

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

DURING 2018

10 VSA 1253(d)

Submitted to the

HOUSE COMMITTEES ON:
AGRICULTURE
NATURAL RESOURCES,
FISH, AND WILDLIFE

SENATE COMMITTEES ON:
AGRICULTURE
NATURAL RESOURCES AND ENERGY

VERMONT AGENCY OF NATURAL RESOURCES
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
WATERSHED MANAGEMENT DIVISION

JANUARY 15, 2019

Section 1) Introduction and Summary	1
Section 2) Tactical Basin Planning Process – Progress in 2018.	3
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	5
Water Quality Modeling to support Tactical Planning, and Phase II Implementation Plans for the Lake Champlain TMDL.....	8
The Role of Regional Planning Commissions and Natural Resource Conservation Districts in Tactical Basin Planning	13
An Ongoing Focus on Protection.....	14
Section 3) Schedule for the development of Tactical Basin Plans and Subsequent Actions	14
Section 4) Individual Basin Plan Contacts and Statements of Progress	19
Basin 1: Battenkill, Walloomsac, Hoosic	19
Basins 2 and 4: South Lake Champlain Basin, including the Poultney and Mettowee Rivers	20
Basin 3: Otter Creek, Little Otter Creek, Lewis Creek	23
Basin 5 - Northern Lake Champlain Basin, including LaPlatte, Malletts Bay, St. Albans Bay	25
Basin 6 Missisquoi Bay, including Pike and Rock Watersheds.....	28
Basin 7 Lamoille	30
Basin 8 Winooski River	32
Basin 9 White River.....	34
Basin 10 Ottauquechee, Black, CT River Direct	36
Basin 11 Williams, West, Saxtons, Lower CT River Direct.....	37
Basin 12 Deerfield, CT River Direct	38
Basin 14 Stevens, Wells, Waits, Ompompanoosuc, CT River Direct	38
Basin 15 Passumpsic.....	40
Basin 16 Northern CT River Watersheds	41
Basin 17 Memphremagog, Coaticook, Tomifobia.....	41
Tactical Basin Planner Contacts	43
Acronyms Used in this Report.....	44

Section 1) Introduction and Summary

In 2018, 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.”

1. 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 2018, substantial progress was achieved in basin planning. In addition to the public review, responsiveness revisions, and approval by ANR Secretary 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 for the Winooski Tactical Basin Plan, as well as some refinement to the TMDL Accountability Framework milestones and interim reporting. 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.

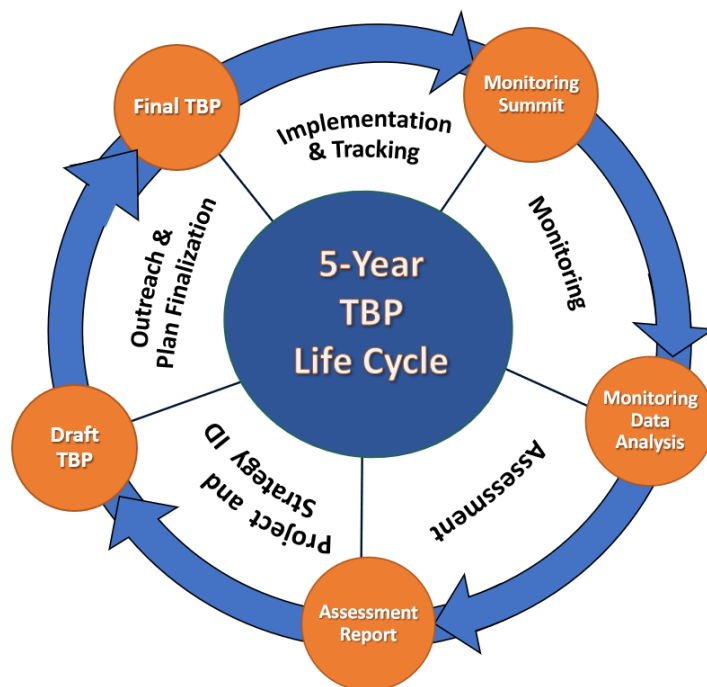
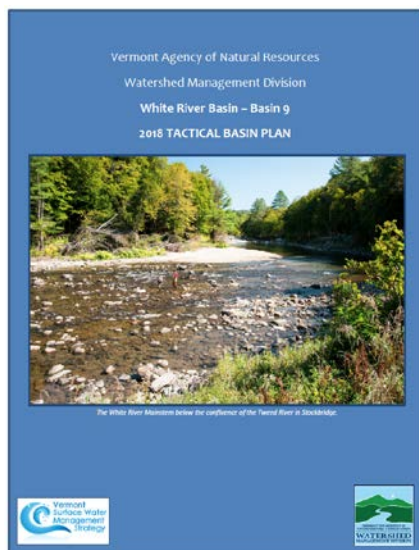


Figure 1. The Tactical Basin Planning process shown on a 5-year cycle of plan development leading to implementation.

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



[Black and Ottauquechee Tactical Basin Plan](#) (June 2018)

[White River Tactical Basin Plan](#) (December 2018) [Story Map link](#)

[Winooski River Tactical Basin Plan](#) (December 2018) [Story Map link](#)

[Otter Creek Tactical Basin Plan](#) (in development) [Story Map link](#)

In addition to the Tactical Basin Plans developed during 2018, the WSMD also developed companion “Story Maps,” which are a form of interactive web mapping that combines electronic maps, narrative text, images, and other multimedia content to provide thematic information on our Tactical Basin Plan content, planning process, and project identification, development, and implementation efforts. Included above are the links to each Tactical Basin Plan story maps.

Section 2) Tactical Basin Planning Process – Progress in 2018.

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 2018, MAPP supported tactical plan development and implementation 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, one tactical plan was recently updated to incorporate the “Phase II” content to support the Lake Champlain Phosphorus TMDL approved by USEPA (see below in this report). There are no longer basins that feature traditional basin plans, and only one basin remains (e.g., the Otter Creek Basin) that was developed using the conventional approach prior to the approval of the LC TMDL Phase I Implementation Plan (link, 2016) and promulgation of the Vermont Clean Water Act. Prior years’ Legislative Reports discussed the differences between the conventional approach to basin plan development (i.e., prior to 2010), the ~ 2010-2012 hybrid plans, and current “tactical” approach to basin plan development.

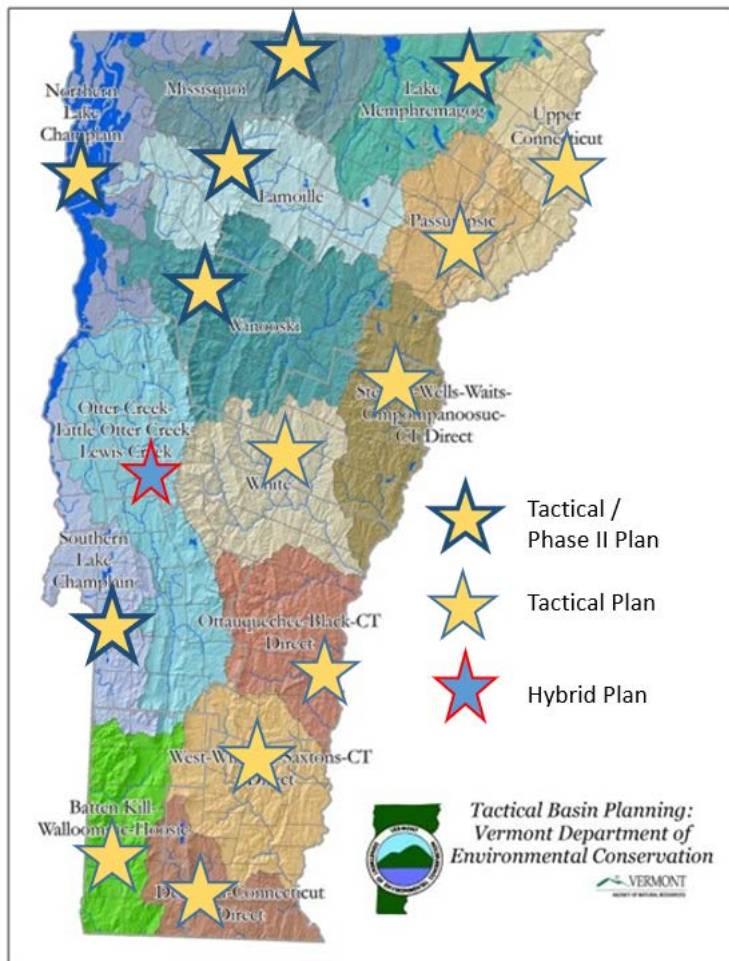


Table 1 (below) provides an indication of the planning status for each Vermont basin for the reporting period, with a more detailed view of activities in each planning basin provided in Section four. Below, we describe the results of business process improvement efforts which the Division led, using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

Figure 2. Vermont’s 15 Tactical Planning Basins, and the status of each basin plan.

The required plan production schedule is shown below and in Section 3 of this report.

Table 1. Overall Status of Basin Planning as of 1/1/2019.

Basin	Year of most recent plan issuance	Planning phase for 2019
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 revision underway and slated to be completed in late 2019 Lake Champlain Phase II Implementation Plan content developed during 2018
Basin 5 Northern Lake Champlain (Upper Champlain, LaPlatte, Malletts Bay, St. Albans Bay, Rock, Pike)	2017 Update (TMDL Phase II)	Plan Update to commence in 2019
Basin 6 Missisquoi	2016	Monitoring, Implementation
Basin 7 Lamoyille	2016	Monitoring, Implementation
Basin 8 Winooski	2018	Approved December 2018, includes Lake Champlain TMDL Phase II Implementation Plan
Basin 9 White	2013	Approved December 2018 Monitoring, Implementation
Basin 10 (13) Ottawaquechee, Black	2012	Approved June 2018 Monitoring, Implementation
Basin 11 (13) Williams, West, Saxton’s, Lower CT, Mill	2016	Monitoring, Implementation
Basin 12 (13) Deerfield, Lower CT, Mill	2014	Plan revision underway and slated to be completed in late 2019
Basin 14 Stevens, Wells, Waits, Ompompanoosuc	2015	Plan revision underway and slated to be completed in late 2019

Basin	Year of most recent plan issuance	Planning phase for 2019
Basin 16 – Northern CT River Watersheds	2014	Monitoring, Implementation Plan Update to commence in 2019
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 of 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 six 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) Standardize the process by which projects are ranked and prioritized based on relevant water quality and environmental benefits, including co-benefits and cost efficiencies.
- 3) Revise 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) Refine the 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 (see Figure 3);
- 5) Align grant allocation mechanisms of Ecosystem Restoration and Clean Water Fund (CWI) grants issued by DEC with prioritization 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.
- 6) Develop a spatially explicit mapping platform through which local and regional governments (e.g., municipalities), stakeholders, and the public can view prospective project locations, project types by sector, project status, and a detailed description of each project in order to enhance project sponsorship, commitments from landowners, and in order to leverage technical and financial resources that will serve to shepherd projects along through implementation. As a recent update to this effort, MAPP is in the process of developing a mapping application referred to as the “Watershed Projects Explorer” which will be used by watershed partners, basin planners, and the general public to explore projects in WPD that are ready to be developed where mapping information is available (see Figure 4).

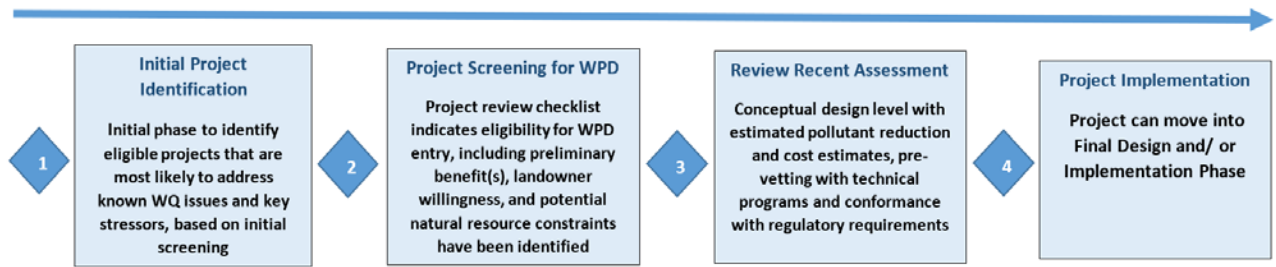


Figure 3. The conceptual model of the project identification, development, and prioritization process for implementation.

Substantial progress was made towards the application of the Lean process outcomes during 2018. The process of standardizing tactical basin plans was further refined and complemented through ongoing water quality modeling analyses that are described subsequently in this report. The [Watershed Projects Database](#) continues to be refined and updated based on project attribute information that will effectively show progress made towards implementation going forward.

The WPD provides a clearinghouse of projects by [sector](#) (e.g., stormwater from developed lands and roads, agriculture, etc) for all of the major river basins in the state and is constantly updated as sector-based assessments (e.g., stormwater master plans and river corridor plans) are used to identify and upload additional projects that are referenced. At present, the WPD does not include projects that are required by regulatory programs. Currently, stakeholders may review the [Watershed Projects Database](#) and the projects identified, by clicking that link to see specific identifiable projects, and searchable by basin, town, and/or project types. The MAPP anticipates that we will have a publicly facing version of the Watershed Project Explorer mapping application in early 2019.

Displaying Projects in the VT Watershed Projects Database

Tactical Basin Planning & Watershed Projects

The Tactical Basin Planning process identifies water quality priorities statewide. The [Vermont Watershed Projects Database \(WPD\)](#) provides basin planners with a way to track and store priorities identified in Tactical Basin Plans that are not being tracked by other means.

A total of 5009 viable projects were listed in the database as of 12/6/2018. 4323 (86%) have been identified for development and 686 (14%) have been completed or are in the funding queue. Of the 86% ready for development, 67% (n=2894) have discrete locations.

The WPD includes projects in all stages of development. For example, of the **4323 projects identified for development, 2189 (51%) require preliminary design, 565 (13%) require final design, 910 (21%) require implementation** and the remaining 659 (15%) are planning projects that include education and outreach, wetland mapping, hazard mitigation, research, assessments, inventories, and technical assistance.

In the majority of cases, some level of funding is also necessary to secure landowner, municipal, and/or regulatory support.

Only projects with discrete locations that were identified for development, not including low to medium priority culvert projects, are displayed on this map. Projects that are town- or basin-wide cannot be included on the map at this time.

Watershed Projects Funded
★

2018 Projects Ready for Development
●

Figure 4. A mock-up of the Watershed Projects Explorer mapping application.

VERMONT OFFICIAL STATE WEBSITE

AGENCY OF NATURAL RESOURCES
CLEAN WATER DASHBOARD

HOME FUNDED PROJECTS **WPD SEARCH** STP CALCULATOR ANR DEC FPR FWD

Watershed Projects Database Search

Name	<input type="text"/>	Status	<input type="text"/>	FED Step	<input type="text"/>
Project Type	<input type="text"/>	County	<input type="text"/>	Grant Number	<input type="text"/>
Basin Plan	<input type="text"/>	Town	<input type="text"/>	Project ID	<input type="text"/>
Grade Type	<input type="text"/>	Grade	<input type="text"/>		

Figure 5. The Watershed Projects Database provides an online, searchable list of completed, funded, and proposed projects

Within the database, project development is an ongoing process in order to update descriptions, environmental benefits, and in order to prioritize projects using a standard set of criteria for each sector, as well as incorporating local and regional metrics that are applied by key planning partners such as Regional Planning Commissions and Natural Resource Conservation District staff, based on factors such as nutrient reduction benefit, hazard 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 and update project information in the WPD with value added attributes as projects move through the development queue for all 15 planning basins in the state. 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 project elements are identified and added to the Watershed Projects Database.

The value of the WPD extends beyond tactical basin planning. As projects move from planning, design, and then are funded for implementation, they are tracked for implementation status, phosphorus and other pollutant reduction, and other indicators. The anticipated “[Clean Water Initiative Dashboard](#)” will be an online, interactive platform to make information on clean water projects, funded by state agencies, available to the public. The [2018 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 3771 projects currently identified in the WPD, which are distributed among tactical planning basins. Total project numbers are frequently changing due to their implementation status, the updating of records that eliminate duplicate listing(s), and in order to link certain projects more closely with the related sector, For instance, many of the road projects initially identified using road erosion inventories have been migrated into the Municipal Roads General Permit database in order to provide the required project attributes that are compliant with that regulatory program.

The most recent outcomes of the Lean project consider how projects are scored from the sector-based assessments and are integrated into the WSMD Watershed Project Database. Since last years’ Legislative Report, reporting period, DEC has been working to revise and update project scoring elements to include project assessment ratings as well as project scoring import functionality for statutory partners to the basin planning process.

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 allocations are assigned to relevant geographic scales, such as municipality, or sub-watershed.

[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, South Lake (Champlain), and Winooski Basins. The Otter Creek TBP is the last in this series that is currently undergoing an update of the Phase II content. The Watershed Management Division is now in the process of developing the Lake Champlain TMDL Phase III framework and content pursuant to the reporting requirements of the Accountability Framework.

Clean Water Roadmap

The [Clean Water Roadmap](#) (CWR) Tool is a map-based application designed to support Vermont DEC's planning and outreach efforts in implementing the Total Maximum Daily Loading (TMDL) for phosphorus in the Lake Champlain basin. The CWR allows users to interact with modeling results related to non-point total phosphorus (TP) loading as well as estimates of high-value conservation lands in the Lake Champlain Basin. The information in the CWR is derived from the original Lake Champlain TMDL basin models and components of the Water Quality Blueprint developed by the Vermont field office of The Nature Conservancy (TNC).

CWR scenarios can be used to estimate the potential TP load reductions of various best management practices (BMPs) on hydrologic units characterized by land use, soil, and slope. Additional relevant spatial data, such as village and township boundaries, partner data (TNC's Conservation Blueprint for Water Quality), street and imagery base maps, etc., are also included.

Thanks to the efforts of the project team – including DEC, Keurig-Green Mountain Coffee Roasters, the Nature Conservancy, LimnoTech, and other stakeholders – the CWR interface is now available online and can be used by everyone from the public to regional planners and DEC staff.

Figures 6 and 7 provide an example of the functionality of the Clean Water Roadmap to estimate phosphorus loading and evaluate BMP options. In this example, a small watershed in the Otter Creek basin that ranks in the highest percentile for estimated TP loading is selected (Figure 6). Imagine that a regional planner wants to evaluate several low to moderately-low impact BMP options targeting TP loading from cropland in this catchment. Three BMPs are selected: cover cropping, crop rotation (corn to hay), and conservation tillage (note that these BMP scenarios represent both voluntary projects as well as those required by the Agency of Agriculture's Required Agricultural Practices, as the Roadmap does not differentiate between regulatorily required projects versus those that exceed BMP base standards).

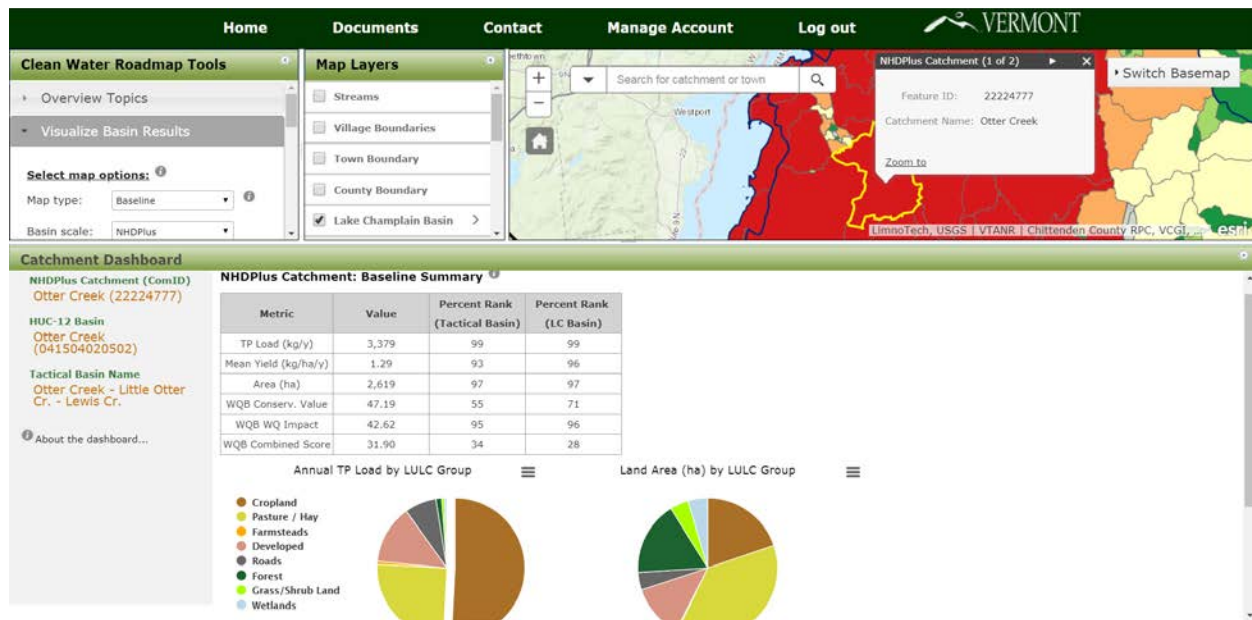
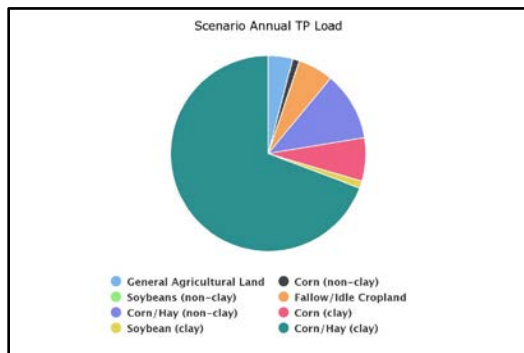
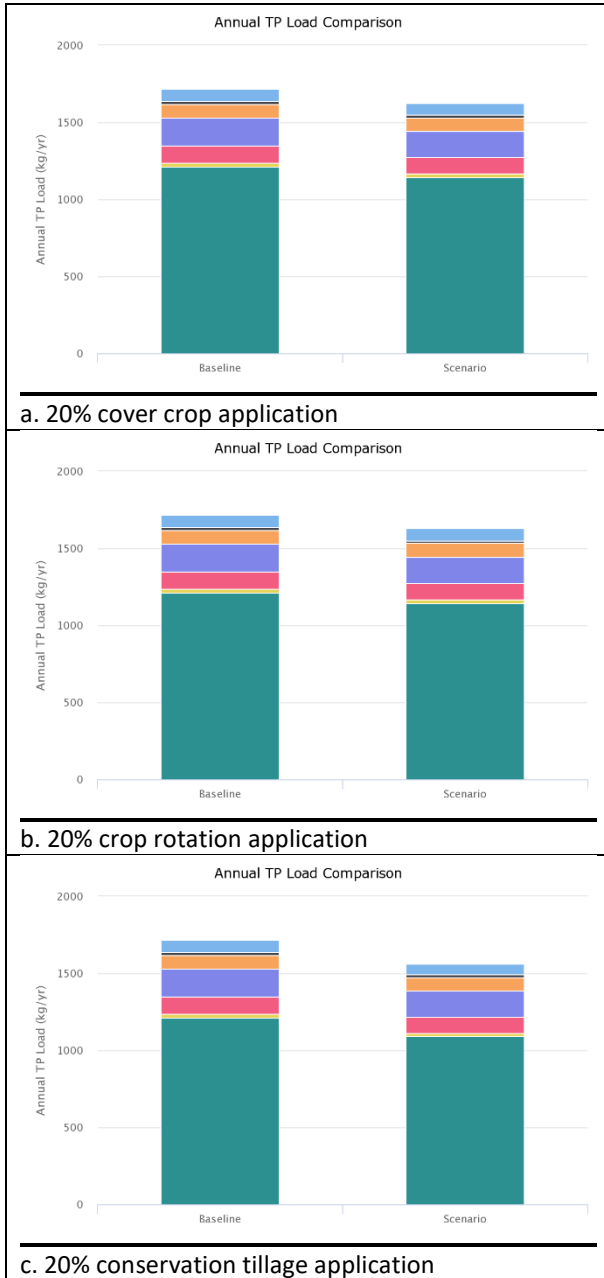


Figure 6. CWR Tool summary information for NHD+ Catchment 22224777, a small watershed in the Otter Creek basin. This catchment ranks in the 99th percentile for estimated TP loading, with over half of the load estimated to come from cropland.

Each of these BMPs is applied to 20% of the cropland area in the catchment, with the option to exclude implementation for selected soil and slope classes if necessary. The CWR-estimated annual TP reductions for these practices in this watershed are, respectively, 91 kg TP/year for cover cropping, 151 kg TP/year for crop rotation, and 216 kg TP/year for conservation tillage (Figure 6). Building off these comparisons, the planner could then explore combining, or *stacking*, management practices, in conjunction with increasing or decreasing the application area to maximize estimated reductions. These results, together with on-the-ground site surveys, could then be used to evaluate the value of public outreach efforts to encourage adoption of these practices, as well as justification for pursuing grants and other funding opportunities to implement these actions in the watershed.

Figure 7. Clean Water Roadmap estimated TP reductions for three BMP scenarios.



Phase II TMDL Plans

The Lamoille, Missisquoi, Northern Lake Champlain, South Lake (Champlain), Winooski, and all subsequent Lake Champlain and Lake Memphremagog basin plans will contain Phase II TMDL content, as mandated by EPA. In order to meet this requirement, 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 managed.

Table 2 describes the analyses 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 Program (CWIP) Funding Report.

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

An example of Phase II content from the forthcoming Otter Creek basin plan is reprinted below. This catchment-scale map shows the potential TP reductions if lake segment-specific TMDL reductions are applied equally to all land use sectors in the Otter Creek Basin, color coded by magnitude (Figure 8). For instance, the warmer color-coded catchments indicate where greater TP reductions can be achieved based on landscape characteristics (i.e., land use by sector, soil types, slope, etc.). These non-point sources of TP include roads, developed lands, forests, cropland, hay/pasture, and forests. The top 20 catchments by largest estimated reduction are shown in the embedded table, with individual catchments identified by the Map ID field. This high-level overview is intended to help prioritize and guide management actions to effectively target on-the-ground surveys and monitoring efforts, with the goal of identifying the most efficient management actions to achieve TP reductions.

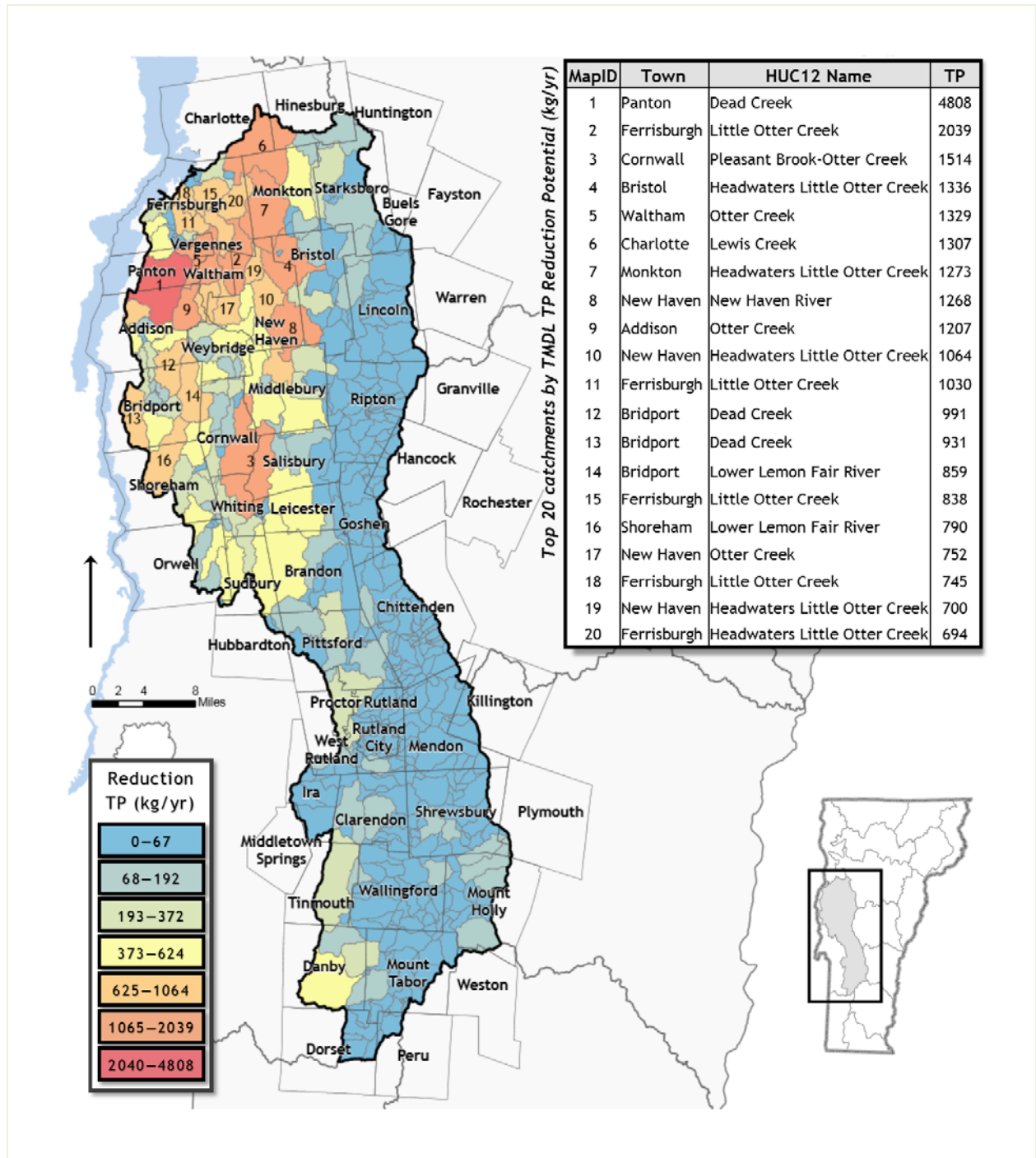


Figure 8. Clean Water Roadmap showing potential TMDL TP reductions if Otter Creek TMDL targets are applied equally across basin.

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

During the past year, and as part of the implementation of Act 64 (Sec. 43), DEC continued to contract with Regional Planning Commissions and the Natural Resources Conservation Districts to fulfill the specific roles and responsibilities around the development of tactical basin plans as articulated in Sections 26 and 27 of Act 64. Through this cooperative process, the Vermont Association of Planning and Development Agencies (VAPDA) as well as the Natural Resource Conservation Council (NRCC) and DEC have set forth a series of activities that each Regional Planning Commission (RPC) and Natural Resource Conservation District (NRCD) shall undertake in support of tactical planning for all watersheds in the State. This relatively new organizational alignment recognizes that significant (and ongoing) municipal and landowner outreach is needed to develop understanding of Act 64 authorities, develop tactical basin plans, assist landowners and municipalities, and ultimately track the implementation of projects and BMP installations that are carried out by municipalities, landowners, RPCs, NRCDs, and other stakeholders. The roles and responsibilities articulated in the State Fiscal Year 2019 (SFY19) performance contract with RPCs and NRCDs specifically acknowledges their strengths in supporting landowner, municipal, as well as other stakeholder activities aimed at water quality protection and restoration. The contracted activities under the SFY2019 contract include:

- 1) Assistance in the drafting and development of Tactical Basin Plans, including the vetting and review with other stakeholders including the RPC Clean Water Advisory Committees and regional coordination workgroups with NRCDs,
- 2) Coordination of landowner, municipal, and regional input to assist in tactical basin plan development, including project prioritization;
- 3) Increase outreach for landowner, municipal, and stakeholder awareness and readiness to implement Act 64 by conducting landowner and municipal outreach and education, and cross-program integration and coordination;
- 4) Promotion of flood resilience and water quality protection and improvement by providing natural resource and municipal planning assistance;
- 5) Enhanced outreach and delivery of information for municipalities by providing coordination of water quality monitoring, and oversight of independently funded assessments;
- 6) Assistance in the coordination of regional partner meetings to address high priority water quality issues such as through Clean Water Advisory Committees and agricultural partner and other sector workgroup meetings;
- 7) Assistance in the protection of high-quality resources and documentation of restoration efforts by participating in tactical basin plan implementation.

For each RPC and NRCD, the specific scope of work has been tailored to the development process associated with the timeframe of each tactical basin plan, and to the constituencies of each partner. There are performance tasks that are required statewide, certain tasks that are required for specific watersheds, and still other tasks that an RPC and/or NRCD may elect as optional but valuable activities. These partner organizations highlighted the following successful aspects of the partnership this year:

- Progress towards prioritization of individual projects incorporating local and regional considerations.
- Substantially augmented communication between DEC and partner organizations over implementation of Act 64, focused thru the tactical planning process and partner coordination efforts.
- Increased incorporation of DEC's monitoring and assessment information in partner-led outreach.
- Augmented collaboration with municipalities, prompted by the requirements of Act 64.
- Integration of tactical basin planning with other important planning activities, such as flood resiliency and transportation planning.

- Opportunities to enhance reclassification and designation of surface waters to achieve higher levels of protection.

The RPCs and NRCs are providing tactical planning services that substantially enhance DEC's ability to reach landowners, municipalities, and other relevant stakeholders. Further, the contracted activities are developing augmented capacity in RPCs and NRCs to support water quality protection and restoration. The outreach process undertaken in late 2018 by RPCs in support of the draft tactical plan release and public comment has benefitted the Department by bringing municipalities into the planning process in a more forthright manner. In coming years, RPCs and NRCs anticipate the opportunity to continue to assist municipalities and landowners with implementation of requirements of Act 64, including project management services. Thus, WSMD will continue to seek the means to strengthen and expand these partnerships in order to maintain the momentum and capacity that has been cemented with these entities and which have enhanced coordination.

An Ongoing 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 VSA § 1251-1253. 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 January 15, 2017. 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 Outstanding Resource Water 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 2 provides the 2018 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 presents 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 [White River](#) and [Winooski](#) 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 9 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	2019	2020	2021	2022	2023	2024	Major Watershed	Planner	
Basin 1 – Hoosic, Battenkill	Assess	Start	Finish	Imp	Imp	Mon	Hudson	Angie Allen	
Basin 2 and 4 – Poultney, Mettawee, South Lake	Mon	Assess	Imp	Start	Finish	Imp	Lake Champlain		
Basin 3 – Otter, Lewis, Little Otter	Finish	Imp	Mon	Assess	Start	Finish			
Basin 5 – Northern Lake Champlain Dir.	Start	Finish	Imp	Mon	Assess	Imp	Start	Finish	Karen Bates
Basin 6 – Missisquoi, Rock, Pike	Assess	Imp	Start	Finish	Imp	Mon	Assess	Lake Champlain	
Basin 8 – Winooski	Imp	Mon	Assess	Start	Finish	Imp	Imp		
Basin 7 – Lamoille	Assess	Imp	Start	Finish	Imp	Mon	Assess	Lake Champlain	Danielle Owczarski
Basin 9 – White	Imp	Mon	Assess	Start	Finish	Imp		Connecticut River	
Basin 14 (16) – Stevens, Wells, Waits, Ompompanoosuc, CT Direct	Start	Finish	Imp	Imp	Mon	Assess	Start		
Basin 10 (13) – Black, Ottauquechee	Mon	Assess	Imp	Start	Finish	Imp	Mon		Marie Caduto
Basin 11 (13) – West, Williams, Saxtons	Imp	Start	Finish	Imp	Mon	Assess	Imp	Start	
Basin 12 (13) – Deerfield, Broad Brook	Finish	Imp	Mon	Assess	Start	Finish	Imp		
Basin 15 – Passumpsic	Finish	Imp	Mon	Assess	Imp	Start	Finish	Imp	Ben Copans
Basin 16 – Northern Connecticut	Imp	Start	Finish	Imp	Mon	Assess	Start		
Basin 17 - Memphremagog	Mon	Assess	Start	Finish	Imp	Imp	Mon	Memphremagog	

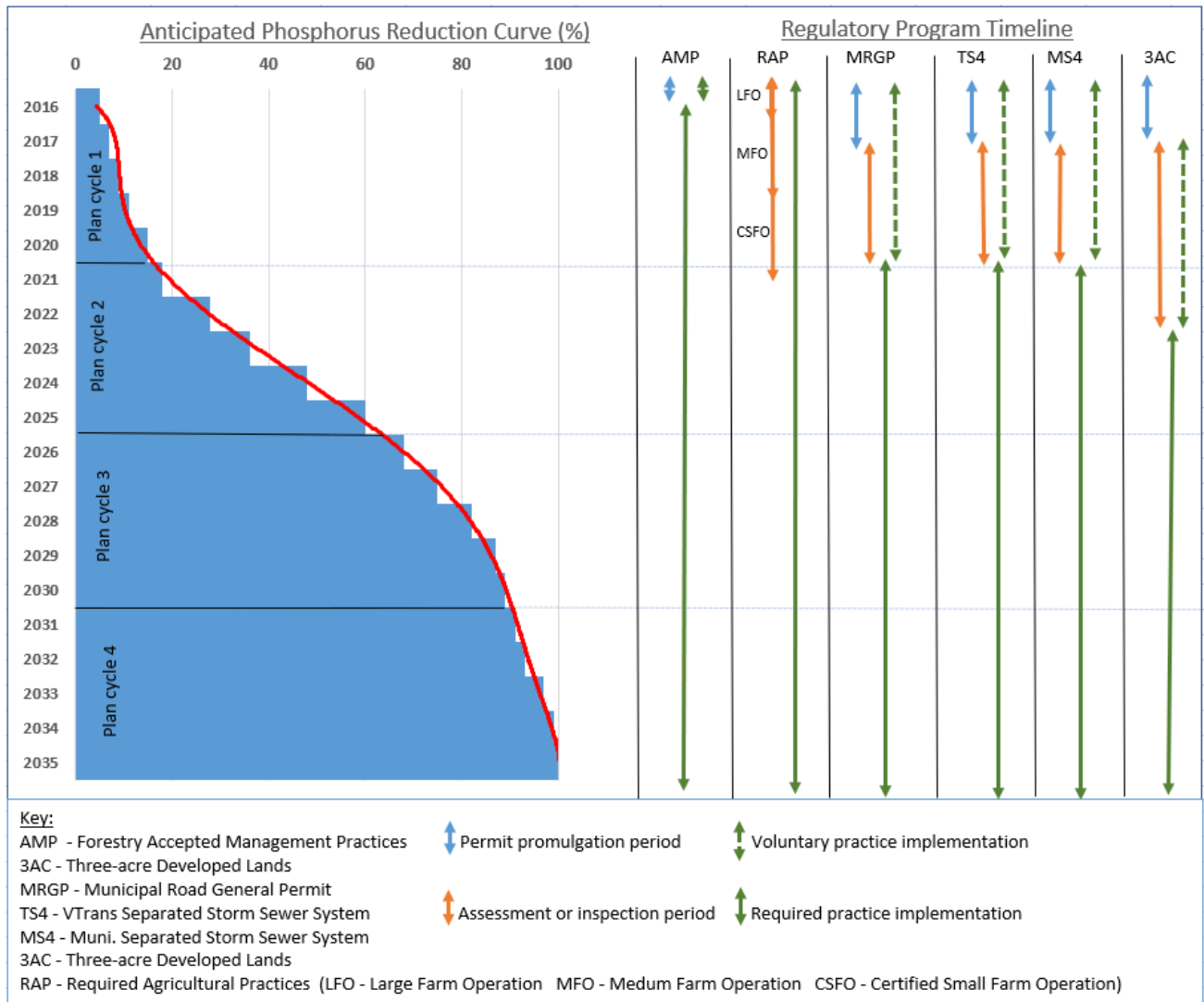


Figure 9. Anticipated phosphorus reduction, relative to the load and wasteload reductions required by the LC TMDL. The projected timelines for regulatory programs and basin plan updates are also shown.

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	-Implement AMP rule -Identify landowners with upcoming harvests, and conduct targeted outreach	-Implement revised AMPs (as of 08-18) -Engage with Conservation Districts and State Foresters to employ WQ friendly practices such as portable skidder bridges -Provide TA to landowners to implement forest management plans that exceed base standards -Consider modifications to forest management plans to emphasize use of ESTAs.
Stream Channels	All streams	-Support funding of highest-priority floodplain or corridor protection projects -Implement Floodplain and River Corridor Rule	-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	-Implement RAP Rule (ongoing) -Conduct inspections annually for LFO, every three years for MFO, every seven years for CSFO -Conduct high-resolution targeted BMP planning to assist landowners. -Engage watershed teams to provide technical assistance -Provide financial assistance -Target enforcement	- Conduct farm assessments (esp. SFOs) - Implement RAPs - Engage in AAFM or NRCS cost-share programs to offset costs of BMP installations.
Developed Land	VTrans owned roads and developed lands	-Implement "TS4" permit program (ongoing)	-Conduct assessments on a HUC12 scale -Implement priority projects resulting from assessments -Sequence implementation with planned major road upgrade projects.
	Roads MRGP	-Implement MRGP permit program (ongoing) -Provide funding for targeted municipalities to conduct road inventories through Better Roads or other funding sources -Continue to support MRGP Grant-in-Aid program	-Conduct inventories to derive capitol road improvement plans. -Apply for coverage for MRGP by 2021 -Implement capital improvement plans over 20-year timeframe.
	MS4	-Implement MS4 permit program by end 2018	-Develop phosphorus control plans coincident with revised MS4 permit.

		-Provide financial support thru Clean Water Initiative or SRF funding	-Implement Phosphorus Control Plans and Flow Restoration Plans over 20-year timeframe.
	Larger unregulated parcels	-Finalize Stormwater Master Rule (LCAR Jan., 2019). -Promulgate “Three-acre” permit in 2019, within 90 days of adoption of Rule. -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 	Angie Allen, Watershed Coordinator Department of Environmental Conservation 430 Asa Bloomer Building Rutland, Vermont 05701 802 490-9081 Angie.Allen@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.

- Biomonitoring of Basin 1 was conducted in Summer 2018 and sample processing is on-going
- The first in a series of regional coordination meetings was held with representatives of the Bennington County Regional Commission, Batten Kill Watershed Alliance, and Bennington NRCD
- The Basin Planner facilitated a presentation of the next TBP process and timeline, slated to commence again in 2020.

Project development and Implementation – The Basin Planner is...

- Working with Bennington County Regional Commission on ERP for SWMP in Manchester
- Working with Bennington NRCD to create a landowner-led Japanese knotweed management program along two watercourses in West Arlington. They are the major source of knotweed in the Vermont portion of the Batten Kill main stem from the Green River downstream.
- Working on the Hoosic River Corridor Planning Project, which includes a closer investigation of the Tubbs Brook Stormwater runoff issue that appears to be exacerbated by steep dirt roads along the brook.

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).

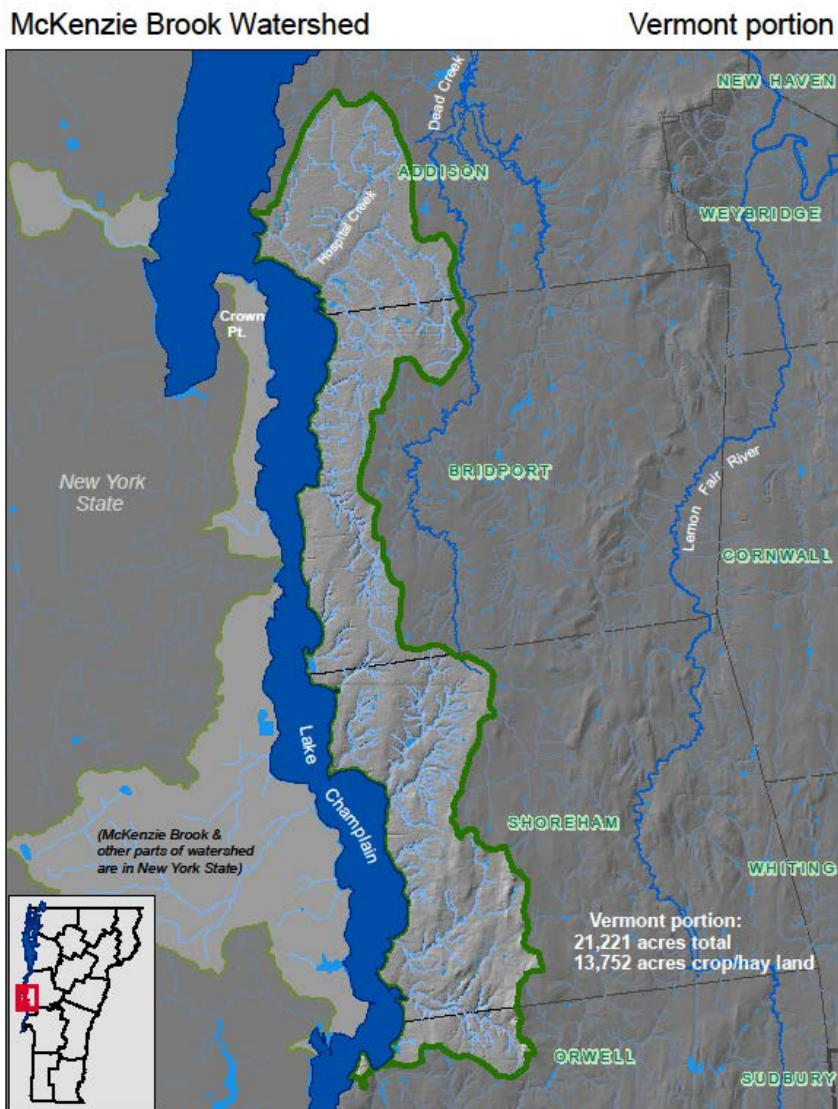


Figure 10. McKenzie Brook watershed in the South Lake Basin. Target phosphorus levels in this segment of Lake Champlain is 25 micrograms/liter. Since 1990, it has only met that once and has in some years almost reached 50 micrograms/liter.

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 Champlain 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 2018 include:

Monitoring and Assessment

- McKenzie Brook/South Lake Champlain Direct Tributary Streamflow, Precipitation and Water Quality Monitoring Project (2017-18 water quality monitoring project in coordination with UVM Extension, AAFM, NRCS representatives, and local farmers):
 - Year 2 of water quality sampling is now complete and was conducted at the 7 sites
 - Data analysis is underway and the final report, which will include a summary of workplan outputs and progress toward achieving outcomes, including flow and initial nutrient load estimates for subwatersheds will be finalized in early 2019.

Project development and Implementation

- Stormwater Master Plan in-progress for the Lake Saint Catherine Basin with the Poultney Mettowee Natural Resource Conservation District (PMNRCD)
- Coordination of Lake Saint Catherine Implementation Team (on-going)
- Assisted Lake Saint Catherine Lake Association with LCBP grants for education and outreach
- PMNRCD - Castleton SWMP funded via Block grant including the completion of the Castleton Transfer Station stormwater project (see figures 11 and 12 below).
- Eaton Hill Road drainage stormwater improvements project development anticipated for next spring (Town of Castleton)
- Lake Bomoseen SWMP--Woodard Marine design has been completed for a bio-infiltration area to manage stormwater from parking lot and roof
- VTrans TAP grant to design the Staso Hill Road as high priority MRGP project (Town of Castleton)
- 6 shoreline tree plantings at Lake Saint Catherine lakeshore homes
- 4,900 riparian trees planted (via the Poultney Mettowee NRCD)
- South Lake meeting with some NY partners at an upcoming Lake George Association meeting
- Exclusion Fencing in Poultney watershed ≈3,000 linear feet installed



Figures 11 and 12. Stormwater treatment practices installed at Castleton Transfer Station

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

The *draft* 2019 Otter Creek Tactical Basin Plan (TBP), currently in development, contains substantive changes including: standardized content and layout, a climate change implications section, updates to the Lake Champlain P TMDL including the Phase II content, and more.

The 2019 Otter Creek Plan will leverage a basin wide assessment of water resources to identify protection and restoration actions. Protection actions will highlight the highest quality waters and their supported uses, whereas restoration actions will address high-priority stressors such as encroachment, stream channel erosion, eutrophication, and pathogens. The plan will also quantify reductions needed to restore water quality (e.g., the Lake Champlain Total Maximum Daily Loads (TMDLs) to meet State and Federal water quality standards.

The summary of actions described in Chapter 5's implementation table and tracked via its online counterpart, the [Watershed Projects Database](#), will guide project implementation from 2019-2024 and beyond. The WPD is continuously updated to capture project information from 1. Through the Tactical Basin Planning process, and 2. emerging projects due to natural and/or anthropogenic events. The WPD will also populate a new "[Watershed Projects Explorer](#)," which will be used in concert with a Story Map during the Plan's public comment period.

Accomplishments and priority projects funded and/or supported during 2018 include:

- A comprehensive assessment of biomonitoring and ancillary data was conducted during 2018.
- The Rutland Natural Resources Conservation District (RNRCD) recently received funding to conduct Stormwater Master Planning in the Moon Brook Watershed in the City of Rutland, and in support of the State's Clean Water Initiative.
- The RNRCD received funding through a Natural Resources Conservation Council (NRCC) Block Grant to implement Green Stormwater Infrastructure (GSI) practices at the Rutland Town School. A total of 1.25 acres of impervious surface, mostly parking lot, are treated by rock swales, rain gardens, bioretention, and an infiltration trench. The goal of this project is to treat and infiltrate stormwater runoff onsite thereby reducing the total volume and peak flow rates of stormwater runoff to the East Creek. East Creek is listed in the State of VT 2016 List of Priority Surface Waters for both sediment and temperature. *See pictures below from this Clean Water sponsored project.*



Figures 13 and 14. Green Stormwater Infrastructure projects at the Rutland Town Elementary School

- The Town of Bristol is conducting a Stormwater Master Plan.
- The Town of Vergennes completed a Stormwater Master Plan and the following final design projects are slated for the next ERP grant round, 1. **High School:** Proposed installation of a gravel wetland that would replace an undersized detention pond and treat 5.77 acres of impervious surface and in total 9.77 acres of land. Proposed infrastructure would manage a total volume of 70,000 cubic feet of water, which would handle a 1" water quality volume and detain channel protection volume for 24 hours. A detailed landscape plan accompanies the gravel wetland to ensure its integration into the school's campus, and 2. **WWTF:** Proposed installation of a gravel wetland that would treat 3.24 acres of impervious surface and 12.53 acres in total and replace an existing eroding swale. The proposed wetland would manage the water quality volume or approximately 4,200 cubic feet of water.

Basin 3 projects identified in the WPD (includes the grant funded #):

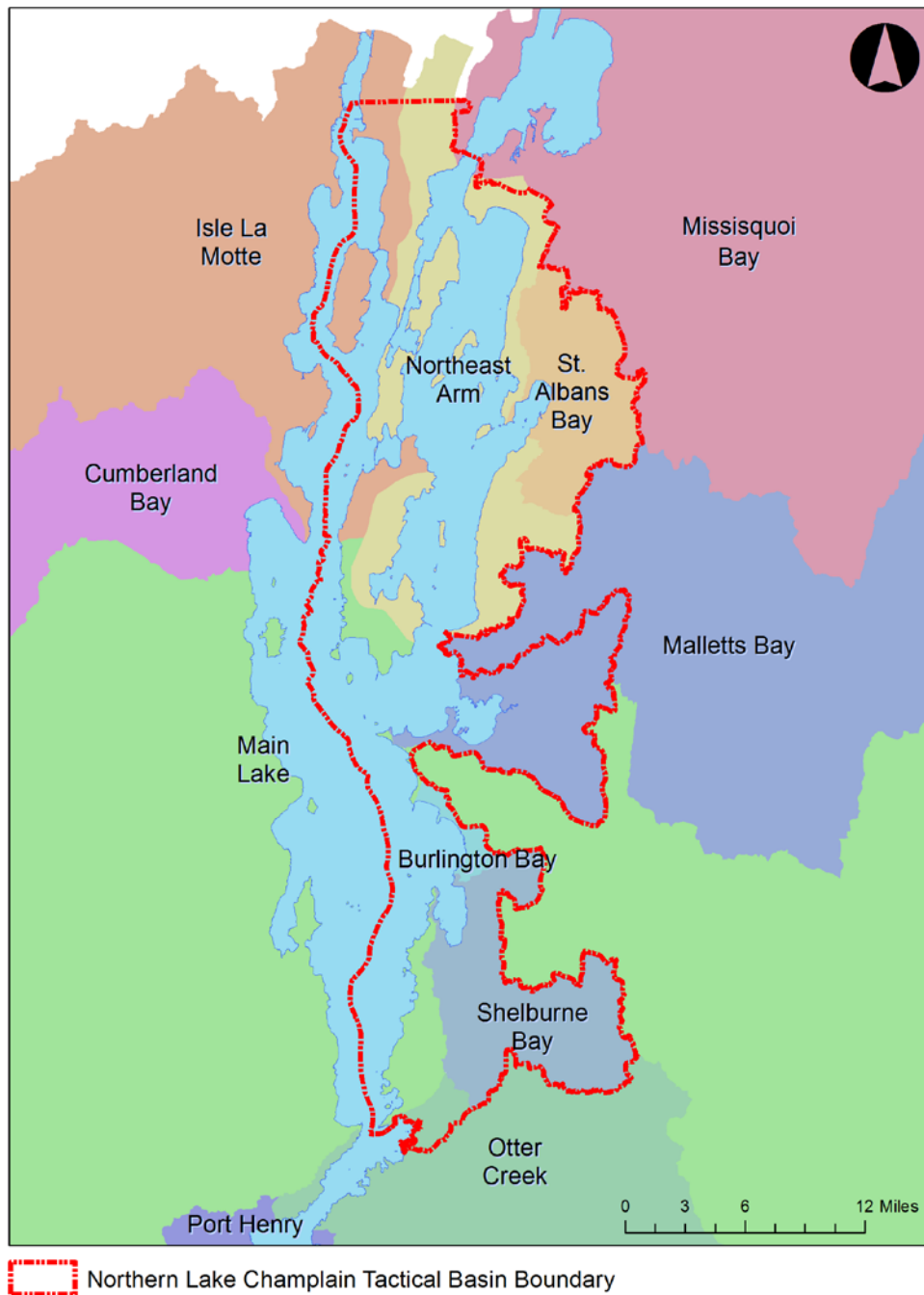
1. **Clean Streets Phosphorus Reduction Project (2018-CWF-S-1-06):** This will fund a design of a nonstructural best management practice that would benefit many existing regulated Vermont municipalities as well as many Vermont municipalities in the future who will be regulated under Act 64, the Vermont Clean Water Act. Implementation of practices by towns will lead to a significant increase in P reduction from street sweeping (from 3% to perhaps 20%). To facilitate adoption of the practice, the project will provide towns with a simplified, straightforward and realistic method of measurement for calculating street cleaning credits for the state's nutrient TMDLs. Two credits will be developed for street cleaning: (1) an interim credit based on the BATT Model and other crediting methods (Region 1 NH MS4 permit, Chesapeake Bay Street Cleaning Work Group, etc.) and, (2) a permanent credit based on phosphorus source area delineations of municipal streets using real time materials sampling of sediment and nutrients, forest cover measurements, forest tree species, seasonal deposition of organic materials from trees, street sweeping equipment efficiencies and street cleaning frequencies.
2. The Town of Wallingford is conducting a Stormwater Master Plan.
3. **Hitzel Terrace Outlet Retrofit (2018-ERP-M-1-12):** The town owned parcel along Hitzel Terrace is a natural wetland area which currently provides some level of stormwater detention and peak-flow attenuation. The completed project involved retrofitting the existing culvert under Hitzel Terrace with a low-flow outlet structure to allow for additional ponding and detention of stormwater in the town owned area.
4. **Cold River Berm Removal (2018-ERP-M-2_02):** This project restores over 10 acres of floodplain along the Cold River in the Town of Clarendon, which is currently cut off by a large berm. The site is located between Rt 7, where it was destroyed during TS Irene, and the Middle Road on the right bank. This project was identified as a top priority through the river corridor planning process.
5. **Homer Stone Berm Removal (2018-CWF-D-3-05):** The project is located on Homer Stone Brook near Audy lane in Wallingford. The river in this area is bermed on both sides, apparently the result of sediment management after tropical storm Irene. The proposed project would open up the berm on the north side of the stream, allowing flood waters to access a historic floodplain/floodchute located on USFS property. The result would be reduced sediment export to Otter Creek.

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 Phase II content includes high-resolution phosphorus-load modeling and projected phosphorus reductions for smaller sub-watersheds as well as by types of sources (wastewater treatment plants, developed lands stormwater, roads, forestry and agriculture). The 2017 plan also describes strategies relating to the development of new regulations associated with the Vermont Clean Water Act.

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 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.

The planning process for the 2021 Tactical Basin Plan rewrite has commenced with a Partners kick-off meeting in December 2018. Additional meeting to fine tune water quality monitoring plans and identify natural restoration projects have occurred in January. Partners include the regional planning commissions, the natural resources conservation districts, the Southern Chittenden County River Watch, the Friends of Northern Lake Champlain and other stakeholders as well as the public to inform the plan development.



Figures 15. The Northern Lake Champlain Basin sub-watersheds

Completed projects this year have addressed strategies in the 2017 plan including:

Lake Iroquois Stream Channel Restoration

The Lake Iroquois Association restored a Lake Iroquois tributary with removal of culvert, addition of timber check dams and plantings to help address stormwater runoff from Pinewood Drive (Figures 16 and 17).

Jewett Brook Off-stream Water Pollution Treatment System

LCBP funded a Phase I regulatory feasibility analysis and is presently supporting a Phase II modeling and design study to develop an off-stream water pollution treatment system that will reduce excess phosphorus that flows from Jewett Brook to St Albans Bay. The proposal would divert a portion of the Jewett Brook flow at appropriate times of year into a series of constructed wetlands designed to strip phosphorus and sediment before returning the flow into the proximal wetlands. The LCBP's Project Advisory Committee continues to track and guide the project. Initial estimates suggest that the project could remove phosphorus from up to 40% of the streams annual flow, assisting concurrent implementation of best management practices in the watershed to achieve the goals of the TMDL.

Flow Restoration Plan projects

Burlington, South Burlington, Colchester, Essex Junction, Shelburne, and St. Albans City and Town continue to work on project design and implementation for seven Flow Restoration Plans to remediate the seven urban stormwater impaired streams in the basin, including Bartlett Brook, Englesby Brook, Indian Brook, Munroe Brook, Potash Brook, Stevens Brook and Rugg Brook

Floodplain Restoration Design for Beecher Hill Brook

The Lewis Creek Association and Town of Hinesburg completed floodplain restoration designs and initial work to reduce encroachment of town garage on Beecher Hill Brook. The goal of this project is to reduce sediment inputs and improve water quality. This will be accomplished by developing a final floodplain restoration design to return the river corridor to a natural vegetated state and allow the river to access its floodplain. The project is currently on the DEC priority project fund list for implementation funds and may be paired for funding with the Hinesburg Wastewater Facility upgrade loan, or another loan, through the DEC state revolving fund's Water Infrastructure Sponsorship Program.



Figure 16. A tributary to Lake Iroquois, where timbers were placed to intercept water flow thereby reducing erosion and trapping sediment.



Figure 17. Lake Iroquois Tributary: Project after subsequent planting in October 2018

Basin 6 Missisquoi Bay, including Pike and Rock Watersheds

The Missisquoi Bay Tactical Basin Plan (TBP) was approved on December 2nd, 2016. The plan 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. An additional goal of the plan is to set priorities for meeting targets for phosphorus loading from the Missisquoi River and all of the waters adjacent to its drainage basin that contribute to Missisquoi Bay in Lake Champlain. As such the plan contains a comprehensive chapter addressing the Lake Champlain TMDL requirements, including high-resolution phosphorus load modeling.

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 watershed. Over 600 individual related projects included in the VT Watershed Projects database.

Project implementation is currently the focus for the basin. Partners' ability to search for projects using the Watershed Projects Database has facilitated their efforts to seek grants to support the projects that have been identified. The towns, local stakeholders, including the Friends of Northern Lake Champlain, The Franklin Watershed Committee, the Missisquoi River Watershed Association, the Upper Missisquoi Wild and Scenic committee, the Franklin Natural Resource Conservation District and the Regional Planning Commissions have participated in project development and implementation.

The division is also continuing to support water quality monitoring by the Franklin Natural Resource Conservation District, Missisquoi River Basin Association and the Franklin Watershed Committee (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 last fall. The meetings have brought in experts from all sectors to provide background information as well as helping to facilitate discussion. A Lake Carmi Action Plan was also developed by WSMD staff with input from the implementation action team.

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

Identifying Stormwater Treatment Practices in Richford

The Northwest Regional Planning Commission (NRPC) worked with the city and a consultant to identify 20 projects that would manage stormwater over 215 acres of the city. The consultant prepared conceptual design plans for the top recommended stormwater retrofit projects, in an effort to protect the watershed and mitigate future stormwater impacts. The top sites were selected based on a comprehensive ranking and feasibility. As a next step the NRPC expects to work with project partners to identify funding to implement priority on-the-ground stormwater mitigation projects

Sleeper Dam Assessment

The Missisquoi River Basin Association supported design work to remove a dam in Newport Center. This project is located on Sleeper Pond and Mud Creek in Newport Center, VT. The dam on this pond impounds more than 500,000 cubic feet and is disrepair. An inspection in 2014 found that the overall condition of the dam on Sleeper Pond is poor; the dam is partially breached and shows severe cracking and spalling, with several large voids throughout. The dam currently serves no purpose and is causing the pond to fill in with sedimentation while preventing passage of aquatic organisms. This project provides an alternatives analysis that includes potential dam removal and would allow for an assessment of the costs and benefits - both ecologically and for safety - and lead to an informed management decision.

Upper Missisquoi River Corridor Easements

Vermont Land Trust is worked with landowners to secure four river corridor easements in the upper Missisquoi. The easement locations are in Orleans County within the towns of Richford, Troy, and Westfield. Over 200 acres of river corridor will be protected as a result of this project.

Two-Tiered Ditch Provides Floodplain in Corn Field

The Friends of Northern Lake Champlain coordinated the installation of floodplain shelf on a farm ditch. This innovative two-tiered ditch was introduced to Franklin county agricultural community through farm visits and articles. This project reconstructed an existing, standard channelized ditch into a two-stage system that will reduce out-of-channel stream flow velocities (Figure 18). This will allow sediments to deposit in the bench while reducing bank erosion within the reach. In turn, this will also reduce downstream peak flooding by increased flood storage capacity of the two-stage ditch. Floodplain is restored to 2500 feet of ditched stream on farmland.



Figure 18. Two-tiered ditch on farmland in the Rock River watershed

Basin 7 Lamoille

Monitoring, implementation and project support have been underway in Basin 7 for a second year since the plan was published in 2016. The towns, local stakeholders, Regional Planning Commissions (RPCs), and Natural Resource Conservation Districts (NRCs) are continuing to engage on priority projects throughout the basin writing grant applications, reaching out to the public, and implementing priority projects identified in the Plan. *Thirty-three* actions are in progress and sixteen have been completed since the plan was published. These actions include implementation and design projects, stormwater master plans, river corridor plans, and road erosion inventories. *Twenty-six* of the sites identified in the Plan for monitoring were sampled where information was needed to close data gaps, support reclassification, identify impaired waters, and measure restoration success. Clean Water Funding has been crucial in supporting most of the projects described below.

RESTORING WATER QUALITY, REDUCING PHOSPHORUS, & LAKE WATERSHED COLLABORATION

Deer Brook Gully Stormwater Project

The Deer Brook Gully Stormwater Project that was funded by the Clean Water Fund through an ERP Grant is almost complete and will be complete in early 2019. This project - implemented by the Friends of Northern Lake Champlain and Northwest RPC - identified several stormwater treatment best management practices (BMPs) along Route 7 and 104A in Georgia to slow the flow of water entering the gully that has caused the gully to erode and deposit sediment into Deer Brook. Deer Brook is impaired by excess sedimentation and these projects will reduce the overall sediment loading to the river. Conceptual designs are being developed for up to twelve projects.

Hardwick Stormwater Master Plan (SWMP) Implementation

The Hardwick SWMP was developed in 2017 to identify and address stormwater pollution in and around Hardwick Village and East Hardwick. Town Manager, John Jewett, who is retiring this year, has been working closely with the Caledonia Natural Resource Conservation District Manager, Kerry O'Brien, to complete the top priority projects identified in the plan. Three of the projects are: a gravel wetland installation at Hazen Union School to treat stormwater runoff in the school's parking lot; stream channel restoration and stormwater treatment along Route 14 to treat and slow runoff from roads and public and private lands before it enters Cooper Brook; and the replacement of a back-flow protection outfall to protect against constriction of flood waters and runoff of moderate and high flow events. These projects are being funded by ERP grants and the Clean Water Block Grant.

Lake Eden Watershed Action Plan

The Lake Eden Watershed Action Plan development was funded by an ERP grant this year and the planning is underway to develop a pilot project that addresses the entire watershed of a lake to identify and address sediment and nutrient loading. The Lamoille NRCD, Lake Eden Lake Association, Town of Eden, DEC staff, Lamoille RPC and lakeshore owners are working in collaboration to complete the assessment. This plan will take into consideration tributary watershed contributions, private and public shoreland inputs, public and private road inputs, and inputs from the surrounding watershed land use to come up with a holistic plan that will address all components of pollutants to the lake using volunteer and grant contributions. The plan and priority projects will be developed in the coming year.

Seymour River Corridor Plan and Project Prioritization

The Seymour River Corridor Plan, funded by an ERP grant, was completed in 2017 and over 15 priority projects were identified for further action by Bear Creek Associates with the help from DEC Rivers Program, the Lamoille RPC, and the Lamoille NRCD. Both parties are applying for funding in partnership from the Lake Champlain Basin Program to develop the projects for design and implementation. The projects range from road stormwater treatments, culvert upgrades, riparian buffer plantings, river corridor easements and agricultural BMPs.

Brewster River Stormwater and Restoration Projects

Several projects identified in the 2015 Brewster River Corridor plan were developed, designed and implemented this year with funding from ERP grants and the Clean Water Block Grant. Two berm removals along a major tributary to the Brewster River and the repair of an in-stream head-cut were completed along with six other projects, funded by Smugglers Notch Ski Resort, along the stream corridor to prevent erosion and sediment input from stormwater runoff (Figures 19 and 20). These projects were completed in partnership with Smugglers Notch Ski Resort, DEC staff, and the Lamoille County NRCDC. This partnership has also led to the completion of a resort-wide Illicit Discharge Detection and Elimination study along with a Stormwater Mapping

Figures 19 and 20. Brewster River tributary project photos (above) showing the results of a berm removal to increase floodplain capacity (left) and bank stabilization, check dams, and a retention basin to prevent sedimentation and capture and treat stormwater runoff (right).



Report of the resort and village. All parties, with the addition of the United States Fish and Wildlife Service, are now collaborating on the removal of the Morse Reservoir Dam at the top of the same tributary. This tributary supports healthy populations of wild brook trout, the Vermont State Fish.

Basin 8 Winooski River

The [Winooski River Tactical Basin Plan](#) was approved in December 2018. Four public meetings were held in September and October and were open for public comment on the final draft of the plan. All comments were considered, and a responsiveness summary was developed for inclusion in the plan's appendix.

The planning process was 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. Implementation of the plan continues with support of assessments and projects (see below). The Friends of the Winooski River, Huntington River group, Winooski Natural Resources Conservation District 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. The draft Winooski River Tactical Basin Plan (TBP) outlines a series of actions the State, towns, and local organizations will take to improve the Winooski River watershed. It also provides information about how landowners, organizations, and communities can access clean water funding and technical assistance.

The TBP's top objectives and strategies support actions that enhance flood resilience and stream equilibrium by protecting river corridors; reduce nutrient and sediment loading and bacteria impairment by increasing Best Management Practices across all land sectors; restore shorelines, wetlands and floodplains, and assist communities in understanding how they can best participate in protecting and restoring water resources.

Based on monitoring results, 40 streams are proposed for reclassification under the Vermont Water Quality Standards to preserve current high-quality waters. In addition, Huntington Gorge and The North Branch are

identified as potential Outstanding Resource Waters. The Derway Island wetland is identified as a prospective Class I wetland candidate

The Plan also includes the Phase II content (Chapter 3) for the Lake Champlain Phosphorus Total Maximum Daily Load (TMDL), including setting targets for phosphorus loading from the Winooski River to Lake Champlain. The Phase II content includes high-resolution phosphorus load modeling and projected phosphorus reductions for smaller sub-watershed as well as by types of sources (wastewater treatment plant, developed lands stormwater, roads, forestry and agricultural). The TMDL as well as the associated Phase I Implementation Plan both point to issuance of this plan as a component of the accountability framework.

Examples of completed strategies, supported by the previous and plan and funded through the Clean Water Fund include:

Enhancing Woody Riparian Buffer along the Winooski River Friends of the Winooski River planted trees on 1000 feet of riparian buffer on the LaFreniere Field in the Camel Hump State Park. The parcel was located along the Winooski River in Bolton. The Friends completed the project as part of its Trees for Streams program with help from the cub scouts and other volunteers.

Treating Stormwater in the Upper Mad River

Friends of the Mad River and the Town of Warren enhanced stormwater management for .7 acres of impervious surface around the Warren Elementary School before it entered the Mad River. Practices installed included underground infiltration chambers to capture and infiltrate stormwater underneath the Warren Elementary School parking lot (Figure 21). The chambers are able to infiltrate up to the one year, 24-hour storm, reducing the number of events that activate that outlet significantly. The project also involves installing a bioretention/Rain Garden that collects a large amount of runoff from the school campus and the school roofs and parking lots.

Figure 21. Stormcheck chamber to hold and slowly release stormwater runoff from the Warren School



Identifying Stormwater Projects to Manage Stormwater in The Mad River and Kingsbury Branch

The Central Vermont Regional Planning Commission supported stormwater master planning with help from a consultant for central Vermont towns in the Mad River and Kingsbury Branch watersheds. The consultant prepared conceptual design plans for the top recommended stormwater retrofit projects, in an effort to protect the watershed and mitigate future stormwater impacts. The top sites were selected based on a comprehensive ranking and feasibility. As a next step the CVRPC will work with project partners to identify funding to implement the top three priority on-the-ground stormwater mitigation projects.

Identifying Stormwater Projects to Manage Stormwater in Richmond

The Chittenden County Regional Planning Commission (CCRPC), Friends of the Winooski River, and the Winooski Natural Resource Conservation District identified projects in Richmond with help of the WSMD basin planner and a consultant. The contractor prepared conceptual design plans for the top recommended stormwater retrofit projects, in an effort to protect the watershed and mitigate future stormwater impacts. The top sites were selected based on a comprehensive ranking and feasibility. As a next step the above-named partners will work with the Richmond town and community to identify funding to implement the top three priority on-the-ground stormwater mitigation projects.

Restoring Floodplain in Northfield.

The Town of Northfield and the Friends of the Winooski River with help from the WSMD river scientist continued working on developing a design for floodplain restoration in Northfield. The project will enhance flood resilience in Northfield by diverting floodwaters away from the Dog River before it enters the densely developed village. In addition to storing flood waters, the floodplain will trap sediment, and allow nutrient uptake to occur. The Dog River is currently channelized with a berm along most of the proposed park that traps floodwaters in the channel and increases water velocities before the river is able to access the floodplain.



Figure 22. Rain Garden at Warren School

Basin 9 White River

The [White River Tactical Basin Plan](#) was approved in December 2018. Four public meetings were held in October and were open for public comment on the final draft of the plan. All comments were considered, and a responsiveness summary was developed for inclusion in the plan's appendix. The plan was completed with input from 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 development of the plan.

A total of three dam removals, one floodplain restoration, two river corridor easement designs, three river corridor easements, two river corridor plan project development proposals, two stormwater master plans, six road erosion inventories, and one volunteer water quality monitoring project were funded in fiscal years 2017 and 2018 by both Clean Water Funds and non-state grants.

REDUCING RUNOFF, IMPROVING RESILIENCY, & RECOVERING RIVER CONNECTIVITY

Bridge Street Bridge Creosote Remediation Planning in Royalton

Spurred by a summer heat wave, [creosote](#), from the treated wooden base of the Bridge Street Bridge in Royalton, dripped onto to people tubing on the White River this summer. Many bridges throughout the state have wooden supports treated with creosote, but do not pose a safety risk. Reports of chemical burns were fielded by the Department of Health, Agency of Transportation and DEC. The three agencies provided technical support for identifying and evaluating health risks to both humans and aquatic organisms. They also coordinated with the Town of Royalton and the WRP to develop a plan to protect recreationists and address the dripping creosote. A long-term solution is being developed for implementation next spring and summer, meanwhile signs were created and posted at access points and along the river and bridge. The coordination effort supported by basin planning identified state sources of funding that will help Royalton with their remediation plan.

River and Roads Training

Two [Tier II River and Roads trainings](#) were held in the White River Basin to provide outreach and education to the watershed community and technical stakeholders that work on road projects with water resource conflicts. The Tier II events are a combination of classroom, indoor river flume table exercises and field trips to observe rivers and streams at work. Tier II focuses on requirements for river equilibrium with a specific application to emergency flood response and recovery operations when design-level technical support may not be readily available to reconstruct roads consistent with the VT Rivers Program Standards for Stream Alterations. The Tier II trainings are intended to share ideas and to forge relationships that will benefit Vermont's rivers and transportation system well into the future. Those in attendance at both meetings included AOT District Garage employees, watershed group members, town officials, road foreman, environmental engineers and consultants, and heavy machine operators.

Rochester Stormwater Master Plan

In coordination with the WRP and the Town of Rochester, funded by an ERP grant, the [Rochester Stormwater Master Plan](#) was developed to identify stormwater inputs into the White River and its tributaries in Rochester. The Town village runs parallel to the Upper White River and stormwater contributions (nutrients, sediment, chloride and other toxins) from road infrastructure, the town garage, town offices, and private businesses end up in the river. The Project area encompasses 32 acres. Within this area, the Stormwater Infrastructure Mapping report, developed by DEC in 2015, estimated the potential to implement on-the-ground projects that would remove 10,167 pounds of sediment and 56.7 pounds of nitrogen from stormwater runoff into the White River. Conceptual designs were created for the top three priority projects. As a next step the WRP will work with project partners to identify funding to implement the top three priority on-the-ground stormwater mitigation projects.

Dam Removal Activities

Three dam removal activities took place in the White River Basin this year with support from the WRP. Two projects were for the dam removal design for the Upper and Lower Eaton Dams on the First Branch of the White River and the Hyde Mill Dam on the Second Branch of the White River. The third project was to remove remnants of an old concrete dam (figure) in the Hancock Branch of the White River in the town of Hancock, which constricted the river causing geomorphic instability leading to erosion and sediment build up in the channel. The project was classified as a high priority due to the potential for effective improvement and protection of habitat and the effective improvement of long-term channel stability. The removal of the Hyde Mill Dam will restore 60 miles of free-flowing habitat for aquatic organisms and increase long-term channel stability. The Upper and Lower Eaton dams are located on a stream reach in poor geomorphic condition that has extreme stream sensitivity. Built in the 1920s, the dams have caused sedimentation upstream and heightened

incision downstream. Removing the dams will reduce erosion downstream and restore sediment continuity along 30 miles of stream. All three projects were funded by ERP grants.



Figure 23. Staff from WRP and Harvey's Excavation working together to build a channel-spanning rock weir (left). A new pool complex for wild trout at the former Killooleet Dam site (right). Photos by the White River Partnership.

Basin 10 Ottauquechee, Black, CT River Direct

The re-draft of the Basin 10 Tactical Plan was adopted in June, 2018 following three public meeting and numerous meetings with boards and committees in the region. This plan includes the tributaries that drain directly to the Connecticut River including Mill Brook, Lulls Brook and Spencer Brook. These brooks were formerly included in Basin 13 which is now incorporated into the large Basin 10 area.

Project implementation is on-going in the Basin. Since the previous plan was completed in 2012, 37 clean water projects have been implemented by watershed partners investing over \$1,000,000 in state, municipal and private funding. 450 projects are now included in the on-line Watershed Projects database. Thirty of these have either been completed or have received funding for implementation.

Projects completed include:

- Removal of both the Harrington dam and the Firehouse dam in West Windsor on Mill Brook.
- Established a volunteer water quality monitoring program on Mill Brook. Maintained and expanded programs on the Black and Ottauquechee rivers and tributaries.
- Installation of an Infiltration-Detention Basin and riparian buffer at the Springfield Transfer Station to reduce and treat stormwater runoff before entering the Black River.
- Completion of a Stream Geomorphic Assessment along Valley Street in Springfield to assess gully erosion sites along Mile Brook.
- Removal of three undersized culverts in Coolidge State Forest to restore stream equilibrium, stop erosion and restore aquatic organism passage.
- Assessment and implementation of road-related Best Management Practices (BMPs) of Class 4 roads in Weathersfield to bring the roads into compliance with the MRGP. This project was conducted by VYCC crews.
- Working with the Dept. of Fish & Wildlife, planned, coordinated and installed a riparian buffer at the new Windsor Grasslands WMA which included 25 disease-resistance elm trees to be monitored by The Nature Conservancy for long-term survival.

Priority project areas going forward include a focus on Kedron Brook in Woodstock to work on addressing nutrient and pathogen issues; work with municipalities on flood-resiliency strategies for long-term protection; addressing impaired waters in Hartford, Killington, Ludlow and Springfield; promoting lakeshore BMPs on the lake system in Plymouth and Ludlow; and reducing stormwater inputs from developed lands in Killington, Ludlow Windsor and Woodstock.

Regional partners Ottauquechee Natural Resources Conservation District, Southern Windsor County Regional Planning Commission, and Two-Rivers-Ottauquechee Regional Commission are hosting and participating in Clean Water Advisory Committees, assisting in basin planning and project prioritization and development, conducting municipal outreach and managing project implementation.

Basin 11 Williams, West, Saxtons, Lower CT River Direct

The Tactical Basin Plan for Basin 11 was signed in January 2016 and is in the implementation phase. The Basin includes the Connecticut River tributaries including Salmon, Canoe, Sacketts, East Putney, Chase, Fullam, Mill, and Morse Brooks. Over 225 projects have been identified in the WPD, twenty-two of which are completed or funded for implementation.

Over the past year several important projects have been completed in the Basin. Highlights include the Adams Brook Stream Bank and Floodplain Restoration was completed restoring over 200 feet of completely blocked stream channel to natural flow and aquatic organism passage stemming on-going erosion and channel degradation. Other highlights include (figures 24 and 25 below):



Before



After

- Removal of a concrete crossing structure completely blocking Trout Brook in Andover causing sediment build-up and blocking AOP.
- Assessment and implementation of road-related Best Management Practices (BMPs) of Class 4 roads in Putney and Jamaica to bring the roads into compliance with the MRGP. This project was conducted by VYCC crews.
- Buffer planting have been installed in cooperation with the Saxtons River Watershed Collaboration and Windham County NRCD. The Collaborative has also provided outreach on river corridor conservation and road erosion and MRGP for watershed municipalities and residents.
- Four dam removals are in the design phase with removals planned for removals next season.
- Volunteer water quality monitoring by the Southeastern Vermont Watershed Alliance (SeVWA) continues on all three major rivers in the Basin and several tributary streams.

Regional partners Windham County Natural Resources Conservation District and Windham Regional Commission are hosting and participating in Clean Water Advisory Committees, assisting in basin planning and project prioritization and development, conducting municipal outreach and managing project implementation.

Basin 12 Deerfield, CT River Direct

The Deerfield River Tactical Basin Plan was completed in 2014 and an update is currently being drafted. Meetings are in progress with municipalities, boards and commissions to revise the Plan, identify emerging issues and develop appropriate projects. There are 104 projects entered in the WPD, sixteen are completed or funded for implementation. Basin 12 includes Whetstone Brook, Broad Brook and Newton Brooks that drain to the Connecticut River.

Project work continues as the new Plan is in development. Include:

- Landowner outreach for project development by the Connecticut River Conservancy has led to agreement on six projects in the watershed that are ready to be pursued for funding. These include buffer planting, berm removal, floodplain restoration and corridor protection.
- A twelve-acre parcel along the Green River has been conserved to provide floodplain access and public recreation and the floodplain will be restored.
- The final phase of restoration on a storm-damaged parcel in Guilford on the Green River has had its banks restored and planted and has in-stream habitat and erosion control structures completed.
- High levels of bacteria in Wilmington village area identified by the Deerfield River Watershed Association's water quality monitoring is being pursued by DRWA and CRC who are conducting outreach to landowners along Beaver Brook to provide assistance and gain support for remediation projects.
- Regional partners Windham County Natural Resources Conservation District and Windham Regional Commission are hosting and participating in Clean Water Advisory Committees, assisting in basin plan development and outreach, assisting with project prioritization and development, organizing agriculture workgroups, conducting municipal outreach and managing watershed organizations and water quality monitoring and doing project implementation.
- The Green River Watershed Alliance hosted numerous outreach events on conservation easements, natural history, vernal pools, climate change, river dynamics and flood resiliency.
- Working along the mainstem of the Connecticut River the multi-state effort continues on the Long Island Sound(LIS) Dissolved oxygen/nitrogen TMDL through the LIS Regional Conservation Partnership Program. The Watershed Coordinator is an active participant on the technical steering committee and the resiliency subcommittee.
- In partnership with CRC, the Watershed Coordinator held the third "Samplepalooza" event coordinating volunteer water sample collection from 45 sites on the Connecticut River mainstem and tributaries in three states (VT, NH, MA) on the same morning. This data is used to track nitrogen and phosphorus levels in support of the LIS-TMDL.

The watershed coordinator is active in the Connecticut River Joint Commissions and the Connecticut River Farmers Watershed Alliance.

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

Monitoring, implementation and project support are still underway in Basin 14. 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.

Since the 2015 Plan was published several priority actions have been completed or are in progress. A sampling of these projects include: one Agricultural Pollution Prevent Project was completed that identified and prepared four high priority projects implementation; four Illicit Discharge Detection and Elimination reports were started

for Thetford, Stafford, Vershire and Topsham; two dam removals were completed, and one was funded for preliminary design; two river corridor easements were completed; one forest road stormwater improvement was funded; one road erosion inventory was funded; and numerous road projects were implemented with Grant-in-Aid funding.

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 (TROP), 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.

RESTORING WATER QUALITY, EDUCATING THE PUBLIC, & INCREASING CONNECTIVITY

Ticklenaked Pond

This year an agricultural workgroup was formed for the Ticklenaked Pond watershed to continue implementation of the Ticklenaked Pond Phosphorus TMDL. Stakeholders from FWD, DEC, NRCS, Caledonia NRCD, and UVM Extension convened to discuss the current status of farms along the tributaries to Ticklenaked Pond that were sampled during a monitoring effort to identify sources of phosphorus into Ticklenaked. This workgroup will coordinate their efforts when working with farmers in this area and will reconvene in 2019 to discuss progress on agricultural BMPs and agriculture outreach efforts in the watershed. Additionally, water quality monitoring by DEC continued this summer on Ticklenaked Pond to track progress on the 2015 Aluminum Treatment in the lake and the nutrient impairment. Results of the last three years will be reviewed in late spring to assess the effectiveness of the treatment and status of the Pond.

Lake Morey Monitoring Development and Tributary Walk

Water quality trends have indicated a slight increase in internal phosphorus loading (in-lake sources of phosphorus) in Lake Morey. As a result, DEC and a group of Lake Morey stakeholder have coordinated to develop a rigorous sampling plan implemented both internally by DEC staff and externally by volunteers of the Lake Morey Group. DEC has been coordinating with the group on in-lake vertical profile sampling efforts and the development of a volunteer monitoring plan which the lake group will use to apply for funding to process the water quality samples at the Vermont Agricultural and Environmental Laboratory (VAEL) through the LaRosa Volunteer Monitoring Partnership. Results of this study will be used to determine if internal loading is leading to increased water quality problems in the lake. The basin planner and the lake group also conducted a tributary walk to identify any obvious external sources of nutrients and sedimentation to the lake.

Ompompanoosuc *E.coli* Outreach and Education

This year the White River NRCD was awarded funds through the Vermont Watershed Grant to produce an education brochure and public outreach for the purpose of educating West Fairlee community members about *E. coli*. Water quality sampling in between 2006 and 2015 indicated elevated levels of the bacteria in the Ompompanoosuc River, as a result, 9.8 miles of the Ompompanoosuc River are impaired for *E. coli*, with the highest levels of the bacteria recorded in the Village of West Fairlee. The impairment affects primary and secondary recreational contact activities like fishing, swimming, wading, and boating. The education and outreach helps the state achieve goals identified in action number 48 in the Basin 14 Tactical Basin Plan (adopted in August 2015), including implementing the Ompompanoosuc bacteria TMDL by promoting outreach and education around septic system awareness that will lead to a septic survey to identify high risk sites in the village that will have long-lasting positive impacts to water quality in the Ompompanoosuc.

Harveys Lake Dam Preliminary Design Project

This year ERP grant funding was awarded to the Connecticut River Conservancy (CRC) to develop preliminary designs (Figure 26) for the removal of Harveys Lake Dam on Peacham Hollow Brook in Barnet to address

back-flow and sedimentation into Harvey Lake, restore stream equilibrium, and enhance aquatic organism passage. The preliminary designs have gone through many layers of review by the Town of Barnet Selectboard, the Harveys Lake Association, Harveys Lake Dam Committee, and other public stakeholders. The preliminary design is currently under review by the state regulatory agencies which include the DEC Rivers Program, Wetlands Program and Dam Safety Program. The added complexity of maintaining a reasonable lake level during and after the dam removal has challenged all stakeholders to work together to come up with a resulting design that will provide the benefits of a standard in-stream dam removal, while maintaining the uses of the lake that lake users have become accustomed to as a result of the dam.



Figure 26. Preliminary design concept for Harveys Lake Dam removal (2018 Harveys Lake Design Concepts Report, Interfluve).

Basin 15 Passumpsic

An updated Tactical Basin Plan for the Passumpsic River Basin is being developed with partners in the Passumpsic River working together to identified priority water quality issues for the tactical basin planning cycle and strategies to address these.

Partners in the Passumpsic River watershed have worked together to identify the priority water quality issues that will be the focus of the next tactical basin plan due to be completed in early 2019. Strategies to address these water quality issues are being formulated and were reviewed at a public forum held in the fall of 2018 were additional locations for protection were identified and a desire to support greater recreational use of waters in this basin. A story map was produced to distribute this information more widely which is visible at the following link: <https://arcg.is/11vj89> .

Several actions identified in the 2014 Passumpsic and Northern Connecticut River Basin Plan were completed or initiated in 2018. Many of these actions are a result of strong partnerships between DEC, Connecticut River Conservancy, the Essex and Caledonian County NRCDC's, Northeast Vermont Development Association and NorthWoods Stewardship Center as well as private landowners in the basin. These efforts have included:

- The Lyndon stormwater master plan was finalized and has led to the installation of two stormwater treatment practices to treat runoff from a nearly 2-acre dirt parking lot at the Fenton Chester arena in Lyndon in addition to 4 projects installed in 2017. Two larger designs are being developed with ERP support to treat runoff from one large drainage and to address a major sediment source in town.
- A stormwater master plan is being developed for the town of Concord with several projects identified as priorities by the Town for implementation – likely with future ERP grant support.
- The Town of St Johnsbury installed a neighborhood scale infiltration practices as part of a combined sewer overflow separation project for the Oak Street drainage which was supported through an ERP Grant. The town also installed a treatment practice that was identified in the stormwater master plan to address sedimentation from the town garage using town funds with technical support from Department staff and the Caledonia County NRCDC.
- A stormwater treatment practice identified in from a stormwater master plan for the Dish Mill Brook watershed was installed at the Burke Mountain Academy to support the remediation of this stressed stream. Additional site restoration efforts were completed to restore riparian lands along the East Branch and Dish Mill Brook upstream from the East Burke Dam removal that was funded in part through an ERP grant.
- The NorthWoods stewardship Center addressed major erosion issues along a legal trail which was being tossed up by the town of Kirby – and completed a project to revegetated and restore an access on Dolloff Pond.

Basin 16 Northern CT River Watersheds

Several actions identified in the 2014 Passumpsic and Northern Connecticut River Basin Plan were completed or initiated in 2018. A tactical basin plan for this basin will be developed beginning in 2019.

- The Essex County Natural Resources Conservation District worked with the Maidstone Lake Association and NorthWoods Stewardship Center to design and implement lake wise restoration practices at Maidstone lake – funded through an ERP grant and supported through the NorthWoods work crew. The project resulted in a restoration of 0.6 acres of acres of native vegetation, the treatment of nine acres of impervious surface with a total of 27 best management practices being installed.
- The Vermont Fish and Wildlife Department completed strategic wood additions in the ___ watershed – which is part of an ongoing effort to restore habitat impacted from log drives many years ago. Studies of this project show that these efforts have doubled brook trout biomass, but observations have also shown that these wood additions can act to trap sediment and nutrients. An ERP grant was awarded to support a continuation of this work and to evaluate how these practices may store sediment in the floodplain reducing sediment and phosphorus loading downstream.

Basin 17 Memphremagog, Coaticook, Tomifobia

Significant progress was made in 2018 toward implementing practices identified in the Basin 17 Tactical Basin Plan and Phosphorus Total Maximum Daily Load for the Lake Memphremagog watershed that was approved by EPA in September of 2017. One key accomplishment was the development of a stormwater strategic plan to outline projects and initiatives that will most effectively decrease phosphorus loading to by the Memphremagog Watershed association with the involvement of 15 local partners. This plan is available

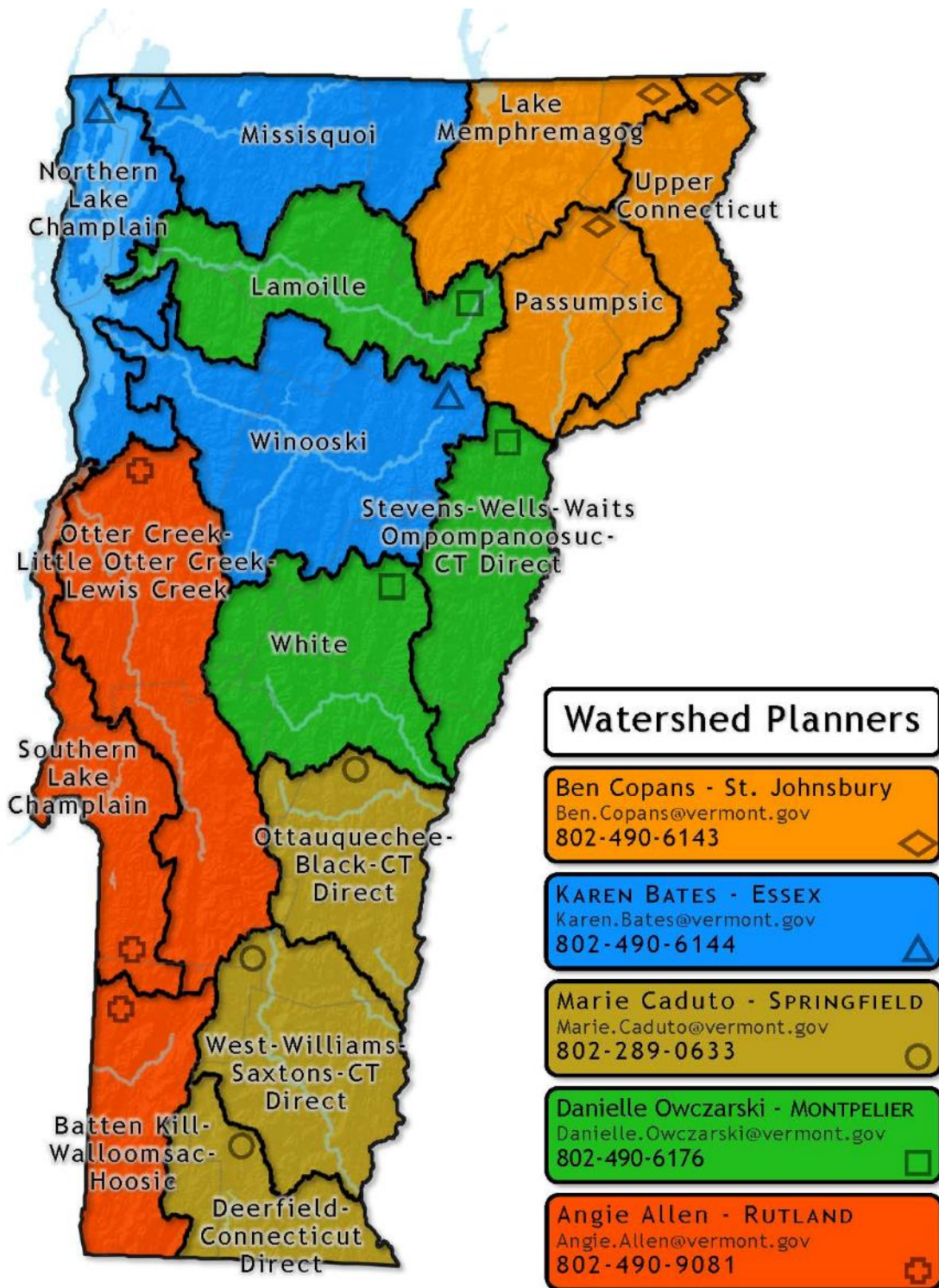
online at: <http://memphremagogwatershedassociation.com/wp-content/uploads/Mem-Watershed-Stormwater-Strategic-Plan-6.11.-Final.pdf>

Another major effort in the basin was the initiation of an International Joint Commission study to address nutrient enrichment and harmful algal blooms on Lake Memphremagog. The Memphremagog Watershed Association is coordinating the drafting of the study report with the Memphremagog Conservation Incorporation. DEC staff have been providing significant support on this project along with other partners through a Memphremagog Study Advisory Committee since this study will lean heavily on work done for the development of the Phosphorus TMDL for Lake Memphremagog.

DEC staff worked closely with the Orleans County NRCD on the Memphremagog RCPP Grant, which targets agricultural implementation efforts using water quality sampling data and uses this data to demonstrate the effectiveness of installing best management practices (BMPs). Through this program over 20 farm BMP's have been strategically implemented or planned on farms based on the targeted water quality sampling. A study using this water quality sampling results estimated that across 8 sites where BMP's have been implemented there was an average 73% reduction in phosphorus concentration. A similar evaluation will be done for the farms currently implementing targeted practices after enough post BMP data is collected. As part of this effort two "Plein Air" art exhibits, displaying farm BMP projects and conserved farms were held in the watershed to get the word out about all the efforts farmers are doing to address water quality concerns in this watershed and to encourage more farmers to partner in this program.

In addition to all the farm projects, several buffer planting and lakeshore BMPs were installed in the watershed by the NorthWoods Stewardship center with the support of ERP funding. The Vermont Fish and Wildlife Department has received a grant to assess their riparian ownership which covers significant lengths of the Barton, Willoughby and Black Rivers. This project will identify riparian restoration opportunities which may be targets for Great Lakes Fisheries appropriations for this basin which have been \$250,000 annually in recent years and initially have been focused on a creel survey of Lake Memphremagog. In addition to this, a design for a major stormwater treatment practice in the City of Newport continues to move along and another grant was received by the Memphremagog Watershed Association to develop a treatment design for another large stormwater drainage in the City.

Tactical Basin Planner Contacts



Acronyms Used in this Report

AAFM – Agency of Agriculture, Food, and Markets

AMPs – Acceptable Management Practice for Silviculture

AOP – Aquatic Organism Passage

AOT – Agency of Transportation

BMPs – Best Management Practice(s)

CCRPC – Chittenden County Regional Planning Commission

CRC – Connecticut River Conservancy

CVRPC – Central Vermont Regional Planning Commission

CWI – Clean Water Initiative

CWR – Clean Water Roadmap

DEC – Department of Environmental Conservation

ERP – Ecosystem Restoration Program

ESTAs - Ecologically Significant Treatment Areas

FWD – Vermont Fish and Wildlife Department

HUC12 – Refers to a 12-digit Hydrologic Unit Code based on a relative watershed scale, approximately the size of the average Vermont town (developed by the USGS and refined by USDA-NRCS)

LC TMDL – Lake Champlain Total Maximum Daily Load

LFO – Large Farm Operation

MAPP – Monitoring, Assessment, and Planning Program

MFO – Medium Farm Operation

MRGP – Municipal Roads General Permit

MS4 – Municipal Separate Storm Sewer System

NRCS – USDA Natural Resource Conservation Service

NRCD – Natural Resource Conservation District

NVDA - Northeastern Vermont Development Association (NVDA).

PMNRCD – Poultney Mettowee Natural Resource Conservation District

RAPs – Required Agricultural Practices

RCPP – Regional Conservation Partnership Program

SFOs – Small Farm Operations

SWMP – Stormwater Master Plan

TA – Technical Assistance

TBP – Tactical Basin Plan

TMDL – Total Maximum Daily Load

TNC – The Nature Conservancy

TRORC - Two Rivers Ottauquechee Planning Commission

TP – Total Phosphorus

TS4 – Transportation Separate Storm Sewer System

USEPA – United States Environmental Protection Agency

VAEL - Vermont Agricultural and Environmental Laboratory

VAPDA – Vermont Association of Planning and Development Agencies

WSMD – Watershed Management Division (DEC)

Vtrans – Vermont Agency of Transportation

VYCC – Vermont Youth Conservation Corps