and is in use to support the development of all 15 tactical basin plans. This project database system houses the complete implementation tables of the recently approved South Lake Champlain and Northern Lake Champlain tactical basin plans, and available projects and implementation actions from other tactical basin plans are being entered on an on-going basis. At present, the reader may review the [Watershed Projects Database](#) and the projects identified, by clicking that link to see specific identifiable projects, and searchable by basin, town, watershed, and/or project types.

Within the database, each specific project is attributed by a standard set of criteria, which are applied by DEC’s basin planners and will be available to key planning partners such as Regional Planning Commissions and Natural Resource Conservation District staff, based on factors such as nutrient reduction benefit, hazard

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mitigation or other co-benefits, municipal factors, and compliance with State water quality policies. DEC planning staff are working with Regional Planning Commissions and Natural Resources Conservation Districts to populate the database with priority projects for all basins, and all implementation table projects that may exist for each basin for which new plans are due this year. DEC envisions that the Watershed Projects Database will continue to be populated to contain existing projects for all planning basins regardless of where they are in the planning cycle, and as relevant assessment reports and attendant projects are identified in the Watershed Projects Database.

The value of the Watershed Projects Database extends beyond tactical basin planning. The same system is also being used to track the implementation of projects, and for the Lake Champlain and Lake Memphremagog basins, to document on-going phosphorus reductions. The 2017 Clean Water Initiative Funding Report, coordinated by the Watershed Management Division's Clean Water Initiative Program pursuant to Act 64 provides a set of financial, social, programmatic, and environmental indicators that are being produced by the Watershed Projects Database. As of this writing, there are 5431 projects contained in the Watershed Projects database, which are distributed among tactical planning basins as shown by Figure 2.

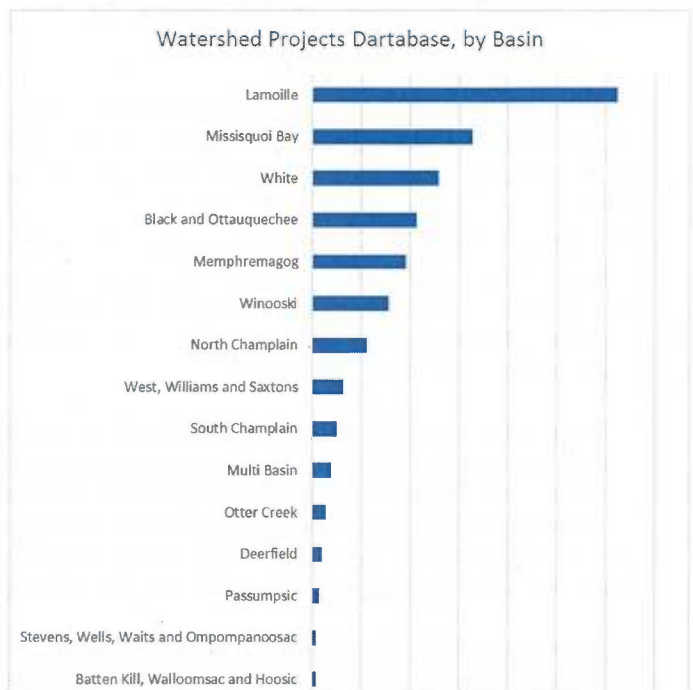


Figure 2. Count of water quality projects in the Watershed Projects Database, as of this writing. The lack of identified projects in any given basin only indicates that data-entry is not yet complete.

Water Quality Modeling to support Tactical Planning, and Phase II Implementation Plans for the Lake Champlain TMDL

Under the US Environmental Protection Agency's TMDL process, the programs and management approaches spelled out by the Lake Champlain TMDL Phase I Implementation plan are being expanded into geographically-explicit planning-level load and wasteload sub-allocations, by subwatershed. These explicit, "Phase-II" plans comprise the blueprints by which the TMDL is to be accomplished.

As described in the final Champlain Phase I Plan, this work has required a significant investment of water quality modeling capacity into the planning process. Two complementary efforts have come together to provide for high-resolution phosphorus discharge modeling for very fine scale sub-watersheds of the Lake Champlain Basin. These are 1) the Clean Water Roadmap, and 2) the publication of the Phase II TMDL plans within the tactical plans for the Lamoille, Missisquoi, Northern Lake Champlain, and South Lake (Champlain) Basins.

Clean Water Roadmap

The Clean Water Roadmap (CWR) is a suite of tools specifically designed to support Vermont DEC's planning and outreach efforts related to implementation of the Total Maximum Daily Loading (TMDL) for phosphorus in the Lake Champlain basin. The CWR allows users to map and interact with watershed modeling results related to non-point total phosphorus (TP) loading sources and conservation in the Lake Champlain Basin, including "baseline" total phosphorus loading rates at various basin scales and components of the Water Quality Blueprint developed by The Nature Conservancy. CWR scenarios are used to explore the relative benefits in

terms of TP load reduction of applying various best management practices (BMPs) to land areas characterized by specific land use, soil, and slope conditions

The CWR is a map-based application that allows users to click on a specified watershed and receive a summary report of relevant best management practices (BMPs) and ultimately, associated implementation table actions in the selected area. BMP suitability is assessed using the landscape criteria in SWAT and EPA's Scenario Tool, while implementation table activity locations will be based on data in DEC's BMP tracking database. The summary data will also include estimated phosphorus loadings based on SWAT modeling. Additional relevant spatial information, such as township boundaries, partner data (TNC's Conservation Blueprint for Water Quality), hydrologically connected backroads, etc., may also be included. The CWR can be used by regional planners, the public, and DEC staff to identify priority areas and actions for Lake Champlain phosphorus reductions.

Figures 3 and 4 provide one example of the functionality of the Clean Water Roadmap to estimate phosphorus runoff and practice effectiveness. In this example, the Marsh Brook tributary to Lake Carmi, in Franklin VT was selected. Figure three shows baseline estimated phosphorus loading to Lake Carmi of 476 kg/yr. In Figure 4, three hypothetical practices were applied: cover crop to 100% of corn land; ditch buffers applied to 100% of crop land (a Required Agricultural Practice (RAP)); and barnyards are managed to minimize runoff. The model estimates a 126 kg reduction in annual phosphorus loading.

Figures 4 and 5 provide a second example of the functionality of the Clean Water Roadmap. In this example, road runoff practices addressing road ditches were applied to roads in the catchment. The baseline loading was 126 kg/year, and the practices are modeled to achieve a phosphorus reduction of 18%.

The Clean Water Roadmap Tool (CWR) is a partnership between DEC, Keurig-Green Mountain Coffee Roasters, The Nature Conservancy (TNC), and other stakeholders. The overall goal of the CWR is to 'map' the results of the Lake Champlain Soil Water Assessment Tool (SWAT) model and associated follow-on products, especially EPA's Best Management Practices (BMP) Scenario Tool, along with the potential to map management actions contained in DEC's Tactical Basin Plan implementation tables and tracking systems. The CWR will provide a description of one way the LC TMDL phosphorus reductions can be achieved, largely based on EPA's reasonable assurance scenario.

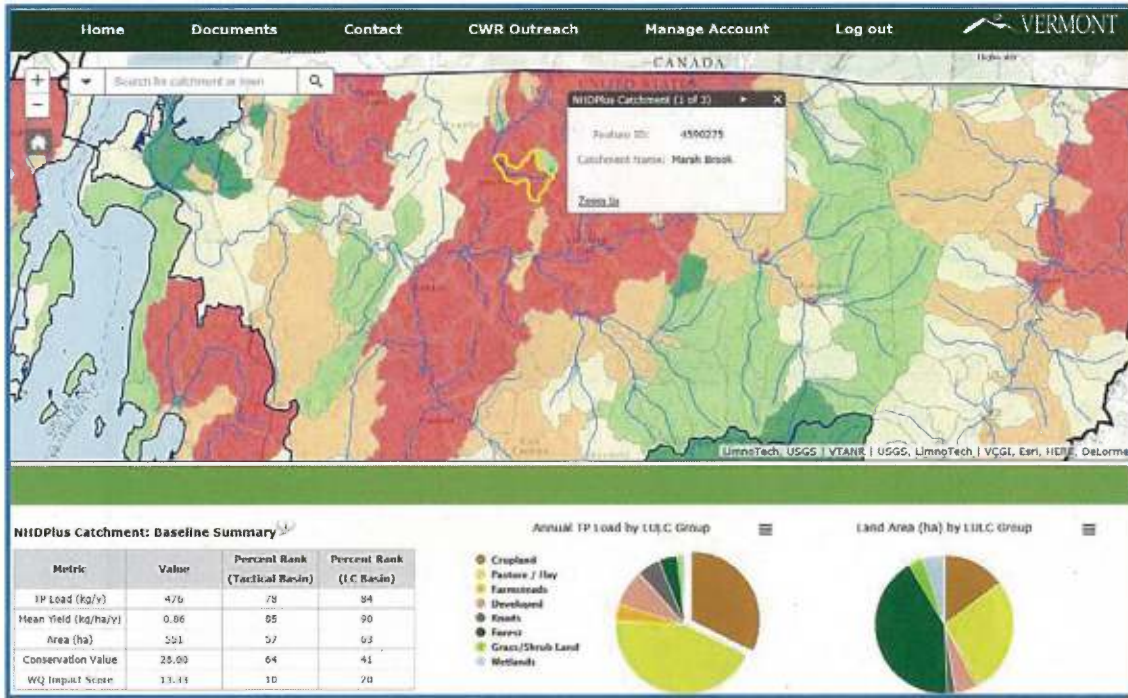


Figure 3. Clean Water Roadmap, showing total phosphorus loading from the Marsh Brook sub-watershed of Lake Carmi, Franklin, VT. This is the scale at which total phosphorus loads have been estimated for every sub-watershed in the Lake Champlain basin.

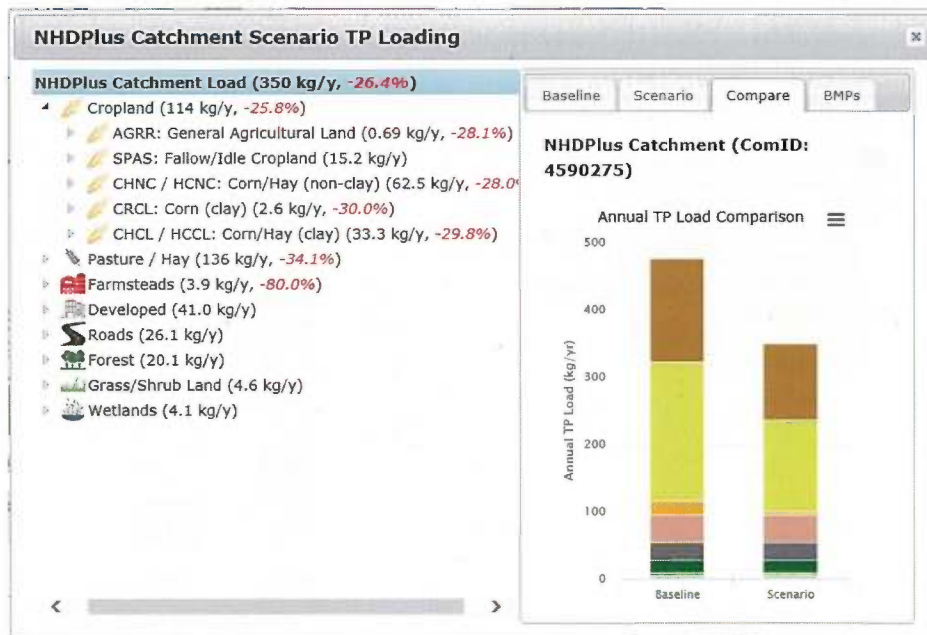


Figure 4. Clean Water Roadmap, example scenario whereby cover crop is applied to 100% of corn land in the Marsh Brook sub-watershed of Lake Carmi, Franklin, VT, RAP-compliant buffers are applied to all hayfields, and all barnyards are managed to minimize runoff. A substantial total phosphorus load is modeled to be achievable based on this practice.

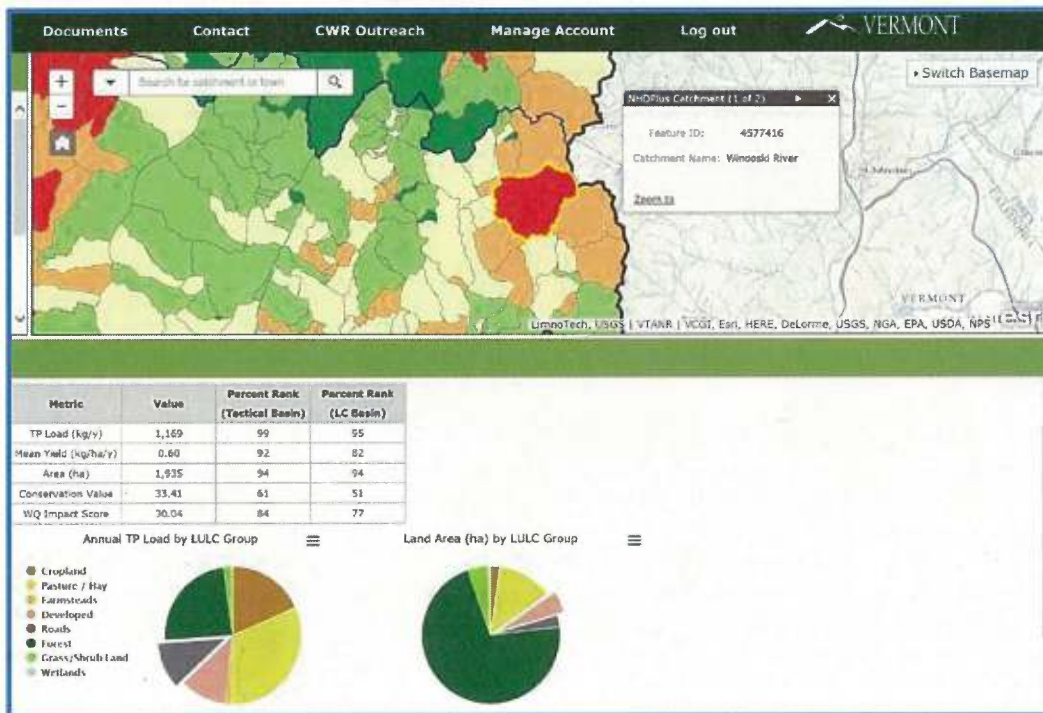


Figure 5. Clean Water Roadmap, showing total phosphorus loading from a small area of the upper Winooski River basin, in Calais. A substantial proportion of phosphorus loading is attributable to the road network in this catchment.

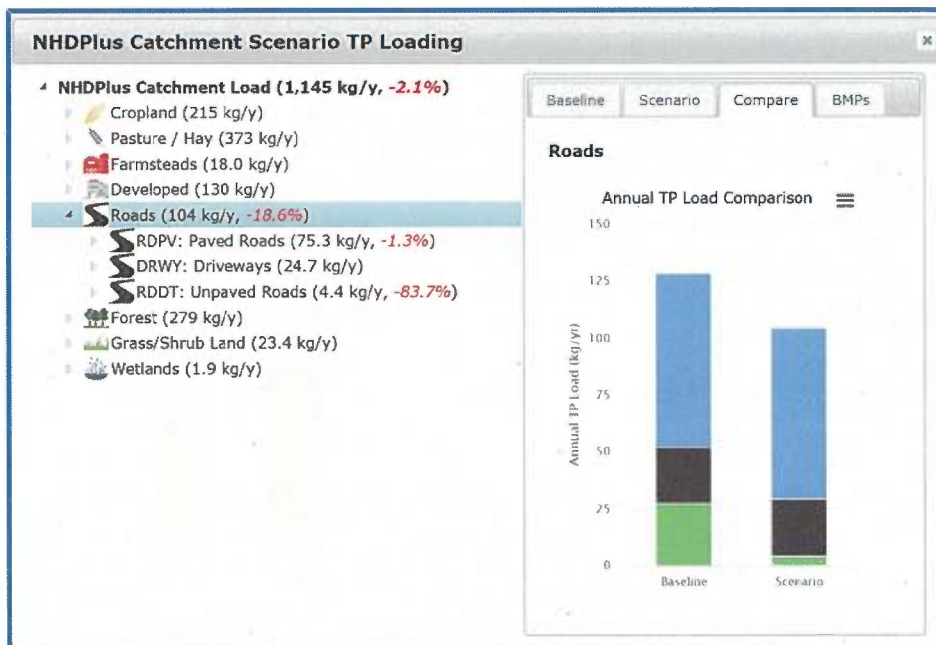


Figure 6. Clean Water Roadmap, example scenario whereby road practices are applied to 10% of connected roads, in a small sub-watershed of the Winooski River, in Calais. This is one practice that will be required by the Municipal Roads General Permit. A substantial total phosphorus load is modeled to be achievable based on this practice.

Phase II TMDL Plans

The Lamoille, Missisquoi, Northern Lake Champlain, and South Lake (Champlain) Basins and all subsequent Lake Champlain and Lake Memphremagog basin plans do or will contain content as described below. Using the modeling analyses provided by the Clean Water Roadmap, MAPP’s planners and scientists have developed downscaled, planning-level estimates of required nutrient reductions at geographic scales that are appropriate to the regulatory program under which the reductions are to be compelled. For example, planning estimates of total phosphorus reductions that may be achieved by controlling runoff from municipal roads under the Municipal Roads General Permit are most useful at the municipal scale. By contrast, the scale of analysis relevant to the management of State highways is larger – reflective of a moderate sized stream watershed (called a “HUC 12” watershed, such as the Lewis Creek, or Huntington River). In some instances, the finer resolution “catchment” scale, which is a small stream watershed, is appropriate.

Table 2 shows the analyses that are being developed for every Lake Champlain basin, broken down by land use sector, the category of allocation, regulatory program, and scale of analysis. It is important to note that the resulting phosphorus reduction targets are not intended to be binding to each geographic area simply because of publication in a tactical basin plan. The USEPA’s TMDLs set the allocations and required reductions at the whole-basin scale. The smaller-scale phosphorus load estimates and target reductions provide planning tools for municipalities or other affected jurisdictions, and identify appropriate BMPs or regulatory programs to achieve the reductions. DEC will track the ongoing implementation of projects accomplished across all sectors by means of the Watershed Projects Database described above, to determine incremental progress towards attainment of the allocations of the TMDL. More information about project tracking is provided in the [Clean Water Initiative Funding Report](#). The reader can see a completed Phase II TMDL plan in either the [Lamoille, Missisquoi, or South Lake Champlain Tactical Basin Plan](#).

Table 2. Phase II TMDL sub-allocation analyses presented in tactical basin plans.

Land Use Source	Category	Allocation Category	Regulatory Program	Scale of Analysis
Forest	All lands	Load	Accepted Management Practice Rule	Catchment
Stream Channels	All streams	Load	Act 138	HUC 12*
Agriculture	Fields/pastures	Load	Required Agricultural Practice Rule, LFO Rule, MFO Rule	HUC 12
	Production Areas	Wasteload		
Developed Land	VTRANS owned roads and developed lands	Wasteload	TS4 Permit Rule	HUC 12
	Roads MRGP		MRGP Permit	Municipality
	MS4		MS4 Permit	Municipality
	Larger unregulated parcels		Three-acre permit	Catchment / municipality
Wastewater	WWTF discharges		NPDES Direct Discharge Permit	Facility

* HUC12 refers to a moderate-sized watershed such as the upper Mad River, or Whetstone Brook

The Role of Regional Planning Commissions and Natural Resource Conservation Districts in Tactical Basin Planning

On December 15th, 2017, DEC submitted to the General Assembly a report entitled: “*WATER QUALITY PARTNERSHIPS: TACTICAL BASIN PLANNING, IMPLEMENTATION AND ADMINISTRATION OF PROJECTS. 2017 Act 84 § 34.*” This section re-iterates important findings and conclusions of that report pertaining to DEC’s important partnership with RPCs and NRCDs.

In 2015, Act 64 contained a provision that DEC shall, contingent upon the availability of funding, contract with Regional Planning Commissions (represented by VAPDA), to fulfill specific roles and responsibilities to assist in the development of tactical basin plans. In 2016, the Vermont General Assembly further amended 10 V.S.A. §1253(d) to include the Natural Resources Conservation Council (NRCC) as an eligible entity.

The Vermont Clean Water Act (2015) authorized DEC to use fee revenues from the Environmental Permit Fund in 2016 to support partnerships that enhance tactical basin planning contingent upon the availability of funding. In 2016 DEC allocated \$300,000 in accordance with this directive, and in 2017 continued to invest in this partnership with an allocation of \$330,000 from the Environmental Permit Fund. This funding approach was intended to provide a bridge while a long-term funding source was identified.

DECs primary goal with this investment is to secure essential tactical basin planning services that support deployment of clean water funding and align services with the needs of each tactical basin plan. Specifically, DEC views the partnership with VAPDA, and more recently the NRCC, as an essential opportunity to grow capacity to conduct outreach, engage with and provide services to municipalities, and support assessments, project development, and project implementation – all essential components of robust tactical basin plans. This expansion in capacity is important – a recent survey, conducted by the University of Vermont, found that just over 50% of municipalities surveyed have “No” or only “Slight” awareness of the tactical basin planning process. The partnership with both VAPDA and NRCC, just entering its second year, has been designed specifically to increase awareness and engagement with municipalities.

Vermont’s 2015 Clean Water Act lays out DEC’s tactical basin planning obligations, and the tactical basin plans are identified as the implementation vehicle for Phase II of the Lake Champlain TMDL. It is imperative that DEC direct the development of tactical basin plans and draw on the expertise of our statewide partners, VAPDA and NRCC.

The current level of funding is providing an appropriate level of service in support of tactical basin planning work. Funds for tactical basin planning services are a small portion of total clean water funds awarded, but provide essential funding for partner staff to deliver these services.

In FY18 DEC is piloting a new statewide framework to secure critical tactical basin services. Two statewide RFP’s have been issued designed to take advantage of the services and expertise available from both VAPDA and the NRCC. DEC is committed to these important partnerships with VAPDA and NRCC, as well as continuing to learn from and adapt over time to ensure that this investment is leveraged to obtain the maximum possible value for clean water.

Recommendations for Tactical Basin Planning:

- Complete FY2018 tactical basin planning award process as outlined above.
- Conduct business process analysis with eligible entities to analyze successes and challenges of FY18 award process, and to explore potential alternative structures for award agreements that facilitate coordination with VAPDA and NRCC.

- Identify funds to provide sustainable funding for tactical basin planning services.

An Added Focus on Protection

In addition to phosphorus reduction and other restoration priorities, tactical basin plans also identify surface waters that merit augmented protections through surface water reclassifications, Class 1 Wetland designation, or Outstanding Resource Water designation. During 2016, DEC worked with the General Assembly to support passage of Act 79, which amended §§10 VSA1251-1253. These amendments created a new classification of surface water uses, and allow for the independent classification of individual designated uses based on the quality exhibited by those uses.

Following passage of Act 79, the Department carried forth the rulemaking necessary to update the Vermont Water Quality Standards to be in alignment with Act 79. The Legislative Committee on Administrative Rules approved the new Water Quality Standards Rule in November of 2016, and the rule became effective December 15, 2016. As part of the Rule updates, the Department completed an ongoing and previously-reported reclassification effort to designate several dozen miles of streams in the Green Mountain National Forest from Class B to Class A(1). This action marks the first time a surface water was classified to a higher tier of water quality protection since 1989. The DEC Wetlands Program also initiated rulemaking and was successful in designating three high-quality wetlands of particularly rare types to Class 1. The MAPP will continue to identify surface waters where Class B(1) management objectives are demonstrably and consistently attained, and promote these for reclassification through the tactical basin planning process. Likewise, the Program will continue to identify surface waters that are suitable for Class A(1), Class 1 Wetland, or ORW designation.

Section 3) Schedule for the development of Tactical Basin Plans and Subsequent Actions

In this section, a five-year schedule for tactical basin plan production is provided, along with a statement of action items that are being undertaken over the coming three years. Figure 1 provides the 2017 status of planning across all watersheds, while Table 3 provides an overview the coming years.

Chapter 10 VSA 1253 also directs that this annual legislative report present a summary of actions to be undertaken over the subsequent three years. In any given tactical basin plan implementation table, those actions identified as required assessments to implement a regulatory requirement (e.g., municipal roads inventory, or phosphorus control plan for a community that is regulated under the municipally-separated storm sewer permit program), will necessarily be accomplished during the initial stages of basin plan implementation, in compliance with the requirements of the permit programs. For follow-up implementation projects, it is difficult to project with specificity which actions from any given basin plan's implementation table will be executed over the coming year, and thus summarizing those actions in a report of this nature presents some speculation. We interpret the legislative intent of this charge as a requirement to document the overall "game plan" at a high-level. The Implementation Table Summaries presented in the new South Lake (Champlain) and Memphremagog Tactical Basin Plans give a strategic-level view of actions at the basin scale, and these are supplemented by expansive project and assessment lists in the Watershed Projects Database. In an effort to provide useful information to the Committees and other stakeholders at the level of specificity appropriate to an annual legislative report, the following is offered.

Generally, the Lake Champlain and recently approved Lake Memphremagog TMDLs are envisioned to be implemented over a 20-year timeframe. Figure 7 provides a hypothetical representation of the pace at which nutrient reductions may be achieved under those TMDLs, juxtaposed against the timelines during which each new Act 64 regulatory program is being put into place.

Table 3. Tactical basin plan production schedule.

Basin Number and Name	Activity	2017	2018	2019	2020	2021	2022	Most Recent Plan Status	Major Watershed	Planner
Basin 15 – Passumpsic	M+A				Mon	Assess		Tactical Plan rewrite underway (2017)	CT RIVER	
	Planning	Start	Finish				Start			
Basin 16 – Northern Connecticut	M+A	Mon	Assess				Mon	June 2014 – Tactical Plan		Ben Copans
	Planning			Start	Finish					
Basin 17 - Memphremagog	M+A			Mon	Assess			November 2017 – Tactical Plan	MEMPHREMAGOG	
	Planning	Finish				Start	Finish			
Basin 1 – Hoosic, Battenkill	M+A		Mon	Assess				January 2016 – Tactical Plan		
	Planning				Start	Finish				
Basin 2 and 4 – Poultney, Mettawee, South Lake	M+A				Mon	Assess		December 2017 – Tactical Plan	CHAMPLAIN	Ethan Swift
	Planning	Finish				Start	Finish			
Basin 3 – Otter, Lewis, Little Otter	M+A	Assess				Mon	Assess	Tactical Plan rewrite slated for 2018		
	Planning		Start	Finish						
Basin 7 – Lamoille	M+A		Mon	Assess				December 2016 – Tactical Plan	CHAMPLAIN	
	Planning				Start	Finish				
Basin 9 – White	M+A			Mon	Assess			Tactical Plan rewrite underway (2017)	CT RIVER	Danielle Owczarski
	Planning	Start	Finish				Start			
Basin 14 (16) – Stevens, Wells, Waits, Ompompanoosac, CT Direct	M+A	Mon	Assess				Mon	August 2015 – Tactical Plan		
	Planning			Start	Finish					
Basin 5 – Northern Lake Champlain Direct	M+A	Assess				Mon	Assess	December 2017 – Tactical Plan Update		
	Planning		Start	Finish						
Basin 6 – Missisquoi, Rock, Pike	M+A		Mon	Assess				December 2016 – Tactical Plan	CHAMPLAIN	Karen Bates
	Planning				Start	Finish				
Basin 8 – Winooski	M+A				Mon	Assess		Tactical Plan rewrite underway (2017)		
	Planning	Start	Finish				Start			
Basin 10 (13) – Black, Ottauquechee	M+A			Mon	Assess			January 2018 – DRAFT Tactical Plan		
	Planning	Finish				Start	Finish			
Basin 11 (13) – West, Williams, Saxtons	M+A	Mon	Assess				Mon	January 2016 – Tactical Plan	CT RIVER	Marie Caduto
	Planning			Start	Finish					
Basin 12 (13) – Deerfield, Broad Brook	M+A	Assess				Mon	Assess	Tactical Plan rewrite slated for 2018		
	Planning		Start	Finish						

Updated June 2017 --- M + A = Monitoring and Assessment --- Mon = Monitoring

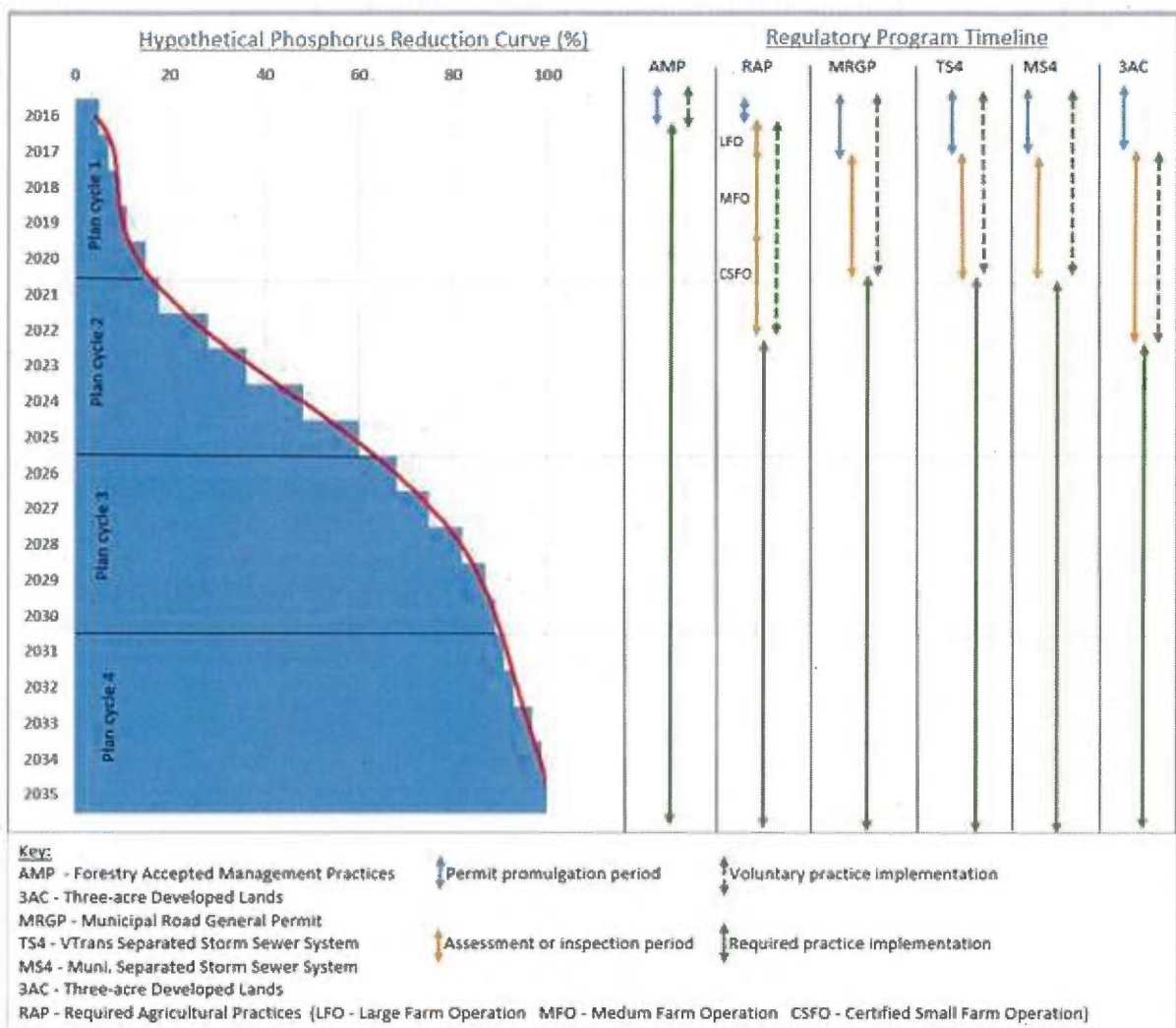


Figure 7. Theoretical phosphorus reduction, relative to the load and wasteload reductions required by the LC TMDL. The timelines for regulatory programs and basin plan updates are also shown.

The capability for the State to compel reductions in the first five-year iteration of tactical plans for these TMDL watersheds is limited by the timelines set forth by Act 64 for the establishment and promulgation of the permit programs. In other words, the State cannot compel, for example, the reduction of phosphorus from specific municipal road segments, until: 1) that permit program has been established; 2) the municipality has applied for coverage under that program; and, 3) the municipality has completed their road assessment, and staged a plan for implementation based on the most effective phosphorus reduction efforts. Figure 7 provides the timelines for permit promulgation, permit application and assessment/inspection, and implementation. These timelines do not, however, preclude any particular landowner or municipality from taking action sooner on specific projects, and many owners or municipalities have done so. These caveats provided, Table 4 presents the categories of priority actions that are identified by tactical basin plan implementation tables that will be conducted in the initial years of a basin plan implementation cycle, by sector.

Table 4. Three-year outlook for actions established by tactical basin plans.

Land Use Source	Category	State actions	Permittee / municipal / landowner actions
Forest	All lands	<ul style="list-style-type: none"> -Implement AMP rule -Identify landowners with upcoming harvests, and conduct targeted outreach 	<ul style="list-style-type: none"> -Implement provisions of AMPs -Engage with Conservation Districts and State Foresters to employ WQ friendly practices such as portable skidder bridges -Consider modifications to forest management plans to emphasize use of Ecologically Sensitive Treatment Areas.
Stream Channels	All streams	<ul style="list-style-type: none"> -Support funding of highest-priority floodplain or corridor protection projects -Implement Floodplain and River Corridor Rule 	<ul style="list-style-type: none"> -Adopt municipal zoning to protect river corridors -Enter into agreements to secure easements for key corridor protection of flood attenuation assets
Agriculture	Fields/pastures Production Areas	<ul style="list-style-type: none"> -Promulgate RAP Rule -Conduct inspections annually for LFO, every three years for MFO, every seven years for CSFO -Publish results of North Lake Farm Survey and other similar surveys -Conduct high-resolution targeted BMP planning to assist landowners. -Engage watershed teams to provide technical assistance -Provide financial assistance 	<ul style="list-style-type: none"> -Implement RAPs -Engage in AAFM or NRCS cost-share programs to offset costs of BMP installations.
Developed Land	VTrans owned roads and developed lands	<ul style="list-style-type: none"> -Promulgation of "TS4" permit program 2016-2017 	<ul style="list-style-type: none"> -Conduct assessments on a HUC12 basis -Implement priority projects resulting from assessments -Sequence implementation with planned major road upgrade projects.
	Roads MRGP	<ul style="list-style-type: none"> -Promulgate MRGP permit program in early 2018 -Provide funding for targeted municipalities to conduct road inventories through Better Roads or other funding sources 	<ul style="list-style-type: none"> -Conduct inventories to derive capitol road improvement plans. -Apply for coverage for MRGP by 2021 -Implement capital improvement plans over 20-year timeframe.
	MS4	<ul style="list-style-type: none"> -Reissue MS4 permit program by end of 2017 -Provide financial support thru Clean Water Initiative or SRF funding 	<ul style="list-style-type: none"> -Develop phosphorus control plans coincident with revised MS4 permit. -Implement Phosphorus Control Plans and Flow Restoration Plans over 20-year timeframe.

	Larger unregulated parcels	-Promulgate "Three-acre" permit -Provide financial support for designs	-Inventory three-acre parcels -Develop and implement designs to manage runoff in accordance with Stormwater manual.
	ALL	-Provide financial and technical support for stormwater master plans to identify highest priority stormwater management actions	-Apply for support to implement priority projects.
Wastewater	WWTF discharges	-Update NPDES direct discharge permits in accordance with wastewater policy set forth in TMDL, within two year after basin plan issuance	-Operate WWTF in accordance with permit conditions. -Initiate engineering performance reviews when capacity approached TMDL threshold trigger for augmented phosphorus reduction.

Section 4) Individual Basin Plan Contacts and Statements of Progress

Watershed Planning Basin	Contact and web links
<ul style="list-style-type: none"> • Basin 1 Battenkill, Walloomsac, Hoosic: • Basin 2 and 4 Poultney, Mettowee, Lower Champlain Direct • Basin 3 Otter, Little Otter, Lewis 	Ethan Swift, Watershed Coordinator Department of Environmental Conservation 430 Asa Bloomer Building Rutland, Vermont 05701 802 490 6141 Ethan.Swift@vermont.gov
<ul style="list-style-type: none"> • Basin 5 Upper LC Direct, including LaPlatte, Malletts Bay, St. Albans Bay • Basin 6 Missisquoi Bay, including Pike and Rock • Basin 8 Winooski 	Karen Bates, Watershed Coordinator DEC Regional Office 111 West Street, Essex Junction, VT 05452 802 490 6144 karen.bates@vermont.gov
<ul style="list-style-type: none"> • Basin 7 Lamoille • Basin 9 White • Basin 14 (+16) Stevens, Wells, Waits, Ompompanoosuc, CT River Direct 	Danielle Owczarski, Watershed Coordinator Department of Environmental Conservation 1 National Life Drive 2 Main Montpelier, VT 05620-3522 802 490 6167 danielle.owczarski@vermont.gov
<ul style="list-style-type: none"> • Basin 10 Ottauquechee, Black, CT River Direct (Mill, Lulls, Hubbard) • Basin 11 (+13) Williams, West, Saxton's, Lower CT Direct (Commissary, Morse, East Putney, Sacketts) • Basin 12 (+13) Deerfield, Lower CT Direct, (Crosby, Whetstone, Broad, Newton) 	Marie Levesque Caduto, Watershed Coordinator 100 Mineral Street, Suite 303 Springfield, VT 05156 802 490 6142 Marie.Caduto@vermont.gov
<ul style="list-style-type: none"> • Basin 15 Passumpsic • Basin 16 Northern CT River Watersheds • Basin 17 Memphremagog, Coaticook, Tomifobia 	Ben Copans, Watershed Coordinator Department of Environmental Conservation 374 Emerson Falls Road, Suite 4St. Johnsbury, VT 05819 802 490 6143 ben.copans@vermont.gov
All tactical basin plans may be found online at this link: http://dec.vermont.gov/watershed/map/basin-planning	

Basin 1: Battenkill, Walloomsac, Hoosic

The Tactical Basin Plan for the the Batten Kill, Walloomsac, and Hoosic Rivers (tributaries to the Hudson River in New York) was approved in January 2016 and represented the first Tactical Basin Plan that has been developed for this basin. This plan identifies high priority actions to protect and restore surface waters for those watersheds, which includes all the land in Vermont that drains to the Hudson River in New York. The restoration and improvement opportunities address high elevation surface waters that are impaired due to acidity, and other surface waters with elevated levels of sediment and nutrients. In addition, there is a good deal of focus on protection opportunities that would attenuate flood and erosion hazard risks in basin waterways. The heart of this plan is the implementation table in Chapter 4, which includes actions to protect or restore surface waters in the basin. High priority stressors in the Hudson River Basin include Acidity (atmospheric deposition), Encroachment, Channel Erosion, Invasive Species, Thermal Modification, and Land Erosion.

In general, the Batten Kill, Walloomsac, and Hoosic Rivers are targeted for protection and restoration strategies while various tributaries are targeted for additional water quality and aquatic habitat monitoring and assessment work. This and all Tactical Basin Plans benefit from biennial implementation table updates. For this Hudson River Tactical Plan, ongoing efforts to build flood resiliency will be a featured priority in the first biennial review, to implement priority actions related to ongoing restoration efforts due to Tropical Storm Irene.

The Hudson River Tactical Basin Plan presents the integrated recommendations of State and Federal resource agencies (such as the US Forest Service), the Bennington County Regional Planning Commission, Bennington County Conservation District, watershed organizations such as the Batten Kill Watershed Alliance and the Hoosic River Watershed Association, the Bennington County Regional Planning Commission, and individual citizens.

Recently funded projects through the State's Clean Water Initiative program include a gully stabilization project that was identified in the Rupert Stormwater Master Plan (with the Bennington County Natural Resource Conservation District), and the development of a river corridor plan for the Hoosic River with the Bennington County Regional Planning Commission. In addition, Stormwater Master Plans are in development for the towns of Sandgate and Sunderland which will incorporate (rural) road erosion inventories to identify and mitigate sediment and nutrients from stormwater runoff into the surface waters located in those towns. Forthcoming projects funded under the FY17 Ecosystem Restoration Program include Stormwater Master Plans for the town of Shaftsbury and hay mulchers for roadside stabilization projects in Bennington and Shaftsbury.

Basins 2 and 4: South Lake Champlain Basin, including the Poultney and Mettowee Rivers

The 2017 South Lake Champlain Tactical Basin Plan (TBP) was developed with the purpose of both improving and protecting water quality and aquatic habitats, and presents the recommendations of State and Federal resource agencies, watershed partner organizations, planning commissions, municipalities, and individual citizens.

The Plan provides an overall assessment of the health of the "South Lake" Champlain Basin, which covers approximately 500 square miles through 24 towns from Rupert to Charlotte, and defines on-going and future actions and strategies to address high-priority stressors. An additional goal of the plan is to set priorities for meeting targets for phosphorus loading from the South Lake and all of the waters in its drainage basin that contribute to the South Lake "A" and "B" and Port Henry segments of Lake Champlain.

The central component of the Tactical Basin Plan is an implementation table summary with targeted actions to protect very high quality waters and to address the water quality issues in the South Lake watershed. To address the myriad of complex surface water challenges and opportunities in the Basin, dozens of actions are identified in the plan with hundreds of individual related projects included in the VT Watershed Projects database.

Top priority actions in the plan include:

- protecting very high quality surface waters by monitoring, assessment, and reclassification;
- promoting implementation of agricultural water quality practices in high phosphorus loading watersheds through accelerated and targeted implementation of agricultural conservation practices (e.g., of conservation tillage and cover cropping in floodable soils) to result in measurable improvements to water quality;
- protecting river corridors and supporting stream equilibrium by implementing high priority projects identified in River Corridor Plans;
- inventorying, prioritization, and implementation of municipal road erosion and related projects that discharge into surface water;
- engaging priority communities in stormwater master planning and implementation;

- improving lakeshore zone habitat by evaluation, protection, and implementing projects identified in lakewide assessments and through basin specific lake watershed management plans (e.g., Bomoseen and Saint Catherine);
- identifying and implementing wetland and floodplain restoration projects; and
- increasing understanding of water quality conditions through water quality monitoring.

The Agency has coordinated with two Regional Planning Commissions and two Natural Resource Conservation Districts along with lake associations and watershed groups to identify and begin to scope and implement projects identified in the plan.

Recent focus on the South Lake and priority sub-basins (i.e., McKenzie Brook) has led to a multi-partner planning and BMP implementation effort as a result of the Lake Champlain Basin Regional Conservation Partnership Program (RCPP). The resource concerns addressed in this proposal include the national priorities of water quality and soil health. The primary resource concern is for water quality, due to excess nutrients and sediment pollution. The funding through the USDA has been awarded for the accelerated implementation of agricultural and forestry conservation practices in the Lake Champlain Watershed of Vermont and New York. Within the South Lake Basin, the McKenzie Brook watershed was selected due in part to the high percentage of agricultural land use and available water quality monitoring and assessment data in order to develop a targeted Watershed Improvement Plan for the McKenzie Brook sub-basin within the South Lake. In coordination with USDA-NRCS and UVM Extension, a Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed has been developed and is in the process of implementation.

This watershed plan, developed by Vermont USDA-NRCS and partners (State of Vermont Agency of Agriculture, Food and Markets, and Agency of Natural Resources as well as UVM-Extension) is meant to address the need for more effective practice implementation of conservation plans on agricultural lands throughout the Lake Champlain Basin. Past conservation practice implementation efforts have been broad in scope and have not resulted in any measurable improvements in water quality. In response to the revised and EPA-approved phosphorus TMDL for Lake Champlain and the availability of increased NRCS funding for the near term, NRCS in Vermont has decided to use a more strategic and focused process for conservation practice implementation. Under this process NRCS has collaborated with the Vermont Department of Environmental Conservation (VTDEC) to contribute information to the agricultural sections of Tactical Basin Plans. These agricultural watershed plans will provide a comprehensive inventory of land use and resource conditions in each of the targeted watersheds, including for the McKenzie Brook watershed (Figure in the South Lake).

McKenzie Brook Watershed Vermont portion

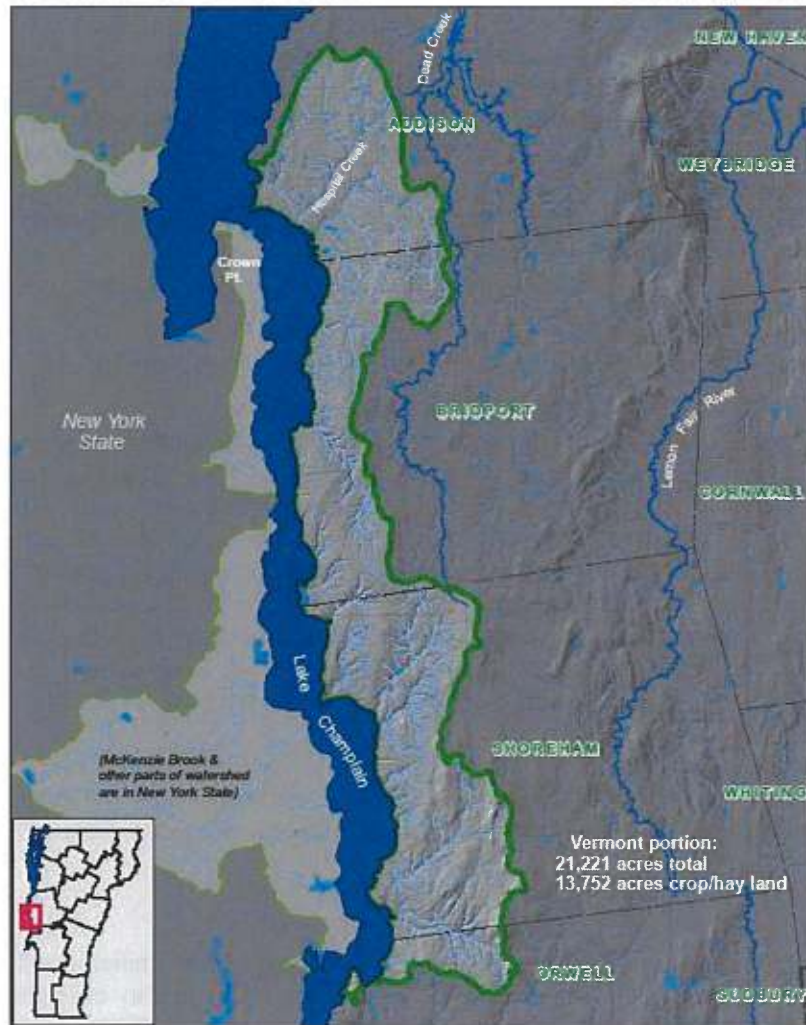


Figure 8. McKenzie Brook watershed in the South Lake Basin. Note that the McKenzie Brook is actually located in New York, but as a HUC-12 watershed it includes several tributaries in Vermont that represent several subwatersheds in a portion of western Addison County

In addition to working on water quality opportunities in the agricultural sector, this 2017 iteration of the South Lake Champlain tactical basin plan features the recent water quality management efforts on lake water quality issues which led to the formation of “Lake Implementation Teams,” comprised of members from South Lake Basin lake associations – Lake Bomoseen and Lake Saint Catherine (including the Little Lake Saint Catherine Conservation Fund), town representatives (including Castleton, Hubbardton, Poultney, and Wells), the Poultney Mettowee Natural Resource Conservation District (PMNRCD), Rutland Regional Planning Commission, UVM Sea Grant, and VTDEC staff (Lakes and Ponds and MAP Programs). Each of the two lake implementation teams meet periodically to promote education and outreach events, review ongoing monitoring and assessment efforts, participate in planning, and move high priority projects to implementation. The outcome(s) of these efforts led to the development of (draft) lake watershed management plans for each lake basin that frame specific strategies and actions to address lake basin specific issues.

Accomplishments and priority projects funded during 2017 include:

- A Green Stormwater Infrastructure (GSI) project in Castleton at Cedar Mountain Road (“encapsulated lift project”) to stabilize the road and provide for natural shoreline erosion control.
- A Stormwater Master Plan for the Castleton River headwaters and Town of Castleton including those portions of the Lake Bomoseen watershed that haven’t yet been addressed under the Sucker Brook Stormwater Master Plan (a tributary to Lake Bomoseen) with the Poultney Mettowee Natural Resource Conservation District.
- Recent funding of a Stormwater Master Plan for the Lake Saint Catherine Basin with the Poultney Mettowee Natural Resource Conservation District.
- Recent funding of the Mettowee Watershed Forest Roads Assessment with the Bennington County Conservation District (BCCD)

Basin 3: Otter Creek, Little Otter Creek, Lewis Creek

The Otter Creek Basin – Water Quality Management Plan was completed and approved by the Secretary of the Agency of Natural Resources and DEC Commissioner in May of 2012. This Plan was one of the last “hybrid” versions of watershed planning between the older “Watershed Initiative” basin plan format and the current tactical basin planning process. The Otter Creek Basin Plan contains priority recommended actions for improving and protecting surface waters in the Otter Creek Basin (including several large tributaries), as well as identifying dozens of potential river restoration projects designed to build flood resiliency and reduce private property losses that occurred following Tropical Storm Irene. The Otter Creek Basin Plan addresses the priority water quality stressors that affect surface waters in the Otter Creek Basin as well as the specific water quality concerns identified by the stakeholders in the basin planning process.

The Otter Creek Basin Tactical Basin Plan is slated for a rewrite following a comprehensive water quality monitoring and assessment data review process that will commence in 2018. A comprehensive rotation of biomonitoring and biological assessment was conducted throughout the basin during the 2016 field season.

Accomplishments and priority projects funded during 2017 include:

- A large Stormwater Mitigation Project has been funded and implemented through the Ecosystem Restoration Program at Georgetti Park along the East Creek in City of Rutland, coordinated with the Rutland Natural Resource Conservation District.
- Gully stabilization project implementation that was causing excessive sedimentation into West Brook, a tributary to the New Haven River in the town of Bristol.
- An engineered design for a berm removal project and river corridor easement along the lower reaches of the Cold River in Clarendon will enhance flood resiliency and attenuate sediment and nutrients.
- Stormwater mitigation best management practices have been implemented at the Rutland Northwest Elementary School in Rutland City along the East Creek.
- A Stormwater Master Plan has been developed for Middlebury’s downtown area in coordination with the Town and the Addison County Regional Planning Commission.
- Stormwater Master Planning is underway in the Towns of Brandon and Wallingford, and for the Moon Brook in Rutland City
- A Green Stormwater Infrastructure project in Rutland Town has been implemented to mitigate stormwater runoff from the Rutland Town Elementary School.
- High priority projects have been identified and developed in the Lewis Creek Association’s “Ahead of the Storm Project” - Preparing Local Watersheds for Flood Resilience and Reducing Runoff in the towns of Shelburne, Charlotte and Hinesburg.

Basin 5 - Northern Lake Champlain Basin, including LaPlatte, Malletts Bay, St. Albans Bay

The Northern Lake Champlain Tactical Basin Plan was approved in August 2015 and an updated version of the Plan includes the Lake Champlain Phosphorus TMDL Phase II content as of December 2017. The planning process drew heavily from assessment information including water quality results obtained this year with the help of volunteers working with the Regional Stormwater Education Program and the South Chittenden County River Watch (formerly the LaPlatte Watershed Partnership) who have received financial and technical assistance from the WSMD. This Basin 5 plan presents discrete, geographically explicit project implementation opportunities. Projects in this plan are included in the Watershed Projects Database described in Section 2 of this report.

Completed projects this year have already addressed strategies in the plan including:

- Improvement stormwater management with check dams and bioretention pool on Charlotte town road as part of the *Ahead of the Storm* project, headed by the Lewis Creek Assn and other partners.
- Assessments of farms completed in the St. Albans bay by AAFM and mapping of ditches
- Project designs and implementation for projects in Flow Restoration Plans



Figure 9. Thompsons Point Road, Charlotte road ditch with check dams and bioretention basin

Basin 6 Missisquoi Bay, including Pike and Rock Watersheds

The Missisquoi Bay plan was approved on December 2nd, 2016. This year, project implementation has been the focus. Partners' ability to search for projects using the Watershed Projects Database has facilitated their efforts to seek grants to support the projects. The towns, local stakeholders, including the Franklin Watershed Committee, the Regional Planning Commissions have participated in project development and implementation. The division is also continuing to support water quality assessments by the Missisquoi River Basin Association and the Franklin Watershed Committees (Lake Carmi watershed). The WSMD LaRosa Program volunteer water quality monitoring program provides community groups with financial and technical assistance. The

WSMD has continued to support a local implementation action team for the Lake Carmi watershed that works to coordinate project identification and development among partners. The meetings have become a central hub for communication with community members deeply frustrated with the length and intensity of cyanobacteria blooms this fall. The meetings have brought in experts from all sectors to provide background information as well as helping to facilitate discussion.

Examples of a few of the plan strategies that were completed this year included:

- AAFM completed the assessment all dairy farms in Franklin County and is now supporting efforts to address farmstead and agronomic needs.
- Franklin Watershed Committee was supported in completing ERP grant supported work including a stormwater design for the Franklin Town Garage, tree planting at the town beach and private road assessments.
- The Missisquoi River Basin Association continued to work on riparian plantings averaging 50 feet in width to cover a total of 12 acres, or two miles of stream over the last three years.
- Vermont Land Trust has worked with landowners to secure river corridor easements in the upper Missisquoi.



Figure 10. Riparian buffer planting in Bakersfield by MRBA and school kids

Basin 7 Lamoille

With the 2016 Lamoille Tactical Basin plan approved on December 2nd, 2016, the last year has been all about project implementation and watershed partner coordination. The towns, local stakeholders, Regional Planning Commissions, and Natural Resource Conservation Districts have hit the ground running and are actively engaging on priority projects throughout the basin writing grant applications, reaching out to the public, and implementing projects.

Stormwater Highlights

The town of Jericho completed their Stormwater Master Plan (SWMP) this year and received an ERP grant to install the highest priority practice identified in the plan. Conceptual designs were provided in the SWMP and the design will be finalized and implemented next year.

The town of Hardwick will have a completed SWMP by the end of the year that will include two concept designs and two design build practices for high priority nutrient and sediment removal projects. One of the concept designs will address significant stormwater runoff to Cooper Brook and has involved coordination with state regulators, VTrans, town officials, and private landowners. The second conceptual design is for a gravel wetland that will treat stormwater runoff at Hazen Union School.

The town of Cambridge received a grant to install an underground infiltration basin under their elementary school parking lot. This practice was identified in a stormwater mapping report by DEC as a high priority to decrease runoff into the Brewster River.

The Friends of Northern Lake Champlain (FNLC) received a grant to address stormwater runoff to the Deer Brook Gully in Georgia. FNLC has hired a contractor to coordinate with VTrans to identify stormwater discharges to the gully and design a remediation plan for the gully. This project has been ongoing for at least ten years and has stalled due to lack of funding. Dollars from the Clean Water Fund have put this project back on track to be finalized.

Multiple priority towns identified in the 2016 Lamoille TBP are working on or have completed Road Erosion Inventories using dollars provided by the Clean Water Fund and Better Roads Program including Walden, Hardwick, Essex, Underhill, Westford, Jericho, Milton, Georgia, Fletcher, Fairfax and Woodbury.

Funding was received for the implementation of stormwater practices at the Wolcott Town Garage and Fire Station. The Lamoille County Planning Commission (LCPC) has been working in partnership with the town to upgrade drainage from the site, which is immediately adjacent to the Lamoille River.

Lake Eden

Coordination among the Lake Eden Association, the Town of Eden, local stakeholders, Lamoille County Conservation District (LCCD) and DEC has led to the interest in working on a Lake Watershed Plan and Assessment. In cooperation with the Lake Eden Association, the LCCD is planning on applying for a grant through the Clean Water Fund to identify hot spots of runoff and sedimentation into the Lake that are impacting water quality.

North Branch Wetlands Complex – Belvidere

The Belvidere Planning Commission has been coordinating with LCPC and DEC to determine the best protection options for the North Branch Wetlands Complex, which is home to a high-quality sedge meadow and fen. The complex is part of the Lamoille and Missisquoi headwaters and provides numerous functions and values to the both watersheds. The planning commission has been exploring the option of Class I wetland protection. Through a 604(b) funding grant, LCPC developed a Wetland Tour for the community to paddle and walk the wetlands and talk about reclassification and wetland function and value.

Cambridge Greenway Railroad Bridge Replacement and Floodplain Connection

One of the most long awaited and exciting water quality and flood resilience projects was finally completed in Jeffersonville this fall. An old narrow railroad bridge was replaced with a long span pedestrian bridge and a large area of floodplain capacity was increased to protect water quality and the village during flooding events. A hydraulic study found that the narrow bridge was causing significant flooding impacts and erosion in the village and to the Lamoille and Brewster Rivers.



Figure 11. Cambridge Greenway railroad bridge replacement and floodplain restoration in Jeffersonville by the Route 15 Park and Ride.

Basin 8 Winooski River

The planning process for Basin 8 commenced at the beginning of 2017 and will be ongoing through 2018. The planning process is supported by the Chittenden, Lamoille, Central Vermont Regional Planning Commissions and the Northeastern Vermont Development Association as well as the Winooski and Lamoille Natural Resources Conservation District. This Winooski Basin Steering Committee has met five times this year to support development of the draft plan and public outreach. The watershed groups, Friends of the Winooski River and Friends of the Mad River have also contributed. The committee has also assisted with 6 community meetings that have led to an increased understanding of community issues and potential project sites. Implementation of the 2012 continues with support of assessments and projects (see below). The Friends of the Winooski River, Huntington River group, and Friends of the Mad River continued their volunteer water quality monitoring of rivers in the basin with financial and technical assistance from the WSMD.

Examples of completed strategies that were supported by the Clean Water Fund include:

- Friends of the Winooski River planted trees on riparian buffers in Calais and Waterbury as part of its Trees for Streams program;
- The City of Montpelier supported an illicit discharge detection assessment;
- Friends of the Mad River coordinated installation of a rain garden at Harwood High School
- The Central Vermont Regional Planning Commission supported stormwater master planning for central Vermont towns.
- The Chittenden County Regional Planning Commission supported stormwater master planning for Jericho and Richmond.
- Town of Northfield and the Friends of the Winooski River began a floodplain restoration project in Northfield
- Vermont Land Trust has worked with landowners to secure three River Corridor Easements

Basin 9 White River

Planning for the 2018 White River TBP is in full progress. Three public outreach and stakeholder discussion meetings were held in the beginning of December to kickoff the draft plan writing and project prioritization throughout the watershed.

Over seventy-seven percent of the actions in the 2013 plan were completed or are in progress. Most of these projects could not have been completed without our major partners including the White River Partnership (WRP), Two Rivers Ottauquechee Planning Commission (TROPC), and the White River Natural Resources

Conservation District (WRNRCD). Other partners, stakeholders, municipalities and landowners were also crucial in the completion and progress on the 2013 implementation table actions.

Watershed Projects Database

Projects identified in recent Stream Geomorphic Assessments (SGA) on the Upper and Middle White River and the Third and First Branches of the White River were added to the DEC Watershed Projects Database this year. Projects identified in stormwater mapping reports supported by DEC and the Ayers Brook SWMP were also entered into the database totaling more than 400 water quality projects at all stages of development. These projects can be searched and viewed by the public at: <https://anrweb.vt.gov/DEC/TWIS/ARK/ProjectSearch.aspx> and will help to populate the implementation table summary in the 2018 White River TBP.

River and Floodplain Restoration

Since 2011 - after rainfall from tropical storm Irene recalibrated the flow paths of mountain streams, tributaries, branches and the mainstem of the White River - watershed partners, municipalities and landowners have been working hard to make their communities more resilient to flooding. Flood mitigation almost always ends up providing co-benefits with water quality on the top of the list.

The Vermont Land Trust, in partial partnership with WRP, completed two river corridor easements totaling 32.2 acres of conserved land and 6.3 acres of streambank plantings along a priority section of the Second Branch of the White River. Both projects will allow the river to re-establish its natural slope and meander pattern resulting in the restoration of floodplain function to reduce erosion hazards, provide flood inundation and fluvial erosion hazard mitigation benefits, and improve water quality through sediment and nutrient attenuation.

This year WRP and Vermont River Conservancy are working on four river corridor restoration and easement projects over 52 acres and one mile of river frontage in priority areas identified in SGAs funded by ERP grants and Clean Water Funds. The White River Partnership also received Clean Water Funds to work in Tunbridge and Hancock to explore the feasibility of buyouts, river corridor easements, and dam removals identified in SGAs for priority stream reaches in the First Branch and Upper White River.



Figure 12. One of the two Vermont Land Trust river corridor easements completed with Clean Water Funds in 2017.

Vermont Fish and Wildlife (WFWD) has teamed up with WRP and The Nature Conservancy to restore a 20-acre floodplain parcel in Bethel owned by VFWD between Locust Creek and Cleveland Brook. The restoration will connect the floodplain to the White River upstream of Bethel providing sediment attenuation and floodwater storage capacity during highwaters.

Stormwater Project Identification

A basin-wide urbanized areas Illicit Discharge Detection and Elimination (IDDE) study is being conducted to improve the management of stormwater runoff and eliminate illegal and/or illicit connections of wastewater in stormwater systems. The purpose of this project is to locate and characterize contaminant sources and initiate correction of bacterial, nutrient, and hazardous material discharges to receiving waters.

The towns of Randolph and Rochester have both received Clean Water Funds to develop SWMPs to identify priority projects for nutrient and sediment reduction. Both towns will utilize stormwater mapping that was completed by DEC.

Teamwork – Stormwater, *E. coli*, and Floodplain Protection

TROPIC received Clean Water Funding to team up with WRP and WRNRCD to pursue projects identified in the Ayers Brook SWMP, White River SGAs and agricultural assessments. This project is aimed at contacting specific landowners to formalize and confirm potential green stormwater infrastructure projects, river corridor easements, riparian buffer plantings, and best management practices for farms. The work on this section of Ayers Brook will specifically reduce the detrimental effects that stormwater, agricultural runoff and erosive forces currently have on surface water quality in the mainstem of Ayers Brook and the Third Branch of the White River.

Basin 10 Ottauquechee, Black, CT River Direct

The Basin 10-13 Basin Plan was adopted in 2012 and the draft plan expected in 2017 is in progress and the public review process has been extended through early 2018. On-going project work is taking place on both the Black and Ottauquechee rivers.

Examples of a few of the plan strategies that were completed this year included:

- In the Ottauquechee watershed, final design plans for the restoration of a portion of Pinney Hollow Brook in Plymouth have been completed with restoration planned for 2017 and a completed study of Kedron Brook, focused on nutrient management and resiliency, has developed a list of projects for implementation. Both streams were severely impacted by TS Irene and restoration of water quality and habitat are needed.
- Along the Black River two important river corridor easements were completed covering over 3275 feet of river. 650 feet of buffer were also planted to enhance the function of the river corridor.
- The Town of Springfield is participating in work to address stormwater treatment at the town transfer station that currently runs untreated into the Black River. Final plans are being developed to treat this discharge and establish a treatment buffer along the riverbank.
- An exciting project on the Black River is the acquisition of a river corridor easement on the alluvial fan of Money Brook where TS Irene inundated the property, destroyed two structures and covered Route 100 with feet of sediment and boulders. This easement agreement has also allowed removal of a berm along the brook that was blocking high flows from accessing the field floodplain and has allowed wetland vegetation to re-establish along the river. In the next phase much of the field will be restored to wetland. Upstream on Money Brook the bottom slopes of extensive mass failures have been planted with willows to stem the discharge of sediment and begin to establish slope vegetation.
- Further work in the Black River watershed has improved 4,300 linear feet of roads and trails in Camp Plymouth State Park & Coolidge State Forest to mitigate erosion by installing 9 broad-based dips, 35 water bars, and 1 pole culvert and re-vegetating slopes for increased infiltration.
- Projects identified in the Mill Brook Corridor Plan are being implemented through both state and private funding. Two dams are slated to be removed next season in West Windsor which will restore aquatic organism passage, remove blockage to sediment transport downstream and reduce flooding pressure in the village.

- Working with the Town of Ludlow, Grant Brook has been reclassified to Class A(1) from A(2). The brook is no longer used as a water supply source but drains to the town wells and the town, wanting to insure high quality water, elected to increase protection of the watershed through reclassification.
- Volunteer water quality monitoring continues on both the Ottauquechee and the Black by the Black River Action Team and Ottauquechee River Group.

Basin 11 and 13 Williams, West, Saxtons, Lower CT, Mill

The Tactical Basin Plan for Basin 11 was approved in January 2016. Several surface water protection efforts have been underway recently including work with the US Forest Service, Mount Tabor Brook and Moses Pond within the Green Mountain National Forest that resulted in reclassifying these streams to Class A(1).

In addition, several initiatives are underway and priority projects funded during 2017 including:

- Completion of the Williams River Corridor plan has resulted in a list of prioritized projects for which funding is now being sought. Work will likely begin next season on Trout Brook in the upper watershed to address erosion, channel stability and increase floodplain access.
- The Saxtons River Watershed Collaborative has been established with all towns in the watershed being represented. The project emerged from an initial High Meadows resiliency grant and has grown into a strong diverse organization working to increase resiliency along the entire Saxtons River.
- Work in the West River watershed includes completion of a 600-foot riparian buffer on the Winhall River, the planned removal of a dam in Dummerston next season, the final approved design of a major channel restoration project on Adams Brook in Newfane.
- Volunteer water quality monitoring by the Southeastern Vermont Watershed Alliance (SeVWA) continues on all three major rivers in the Basin. This monitoring work is helping to identify reaches where follow-up state monitoring is needed to identify suspected pollutant discharges.
- SeVWA data revealed high levels of bacteria in the lower Sacketts Brook in Putney prompting the town Conservation Commission under guidance from the watershed coordinator, to undertake a monitoring blitz to try to locate the source of the pollutant. Working with SeVWA and town volunteers the one-day event revealed that the issues impact the lower portion of the brook. Follow-up work will commence next season to track the source and try to identify the problem.

Basin 12 and 13 Deerfield, Lower CT, Mill

The Deerfield River Tactical Basin Plan was completed in 2014 and is now being implemented.

Several surface water protection efforts have been underway recently including work to Reclassify high quality streams in the Deerfield watershed which has led to increased protection of the Deerfield River and its tributaries downstream to GMNF boundary north of Searsburg-Somerset town line, including Castle and Redfield Brook watersheds and Rake Branch Watershed below the confluence with Redfield Brook as well as Stamford Pond.

In addition, the River Corridor Plan for the East Branch of the North River is underway and is being enhanced by work of the Deerfield River Cooperative and the Department of Fish & Wildlife which has funded and completed a bridge and culvert assessment of the entire Deerfield River watershed with the assistance of Trout Unlimited. More work is planned to re-establish the riparian buffer and address unstable in-stream conditions. A river corridor easement is being but in place as well.

In addition, several initiatives are underway and priority projects funded during 2017 including:

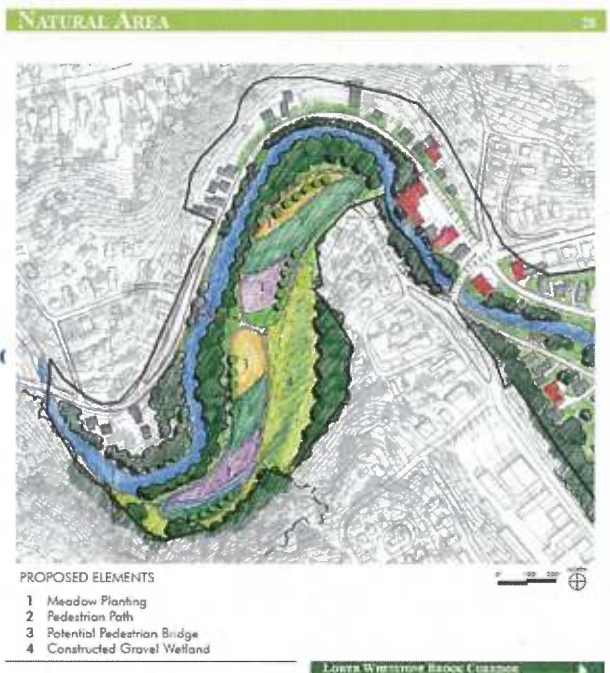


Figure 13. Projects resulting from the Green River Corridor Plan have resulted in the removal of several flood damaged structures on a TS Irene-created island and restoration of the entire site to natural conditions.

- Removal of a berm for improved floodplain access, wetland restoration and a corridor easement are in progress for a parcel downstream of this site.
- Significant work is being done along the Whetstone Brook in Brattleboro with two recent EPA grants, FEMA funding and Ecosystem Restoration funds (see conceptual design on this page – inset).

An EPA’s Smart Growth grant had funded the “Design for Resilience in Brattleboro’s Whetstone Brook Corridor” project which has involved many community groups and citizens in planning for improved flood resiliency designs for the downtown Brattleboro area while maintaining the residential and economic needs of the town. DEC involvement and basin planning are working to conserve open space floodplain parcels to decrease flooding in downtown Brattleboro and plant riparian buffers.

- The Long Island Sound (LIS) Dissolved oxygen/nitrogen TMDL is being addressed through the LIS Regional Conservation Partnership Program to which the Watershed Coordinator is an active participant on the technical steering committee and the resiliency subcommittee.
- The FERC relicensing process for the three lower Connecticut River hydroelectric dams continues. Finally, efforts to control the invasive plant water chestnut are having the intended effect on the lower Connecticut River with the population decreasing every year.



Basin 14 Stevens, Wells, Waits, Ompompanoosuc, CT River Direct

Monitoring, implementation and project support have been underway in Basin 14 this year. Some of the main considerations for this Basin are protection and maintenance of high quality waters, invasive species management in large inland lakes, river corridor protection, and correction of flow alterations.

Our main partners in this basin are the Caledonia County and White River Natural Resource Conservation Districts (CCNRCD, WRNRCD), the Connecticut River Conservancy, Two Rivers Ottauquechee Planning Commission (TROPIC); and Northeastern Vermont Development Association (NVDA). All partners have been working in each sector to meet the goals laid out in the 2015 Basin 14 TBP.

Ticklenaked Pond & Lake Morey

After heavy rains and a beaver dam failure in early July of this year, Ticklenaked Pond in Ryegate experienced a large amount of sediment input. During the month of August, the pond experienced a toxic algal bloom. Samples were collected, and lakeshore owners and the town were notified. An action plan was developed with coordination between DEC, the Ticklenaked Pond Lake Association, and concerned citizens. DEC also coordinated with the Department of Health to ensure proper notice and signage for current and future blooms at the pond. A meeting was held with the Selectboard and town health officer to discuss the impacts of algal blooms and importance of notification. The town now notices algal blooms on their website. Follow-up sampling will continue and phosphorus reduction practices in the watershed are being explored.

Concerned citizens from Lake Morey contacted DEC about water quality concerns about their lay-monitoring data. The watershed coordinator set up a meeting with the group to look at long-term data and discuss other water quality concerns. As a result, DEC is working with the lake group to set up a septic social event to engage people in learning how septic systems work, conduct LakeWise water quality assessments on willing shoreland owner properties, develop a volunteer water quality monitoring plan for lake tributaries, and investigate and fix potential stormwater runoff issues.

Dam Removal & Feasibility Projects

Seventeen miles of prime habitat was restored to Brook Trout and other aquatic species in the Ompompanoosuc River at the site of the Geer Dam in West Fairlee. The small dam was built by its namesake in 1983 for hydroelectric power generation by a retired Dartmouth professor and farmer. No longer producing electricity and acting as a blockage to upstream movement of aquatic species and downstream movement of stream materials, the dam was listed as a priority for removal in the Basin 14 Tactical Basin Plan in 2015. Video link: <https://vimeo.com/230166602>.

The Connecticut River Conservancy (CRC) worked with a consultant and state regulators to finish up an engineering design for the Norwich Reservoir dam removal project upstream from the site of the Norwich Pool Dam. This dam, owned by the Norwich Fire District, is the last dam in the Charles Brown Brook, which is a tributary to Bloody Brook, a direct tributary to the Connecticut River. The removal will restore 2 acres of aquatic habitat and aquatic organism passage and open up 90% of the stream's watershed (5.2 square miles). CRC plans to apply for removal funding in 2018.

The town of Barnet has recently partnered up with the CRC to explore the feasibility of removing the Harveys Lake Dam to restore river connectivity in the Stevens River watershed. CRC received a grant this fall from Clean Water Funds to pursue the project. This partnership is a result of many months of coordination and discussion between the town, lake community and the Agency of Natural Resources. The intention is to restore connectivity to the river, decrease sedimentation behind the dam, improve water quality in the lake, and remove the Stevens River and Harveys Lake from the flow altered priority waters list, while maintaining a reasonable water level for the lake and shoreland community.

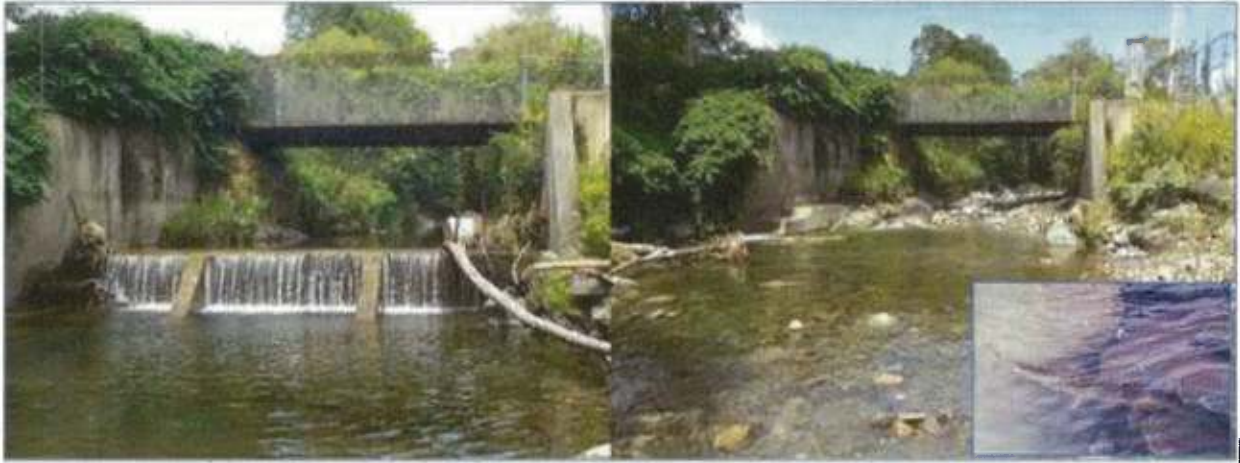


Figure 14. Before and after photos of the Geer Dam removal on the Ompompanoosuc River. Inset photo of a Brook Trout waiting near the dam face during the removal.

Water Quality Monitoring

A total of forty-six priority surface water locations in Basin 14 were monitored this season: nine lake sites (including five lay-monitoring sites), twenty-six stream sites, and thirteen wetland sites. The monitoring was completed as recommended in the 2015 Basin 14 TBP for assessing long-term trends, filling data gaps on sites not previously sampled, determining status for reclassification of high quality waters, assessment of impaired or stressed waters, and above and below sampling for tracking improvements from water quality projects.

Basin 15 Passumpsic

Key partners in the Passumpsic River watershed meet in late 2017 to kick off the tactical basin planning process, identifying priority water quality issues for the tactical basin planning cycle. In addition to this, several actions identified in the 2014 Passumpsic and Northern Connecticut River Basin Plan were completed or initiated in 2017. Many of these actions are a result of strong partnerships between DEC, Connecticut River Conservancy, the Essex and Caledonian County NRCD's, NVDA, NorthWoods Stewardship Center as well as private landowners in the basin. These included:

- Road restoration and rain gardens were installed in the Dish Mill Brook watershed to try to remediate this stressed stream.
- The East Burke Dam was removed through efforts of the Connecticut River Conservancy and the Passumpsic River Land Trust. Below is a link to a video about the project and before and after photos showing the restoration of the East Branch of the Passumpsic River after over 550 truck loads of sediment had been removed.



Figure 15. Before and after photos of the East Burke Dam removal on the East Branch of the Passumpsic River.

- The NorthWoods Stewardship Center Work Crew worked with the towns of Burke, Danville and Newark to install best management practices that can be done through handwork. One project included restoring heavily eroding road segment that was turned into a legal trail forest with a winding trail, reducing town maintenance and water quality impacts.
- A Stormwater Master Plan was nearly completed for the Town of Lyndon with four projects already installed by a NorthWoods Stewardship Center work crew and with two 30% designs of larger projects that have community support to move forward with final design and implementation.

Basin 16 Northern CT River Watersheds

Several actions identified in the 2014 Passumpsic and Northern Connecticut River Basin Plan were completed or initiated in 2016.

- Extensive buffer planting projects were completed on the Connecticut River in 2017 on the Johnson Farm WMA.
- The Essex County Natural Resources Conservation District received a grant to complete a stormwater mater plan for Concord Village to address erosion into two stormwater outfalls to the Moose River.

Basin 17 Memphremagog, Coaticook, Tomifobia

The Phosphorus Total Maximum Daily Load for the Lake Memphremagog watershed was approved by EPA in September of 2017 after an extensive public review process over the summer of 2017. Partners were involved in developing the TMDL to maximize the support and effectiveness of this cleanup plan. Fact sheets were developed to communicate information about the TMDL across each major land use sector and these are now available online at: <http://dec.vermont.gov/watershed/map/basin-planning/basin17>

The tactical basin plan for the Lake Memphremagog, Coaticook, Tomifobia basin was also approved in 2017. One objective in the plan was the creation of the Lake Memphremagog Stormwater Collaborative to bring together all the active partners in the basin working on addressing stormwater runoff across municipal roads and properties as well as private lands across the watershed. With support from DEC staff and other watershed partners the Memphremagog Watershed Association received a \$40,000 to form this collaborative which will be key to effective implementation of stormwater practices across this watershed necessary to meet TMDL reduction targets. The Memphremagog Watershed Association was able to hire a staff person to lead

the collaborative effort and held the first meeting of the collaborative in December with 10 partnering organizations to kick off the development of a strategic plan for this group.

In 2017 the following actions were completed in the basin:

- The NorthWoods Stewardship Center planted riparian buffers at ten sites covering over 4 acres within the Lake Memphremagog watershed through the Trees for Streams Memphremagog (TFSM) program and the Lakeshore Buffering (NEKLB).
- A tributary water sampling program was continued working directly with farmers to identify phosphorus source areas to prioritize BMPs to address barnyard and field runoff issues.
- Rain Gardens were installed at the Shadow Lake Beach in 2017 by the NorthWoods Stewardship Work Crew with support of the Shadow Lake Association and Town of Glover to address erosion of the beach which was observed in the spring of 2016.
- Echo and Seymour lakes were the first two lakes in the state to receive the gold lake wise award meaning that more than 15% of lakeshore property owners meet lake wise standards encouraging voluntary improvements in lakeshore practices. Through the lake wise assessments over 100 lake wise BMPs were identified and several of these are proposed for implementation in 2018.
- The Memphremagog Watershed Association received a grant to complete a 100% stormwater design for a stormwater treatment practice that will treat over 20 acres of impervious surface in the City of Newport.
- The Town of Brighton completed two major stormwater retrofits covering a large portion of the downtown area before this water enters Island Pond (Figure 16 below).



Figure 16. Picture of a stormwater treatment wetland installed in the Town of Brighton.