Vermont Agency of Natural Resources

Watershed Management Division

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SOUTH LAKE CHAMPLAIN TACTICAL BASIN PLAN

The Lower Poultney River floodplain forest (Photo Credit: TNC/ Mary Droege)

The South Lake Champlain Basin - Water Quality Management Plan was prepared in accordance with 10 VSA § 1253(d), the Vermont Water Quality Standards[1], the Federal Clean Water Act and 40 CFR 130.6, and the Vermont Surface Water Management Strategy.

Approved:

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Emily Boedecker, Commissioner Date

Department of Environmental Conservation

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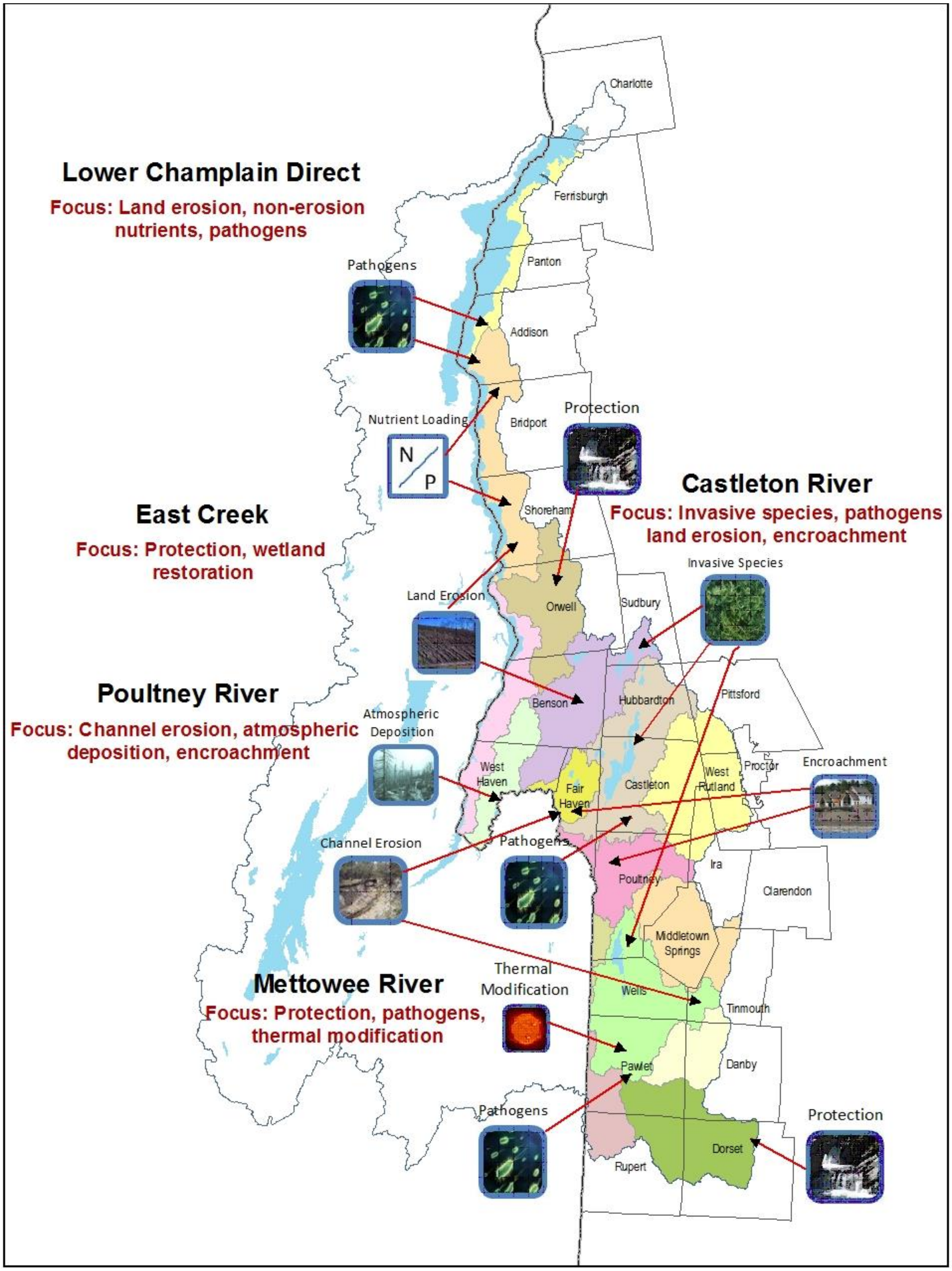
Julie Moore, Secretary Date

Agency of Natural Resources

1) Pursuant to Section 1-02 D (5) of the VWQS, Basin Plans shall propose the appropriate Water Management Type of Types for Class B waters based on the existing water quality and reasonably attainable and desired water quality management goals. ANR has not included proposed Water Management Types in this Basin Plan. ANR is in the process of developing an anti-degradation rule in accordance with 10 VSA 1251a (c) and is re-evaluating whether Water Management Typing is the most effective and efficient method of ensuring that quality of Vermont's waters are maintained and enhanced as required by the VWQS, including the anti-degradation policy. Accordingly, this Basin Plan is being issued by ANR with the acknowledgement that it does not meet the requirements of Section 1-02 D (5) of the VWQS.

South Lake Champlain Tactical Basin Plan Overview



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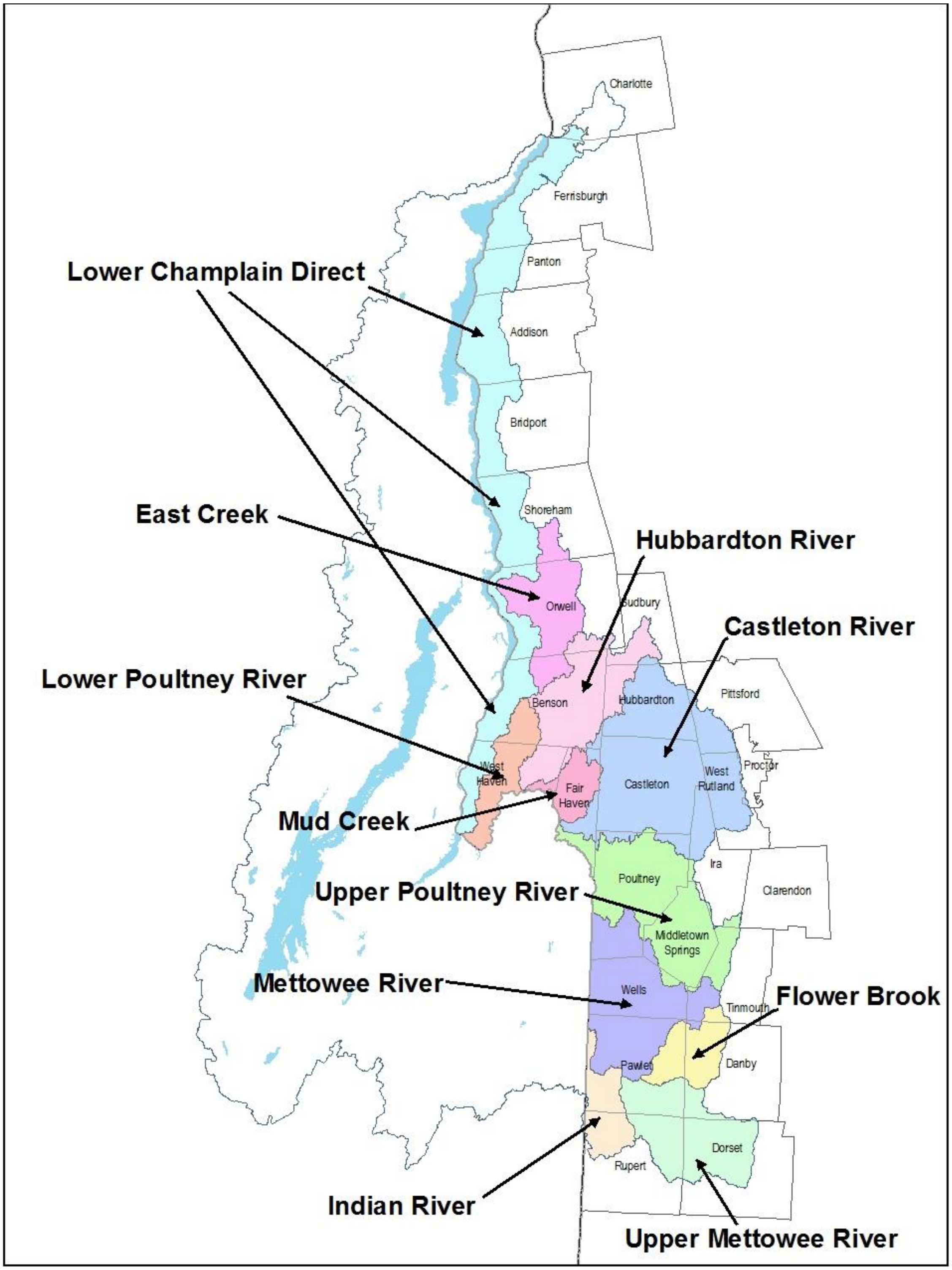

Figure 1. Southern Lake Champlain Watershed Map with Sub-Watershed Delineations

Executive Summary

Top Objectives and Strategies

The following is a list of the basin-wide top objectives and strategies identified in the plan targeted to town, watershed, water resource or geographic region based on the most current assessments, inventories, environmental modeling and monitoring data. Each objective or strategy also identifies the table and section where the corresponding actions can be found in the Plan. Priorities across different sectors will be completed simultaneously given the different funding and regulatory mechanisms.

Protect very high-quality surface waters throughout the South Champlain Basin watershed for re-classification and designation of significant natural resource assets such as biological integrity, recreation, water quality protection, and fisheries, with a focus on Tables 3 and 4.

Promote (or provide) education and outreach opportunities to communities, landowners, farmers, road crews, conservation commissions, and all other stakeholders within the watershed on the Vermont Clean Water Act and associated regulatory and non-regulatory water quality protection programs.

Promote implementation of agricultural water quality practices, specifically cover cropping in areas of corn-hay rotation, continuous hay, and continuous corn that are a significant source of phosphorus and where field practices are best suited to conditions. This should be concentrated in the following sub-basins: McKenzie Brook (HUC-12), East Creek, Hubbardton River, the Mettowee River and Wells Brook-a tributary of the Mettowee River.

Protect riparian areas from encroachment and increase flood resilience through conservation easements, floodplain and wetland restoration, as well as encouraging towns to adopt appropriate ordinances with a focus on flood prone communities, such as Castleton, Danby, Fair Haven, Middletown Springs, Pawlet, Poultney, Tinmouth, and West Rutland.

Protect river corridors and support stream equilibrium through active and passive stream channel restoration and conservation easements with a focus on the Castleton River, East Creek, Flower Brook, Indian River, Mettowee River, Poultney River, and Wells Brook.

Inventory and prioritize municipal road erosion features that discharge into surface water and implement high priority actions in existing road erosion inventoried sites with a focus on priority catchments in Castleton, Hubbardton, Poultney, and Wells. Implement high priority municipal road improvement projects based on Road Erosion Inventories (priority towns include: Castleton, Danby, Dorset, Hubbardton, Ira, Middletown Springs, Pawlet, Sudbury, Wells, and West Rutland).

Reduce stormwater inputs into water resources in villages and town centers through stormwater master planning and the implementation of existing stormwater mapping inventories using green infrastructure and low impact development techniques, with a focus on Castleton, Fair Haven, Middletown Springs, Pawlet, Poultney, Wells, West Rutland and other high priority catchments.

Improve lakeshore (littoral zone) habitat along Lake Bomoseen, Lake Saint Catherine/ Little Lake, Lake Hortonia, Beebe Lake, Burr Pond, and the Perch/ Sunrise, Sunset Lakes through direct outreach with landowners and lake watershed management plans and encourage participation in the VT Lake Wise Program and implementation of lakeshore best management practices.

Prioritize potential wetland restoration projects and floodplain restoration on agricultural lands for phosphorus retention and sediment attenuation, with a focus in the Castleton, Hubbardton, Mettowee and East Creek watersheds and other high priority catchment areas.

Increase understanding of water quality conditions in the basin through the establishment and/or continuation of short-term intensive and long-term monitoring programs, and carry out priority monitoring recommendations on stressed waters for possible impairments and reclassification.

The Vermont Agency of Natural Resources has prepared an online mapping tool, the VANR Natural Resources Atlas, that allows the reader to identify the locations of many Basin features at Vermont ANR - Natural Resources Atlas HTML5 Viewer.

South Lake Champlain Tactical Basin Plan Overview

The South Lake Champlain Tactical Basin Plan (TBP) provides an overall view of the health of the basin and defines on-going and future actions to address high-priority stressors - http://dec.vermont.gov/watershed/map/strategy

In addition to these top priority actions and classification opportunities, the basin plan also includes actions to address all impaired or stressed waters in the basin. High priority basins and sub-basins that have been identified through monitoring and assessment data are identified in Table 1. Subsequent priority actions to address surface water stressors are identified in the South Lake Champlain Basin Implementation table (Chapter 5), and specific projects to implement related actions are identified in the online Watershed Projects Database. In addition, a list of highest priority catchments (i.e., also called catchment basin, drainage area, drainage basin, and is defined as the area of land bounded by watersheds draining into a river, basin, or reservoir), identified through the downscaled Soil and Water Assessment Tool, or "SWAT" modeling analysis (for more on the Lake Champlain SWAT modeling see Chapter 3) which allows geographic targeting as the highest priority for project ("BMPs" or best management practices) implementation, and the prospective locations for practices in a general sense (see Tables: TMDL3, LA-1, LA-3, WLA-4, WLA-5, and WLA-6).

Table 1. High priority basins (and sub-basins) for restoration and protection

Priority Basins (sub-basins)	Stressor	Priority strategy	Priority actions
Mettowee River (Flower Brook) - physically altered due to post-Irene river modification and streambank erosion	Encroachment, channel erosion, land erosion	Sediment reduction, river corridor protection, flood resilience	River corridor plans and protection, road erosion inventories
Poultney River (Castleton River) – pesticides/ atmospheric deposition (mercury methylation), toxics from contaminated soils (Fair Haven landfill)	Toxics, Land erosion, pesticide application	Remediation plans, site stabilization	Identifying sources stabilizing soils, removing structures, alternative(s) to pesticide application
Lake Bomoseen watershed, Lake Saint Catherine watershed - excessive sedimentation from land erosion and increasing nutrient trends from land erosion from lake watershed and near lake zones	Land erosion, encroachment	Sediment reduction, stormwater management, LakeWise Assessment, Road Erosion Inventories and MRGP projects	Full lake assessment, logging AMPs, LakeWise BMPs, road BMPs
Poultney River (Castleton River), Mettowee River (Wells Brook) - Encroachment, bank erosion and channel instability from development along stream channel and removal of vegetation	Land erosion, channel erosion, encroachment	Sediment reduction	Riparian plantings, river corridor easements

East Creek, Hubbardton River, McKenzie Brook (HUC-12s) - Agricultural land use has led to removal of riparian vegetation, channelization of streams, and agricultural runoff	Land erosion, channel erosion, nutrient loading	Phosphorus and sediment reduction	Field, barnyard and road BMPs, riparian plantings
Upper Mettowee River - Mostly forested in the headwaters with steep hillsides, more developed lower in the watershed with significant riparian vegetation removal, floodplain and wetland encroachment from agriculture and residential development	Encroachment, channel erosion, land erosion	Sediment reduction, floodplain & wetland restoration	River corridor protection, Field and road BMPs,
Poultney River (Mud Creek) - a mix of forest, agriculture and urban development throughout the watershed with highly erodible soils	Channel erosion, land erosion, encroachment	Sediment reduction, stormwater management	Stormwater treatment, river corridor protection, field and road BMPs

High priority stressors in the Southern Champlain Basin include nutrient enrichment, encroachments, channel erosion, invasive species, land erosion, pathogens, thermal stress, and flow alteration.

Chapter 1 of the Tactical Basin Plan (TBP) provides a brief description of the basin, the purpose of tactical basin planning, the planning and implementation process, and the new regulations for water quality protection. Chapter 2 provides a summary of water quality in the basin based on assessment reports, inventories and monitoring data from internal and external partners, and identifies target areas for implementation, protection, monitoring, and assessment. Chapter 3 provides information on regulatory programs for addressing stressors and pollutants, including the Lake Champlain Phosphorus "Total Maximum Daily Load" (TMDL). Chapter 4 establishes management and protection goals identified in the Vermont Water Quality Standards for surface waters, including existing uses, designations and reclassifications. Chapter 5, the heart of this plan, is the implementation table which describes overarching objectives and related actions to protect or restore surface waters in the basin. More geographically explicit actions and projects can be queried from the on-line Watershed Projects Database, which serves as a clearinghouse of priority projects that have been identified via land use and media specific assessments, such as municipal road erosion inventories, stormwater master plans, and river corridor plans.

These strategies address both overall regional water quality issues as well as specific actions on targeted waters. The goal is to carry out as many of these actions as possible over the next five years, to bring improvements and protections to the regions surface waters. **Priority is given to those waters that are identified as facing the greatest**

challenges due to water quality stressors or that have exceptional quality and characteristics that should be protected.

The Tactical Plan actions will protect, maintain, and improve surface waters by managing the activities that result in surface water stressors, and address the attendant pollutants associated with them. The actions will be strategically targeted to those sub-basins (Figure 1) and specific waters where their implementation would achieve the greatest benefit to water quality and aquatic habitat as well as being the most cost effective. In general, the Poultney River (specifically the Castleton and Hubbardton drainages), Mettowee River (Flower Brook, Indian River drainages) and East Creek will be targeted for restoration and protection strategies while Lake Champlain direct drainages will be targeted for restoration (nutrient reduction) and additional water quality and aquatic habitat monitoring and assessment work. For this South Lake Champlain Tactical Plan, the phosphorus status of south Lake Champlain will be a featured priority in the first biennial review, to implement priority actions of the Lake Champlain "Total Maximum Daily Load" (TMDL) or restoration plan for the Lake.

Accompanying this public review draft, the Vermont Agency of Natural Resources has prepared an online mapping tool that allows the reader to identify the locations of many Southern Champlain Basin features, and actions identified in the Implementation Table. This resource is available online via this link.

Summary of Classification Opportunities

Surface waters recommended for reclassification to Class B(1) (including town(s)) for Aquatic Life Support Use:

- Giddings Brook, Hubbardton
- Belgo Brook, Castleton
- Sykes Hollow Brook, Pawlet, Rupert

Waters identified as Very High Quality (including rationale):

- Hubbardton River — Excellent macroinvertebrates, very good fish
- Breese Pond Outlet — Excellent macroinvertebrates
- Castleton River — Excellent macroinvertebrates
- Giddings Brook — Excellent macroinvertebrates, very good fish
- Belgo Brook — Excellent macroinvertebrates
- Gully Brook — Excellent macroinvertebrates
- Poultney River — Excellent macroinvertebrates

- Mettowee River — Excellent macroinvertebrates, very good fish
- Flower Brook — Excellent macroinvertebrates

Waters recommended for evaluation as prospective Outstanding Resource Waters (ORW):

- No waterbodies in the basin are recommended for ORW designation at this time.

Wetlands recommended for additional assessment to determine potential reclassification to Class 1:

- South Fork of East Creek
- Wards Marsh within the Lower Poultney River floodplain forest (see Figure 2).

Figure 2. Wards Marsh Wildlife Management Area along the Lower Poultney River (the area shaded in beige represents the extent of the Wildlife Management Area)

Chapter 1 - Introduction

A. Basin Description

The VTDEC Poultney Mettowee Basin Assessment Report, 1999 indicates that the Poultney Mettowee River Basin encompasses 373 square miles and the Lower Champlain Direct is approximately 125 square miles, totaling 498 square miles in Vermont draining portions of Addison, Bennington, and Rutland Counties. The Southern Champlain Basin and its sub-watersheds are described in detail in Chapter 2.

B. Purpose of the Tactical Plan

Tactical basin plans are developed according to the goals and objectives of the Vermont Surface Water Management Strategy to protect, maintain, enhance, and restore the biological, chemical, and physical integrity, and public use and enjoyment of Vermont's water resources, and to protect public health and safety. The Tactical Planning Process is outlined in Chapter 4 of the Surface Water Management Strategy.

ANR completed a Poultney Mettowee Basin Plan in 2005. That plan contained 91 recommendations to protect and restore water quality and aquatic habitat in the basin. Many of these recommendations have been implemented or are in progress by ANR and its watershed partners. This tactical plan builds upon those original plan recommendations by promoting specific, geographically explicit actions in areas of the basin that have been identified for intervention, using on-the-ground monitoring and assessment data.

C. Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in the Southern Champlain Basin. These partners are non-profit, state, and federal organizations working on both private and public lands.

Poultney Mettowee and Otter Creek Natural Resources Conservation Districts

Vermont Natural Resource Conservation Districts are locally-led and operated organizations that promote and support soil and water conservation. The mission of the District(s) is to "help provide conservation assistance to the people living in the area through education programs and partnerships with federal, state, and local entities involved in natural resources management." Some specific programs include:

- The Cover Crop Incentives Program
- Agricultural Environmental Management Assessments (Appendix E)
- Portable Skidder Bridge Rental Program

Poultney Mettowee Natural Resource Conservation District

The mission of the Poultney Mettowee Natural Resources Conservation District (PMNRCD) is to provide educational outreach, technical assistance, and financial support to communities and landowners to protect healthy soil and clean water and preserve the ecological integrity and economic vitality of communities. The District brings together the efforts of citizens and organizations that share the common goals of conserving, protecting, and enhancing the natural and cultural resources of the watershed.

Rutland Regional Planning Commission (RRPC)

The Rutland Regional Planning Commission (one of eleven Regional Planning Commissions in the state) was established in 1968, and includes 27 member towns in Rutland County, VT. The Commission is enabled under the Vermont Municipal and Regional Planning and Development Act (24 V.S.A. §4341). The RRPC is led by a board made up of one representative from each of the Commission's member communities plus members representing area-wide citizen interest organizations and four ex-officio partner organizations.

The RRPC is working directly with the Agency of Natural Resources, Department of Environmental Conservation (Watershed Management Division) on implementing the Vermont Clean Water Act passed by the legislature in 2015. The Agency of Natural Resources (VANR) will work with the RRPC and other regional planning commissions to develop an analysis and formal recommendation on conformance with the goals and objectives of applicable regional plans (*see also 10 V.S.A 1253(d)(2)(G)*). The South Lake Champlain Tactical Basin Plan encourages communities to take proactive measures that will protect, restore, maintain, and enhance water quality in all areas that in turn will ensure for long-term ecological integrity, public safety, human health, and water-based recreational uses. The TBP does not preclude any development that is consistent with municipal zoning, regional and municipal plans and with applicable State and federal regulations.

RRPC also works closely with the two conservation districts in the region – Poultney Mettowee Natural Resources Conservation District and the Rutland Natural Resources

Natural Resources Conservation District – on local water quality-related projects, such as stormwater management.

Lake Implementation Teams for Lake Bomoseen and Lake Saint Catherine (including Little Lake and Lily Pond)

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

Since the formation of these teams in 2016, several meetings have been convened to discuss policy and management approaches to address aquatic plant management and water quality issues within each lake as well as to conduct and review the results of lake watershed stormwater assessments, including high priority municipal road projects.

In 2016, the PMNRCD was awarded an Ecosystem Restoration Program (ERP) grant to conduct a Stormwater Master Plan (SWMP) for the Lake Bomoseen watershed, including Sucker Brook, a high priority sub-basin for sediment and nutrient reduction. Several high priority projects have been identified during that assessment process, and a couple of those projects are moving forward to the design and implementation phases. High priority projects identified via the Lake Bomoseen watershed (including the Castleton River headwaters) stormwater master planning assessment have been and will be incorporated into the Watershed Projects Database and referenced here in the South Lake Champlain Tactical Basin Plan in order to implement nutrient and sediment reduction projects that will ultimately benefit the South Lake Champlain lake segments as well.

In the Fall of 2017, the PMNRCD received an ERP grant to conduct a similar SWMP for the Lake Catherine basin, and to look for opportunities to mitigate the effects of stormwater runoff from roads, large impervious areas, and lakeshore residential properties.

The Lake Implementation Teams have continued to hold periodic meetings in coordination with each lake association, town representatives, the Poultney Mettowee NRCD, Rutland RPC, UVM-Sea Grant, and landowners to address multiple lake assessment and management topics including but not limited to stormwater, roads, aquatic plants, shoreline stabilization, wetlands, boat traffic, and municipal government involvement. The recent (July 2017) Lake Bomoseen Green Stormwater Infrastructure (GSI) workshop and Lake Saint Catherine Lakewise workshop were included as a Vermont "2017 Clean Water Week" events.

Figures 3 and 4. Example of GSI project in Castleton at Cedar Mountain Road ("encapsulated lift project" to stabilize the road and provide for natural shoreline erosion control)

The goal of the Lake Implementation Team(s) is to improve water quality conditions throughout each lake watershed, which will also have the intended effect of improving in-lake conditions. The objectives and actions needed to meet this goal are:

1. Guide project development and implementation for each lake watershed assessment and management plan which will have the dual purpose of implementing the Lake Champlain Phosphorus TMDL;

2. Promote and manage education and outreach efforts;

3. Track progress toward meeting water quality improvement goals for each in-land lake within the South Lake Basin; and

4. Serve as a conduit for information about the requirements under the Vermont Clean Water Act in order to meet Champlain TMDL Implementation Plan goals and objectives via this process among local, regional, and state organizations.

The South Lake (Champlain) Workgroup

Partners in the Poultney and Mettowee River Basins as well as the Lower Champlain Direct drainage formed as the "South Lake Group," (a subset of the Lake Champlain Citizens Advisory Committee) in 2009 to discuss issues and develop strategies for issues ranging from aquatic invasive species to phosphorus load reductions. The South Lake Group submitted several resolutions regarding the South Lake initiative to the Lake Champlain Citizens Advisory Committee for consideration. The group expanded to include the entire South Lake Champlain Basin and includes partners on the New York side of the Lake as well.

A series of meetings were convened to present an overview of several ANR and AAFM programs and activities that have been implemented in the greater South Lake area in order to inform South Lake Group members of existing resources and assistance. In anticipation of the development of a workplan, meetings provided information on agricultural resource programs, river basin planning, stormwater management, river corridor planning and management, wetlands protection, and better backroads management.

Other participants in the "South Lake Group" included representatives from The Nature Conservancy (Southern Lake Champlain Valley Chapter), Lake Champlain Committee, Lake Champlain Restoration Association, Lake Bomoseen Association, the Champlain Watershed Improvement Coalition of New York (CWICNY), the Poultney Mettowee NRCD, and VTDEC Water Quality Division (renamed the Watershed Management Division).

This Tactical Plan provides an inventory of assessment information for the southern Lake Champlain river basins. It should serve as the foundation for continued refinement of a workplan for the South Lake. Additional research and assessment will provide future coordinated efforts with greater focus and direction on priority issues affecting the South Lake.

The Nature Conservancy

The ecological gem known as Southern Lake Champlain Valley is tucked among three mountain ranges at the southern headwaters of Lake Champlain. Where the lake narrows, a medley of small towns and family farms commingle with biologically rich forests, dramatic cliffs, wetlands and rivers. Three ecological regions also converge here, creating incredible natural diversity in a relatively concentrated area. The Nature

Conservancy recognizes the Southern Lake Champlain Valley as one of its Last Great Places, making it a national conservation priority.

The Southern Lake Champlain Valley Program is made up of three chapters of The Nature Conservancy - Eastern New York, Adirondack, and Vermont working together to implement the following strategies:

- Restore and protect clayplain forest and riparian systems.
- Advance conservation of and connectivity between the forested systems in the landscape.
- Reduce, prevent and manage establishment of invasive species.
- Advance scientific knowledge that will lead to informed decision-making by the Conservancy and other partners in management strategies.
- Manage Conservancy properties to maintain viable populations, communities and systems, and to ensure a positive experience by those who visit.
- Engage community members in conservation activities.

Vermont Agency of Transportation (VTrans) manages and maintains miles of State highway and stream crossings within the basin including Routes 4A, 22A, 30, 73, 133, 140, and Interstate 4. VTrans provides technical assistance in the form of hydraulic modeling for bridge and culvert replacements and transportation maintenance. VTrans also provides grant funding to basin municipalities including Structures and Transportation Enhancement grants.

USDA Natural Resources Conservation Service (NRCS) provides cost-share, technical assistance, and targeted support of agricultural best management practices. Additionally, NRCS provides funding and technical assistance for forestry and wildlife habitat projects.

Watershed Municipalities - Twenty-four towns are wholly or partially within the Southern Champlain Basin within the counties of Addison, Bennington, and Rutland (Figure 1.2). Municipalities can protect water resources through town plan language and zoning bylaws. Additionally, towns are responsible for managing large networks of roads, drainage ditches, and stream crossings.

ANR Internal Partners- All Departments within ANR (Fish & Wildlife Department (FWD), Forest, Parks, and Recreation (FPR), and DEC) and Divisions within them, work collaboratively on a number of watershed assessment, restoration and protection projects. Additionally, FWD and FPR own and manage hundreds of acres of state-owned lands within the basin. Annual stewardship plans are prepared by District

Stewardship Teams and include staff from FWD, FPR, and DEC. Long Range Management Plans of state-owned properties include restoration and protection of water resources. Some specific watershed restoration projects are described in this plan.

The Vermont Lake Wise Program

The Lake Wise Program is offered through WSMD's Lakes and Ponds Section to provide trainings in lake-friendly shoreland management to Lake Associations and shoreland property owners. Through Lake Wise, participants receive technical assistance to evaluate specific landscaping practices for fixing erosion and polluted runoff, while improving lake quality and wildlife habitat.

Lake Wise participants passing all four categories for driveway; structures and septic systems; recreation areas; and shorefront receive the Lake Wise Award, which can include a beautiful Sign that can be proudly displayed on the property. Lake Associations are also awarded the "Gold Award," depending on the percentage of shoreland owners participating in Lake Wise.

The goal of Lake Wise is to improve or maintain water quality and in-lake and on-shore wildlife habitat by encouraging lake friendly landscaping practices.
http://dec.vermont.gov/watershed/lakes-ponds/lakeshores-lake-wise

D. The Vermont Clean Water Act

In 2015, the Vermont Legislature passed Act 64, the Vermont Clean Water Act. This Act strengthens multiple statutes related to water quality in the State. The Act addresses agricultural water quality on small, medium, and large farms through the Agency of Agriculture, Food and Markets. It establishes water quality requirements for stormwater discharges from new and existing development, industrial and municipal stormwater discharges, and runoff from municipal roads through the VDEC. Through FPR and VDEC, the Act addresses water quality runoff from forest silvicultural activities and supports wetland restoration efforts within the Lake Champlain Basin. Regulations specific to these new requirements are covered in detail in the final VT Lake Champlain Phosphorus TMDL Phase I Implementation Plan and summarized in Chapter 3.

The Act also establishes the requirement that all water quality improvement actions undertaken by the State be integrated by means of TBPs, and establishes partnerships with Regional Planning Commissions, Conservation Districts, and other organizations to support this work. Regarding work with the Regional Planning Commissions, ANR will work with the applicable regional planning commissions to develop an analysis and formal recommendation on conformance with the goals and objectives of applicable regional plans, see 10 V.S.A 1253(d)(2)(G). The overall role of the TBPs is not to determine where development should happen. This TBP encourages communities to take protective measures that will restore, maintain and enhance water quality in all areas, and does not preclude any development that is consistent with municipal bylaws, regional and municipal plans, and with applicable state and federal regulations.

In order to assist Vermonters in meeting these requirements, the Clean Water Fund has been established, and paired with other funds available for water quality improvements, allocations will be dedicated towards the highest priority water quality remediation actions.

The Tactical Basin Plans are also consistent with the U.S EPA's framework for developing watershed-based plans. EPA's framework consists of nine key elements that ensure that the contributing causes and sources of nonpoint source pollution are identified, key stakeholders are involved in the planning process and restoration and protection strategies, addressing water quality concerns are identified. The resulting tactical basin plan uses adaptive management, established high priority implementation actions for restoration or protection, and identifies projects that are eligible for federal and State funding.

In order to implement the high priority actions required to protect, enhance, maintain and restore water quality, the TBP spells out clear attainable goals and targeted strategies to achieve goals laid out in the Vermont Clean Water Act, the Lake Champlain Phosphorus TMDL, and EPA's nine elements. The online Watershed Projects Database and Implementation Table summary are tools by which progress can be tracked with regard to measurable indicators of each major goal. In addition, the implementation of actions and Implementation Table summary itself will be revisited periodically, and be modified accordingly to best address newly emerging information, unanticipated events, and new requirements such as are anticipated by legislative acts such as Act 110, Act 16, and Act 64, now generally referred to as the Vermont Clean Water Act.

For more information about the Vermont Clean Water Act, readers should review the content of the Vermont Clean Water Initiative website at: http://dec.vermont.gov/watershed/cwi.

E. Implementation Process

This Tactical Basin Plan spells out clear, attainable goals and targeted strategies to achieve those goals. The plan contains an Implementation Table (Chapter 5) by which progress can be tracked with regard to measurable indicators of each major goal.

Actions defined in the Implementation Table will be addressed over the life of the Southern Lake Champlain Basin Tactical Basin Plan. Successes and challenges in implementing Actions will be reviewed and addressed in annual meetings with watershed partners. The Tactical Plan will not be a static document. Tropical Storm Irene has taught us that VTDEC and its partners have to develop adaptive management techniques as new natural and anthropogenic events present themselves. In addition, the implementation of actions and Implementation table itself will be revisited biennially, and be modified accordingly to best address newly emerging information, unanticipated events, and new requirements such as are anticipated by the Lake Champlain Phosphorus TMDL.

The Role of Municipalities in the Tactical Basin Planning Process

Tactical basin planning work has a significant link and coordination with towns as a means to achieve many of the over-arching goals and objectives associated with surface water improvement and protection. Towns are seen as significant players in our watershed planning efforts and directly participate in several water quality planning and implementation programs. We rely on this high level of interaction in order to provide education and outreach to towns, technical assistance, and to implement high priority action items that have been identified in Tactical Basin Plans. Towns are often in the best position to conduct local implementation work to improve water quality by seeking technical assistance for projects (such as with the Better Roads Program or in adopting river corridors as a planning and zoning tool), and applying for funding (such as through our Ecosystem Restoration Program). In addition, we rely on towns (and regional planning commissions) to supplement assessment information to help prioritize which towns and where the greatest need for assistance may exist.

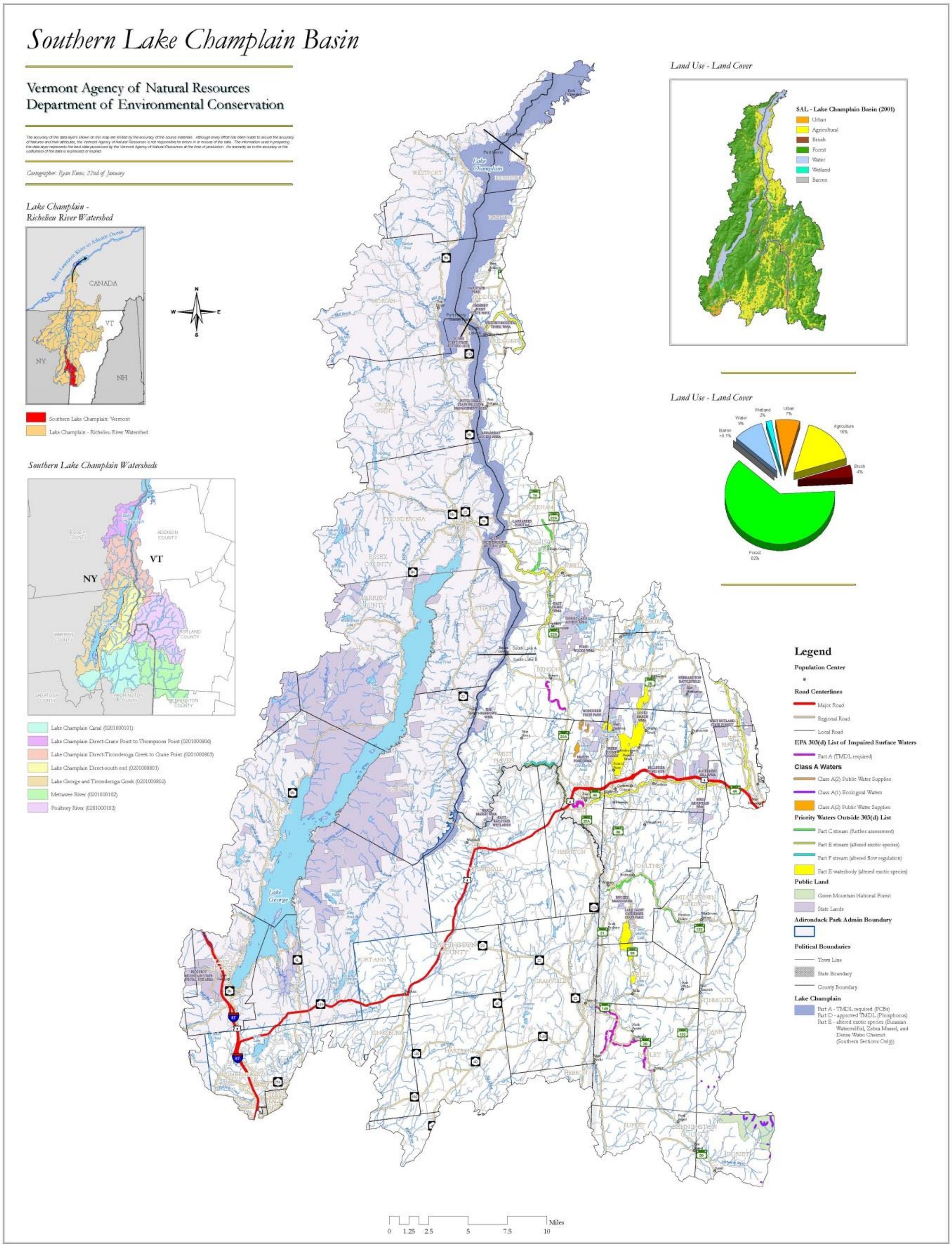

Figure 5. Southern Champlain Basin (in VT and NY) map with municipal delineations.

Chapter 2- Water Quality in the Basin

A. Watershed Description

The Southern Champlain Basin has two major tributaries: the Poultney River with a length of 40 miles and drainage area of 236 square miles; and the Mettowee River with a length of 17 miles and a drainage area of 137 square miles in Vermont. The sub-watersheds for the Poultney River (see Figure 2) include the Castleton River with a length of 20 miles and a drainage area of 99 square miles as well as the Hubbardton River with a length of 17 miles and a drainage area of 45 miles. The sub-watersheds of the Mettowee River (see Figure 3) include Flower Brook with a length of seven miles and a drainage area of 17 square miles as well as Wells Brook with a length of 10 miles and a drainage area of 34 square miles. Within the Lower Champlain Direct drainages (see Figure 4), the most significant sub-watershed is the East Creek, which drains an area of 32 square miles and is comprised of two major forks (North and South) as well as several smaller tributaries. In addition, there are approximately a dozen smaller tributaries with the Lower Champlain Direct drainage, including Braisted Brook, Horton Marsh Brook, Hospital Creek, and Whitney Creek.

The watershed was broken up into the following four priority sub-watersheds (including the three major tributaries for both the Poultney and Mettowee Rivers) for the purposes of presenting information:

- McKenzie Brook Basin (including Hospital, Stony, and Whitney Creeks, and Braisted Brook)
- East Creek Basin
- Poultney River Basin
    - Castleton River
    - Hubbardton River
    - Mud Creek
- Mettowee River Basin
    - Flower Brook
    - Indian River
    - Wells Brook

In this plan, the following sub-watersheds are highlighted for specific intervention based on DEC's evaluation of monitoring and assessment data.

The Southern Champlain Basin is significant for providing the source waters of Lake Champlain, as the Lake flows northward into the Main Lake from the South Lake. The

Lower Poultney River has been designated as an Outstanding Resource Water (one of four in the state) due to its exceptional natural, cultural and scenic values, and extensive flood plain forest where it enters southern Lake Champlain. In addition, the fishery in the Poultney River is very diverse; fish surveys have found that two thirds of the fish species in Vermont are found in the Poultney River. The lower Poultney River also supports the most diverse native mussel populations in the state.

The Mettowee River valley is one of the most bucolic areas of the state and is still largely dominated by agricultural activity. The Mettowee (also called the Mettawee) rises in the Taconic Mountain range in Dorset, Vermont and flows northwesterly into New York before entering southern Lake Champlain. The Mettowee River has long been prized for its exceptional recreational opportunities, including swimming, boating (including whitewater), and fishing due to its outstanding cold-water fishery.

The Southern Champlain valley is often referred to as the "banana belt" because it is low, warm, and comparatively dry. The Champlain Valley is uniquely different from other biophysical regions in Vermont and supports a very diverse assemblage of natural community types.[1] The smaller Lake Champlain direct drainages, such as East, Hospital, and Whitney Creeks, are characterized as small, slow-winder streams that typically occur below the first natural fall line above Lake Champlain.

ANR Natural Resource Atlas – Tactical Basin Planning theme

In December 2012, ANR introduced the **Natural Resource Atlas.** Many of the assessment, monitoring, and other information included in Chapter 2 is now accessible through the Natural Resource Atlas. The purpose of the **Natural Resources Atlas** is to provide geographic information about environmental features and sites that the Vermont Agency of Natural Resources manages, monitors, permits, or regulates. In addition to standard map navigation tools, the Natural Resources Atlas allows the viewer to link from sites to documents where available, generate reports, export search results, import data, search, measure, mark-up, query map features, and print maps.

The Natural Resource Atlas now includes a Tactical Basin Planning theme, which highlights the major priorities and implementation categories in each watershed planning basin. The Tactical Planning theme shows where in the basin actions will be targeted. Examples include candidate waters for protection and reclassification, high

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[1] Thompson, Elizabeth H. and Sorenson, Eric, 2000.Wetland, Woodland, Wildland, A Guide to the Natural Communities of Vermont. University Press, Hanover, NH

priority waters for nonpoint source mitigation, priority areas identified for aquatic habitat restoration, opportunities for additional public access to surface waters, and priority waters for additional monitoring and assessment.

B. Sub-basin Descriptions

The 2013 updated water quality and aquatic habitat assessment report is focused on data and information incorporated here in the South Lake Champlain tactical basin plan, which includes Basin 2 (Poultney and Mettowee) and Basin 4 (direct tributaries to southern Lake Champlain).

The Poultney River

The Poultney River drains 236 square miles in Vermont (Figure 2) and is 40 miles long within and along the borders of Vermont. It originates in the town of Tinmouth in the valley between Tinmouth and Spoon Mountains. From its source, the Poultney River flows northerly for about four miles and enters the town of Middletown Springs, from which point it flows westerly to its confluence with South Brook 6.7 miles downstream from its origin.

The Lower Poultney River begins at the Poultney – Fair Haven town line and extends 22 miles to a headwater region of Lake Champlain, referred to as "the elbow." From Poultney to U.S. Route 4, the river is a winding scenic corridor with undeveloped shorelands. At twenty-two miles in length, the Lower Poultney River has one of the longest segments of natural stream corridor of any stream in Vermont. Canoeing is excellent in this segment, and provides natural habitat for a diversity of plants and animals.

Carver Falls is located in the town of West Haven, 16 miles upstream from Lake Champlain. It is, the highest major falls in Vermont, containing two falls at the head of a limestone gorge. The falls have been altered by hydropower development since 1894. For 100 years before that date, they were harnessed to drive mill operations. The river above the falls lies in ravine 100 feet deep. Below the falls, the ravine is 200 feet deep. A cave in a limestone cliff above the ravine is located about one mile below the falls. Indian artifacts have been found in the cave, as well as in the vicinity of Carver Falls, and in a field near Hackadam Road. Sunken boats from the War of 1812 can be seen at certain times of the year at the "Elbow" – an area of the river that turns north toward Lake Champlain. These historical artifacts are on the National Register of Historic Places.

In 1991, the Lower Poultney River Committee successfully petitioned the Water Resources Board to designate the Lower Poultney River as an Outstanding Resource Water due to its exceptional natural, cultural and scenic values. Based on this designation, the Vermont Agency of Natural Resources developed a management plan for the Lower Poultney River that established the following goal: "For that portion of the Lower Poultney River within Vermont borders, the State will seek to manage certain activities affecting the water quality, flows, course, current, and cross-section of the Lower Poultney River to preserve and enhance the exceptional natural, cultural, scenic, and recreational values of the river and river corridor (refer to uses and values included in Section III of the VANR Management Plan for The Lower Poultney River, A Vermont Outstanding Resource)."

The Castleton River is the largest and most important tributary of the Poultney River, with a length of 20 miles and a drainage area of 99 square miles. The Classification of the Aquatic Communities of Vermont (1998) as well as the Vermont Natural Heritage Report (2002) cites the Castleton River as one of the best examples of a moderately sized mountain stream anywhere in the state. It originates on the southeastern slopes of Biddie Knob in the town of Pittsford. It flows southerly through Whipple Hollow, entering the town of West Rutland and proceeds through a large marsh northwest of West Rutland Village. The Castleton River then turns west and flows into the town of Castleton, where at a point 11 miles from its source, it is joined by North Breton Brook from the north. Several other steep gradient, mountain tributaries, such as Gully Brook, join the Castleton River as it travels from east to west along the Route 4 corridor.

The Castleton River proceeds westerly, passing to the north of Castleton Village and south of Castleton Corners and Hydeville. Downstream four miles from North Breton Brook, it is joined from the north by its principal tributary, the Lake Bomoseen outlet stream. Although the length of this stream is only 0.4 miles, it has a drainage area of about 40 square miles, being the terminus of several brooks draining the many lakes and ponds of this area of Rutland County. Below the Lake Bomoseen outlet brook, the Castleton River flows westerly for the final five miles of its course, entering the town of Fair Haven where it passes through Fair Haven Village and joins the Poultney River.

From its confluence with the Castleton River, the Poultney River flows northerly for three miles into the town of West Haven, to Carver Falls, where it cascades over a total drop of 126 feet. From this point, the Poultney River proceeds westerly for 2.4 miles, where it is joined by the Hubbardton River, which enters from the northeast.

The Hubbardton River has a length of 17 miles and a drainage area of 45 square miles. Flowing generally southerly and southwesterly for its entire course, the Hubbardton River begins at a wetland in the town of Orwell, passes through the town of Benson and into the town of West Haven, to its juncture with the Poultney River. A tributary from Lake Hortonia joins the Hubbardton River in Benson.

The Mettowee River

The Mettowee River has a length of 17 miles within Vermont and has a drainage area within the state of 137 square miles (Figure 3). It originates on the southern slopes of Dorset Mountain near the northern boundary of the Town of Dorset. From its source, the small stream tumbles rapidly down the mountainside, flowing in a southerly direction through Dorset Hollow and westerly onto the valley floor, entering the town of Rupert in East Rupert. In East Rupert, the Mettowee River becomes a slower and more meandering stream. It flows northwesterly through the town of Rupert and into the town of Pawlet. At a point 9.5 miles from its source and adjacent to the village of Pawlet, it is joined by Flower Brook from the east.

Flower Brook is seven miles long and has a drainage area of 19 square miles. This brook begins on the southern slopes of Tinmouth Mountain in the Town of Tinmouth, and flows southerly into the Town of Danby. After passing between Mount Hoag and Dutch Hill, Flower Brook flows southwesterly into the town of Pawlet to its confluence with the Mettowee River. Flower Brook is a flashy stream with a history of minor flooding (as well as the significant flooding that occurred during Tropical Storm Irene in 2011). Proceeding west then north from Pawlet Village, the Mettowee River forms a wide "S" loop at Butternut Bend and continues under Vermont Route 153. It passes through a rocky gorge and continues to the point where Wells Brook enters from the northeast, 6.9 miles downstream of Flower Brook.

Wells Brook is the largest tributary to the Mettowee River (Figure 4). This brook, generally flashy upstream of Wells Village, begins in the town of Tinmouth on the western slopes of Tinmouth Mountain. It flows southwesterly to the Wells town line, westerly past the village of Wells, and to a point 9 miles from its source. Here it is joined by Mill Brook from the northeast. Mill Brook is the outlet brook of the Lake St. Catherine chain of lakes. It is two miles long and has a drainage area of 26.5 square miles. From its confluence with Mill Brook, Wells Brook proceeds southerly into the town of Pawlet, where one mile downstream of Mill Brook, it joins the Mettowee River. Wells Brook has a total length of ten miles and a drainage area (including Mill Brook) of 34 square miles.

Continuing westerly, the Mettowee River enters the State of New York at a point 0.6 mile below Wells Brook, and proceeds to its eventual union with the Champlain Canal south of Whitehall, New York. Another tributary of the Mettowee River within Vermont is the Indian River, which joins the Mettowee at Granville, New York. The Indian River is generally a meandering stream 7 miles long in Vermont. It drains 39 square miles of land within the state. This stream begins at the watershed divide just north of the village of Rupert and proceeds northerly into the town of Pawlet entering New York at West Pawlet Village.

The Mettowee River watershed in Vermont is a little more forested than the Poultney River watershed with 71% of the watershed forested. The land used for agricultural purposes is about the same for both watersheds, approximately 16% of the watershed area. Surface water covers 6% of the Mettowee watershed and wetlands cover 2%. Transportation and other developed land comprise 4%.

The East Creek

Lower East Creek is a slow-moving, nutrient-rich stream that flows into Lake Champlain and serves as host for 800 acres of contiguous wetlands. The creek drains 21,000 acres of surrounding land. East Creek includes a large area of high quality marshland that serves as important habitat for waterfowl and many species of fish. Located near the mouth of the stream, the marsh contains one of the largest stands of narrow-leaved cattail in the state, and is a haven for nesting waterfowl like the American bittern and the common moorhen[2]. The confluence of the main creek and the north fork is a prime example of the floodplain forests that once dominated riparian areas in the Lake Champlain Valley.

The fertile portion of the Champlain Valley drained by East Creek has been farmed since early European settlement. In the past, the State sometimes bought good farmland and then swapped with farmers for wetland parcels to create the East Creek Wildlife Management Area in the Towns of Benson and Orwell. There are three dams on the East Creek that are managed to support fish and wildlife habitat, including migratory waterfowl. The Nature Conservancy (TNC) owns much of the remaining wetland in the lower reaches of East Creek. Thus, between TNC and State ownership, much of the East Creek wetland complex has been conserved.

[2]http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/vermont/placesweprotect/east-creek-natural-area.xml

Special Values and Features of Certain South Lake Basin Surface Waters

Waterfalls, Cascades, Gorges, and Swimming Holes

The Poultney and Mettowee Rivers, and the Lower Champlain Direct drainages are collectively referred to as Basin 2/4 by the DEC. Waterfalls, Cascades, Gorges, and Swimming Holes are considered valuable water resource features for preservation and public access. Many of these features were documented in Jenkins and Zika, 1985. Other features noted here are from local residents or personal experience.

Poultney River – Deep Rocks, Horses Heaven[3]

A small gorge, cascades and a swimming hole are located in Lewis Brook in the Town of Poultney. This privately-owned site is approximately three miles upstream from the confluence of the brook with the Poultney River, approximately two miles upstream of Cemetery Cedar Swamp.

A deep gorge with a waterfall and cascades at an old mill site in the center of the village of East Poultney has impressive cliffs but is not accessible for swimming.

Just upstream of East Poultney, and continuing for approximately one mile, are a series of gorges, waterfalls, pools and cascades. Two or three of these are accessible for swimming. There is a small cascade, waterfall, and approximately 20-foot deep gorge in an unnamed tributary to the Poultney River just north of the village of East Poultney. A Vermont Youth Conservation Corps Crew spent a day during the summer of 2001 removing garbage from an illegal dumpsite that was sliding down into the gorge.

Directly north of the Delaware and Hudson Railroad crossing in Fair haven, is an interesting geologic area known as the “Slide – swimming flume”. This is a rock outcrop in the streambed, which has had recreational use over the years. Several other exceptional geological features are found downstream of the “Slide/swimming flume,” including “Ranney’s Rocks/Mud Turbidites/Boudinage Structure,” “Layered Cliffs,” “Poultney River Folds/Deep Sea Fan,” “Carver Falls,” and “Limestone Cliffs”.

Mettowee – Button Falls, Flower Brook gorge

A fishing area is located on Mill Brook in Pawlet, at its juncture with the Mettowee River accessible from the Route 140 Bridge west of Blossoms Corners. Approximately

[3] Waterfalls, Cascades and Gorges, September 1985. Jerry Jenkins and Peter Zika for the Vermont Agency of Natural Resources, Department of Environmental Conservation, Water Quality Division.

one mile south of this juncture is Button Falls on the Mettowee River in Pawlet. The Jenkins Report describes it as a "wide gorge and superb swimming hole with a falls 15-20 feet high," on the south side of Button Falls Road. On the north side of the road, "there is a narrow limey gorge with some fine swimming pools and very handsome rocks." Jenkins rates it as "State significant", in a part of the state where cascades (i.e., waterfalls) are "rare". He also rates it as "significant for good swimming".

A small gorge and cascade is located on Flower Brook, a tributary to the Mettowee River, in the Village of Pawlet. The gorge is an old mill site, with a dam at the upper end, and is spanned by the village general store. The site is presently operated for hydroelectricity, and a penstock bypasses the gorge.

C. Assessments Undertaken in the Southern Champlain Basin

Several types of assessments are conducted to support tactical basin planning. In the Southern Champlain Basin, geomorphic assessments, water quality monitoring, and biological monitoring are ongoing. Agricultural Environmental Management assessments have been conducted in certain sub-watersheds, and Better Back Roads inventories have been undertaken in several towns. Stormwater master planning and Illicit Discharge Detection and Elimination infrastructure mapping has been undertaken or is currently in process.

Table 2. Status of assessments for the Southern Champlain Basin

Sub-Basin	Geo-morphic Assess-ment	Water Quality Monitoring	Bio monitoring (completed / planned)	NRCS Focused Watershed Management Plan	Better Backroads/ Road Erosion Inventory	Stormwater master plan or Illicit Discharge Detection
McKenzie		O	U	U	PC	
East Creek	C	O	O	X	PC	
Poultney River	C	O	O		PC	PC
Castleton	C	O	O		PC	PC
Hubbardton	PC	O	O	X	PC	
Mettowee	C	O	O	X	PC	
Flower	C	O	O	X	PC	C
Wells	U	O	O		PC	U

X= proposed in plan C= Completed PC= Partial Completed O= On-going U=Underway

Stream Geomorphic Assessments

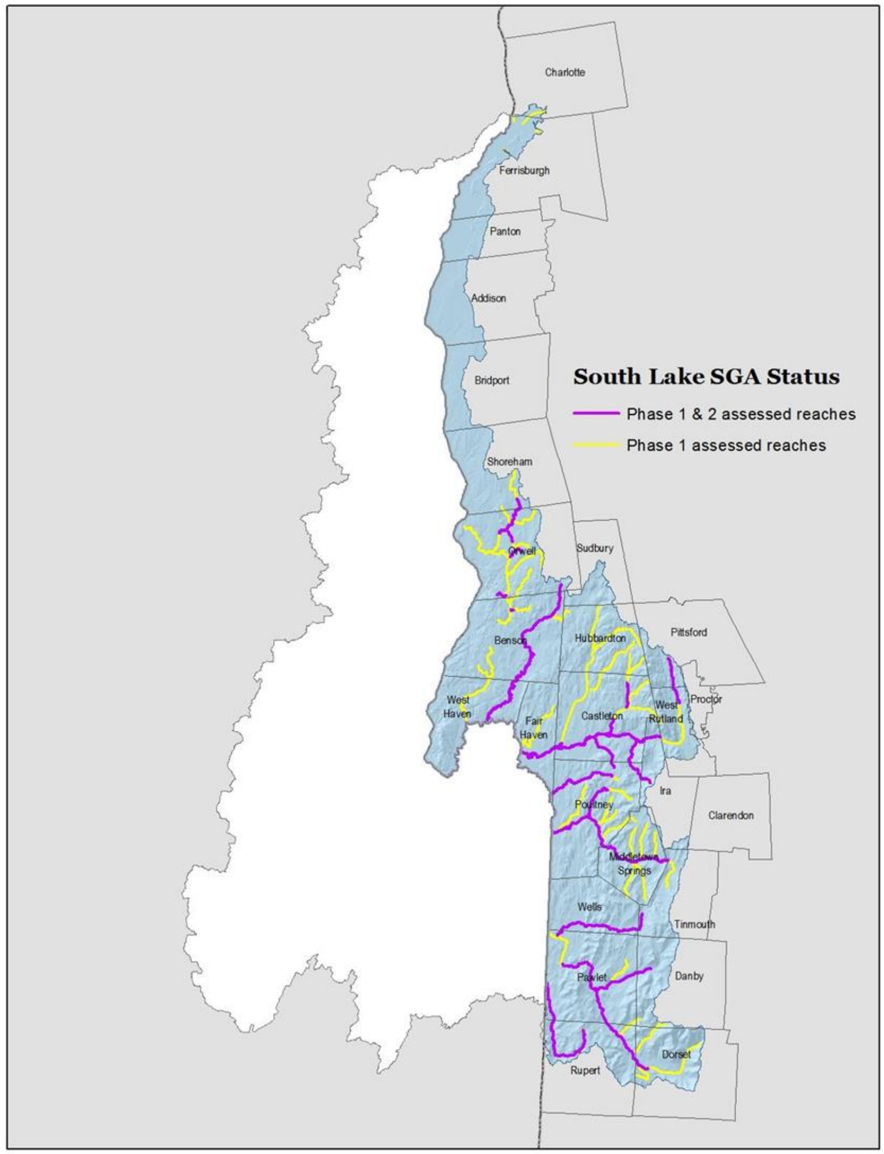


Figure 6. Stream geomorphic assessments conducted in the Southern Champlain Basin through 2017.

Stream geomorphic assessments (SGA) provide the basis for stream alteration regulatory decisions, technical assistance for fluvial conflict resolution, stream corridor protection and restoration, flood hazard mitigation and water quality protection. The assessment data is critical to prioritization of riparian and fluvial process-related water quality restoration and protection projects, project design alternatives analyses, and project design criteria. SGA provides insight into the social, economic and ecological interrelationships between people and fluvial systems and as such, it is a valuable educational tool. All of the SGA datasets collected in Vermont are compiled in the Stream Geomorphic Assessment Tool database and related Vermont

Online Bridge and Culvert Inventory Tool. These databases are used to ensure that projects are implemented in a manner consistent with and complementary to equilibrium conditions. Much of the Southern Champlain Basin has been subject to SGA at the Phase I or Phase II level (Figure 6), and Corridor Plans have been established for several watersheds, including the Poultney River (and Castleton River sub-basin), Mettowee, and East Creek. A description of geomorphic assessment and river corridor management summaries and recommendations from specific sub-watersheds is provided in Appendix G.

Since 2005, Partners in the planning process (RRPC and TNC) have conducted geomorphic assessments on the Castleton, Hubbardton and Mettowee Rivers and many of their tributaries to identify priority stream reaches for protection (with assistance from VTDEC– River Management Program)

Table 3. Stream Geomorphic Assessments in the Basin.

Date	Watershed	Sub-Watershed	Link to report
9/01/2005	Castleton	Castleton River	Castleton River Phase 1 SGA
4/01/2007	Castleton	Castleton River	Castleton River Phase 2 SGA
3/01/2007	Castleton	Castleton River	Town of Castleton Corridor Plan
9/01/2005	Mettowee	Mettowee River	Mettowee River Phase 1 SGA
11/01/2007	Mettowee	Mettowee River	Mettowee River Phase 2 SGA
12/01/2013	Mettowee	Mettowee and tributaries	Mettowee River Corridor Plan
3/01/2006	Poultney-Hubbardton	Poultney - Hubbardton River	Hubbardton River Debris Project Summary
3/01/2006	Poultney	Poultney - Hubbardton River	Poultney and Hubbardton Alternatives Analysis
12/01/2006	Poultney	Poultney - Hubbardton River	Poultney River Phase 2 SGA and Corridor Plan
8/01/2006	Poultney tributaries	Poultney Tribs	Lewis Brook and Finel Hollow Brook Phase 2 SGA

5/01/2007	Poultney tributaries	Poultney Tribs	Select Poultney tributaries Phase 1 SGA
11/01/2007	Poultney tributaries	Poultney Tribs	Vail Brook Phase 2 SGA
05/25/2011	East Creek	East Creek and tributaries	East Creek Corridor Plan
9/28/2012	East Creek	East Creek and tributaries	East Creek Corridor Plan - Draft Wetland Restoration Addendum

General Fisheries Assessment

There is a wide variety of fish habitats found throughout the Southern Champlain Basin, from warm-water fisheries in lakes, ponds, and mainstem rivers, to the cold-water fisheries of high mountain streams These fishery habitats range from high velocity riffles with cobble substrate to slow moving pools with sand substrate to seasonally flooded wetlands.

The South Lake Champlain Basin is home to a wide diversity of fish species, many of which support popular recreational fisheries. The majority of small streams within this watershed provide suitable habitat to support naturally reproducing, i.e. "wild" trout populations, and most of the larger, warmer rivers are stocked with trout to provide fishing opportunities for anglers. Wild populations of native Brook Trout flourish in the colder, higher elevation streams. Some of the smaller tributaries of the Mettowee River also support naturalized populations of wild Rainbow and Brown Trout. Both species were introduced to Vermont in the late 1800's, Rainbow Trout from the west coast and Brown Trout from Europe. These small tributaries are serving as spawning and juvenile rearing habitat for Brook, Brown, and Rainbow Trout living in the Champlain Basin.

Trout and other species move upstream and downstream to meet other habitat needs. These movements may be localized or may involve many miles of travel. For example, during warm periods in the summer, trout often migrate to cold-water refuges such as the mouths of tributary streams or to areas of groundwater inflow. Likewise, trout may migrate in the fall to deeper, ice-free areas providing overwintering habitat.

In addition to stream fisheries, there is a wide diversity of lake and pond angling opportunities in these basins. It is important to note that ponds with wild populations of Brook Trout that are abundant enough to provide angling opportunities are exceedingly rare in Vermont. While the majority of small, cold-water ponds in Vermont were probably once home to Brook Trout, the widespread introduction of warm water fish species have eliminated brook trout from nearly all of these waters.

The maintenance of quality fisheries requires the continued protection and enhancement of aquatic habitat including:

- *Forested riparian areas* - forested buffers along streams, rivers, lakes and ponds are extremely important in maintaining cool water temperatures and stable streambanks and shorelines, filtering pollutants and providing food and shelter (habitat) for fish and other aquatic populations.
- *Habitat connectivity* – dams and poorly designed culverts can limit the movement of fish and other aquatic populations to critical spawning, feeding and refuge habitats.
- *Natural hydrologic regimes* – regulated stream flows from hydroelectric facilities and water withdrawals can reduce habitat availability and quality in downstream reaches. Lake level fluctuations often affect littoral zone habitats and can negatively affect fish and other aquatic populations.
- *Preventing the introduction of exotic species and pathogens* – A variety of non-native invasive aquatic species and harmful pathogens are present in Vermont or surrounding states. Limiting the spread of these detrimental species will help maintain healthy fisheries.

The following is by no means a comprehensive description of all fisheries in the basin, but rather a summary of fisheries in major waterbodies.

Poultney River – The headwaters are good habitat for adult Brook and Brown Trout, below the village of Poultney, which lacks spawning and nursery habitat. Sparse coverage exists for large fish as evidenced by a lack of deep holes or riffle areas. Spawning and nursery areas are very good throughout the upper sections of the Poultney. All tributaries feeding into the Poultney River above Fair Haven have excellent brook and brown Trout spawning and nursery habitat. No trout have been stocked since 1972. two thirds of the fish species found in Vermont are found in the lower Poultney River.(note: 1999 Assessment Report notes over 55% of fish species known to Vermont found in the Poultney River). The following list provides a snapshot of fisheries conditions in the Poultney watershed:

• Hubbardton River and Coggman Creek – Supports a warm water fishery.

• Castleton River – Very good Brown Trout stream. Good spawning and nursery habitat throughout the upper sections of the Castleton. The West Rutland Marsh provides good cover for larger trout. The lower reaches support Brown Trout while the upper reaches support Brook Trout.

• Sunset Lake – Supports Lake and Rainbow Trout, Northern Pike and Yellow Perch.

Mettowee River – The mainstem of the Mettowee River and its tributaries generally support trout (brook, brown, and rainbow). The aquatic habitat and biota closer to the New York border is marginal. The lower section of the river in Vermont runs through long stretches of open agricultural land, resulting in elevated water temperatures. This in turn has led to fish kills during periods of extremely high summer temperatures. Temperature data collection and modelling was conducted during the summers of 2000 and 2001 by VTDEC and VT Fish & Wildlife. The Mettowee has been classified as a wild trout stream with a "no-stocking" policy. Fish and Wildlife annual surveys have documented abundant natural reproduction. As of 2001, Vermont Fish & Wildlife has also targeted the Mettowee for special regulations regarding protected slot limits and protected length limits for fish to be released. The protected size limit for the Mettowee is 10" to 14" with a two fish per day limit, which includes one fish that may be kept above the protected slot size.

The Indian River, a tributary of the Mettowee River, experiences very low flows in summer, and becomes a "losing stream" along certain reaches during the summer, meaning that the river bed runs dry during these conditions. However, abundant natural salmonid reproduction occurs, so it has been removed from the stocking list.

East Creek – The Lower East Creek has a variety of warmwater fish associated with Lake Champlain. This includes Largemouth Bass, Northern Pike, Channel Catfish, Yellow and White perch, and Black Crappie. Upper East Creek contains Brown Bullhead and smaller species such as the Golden and Black Chin Shiner have been found. The lower reaches of East Creek serve as important spawning habitat for several Lake Champlain fishes.

Other Assessments Used to Develop the Southern Lake Champlain Tactical Basin Plan

Transportation Infrastructure Assessments:

- Better Back Road Category "A" Road Erosion and Culvert Inventories (2017 REI planned assessments include Castleton, Hubbardton, Poultney, and Wells)

- Class 4 Roads Assessment (Poultney Mettowee NRCD and GMC, 2014)
- Water Quality Mapping and Culvert Assessment (Rutland RPC 604 Project, 2013)
- Bridge and Culvert Inventory and Assessment for AOP and SGA (TNC, 2012)
- Municipal Road Erosion Inventories (ongoing MRGP, RRPC, 2017)

Land Use by Category:

- Small farm Operation inspections (ongoing, per the Required Agricultural Operation Rules, 2017).
- Agricultural Environmental Assessments (AEM), ongoing (AAFM, NRCDs)
- Detecting and Eliminating Illicit Discharges in Rutland County to Improve Water Quality, 2014 (Pawlet completed during the 2014 field season)
- Prioritizing Conservation Practices Through Flow Accumulation Modeling of Crop Field Drainage in West-Central Vermont (GMC and USDA-NRCS, 2009)
- VTANR Natural Resource Atlas (Biofinder II), ongoing wildlife corridor mapping
- USDA-NRCS Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed, May, 2016 – see Appendix E
- Flower Brook Stormwater Master Plan (PMNRCD, 2015)
- Lake Bomoseen watershed and Castleton Headwaters Stormwater Master Plan (PMNRCD, 2017)
- Lake Saint Catherine Watershed Stormwater Master Plan (PMNRCD, underway, 2017)

D. Surface Waters Exhibiting Very High Quality Biological Integrity or Fisheries.

There are several sub-watersheds in the Southern Champlain Basin that support very high water quality conditions. VTDEC assesses ecological integrity using biological assessments of macroinvertebrate and fish communities. VT Department of Fish and Wildlife assesses wild trout populations and important nursery areas to document very high quality recreational fisheries, which are typically found in surface waters that exhibit clean and cool conditions. Based on VTDEC's long-term sampling of stream locations in the Southern Champlain Basin, there are several streams that reliably exhibit very high quality ecological integrity (consistent with very good or excellent assessments; Table 3). These surface waters may be potential candidates for reclassification to Class B(1). Figure 7 provides a example monitoring summary for one stream in the basin, Sykes Hollow. For more information and data on specific stream assessment condition, a searchable database can be queried through [the Vermont Integrated Watershed Information System.]()

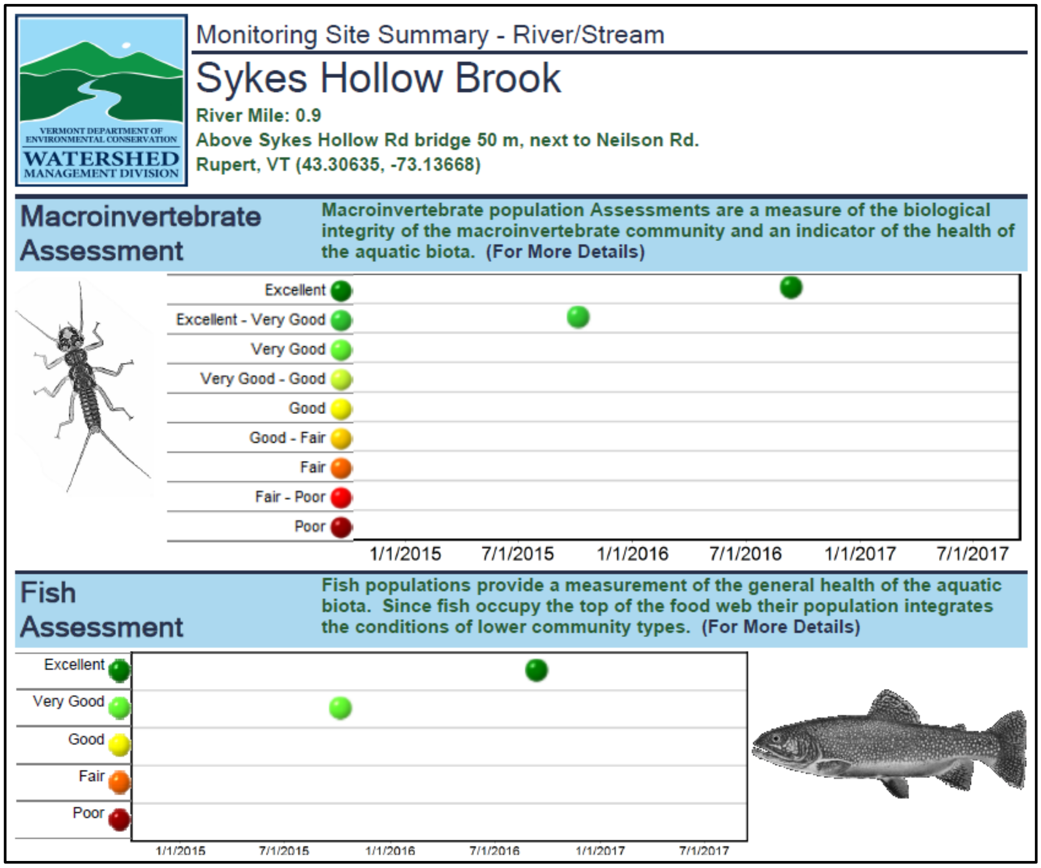


Figure 7. Example Monitoring Site Summary for Sykes Hollow Brook in Rupert reflecting assessed condition by color (sites include biomonitoring and chemical water monitoring locations). Assessed condition depicted as green = "excellent", yellow = "good", orange = "fair", and red = "poor."

That assessments of biological integrity from macroinvertebrate and fish communities identify *excellent* overall biological integrity. Excellent overall biological integrity, for the purposes of this procedure, is defined as a minimum of three combined *excellent* ratings from at least two years of data from both communities (three out of the four possible assessments). If more than two years of assessments are available, then at least two-thirds of the combined fish and macroinvertebrate assessments must be *excellent*. All assessments are to be from data collected that is no older than 10 years with no longer than six years elapsed between each sample. Assessment procedures must be those established in *Biocriteria for Fish and Macroinvertebrate Assemblages in Vermont Wadeable Streams and Rivers -Implementation Phase* (VTDEC 2004).

Table 4. Basin streams that support very high quality ecological integrity (based on most recent supporting biomonitoring data)*

Waterbody	Location	Most Recent Supporting Data (Fall, 2017)
Hubbardton River	Benson (RM* 10.7/ 10.9)	Excellent macroinvertebrates, very good fish
Breese Pond Outlet	Hubbardton (RM 4.7)	Excellent macroinvertebrates
Castleton River	Castleton (RM 8.7)	Excellent macroinvertebrates
Giddings Brook	Hubbardton (RM 1.1)	Excellent macroinvertebrates, very good fish
Belgo Brook	Castleton (RM 1.0)	Excellent macroinvertebrates
Gully Brook	Castleton (RM 0.5)	Excellent macroinvertebrates
Poultney River	Middletown Springs (RM 32.9)	Excellent macroinvertebrates
Mettowee River	North Rupert (RM 32.5)	Excellent macroinvertebrates, very good fish
Flower Brook	Pawlet (RM 0.5)	Excellent macroinvertebrates
Sykes Hollow Brook	Rupert (RM 0.9)	Excellent macroinvertebrates, very good fish

RM = river mile as measured from the mouth upstream

**Note - Biological data indicates a consensus very good or excellent condition by one or both groups of fish and macroinvertebrates. To qualify as a Class B(1) candidate through biomonitoring, data must reflect a minimum of 3 out of 4 total very good or excellent assessments from both communities from the most recent 2 years of data collected within 6 years or less of each other and no greater than 10 years old;*

Very High-Quality Lakes

Best Lakes – Southern Champlain Basin

The Lakes and Ponds Management and Protection Section of VTDEC recently completed a process to identify high quality lakes in the state to prioritize conservation and protection efforts. Lakes were independently ranked in three separate categories using long-term datasets for water quality, biological diversity and unusual or scenic natural features. Scores from the separate categories were combined to identify lakes with exemplary qualities in all three, deemed by VTDEC as Best Lakes.

One pond in the Southern Champlain Basin, Hinkum, is ranked in the top 10% of the ***Best Lakes*** in Vermont, and four ponds are ranked in the top 25% - Perch, Spruce, Half Moon and Inman Ponds. Lake Bomoseen is in the top 5% of all lakes for biodiversity, and Half Moon and Perch were both in the top 20% for water quality. All four ponds as well as Lake Bomoseen were included in ANR's BioFinder Analysis, which means that they were determined to be the best examples of their lake type in Vermont. The BioFinder lake types were classified with physical data (trophic status, alkalinity and depth) that are known to influence biological communities. Many lakes in the basin were ranked for one or more categories in the ***Best Lakes*** analysis, but not high enough to be among the overall highest ranked in the state. These lakes are presented in Table 4. Best Lakes Scores are presented under "Supporting Data" column if lakes were ranked in any of three categories, along with the rank score from 1 (lowest) to 5 (best) in each: WQ - Water Quality, BD – Biological Diversity, USNF – Unusual or Scenic Natural Features.

Table 5. Lakes and ponds in the Basin that exhibit Very High Quality condition based on DEC's Best Lakes analysis.

Lake/pond	Location	Supporting Data
Hinkum Pond	Sudbury/ Hubbardton River headwaters	"Best Lake"- top 10% VTDEC state ranking: USNF (top 5%)
Perch Pond	Benson/ South Branch East Creek	"Best Lake"- top 20% VTDEC state ranking: water quality (top 20%)
Spruce Pond	Orwell/ South Branch East Creek	"Best Lake"- top 20% VTDEC state ranking
Half Moon Pond	Castleton/ Castleton River headwaters	"Best Lake"- top 25% VTDEC state ranking: water quality (top 20%)
Inman Pond	Fair Haven/ Poultney River	"Best Lake"- top 25% VTDEC state ranking

Lake Bomoseen	Castleton, Hubbardton/ Castleton River headwaters	"Best Lake"- top 10% VTDEC state ranking: biodiversity

Very High-Quality Waters That Support Recreational Fishing

Abundant wild trout populations are defined as supporting multiple age classes of one or more species of wild trout (brook, brown, rainbow trout) at levels generally equal to or greater than 1,000 fish/mile and/or 20 pounds/acre. It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values in a given year. Other waters that have not been surveyed may also support similar wild trout densities and may be identified in the future. Certain noteworthy streams are also important to support spawning and nursery habitat for the main stem of the Mettowee and Poultney Rivers. Tables 5 and 6, respectively, list streams supporting wild trout populations and nursery tributaries. An updated survey of recreational fisheries should be conducted regularly within the basin to update wild trout age classes, species, and quantities.

Table 5. Basin streams supporting Very High Quality significant wild trout populations

Sub-watershed	Streams Surveyed	Description (entire unless otherwise described)
Mettowee River	Mettowee River	Upstream of confluence with Flower Brook
	Wells Brook	
	Flower Brook	
	Sykes Hollow Brook	
	Kirby Hollow Brook	
	Hagar Brook	
	Jenks Brook	
	Dayton Brook	
	Indian River	Upstream of Dry Brook
Poultney River	Poultney River	Upstream of Burnham Hollow
	Drew's Crick	
	South Brook	
	Castleton river	Upstream of confluence with Lake Bomoseen outlet stream

Table 6. Very High-Quality spawning and nursery tributaries in the Southern Champlain Basin

Sub-watershed	Streams Surveyed	Description
Poultney River	Lower Poultney	Lower reaches below Carvers Falls
East Creek	Lower East Creek	Lower reaches below fall line

Significant Natural Communities and Rare, Threatened and Endangered Species of the Basin

There are 1106 occurrences of species or natural communities in the Southern Champlain Basin watershed that are considered state significant. Of these 1106 occurrences, 744 are plant species, 274 are animal species, 87 are natural communities, and one is a bat hibernaculum.

Significant natural communities present in the Basin are various unique and interesting wetland communities including Red Maple-Black Ash Seepage Swamp, Northern White Cedar Swamp, Silver Maple-Sensitive Fern Riverine Floodplain Forest, and the Red Maple-Northern White Cedar Swamp among others.

The watershed consists of many other natural communities including floodplain forests, oak-hickory forest, rich northern hardwood forest, birch-beech-maple forest, emergent marsh, hardwood-cedar swamp, shrub swamp, calcareous outcrop and talus slope.

Extensive wetland complexes are adjacent to and are interdependent with the Poultney River in Fair Haven and West Haven: Steves Marsh, Blue Hole, Schoolhouse Marsh, Corroscaden Marsh, Billings and Reed Marshes, Coggman Pond and Cemetery Cedar Swamp. Cemetery Cedar Swamp drains to the Poultney in Fair Haven, between Routes 22A and 4. The Vermont Natural Heritage program lists Cemetery Cedar Swamp as one of the largest cedar wetlands in Vermont. It is an example of a forested-swamp type of wetland and adds many species of flora and fauna to that of the river proper.

The Poultney River and East Creek and adjacent floodplain and wetland communities are important for a number of social and ecological reasons including:

- Providing important habitat for migrating waterfowl,
- Filtering out phosphorus and nitrogen, which reduces nutrient and sediment loading to Lake Champlain.

- The ability of these habitats to store of floodwaters and reduce the magnitude of downstream flooding.
- Where unconstrained by existing infrastructure, these floodplains can also provide locations for the natural migration of the Poultney River to support a return towards the equilibrium condition. The Poultney River has been straightened in many locations in the upper watershed (Fields, 2004) and in many places, is working to reestablish it natural sinuosity.
- The potential for the restoration of significant areas of floodplain forest habitat. This habitat has largely been lost through the conversion of this natural community to agricultural lands. These habitats support many plant and animal species some of which are rare or uncommon in Vermont.
- Benefits to the aquatic community adjacent to and downstream from floodplain forests from increased shading and improved adjacent aquatic habitat.
- As a migration pathway facilitating the movement of wildlife between larger habitat blocks (See Figure 8, Marangelo, 2016).

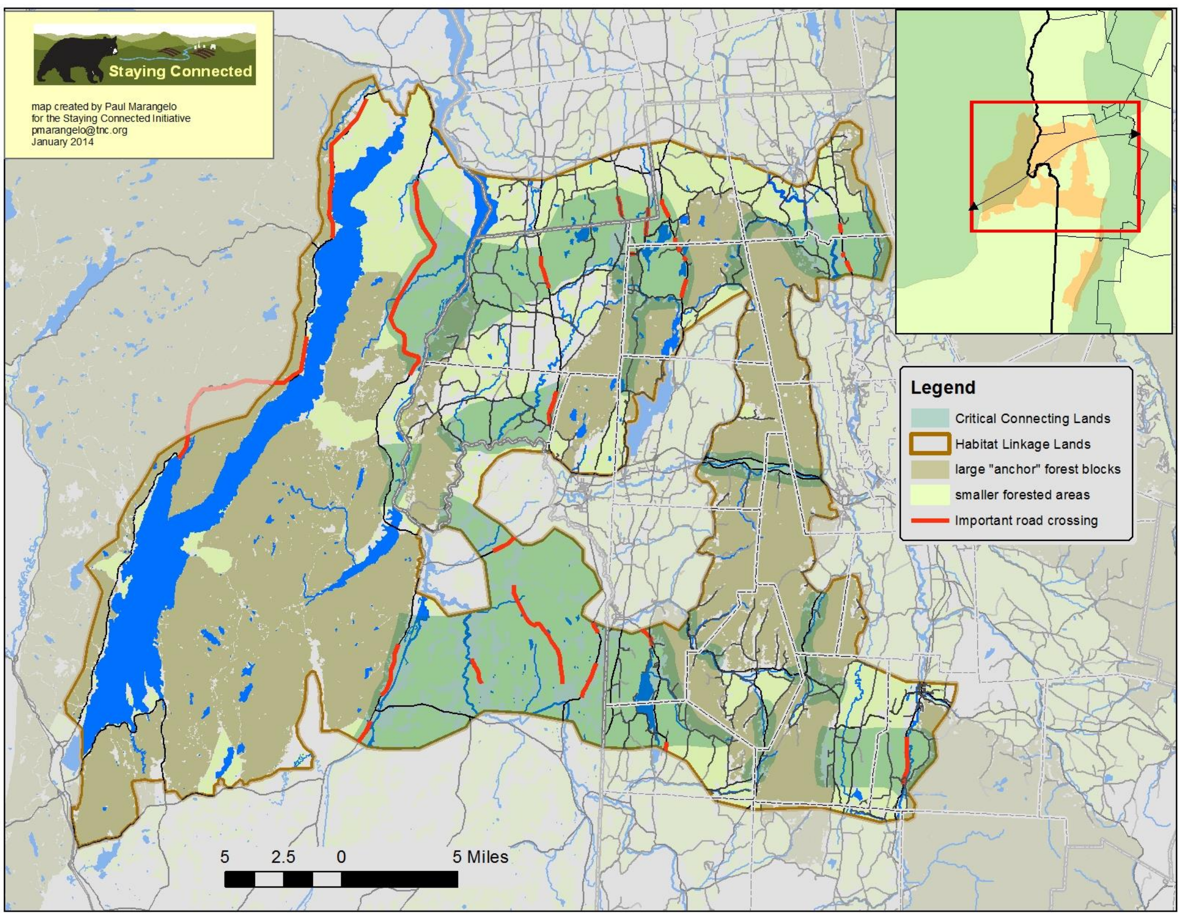


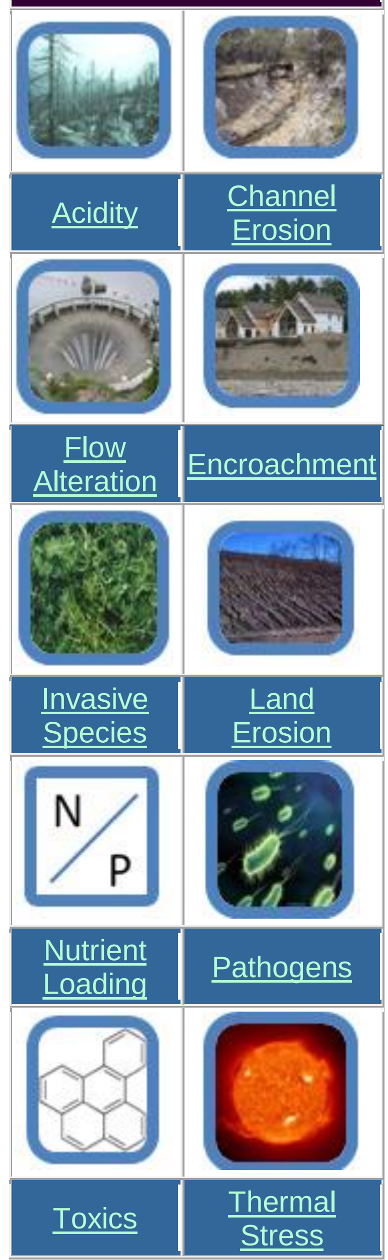
Figure 8. Green Mountains to Adirondacks habitat connectivity priorities

E. Stressors, and Causes and Sources of Impairment

Stressors and related pollutants

The Vermont Surface Water Management Strategy (VVTDEC2012) lays out the goals and objectives of the Watershed Management Division to address pollutants and stressors that affect the designated uses of Vermont surface waters. The strategy discusses the 10 major stressors that are managed to protect and improve surface waters. A stressor is defined as a phenomenon with quantifiable damaging effects on surface waters resulting from the delivery of pollutants to a waterbody, or an increased threat to public health and safety. Stressors result from certain activities on the landscape, although occasionally natural factors result in stressors being present. Managing stressors requires the management of associated activities. When landscape activities are appropriately managed, stressors are reduced or eliminated, achieving the objectives of the Strategy, and the goals met. The pictures at the right link to the stressor chapters of the Surface Water Management Strategy. The SWMS describes in detail the stressors, its causes and sources. It also presents the Division's approach to addressing the stressor through monitoring, technical assistance, regulations and funding.

The Vermont Surface Water Management Strategy identifies 10 major stressors that impact surface waters...click to choose stressor for more information.



VTDEC uses monitoring and assessment data to assess individual surface waters in relation to Vermont Water Quality Standards and other relevant guidelines (e.g., stream equilibrium standard). The 2011 Assessment and Listing Methodology articulates three categories of surface waters where degradations are noted.

Stressed waters support designated uses, but the water quality and/or aquatic biota/ habitat have been disturbed to some degree by point or by nonpoint sources of human origin and the water may require some attention to maintain or restore its high quality. In some instances, stressed waters may have documented disturbances or impacts and the water needs further assessment to confirm impairment. See Figure 9.

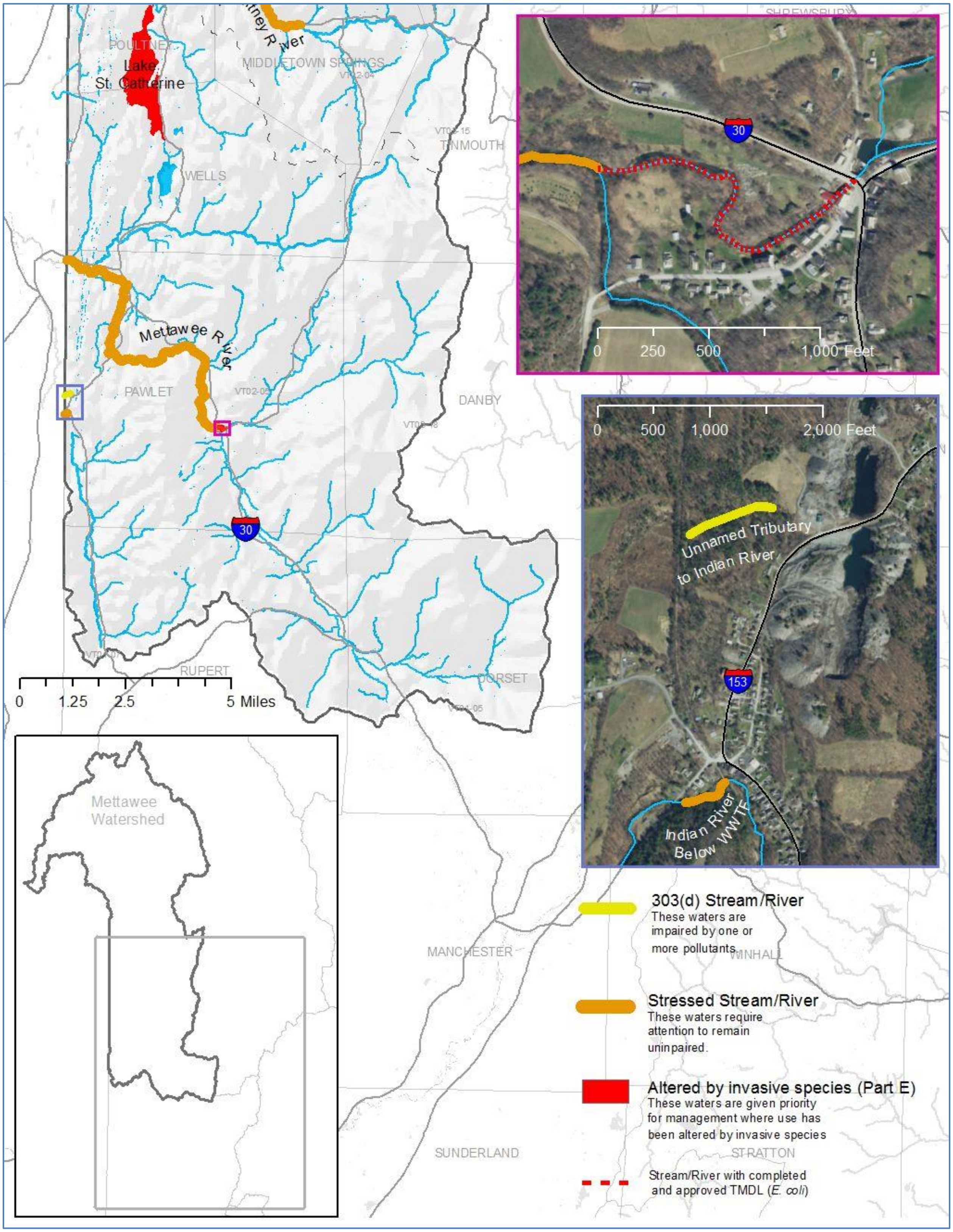


Figure 9. Impaired, altered, or stressed waters on the Vermont Priority Waters List (Mettowee River Basin)

Altered waters are affected by lack of flow, water level or flow fluctuations, modified hydrology, physical channel alterations, and where documented channel degradation or stream type change is occurring, which typically occurs from some human activity, or where the occurrence of aquatic invasive species such as Eurasian watermilfoil (EWM) or Water chestnut (WC)has had negative impacts on designated uses. The aquatic communities are altered from the expected ecological state. See Figure 10.

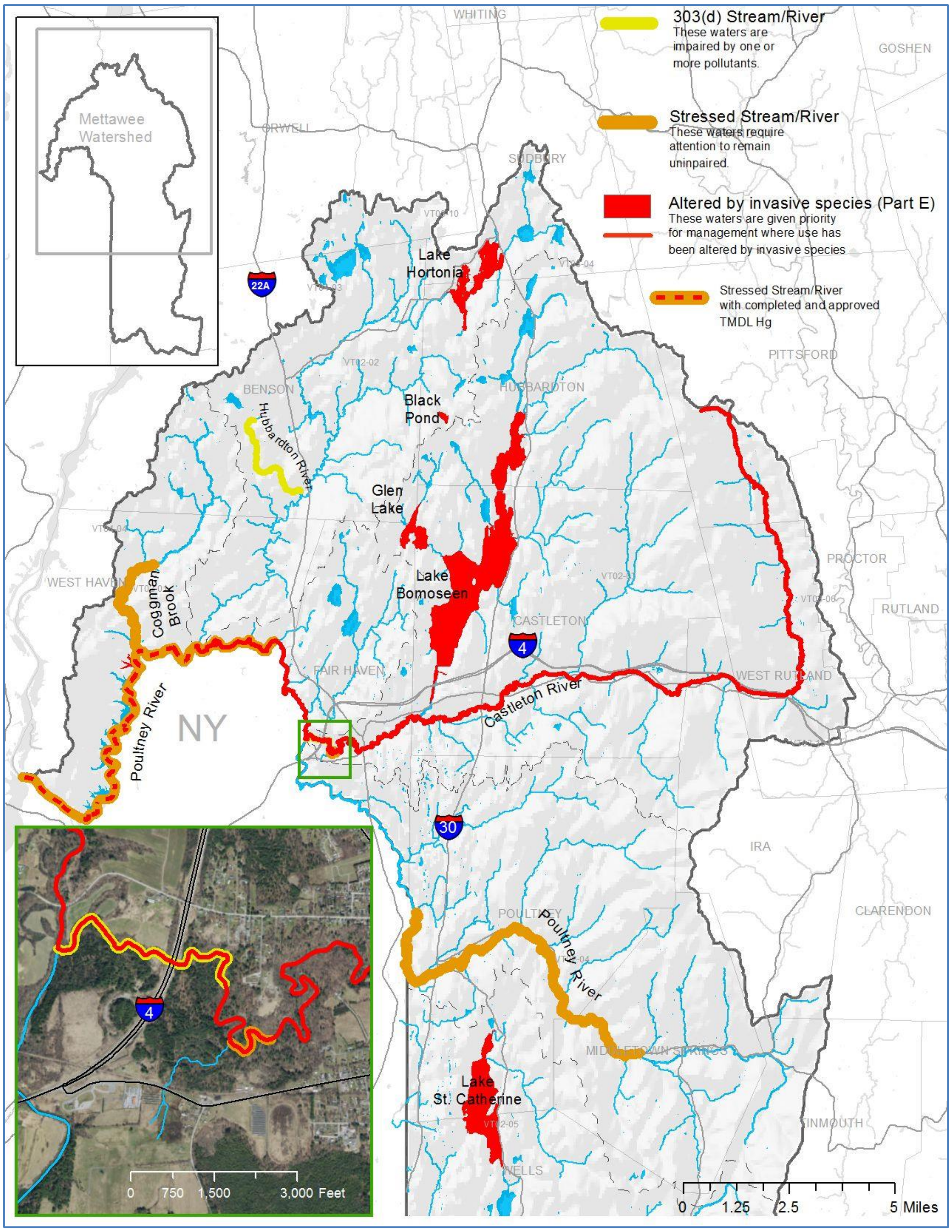


Figure 10. Impaired, altered, or stressed waters on the Vermont Priority Waters List (Poultney River Basin)

Impaired waters are those surface waters where there are chemical, physical and/or biological data collected from quality assured and reliable monitoring efforts that reveal 1) an ongoing violation of one or more of the criteria in the Water Quality Standards and 2) that a pollutant of human origin is the most probable cause of the violation. Impaired waters are those that require pollution control efforts under one or more provisions of the Clean Water Act. The most common mechanism to address an impaired water is the development and promulgation of a Total Maximum Daily Load.

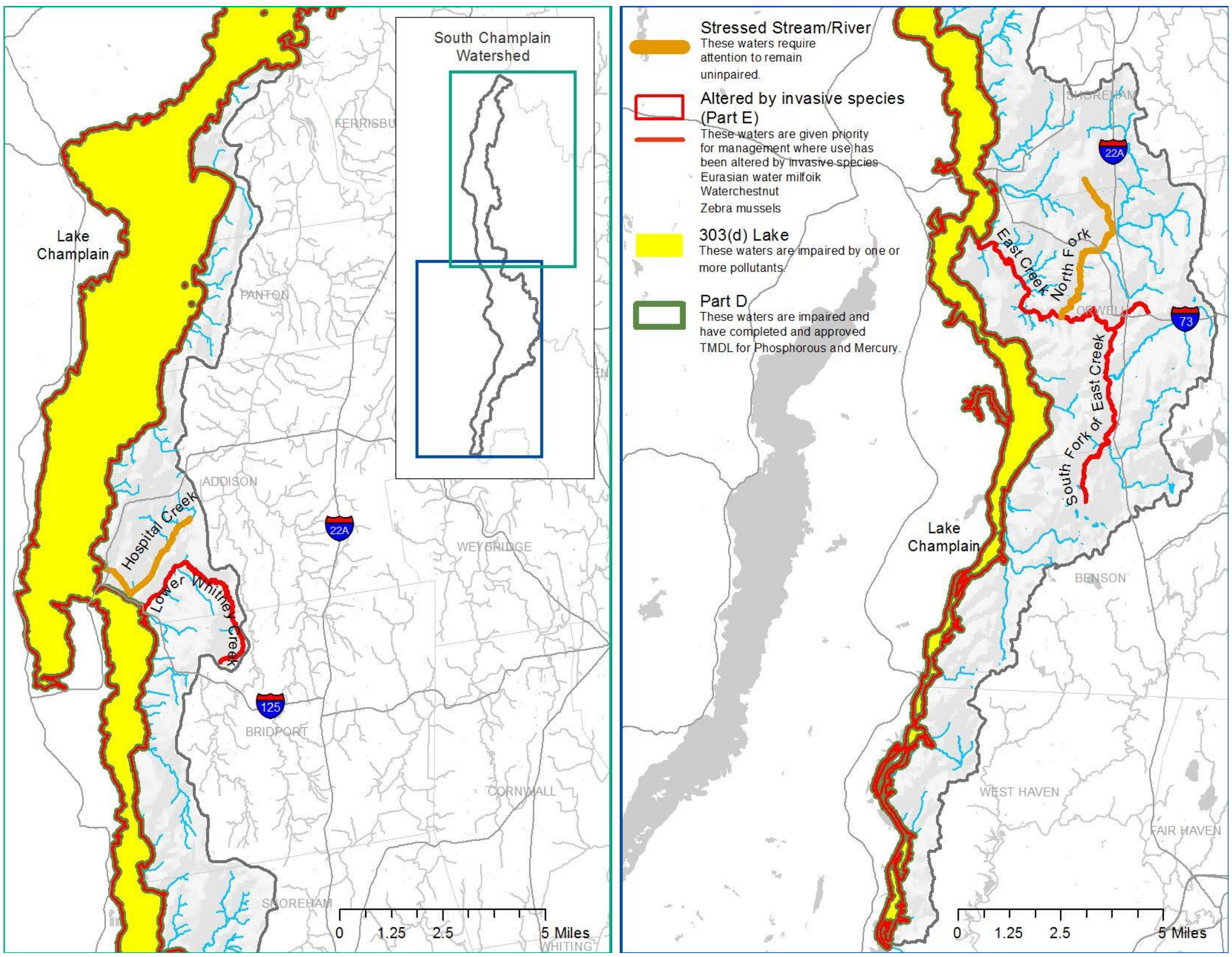


Figure 11. Impaired, altered, or stressed waters on the Vermont Priority Waters List (East Creek and McKenzie Brook (HUC-12) Basin)

Based upon the available monitoring and assessment data, the highest priority stressors for streams in the Southern Champlain Basin are shown in Table 8. Lakes are presented in Figure 6. The specific pollutants or conditions that cause stress or impairment from each stressor are shown for streams in Table 8, and for lakes and ponds in Figure 5.

Figure 12 tallies how many lakes are altered or stressed by each pollutant or condition in the Basin. Primary pollutants include nutrients (and sediment), temperature, pathogenic bacteria, and invasive species. Atmospheric deposition of mercury and other airborne pollutants affects all lakes in the basin, and the lower Poultney River.

Table 8. Major stressors affecting rivers and streams in the Basin (a complete description of each stressor, including management intervention, is available by clicking the stressor icon). Causes and sources resulting in Impaired (I), Altered (A), or Stressed (S) stream conditions in the Southern Lake Champlain sub-basins are noted along with assessment priority and needs (VTDEC2012a, VTDEC2012b, VTDEC2012c).

Stream segment(s)	Stressor	Source(s)	Mileage (condition)	**Assessment Priority** / Assessment need
Flower Brook	 Pathogens	Illicit discharges, failing septic, agriculture	0.5 (I)	**High**/ IDDE, SWMP completed in 2015
Mettowee River		Illicit discharges, failing septic, agriculture	8.2 (S)	**Medium**/ Further assessment needed
Castleton River		Combined sewer overflows	0.5(I)	**Low**/ Adams St pump station needs final effectiveness evaluation
Unnamed tributary to the Hubbardton River		Benson WWTF, agriculture, wildlife sources Strongs Swamp	3.0(I)	**Medium**/ Further assessment needed for WWTF sources (check 303(d) status)
Poultney River (Buxton Hollow downstream to the D&H Rail Trail)		unknown	7.8 (S)	**Medium**/ Stretch includes Ag land, villages. Natural sources also possible – stressed listing based on *E. coli* sampling.
Gully Brook	 Channel erosion  Land Erosion	Channelization bank erosion, road runoff	0.5 (S)	**Low** / Floodplain restoration project completed 2004, additional berm removal 2010
Finel Hollow Brook		Morphological instability	? (S)	**Medium** / Phase 1 and 2 SGA completed
Lewis Brook		Morphological instability, agriculture	? (S)	**Medium** Further assessment needed
Mettowee River		Agriculture, backroad erosion	8.2 (S)	**High**/ Phase 2 SGA/ Corridor Plan Completed/ SFOC underway
Poultney River		Urban (stormwater), Agriculture, backroad erosion	?	**Low**/ Phase 2 SGA completed/ SFO, BR assessments needed

Stream segment(s)	Stressor	Source(s)	Mileage (condition)	**Assessment Priority** / Assessment need
Hubbardton River, (from Pleasant Valley road downstream to mouth)		Agricultural runoff, streambank erosion, road erosion	15.0 (S)	**Medium**/ SFOC and BR assessments needed
East Creek (North Fork)		Agriculture	2.2 (S)	**Medium**/ SPOC, additional water quality monitoring needed
Hospital Creek		Agriculture	3.0 (S)	**High**/ SPOC, additional water quality monitoring needed
Whitney Creek		Agriculture	3.0 (S)	**High**/ SPOC, additional water quality monitoring needed
All Lake Champlain tributaries	 Non-Erosion Nutrients  Channel erosion  Land Erosion	Developed (stormwater) and agricultural lands, morphological instability, WWTF	Basin-wide	**High /** Phosphorus loading basin-wide. Revised Lake Champlain Phosphorus TMDL Spring 2014
Lower Poultney River	 Atmospheric Deposition	Long range transport of air pollutants, medical waste incinerators, mercury waste disposal	10.4	**Medium** / Biological Assessment Elevated levels of mercury in fish tissue. TMDL approved December 20, 2007.

Stream segment(s)	Stressor	Source(s)	Mileage (condition)	**Assessment Priority** / Assessment need
Castleton River (below old Fair Haven landfill)	 Toxic substances	Trash, high pH Fair Haven landfill	0.2 (S)	**Low/** Monitoring wells do not indicate that leachate is occurring. Landfill needs proper capping.
Tributary to Mettowee River in West Pawlet		Metals (iron & zinc) Pawlet landfill leachate	0.2 (I)	**Medium**/ Surface water sampling May 2011 still showing high metals number
Mettowee River	 Thermal Modification	Loss of riparian vegetation. Ag land uses, removal of riparian veg, streambank erosion	8.2 (S)	**Low** – thermal monitoring and assessment ID highest priority reaches for re-buffering.
Flower Brook		Loss of riparian vegetation		
Castleton River	 Invasive species	EWM - human transport of exotics then spread	(A) Downstream of Lake Bomoseen	
Discrete areas of lower Poultney River		WC - human transport of exotics then spread	(A)	Handpulling ongoing by TNC/ VTDEC
East Creek		WC - human transport of exotics then spread	3.0 (A)	Handpulling ongoing by TNC/ VTDEC
East Creek (South fork)		EWM - human transport of exotics then spread	2.2 (A)	Handpulling ongoing by TNC/ VTDEC
Whitney Creek		EWM/ WC - human transport	1.0 (A)	Handpulling ongoing by TNC/ VTDEC

Stream segment(s)	Stressor	Source(s)	Mileage (condition)	**Assessment Priority** / Assessment need
		of exotics then spread		
Hospital Creek		EWM/ WC - human transport of exotics then spread	0.5 (A)	Handpulling ongoing by TNC/ VTDEC
Indian River (below West Pawlet WWTF)	Non-erosion nutrients	Low D.O. - WWTF	(S)	**High**/ re-assessment prior to permit renewal/ re-licensing
Tributary 7 to Hubbardton River (below Benson WWTF)	Non-erosion nutrients	Low biological integrity	(S)	**Medium/** re-assessment prior to permit renewal/ re-licensing

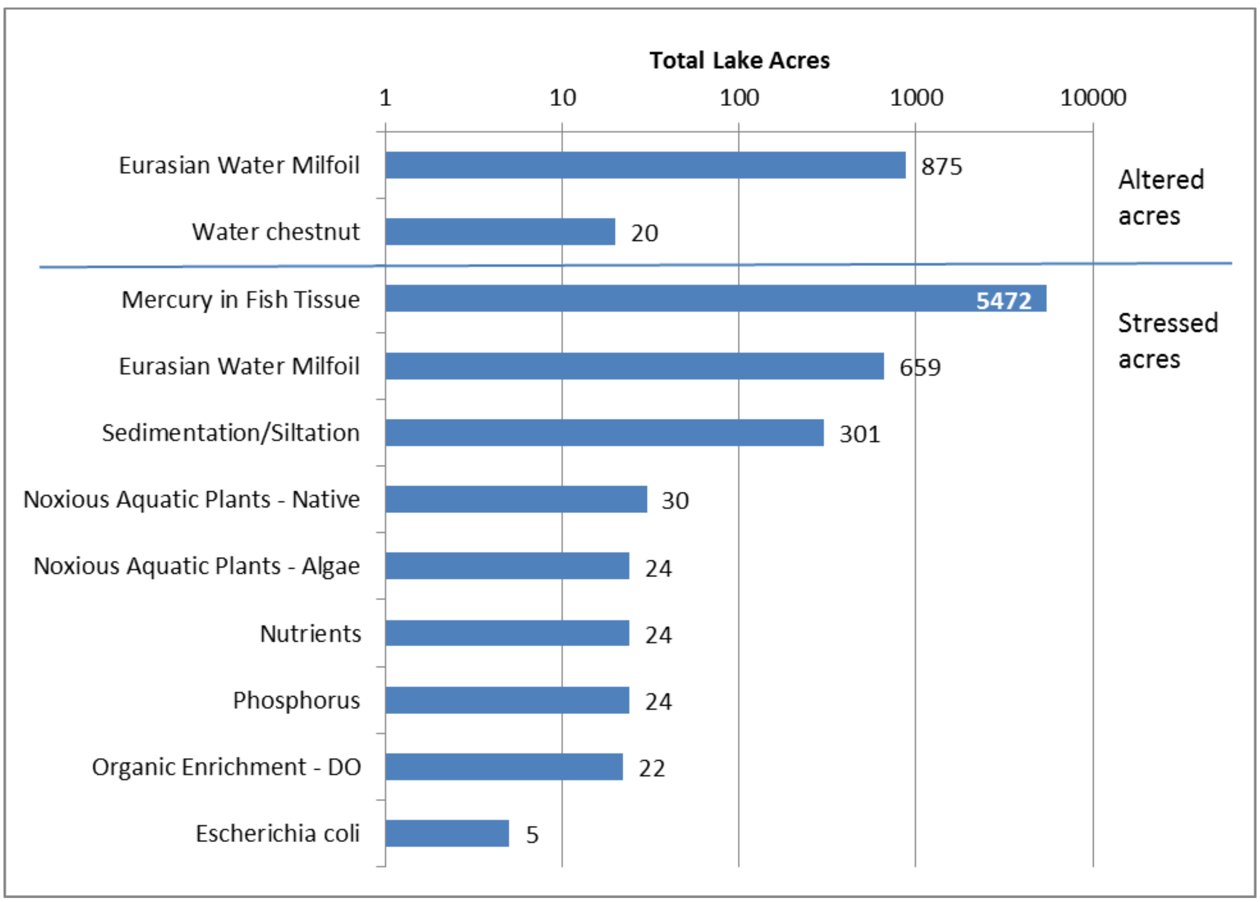


Figure 12. Pollutants or conditions that alter or stress water quality or habitat in Basin lakes and ponds.

" Altered" in this instance, refers to non-native invasive species present in densities sufficient to alter native biological communities. For example, overall plant density is classified as "moderate," indicating locally abundant (50% or greater coverage) growth, or "heavy," (75% or greater littoral cover overall) indicating growth in most shoreline areas.

Specific surface waters that need further assessment, and impaired waters in need of a TMDL or other Clean Water Act pollution control effort are shown in Table 8 above and the subwatershed-specific sections of this Plan.

The Lakes Scorecard

There are 31 lakes and ponds over 20 acres in size in the Southern Champlain Basin. Lake and pond water quality and habitat conditions are monitored through numerous WSMD programs including the Spring Phosphorus and Lake Assessment Programs and by the Lay Monitoring Program among others. While many fully lakes support the criteria of the VWQS, most lakes and ponds are affected by atmospheric deposition of pollutants from sources outside of Vermont, and several lakes and ponds exhibit high levels of fish mercury.

This lake-specific information is compiled by WSMD to create the Vermont Lake Score Card, which has been developed to convey a large amount of data gathered and analyzed through these monitoring efforts. The Score Card rates Vermont lakes in terms of water quality, invasive species, atmospheric deposition, and shoreland condition. Table 9 provides the current Scorecard and an assessment of individual lakes covered under the South Lake Champlain Tactical Basin Plan.

Table 9. Assessment of basin lakes and ponds from the Vermont Lakes Scorecard. The scoring methods are outlined in the document "Learn How lakes are Scored."

Lakes Score Card

(blue)	Good Conditions
(yellow)	Fair Conditions
(red)	Stressed or impaired Conditions
	Unassessed

Lake ID	Lake Area(acres)	Town	WQ Trend	WQ Status	AIS 2015	2015 Mercury	2015 Shoreland	Land Disturbance Index
AUSTIN	28	Hubbardton						1.21
BEEBE (HUBDTN)	111	Hubbardton						1.27
BILLINGS MARSH	56	West Haven		phosphorus				1.87
BLACK (HUBDTN)	20	Hubbardton						1.28
BOMOSEEN	2360	Castleton						1.48
BREESE	22	Hubbardton						1.46
BROOKSIDE	14	Orwell						2.13
BULLHEAD (BENSON)	7	Benson						1.02
BURR (SUDBRY)	85	Sudbury						1.37
BUTLER	3	Pittsford						1.41
CHOATE	11	Orwell						1.65
COGGMAN	20	West Haven		phosphorus				1.97
DOUGHTY	17	Orwell						1.08
ECHO (HUBDTN)	54	Hubbardton						1.21
FAIR HAVEN-W;	18	Fair Haven						1.76
FAN;	12	Wells						1.11
GLEN	206	Castleton						1.21
HALF MOON	23	Hubbardton						1.11
HIGH (HUBDTN)	3	Hubbardton						
HINKUM	60	Sudbury						1.02
HORTON;	15	Benson						
HORTONIA	479	Hubbardton						1.34
HOUGH	16	Sudbury						1.27
INMAN	85	Fair Haven						1.11
LILY (CASLTN)	9	Castleton						1.23
LILY (POULTY)	22	Poultney						1.58
LITTLE (WELLS)	162	Wells						1.57
LOVES MARSH	62	Castleton						1.74
MILL (BENSON)	39	Benson						1.85
MOSCOW	3	Hubbardton						
MUD (BENSON)	8	Benson						1.48
MUD (ORWELL)	10	Orwell						1.12
N.E. DEVELOPERS	27	Wells						1.98
OLD MARSH	131	Fair Haven						1.1
PERCH (BENSON)	24	Benson						1.13
PHILLIPS;	2	Benson						
PINE	40	Castleton						1.75
PINNACLE;	6	Wells						1.11
PRENTISS	2	Dorset						
QUARRY;	17	Castleton						1.84
ROACH	20	Hubbardton						1.19
ROOT	18	Benson						1.61
SHELDON;	2	Fair Haven						1.05
SPRUCE (ORWELL)	25	Orwell						1.12
ST. CATHERINE	904	Wells						1.58
SUNRISE	57	Benson						1.22
SUNSET (BENSON)	202	Benson						1.19

Table 10. Lakes and ponds that are Impaired (I), Altered (A), or Stressed (S) in the Southern Lake Champlain basin, along with current management approach

Lake	Stressor	Management intervention
St. Catherine (SA) Lily (Poultney, S), Beebe (S), Burr Pond (Sudbury, A) Hortonia (A)		Eurasian milfoil control employing coordinated chemical, harvesting, and handpulling approaches
Bomoseen (A) Coggman Pond (A) Mill Pond (Benson, A) Hinkum (S) Little (Wells, S) Parson's Mill Pond (S) Sunrise and Sunset (S) South Lake Champlain (A)	 Invasive species	Eurasian milfoil or water chestnut control employing non-chemical, approaches
Black Pond (Hubbardton A) Glen (A) Austin (A) Bullhead (S) Echo (S) Hough (S) Loves marsh (S) Prentiss (S)		Limited management Eurasian watermilfoil
Brookside (S) South Champlain (A) Lily (Poultney, S) Mill (Benson, S) Prentiss (S) Root (S)		Water chestnut
St. Catherine (S)		Alewife, no management
Bomoseen		Asian clam
South Champlain (S)		Zebra mussels
South Champlain		Spiny waterflea
Little (Wells, S)	 Land Erosion	-Experimental aeration-based control of rapid sediment accumulation. -Hydraulic dredging to remove excessive sediment accumulation on W. shore. -Shoreline management planning to mitigate sedimentation from shoreline development.

Lily (Poultney, S) Prentiss (S) South Champlain (I)	Nutrient	Phosphorus – South Lake Champlain is subject to the 2016 Phosphorus TMDL
Austin (S) Beebe (S) Billings Marsh (S) Black (S) Bomoseen (S) Breese (S) Burr (S) Butler (S) Choate (S) Coggman (S) Doughty (S) Echo (S) Fan (S) Glen (S) Halfmoon (S) High (S) Hinkum (S) Hortonia (S) Hough (S) Lily (Castltn, S) Lily (Poulty, S) Little (Wells, S) Loves Marsh (S) Mill (Benson, S) Mud (Benson, S) N.E. Developers (S) Old Marsh (S) Perch (Benson, S) Phillips (S) Pine (S) Pinnacle (S) Prentiss (S) Quarry (S) Roach (S) Root (S) Spruce (Orwell, S) St. Catherine (S) Sunrise (S) Sunset (S)	Mercury	
South Lake Champlain (I)	 Toxic substances (mercury)	Subject to the Northeast Regional Mercury TMDL (approved 2007).

Managing stormwater runoff

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

Stormwater runoff management is a major priority within the Southern Champlain Basin because of the chronic nutrient enrichment condition in the South Lake, which is a high priority for restoration and water quality attainment per the Lake Champlain Phosphorus TMDL. While most of the urbanized areas of the South Lake Champlain watershed occur in New York State (including the communities of Glens Falls, Lake George, and Queensbury), there are urban areas and rural road networks within the Vermont portion of the basin that contribute stormwater runoff. Unmitigated runoff results in channel erosion, land erosion, nutrient loading, and even thermal stress. Although the South Lake Basin in Vermont is predominantly rural, developed areas do exist (Castleton, Fair Haven, and Poultney, etc.) and are recommended for stormwater master planning. Actions listed in Table 12 will address the current data gaps related to stormwater runoff.

Given the history of stormwater issues in other watersheds (Winooski and Otter Creek); it is prudent that the issue be addressed pro-actively. Many of the stormwater issues associated with developed lands can be mitigated and prevented using Low Impact Development (LID) and Green Infrastructure (GI) systems and practices. These new design approaches strive to manage stormwater and pollutants by restoring and maintaining the natural hydrology of a watershed. Rather than funneling stormwater off site through pipes and infrastructure, these systems focus on infiltration, evapotranspiration, and storage as close to the source as possible. Typical practices include green roofs, rain gardens, cisterns, porous pavements, infiltration planters, buffer zones, and sustainable site design. These practices could go a long way towards preventing current and future stormwater problems.

Lake Bomoseen Stormwater Master Planning Project (PMNRCD, 2017)

In 2016, the Poultney Mettowee Natural Resources Conservation District (PMNRCD) was awarded Ecosystem Restoration Program funding to work with the Lake Bomoseen Association (LBA), and the Towns of Hubbardton and Castleton to develop a Stormwater Master Plan within the Lake Bomoseen Watershed. Lake Bomoseen drains to the Poultney River (via the Castleton River), which is one of the major tributaries to the South Lake of Lake Champlain.

The State of Vermont and local conservation partners are working together to identify high-priority projects to reduce the movement of phosphorus to waterbodies. These projects have many other beneficial effects, such as decreasing stormwater flows to streams and increasing resiliency to floods. Through the Lake Bomoseen Stormwater Master Plan, 48 potential projects were identified, 20 projects were ranked as high priority, and six projects were selected for conceptual designs. These projects were approved by the Lake Bomoseen Association and the Lake Bomoseen Water Quality Committee (LBWQC) and received support from the Castleton Planning Commission and the Castleton Select Board.

Residents living on the lake believe that phosphorus, sediment, and bacteria are creating water quality concerns. For example, since Tropical Storm Irene, the sediment flows via Sucker Brook have increased significantly. Resident Bill Wood measured 900 cubic yards of sediment deposition that has entered the lake through the brook since Irene (this is equivalent to 765-900 tons of soil, or 90 dump truck loads). The Lake Bomoseen Water Quality Committee reports that certain neighborhoods have a strong septic smell. The landowners cite eroding streambanks and trees from the riparian buffer that have fallen into the widening stream in the past few years, leaving a buffer with decreased functionality. Additionally, the back roads in this subwatershed are steep and parallel the streams, and the 'urban' areas can be dense, located adjacent to the lake, with unknown septic efficiency. The lakeshore areas currently lack green stormwater infrastructure.

Originally, the partners planned to focus on the Sucker Brook watershed, since they felt that there was clear documentation of an unusually high sediment load associated with that stream, however, the Lake Bomoseen Water Quality Committee identified seven additional stormwater, erosion, and septic projects in other parts of the lake, illustrating a need to expand the study to the entire lake.

This Stormwater Master Plan represents an extensive effort to identify, describe, and evaluate stormwater problem areas affecting Lake Bomoseen. Consultants provided a preliminary cost estimate and a site rating to aid the Poultney Mettowee Natural Resources Conservation District, the Lake Bomoseen Association and other stakeholders in planning and prioritizing restoration efforts. Many of the problem area descriptions (e.g., roadside ditches) will aid the Castleton Highway Department in proactively stabilizing and maintaining these features to avoid future stormwater problems. Several of the twenty projects that have been identified as high-priority projects and have been uploaded into DEC's Watershed Projects Database and are being prioritized for funding to move these projects towards implementation.

Managing Agricultural Runoff

Priority sub-watershed implementation plans have been developed by USDA-NRCS in Vermont to address the need for more effective practice implementation of conservation plans on agricultural lands in the Lake Champlain Basin. Past conservation practice implementation efforts have been broad in scope and have not resulted in any significant improvements in water quality. In response to the 2015 Lake Champlain Phosphorus TMDL Phase I Implementation Plan and due to the availability of increased NRCS funding for the next five years, NRCS in Vermont has decided to use a more strategic and focused process for conservation practice implementation. Under this new process NRCS is collaborating with multiple natural resource agencies and organizations, including 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. This information is being used by local NRCS staff and partners working in each watershed to identify and target specific farms and fields for further resource assessment and for the development of practice alternatives.

The McKenzie Brook Resource Assessment and Watershed Level Plan

The "McKenzie Brook Watershed" in Vermont is a composite of several subwatersheds in a portion of western Addison County. These sub watersheds drain directly into the South Lake segment of Lake Champlain and comprise one of the most intensive agricultural areas in Vermont. It is part of Lake Champlain Segment "A" which requires a 60% reduction in phosphorus loading from agricultural sources. Recently, the McKenzie Brook Watershed in Vermont has been targeted by NRCS and its partners for accelerated implementation of agricultural conservation practices over the next 5 years (see Appendix E. *Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed*, USDA-NRCS, 2017). NRCS technical and financial assistance as well as resources provided by partners will be directed to this watershed through the next several years.

To this end, DEC's Monitoring, Assessment and Planning Program initiated a water quality sampling effort in 2016 to complement on-going and rapidly expanding efforts to implement targeted, coordinated BMP installations in watershed farms (see more on this flow monitoring and nutrient loading analysis in Chapter 5). Figure 13 demonstrates the amount of phosphorus reduced each year through these efforts. The estimated amount of phosphorus reduction tripled compared with 2015 and exceeded the reduction goal established for 2016.

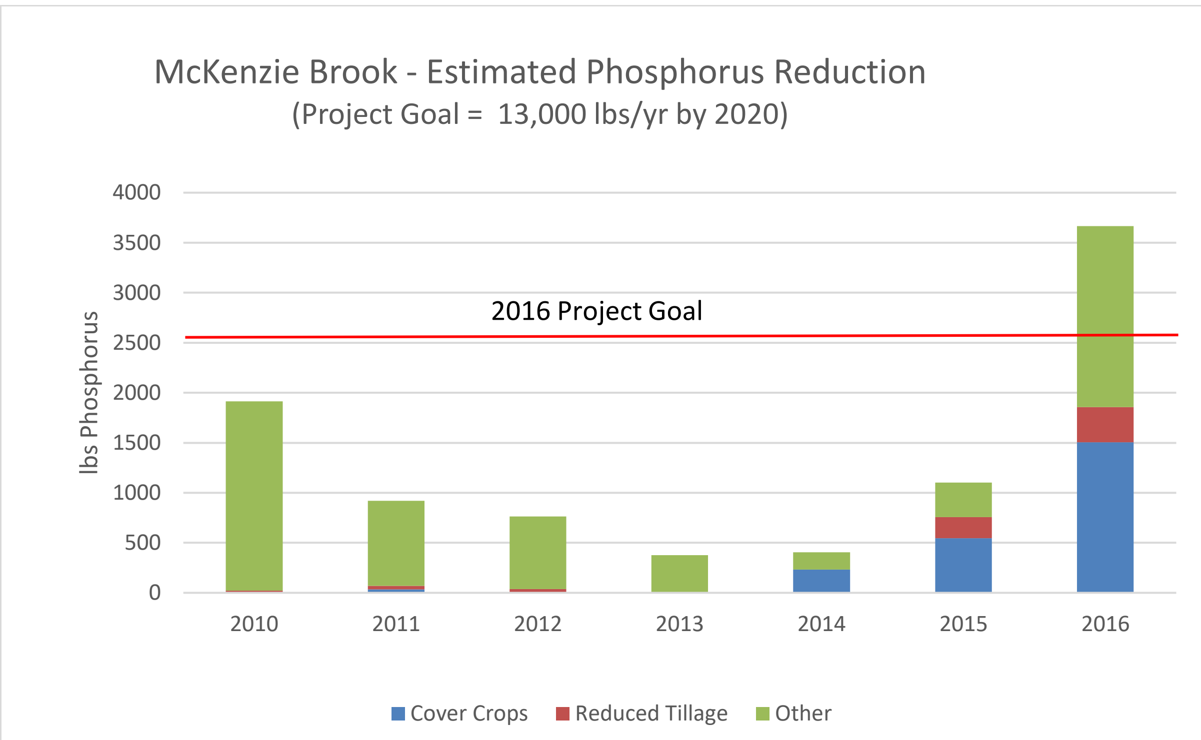


Figure 13. Progress made with accelerated rate of Ag BMP practice implementation in 2016.

Reducing the Spread of Aquatic Invasive Species

Aquatic invasive plants and animals have become a significant stressor to many waters of the state, and the South Lake Champlain Basin is certainly no exception. There are several waterbodies affected by at least one exotic pest, and management of those infestations to mitigate their social and ecological effects is an ongoing effort. Because many of these species are impossible to eradicate once they have become established in a waterbody, VTDEC's primary focus is to prevent further spread to new waters.

There are dozens of lakes and ponds, and many river miles, impacted by invasive species in the Basin, making it the most affected region in Vermont. Some of these infestations, including Eurasian watermilfoil populations in Lake Bomoseen and Lake Saint Catherine, are managed through mechanical means to minimize their impacts on recreational uses. Many others are not controlled with any form of active management. VTDEC continues to prioritize spread prevention efforts in the Basin – those aimed at protecting uninfested waters. To that end, VTDEC continues to support Public Access Greeter Programs in the Basin, and works to expand the number of waters covered under the program. In addition, consistent messaging about invasive species and methods to prevent their spread is also a focus. VTDEC strives to maintain up-to-date signage at all access locations, and provides outreach materials to bait shops, boat dealers, and other businesses.

The Importance of Basin Planning in the Face of Tropical Storm Irene

On August 28, 2011, Tropical Storm Irene struck the central and southern portions of the State with over 10 inches of rain in many locations. The Southern Lake Champlain river basins experienced flood damage during Tropical Storm Irene in 2011, including localized damage to major roads and bridges along significant sub-basins, especially within the southern portion of the Mettowee River Basin in Bennington and Rutland Counties.

The Castleton and Mettowee River Basins sustained flood damage in some areas due to erosion and flood inundation. This damaged or destroyed roads, bridges, culverts, private and public property, and farmland. This Plan will emphasize actions that will assist watershed residents and towns to remediate Irene's impacts and enhance the flood resilience of the Basin against future flood events.

Amidst the devastation, many opportunities were created by Irene for the enhancement of resiliency, with limited funding for restoration of these areas. Given the need for protection of critical flood attenuation assets and new pollution control fixes for non-flood related problems, Basin Planning emerges as a critical prioritization tool for Vermont's restoration and resiliency efforts. In recognition of this, VTDEC planners and river scientists have engaged in a collaborative process with Regional Planning Commissions and Natural Resource Conservation Districts to map critical infrastructure damage, and prioritize restoration.

Chapter 3 - Regulatory Programs for Addressing Stressors and Pollutants under the Lake Champlain Basin Phosphorus TMDL Implementation Plan

Regulatory programs play a significant role in ensuring that pollutants and stressors responsible for degraded water quality are addressed. The Vermont Agency of Natural Resources' (VANR) and the Agency of Agricultural, Food and Markets' regulatory programs that are associated with water resource protection are described Vermont Surface Water Management Strategy - Appendix A .

The passing of Act 64 in 2015, resulted in the creation of the State's Clean Water Initiative Program (CWIP). The CWIP has provided additional resources and direction to the Tactical Basin planning process for Basin 2-4 with regard to sediment and phosphorus reduction. The goal of this Initiative is to satisfy the State's legal obligations under both the Vermont Clean Water Act and the federal Clean Water Act. The priorities to achieve this goal include:

1. Implementing agricultural best management practices
2. Reducing and treating stormwater runoff and erosion from developed lands
3. Installing pollution controls on state and municipal roads
4. Restoring and protecting natural infrastructure for flood resiliency and water quality improvements
5. Increasing investments in municipal wastewater treatment infrastructure
6. Expanding sector based assessments that identify priority projects

The CWIP also strengthens the relationship between VANR and the Regional Planning Commissions, Vermont League of Cities and Towns, and municipalities to strategically identify projects for the Tactical Basin Plans to address the above priorities.

The regulatory processes that will support the priorities include the development of the following permits or regulations:

Regulatory Program or Permit	Application	Issuance Date	Regulated Community
Required Agricultural Practices (RAPs)	Adopt and implement a set of minimum conservation practices to protect water quality	2016	Agricultural operations
Municipal Roads General Permit (MRGP)	Inventory and control stormwater discharges from municipal roads	2017	Municipalities

Regulatory Program or Permit	Application	Issuance Date	Regulated Community
Municipal Separate Sewer System (MS4) General Permit	Restore stormwater-impaired streams	2017 (Re-issuance)	12 MS4 communities
Operational Three-Acre Permit	Inventory and control stormwater discharges on sites where impervious surfaces exceed 3 acres	2017	Municipalities and Private Land Owners
Transportation Separate Storm Sewer System (TS4) Permit	Inventory and control stormwater discharges from the transportation network and associated transportation facilities	2016	State transportation

See VDEC's Clean Water Initiative webpage for additional information, including timing for permit enactment. The new as well as existing regulations will be an important tool for ensuring that Vermont water quality standards are met. While the implementation table of this plan includes numerous actions that will be implemented on a voluntary basis, actions will also help to facilitate adoption of permit requirements and provide municipalities and landowners with incentives to develop and implement required management plans under the new permits.

Lake Champlain Phosphorus TMDL

The Basics

A total maximum daily load or TMDL is the amount of a pollutant a waterbody can safely absorb and still meet water quality standards. The maximum pollutant load is divided among the various pollutant sources and locations. In the case of Lake Champlain, there are proposed TMDLs outlining the phosphorus reductions for each of the twelve lake segments required to restore the Lake and meet Vermont's Water Quality Standards. The South Lake Basin inputs into the South Lake Champlain segments (A, B, and Port Henry).

In 2002, the U.S. Environmental Protection Agency (EPA) approved a Lake Champlain Phosphorus TMDL that was prepared by the States of Vermont and New York. In 2011, the EPA concluded that two elements of the TMDL did not comply with EPA regulations and guidance, and thus their approval of the 2002 TMDL was withdrawn. The EPA approved the Vermont Lake Champlain Phosphorus TMDL Phase 1 Implementation Plan in September 2016 and the State of Vermont is finalizing a new aggressive restoration plan for Lake Champlain and its tributaries. The approved proposal addresses all major sources of phosphorus to Lake Champlain and involve new and increased efforts from nearly every sector of society, including state government, municipalities, farmers, developers, and homeowners.

Phosphorus in the Lake comes primarily from nonpoint sources (Figure 16). Nonpoint sources deliver phosphorus from the land to our waterways by rain or snowmelt. Nonpoint sources of phosphorus come from roads, parking lots, lawns, agricultural and logging operations, and eroding stream channels. Point source discharges of phosphorus include regulated stormwater discharges and sewage treatment plants.

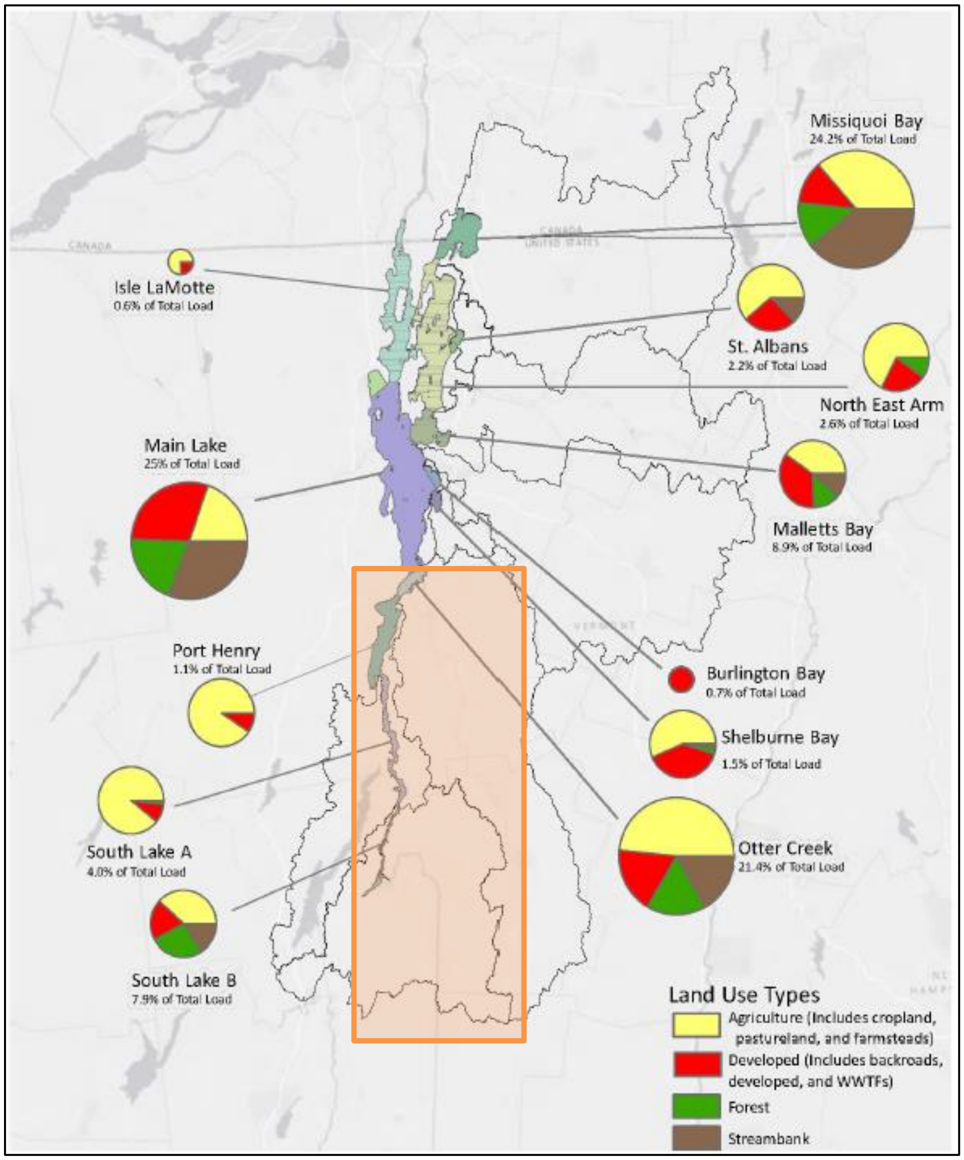


Figure 14. Vermont sources of phosphorus loading to Lake Champlain segments, by land use; annual average of 2001-2010.
The South Lake Champlain Basin is highlighted in the orange box.

Source: US Environmental Protection Agency, 2016.

Measuring the phosphorus content of water that comes out of a pipe (point source) is less complicated than measuring phosphorus content of water flowing over land surfaces (non-point source). As a result, determining phosphorus loading of non-point sources requires environmental modeling based on long-term field measurements and land use information from satellite imagery and LiDAR data. More information on how phosphorus loading was projected in the Lake Champlain Basin can be found in Chapter 5 of the [Phosphorus TMDLs for Vermont Segments of Lake Champlain](#).

Phosphorus pollution in the South Lake Basin ultimately ends up in Lake Champlain, but the sources of pollution by land use type are slightly different within the South Lake Basin compared to the entire Lake Champlain watershed (Figures 2 & 3).

Agricultural lands are the largest source of phosphorus to the South Lake Basin followed by forest lands, developed lands, river channel instability (which includes eroding and non-eroding banks), unpaved roads, and wastewater treatment facilities. The percent reductions required for certain sectors in the South Lake "B" segment are significantly higher than South lake "A" and the Port Henry segments as there is a much greater percentage of forest lands and river channel instability in the Poultney Mettowee River basins. Conversely, there is a much greater percentage of phosphorus loading occurring from agricultural lands in the South Lake "A" and Port Henry segments.

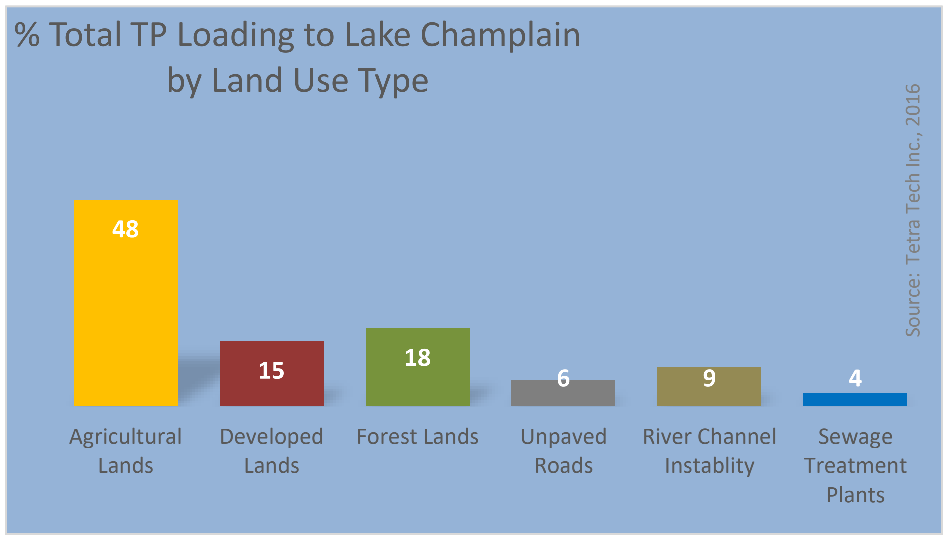


Figure 15. Sources of phosphorus in Lake Champlain by land

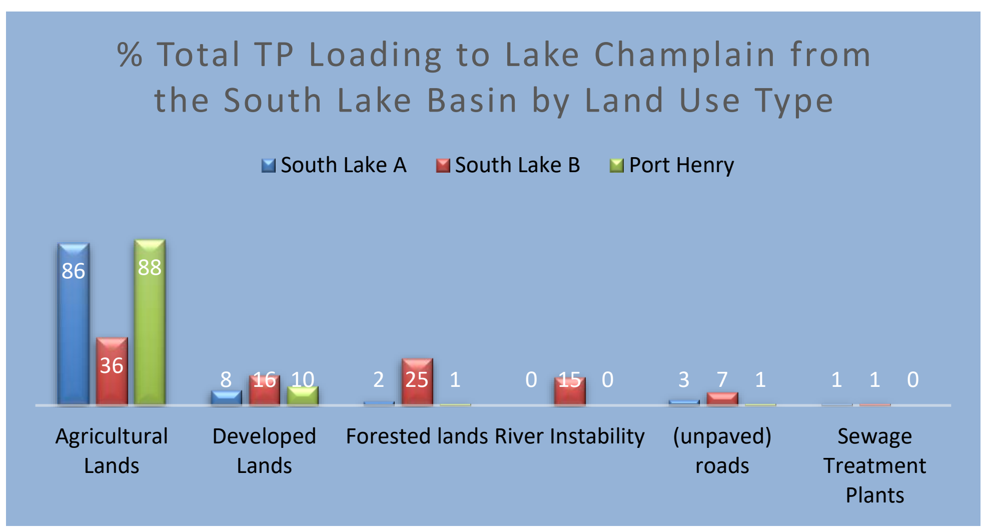


Figure 16. Sources of phosphorus from the South Lake Basin in Lake Champlain by land use type.

Understanding the relationship between phosphorus and land use is important because phosphorus pollution is a significant threat to clean water in the South Lake Basin and Lake Champlain, which are both important for recreational and drinking water uses, as

well as aquatic life and habitat function. Addressing phosphorus pollution through actions on the landscape will also lead to reductions in other pollutants in the watershed.

Investments in a clean Lake Champlain will support local and regional economies, enhance tourism and recreation-based businesses, support property values, help local communities reduce future flood damage risk, support the viability of public infrastructure, and improve the ecological functions within the watershed.

The South Lake Basin Tactical Basin Plan will report actions to reduce phosphorus loading per land use type in sub-watersheds and catchments within the basin. However, the reduction of phosphorus to Lake Champlain could take decades in some areas. Accomplishing all the necessary phosphorus reduction actions on the land that drains to the Lake will require many phases of action. Progress will be tracked incrementally through internal tracking systems and a portion of the progress will be tracked in the tactical basin plan implementation table database, which is an electronic extension of the implementation tables included in past tactical basin plans.

The South Lake Champlain Basin and the Lake Champlain Phosphorus TMDL

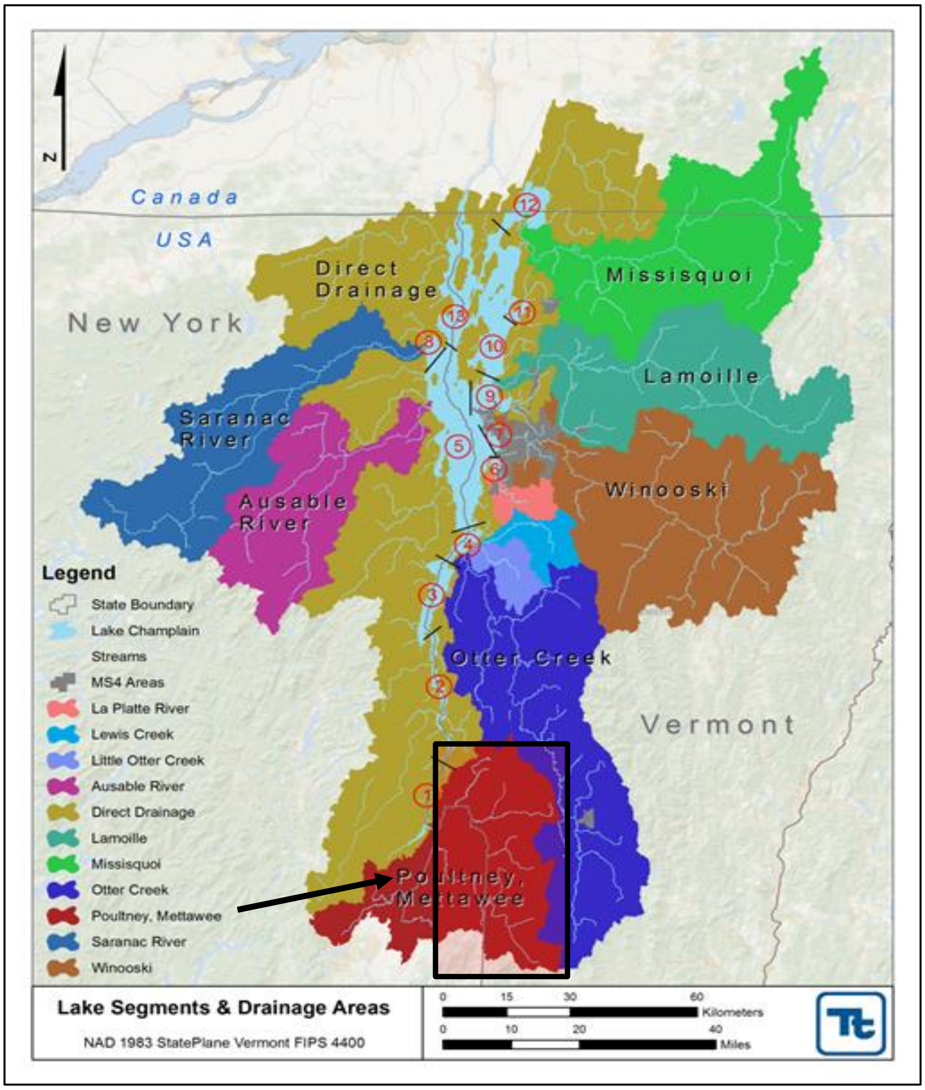


Figure 17. Lake segments and drainage areas of the Lake

As discussed in the previous chapter, the Poultney and Mettowee Rivers drains into the South Lake "B" segment of Lake Champlain, which then flows north (Figure 17). The South Lake "B" segment (number 1 in Figure 17) are fed by those two larger rivers and several direct drainages flow into South Lake "A" and the Port Henry segments (numbers 2 and 3 in Figure 17). These drainages include: East Creek (Orwell), Stoney Creek, Braisted Brook, Whitney and Hospital Creeks in Addison County. The latter drainages are part of Basin 4 or the Lower Lake Champlain Direct tributaries.

Vermont contributes about 69 percent (630.6 MT/yr) of the total phosphorus load per year to Lake Champlain in comparison to Quebec at 9 percent (77 MT/yr) and New York at 23 percent (213.8 MT/yr). On average, the Vermont portion of the South Lake receives approximately 13 percent (84.6 MT/yr) of the total load to Lake Champlain compared to the Otter Creek, which receives about 21. 4 percent (141 MT/yr) of the total load and Shelburne Bay, which receives about 1.5 percent (10.2 MT/yr) of the total load[4].

Total annual total phosphorus (TP) loading varies from year to year based on flow and on-going land use. Compared to the ten major watershed contributors shown in Figure 5, the Poultney and Mettowee River basins are Vermont's sixth and seventh highest contributors of phosphorus into Lake Champlain after the Winooski, Missisquoi, Pike,

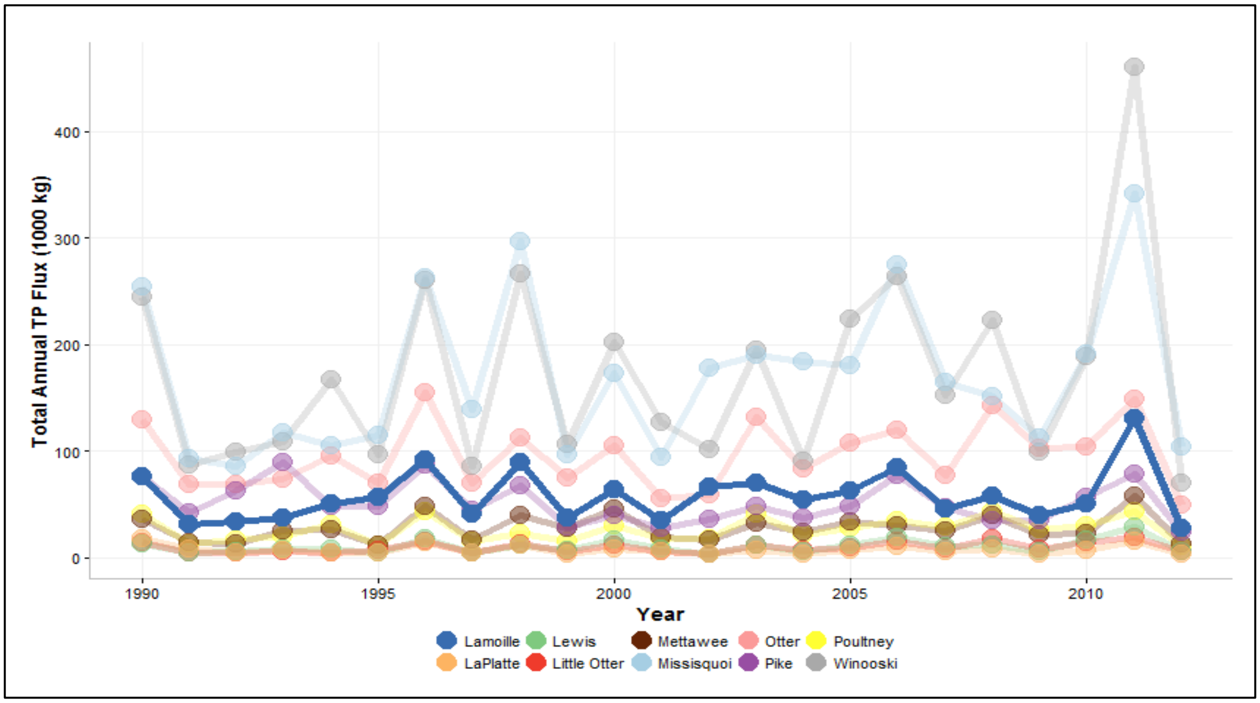


Figure 18. Total annual total phosphorus contributions to Lake Champlain from 1990 to 2012 by the ten-major watershed's in the Lake Champlain basin. The Poultney is in

Otter Creek and Lamoille River basins.

In order to meet the Lake Champlain Phosphorus TMDL expectations, total annual TP loading into the South Lake is required to be decreased by approximately 47 percent (averaged across all sectors) or by approximately 40 MT/yr. The following sections will address how these requirements will be met across all sectors within the South Lake Basin including regulatory and non-regulatory actions.

[4] This information is based on tables in the June 17, 2016 Phosphorus TMDLs for Vermont Segments of Lake Champlain by the U.S. Environmental Protection Agency.

Lake Champlain Phosphorus TMDL Phase II Plan

The Lake Champlain Phosphorus Total Maximum Daily Load (LC TMDL) establishes the allowable phosphorus loadings, or allocations, from the watershed for the lake water quality to meet established standards. These allocations represent phosphorus loading reductions that are apportioned both by land use sector (developed land, agriculture, etc.) and by lake watershed basin (South Lake, Otter Creek, etc.). Due to the large size of the Lake Champlain watershed in Vermont, the modeling techniques used to estimate loading were implemented at a coarse scale. For example, the modeled loading at the mouth of the major river basins is based on monitoring data and represents the collective inputs from the various land uses and physical features of the watershed. On the whole, this is useful to estimate the necessary level of phosphorus reducing Best Management Practices (BMPs). However, when looking at smaller scale areas such as a municipality, a particular farm or a local road network, it's necessary to complete a detailed on-the-ground analysis to determine appropriate actions for the particular area.

As part of the LC TMDL development, EPA developed a "Reasonable Assurance" analysis at the major-basin scale to determine if it was theoretically possible to obtain to necessary phosphorus reductions. By using modeling results for the entire Champlain Basin, the TMDL was able to show that through a concerted effort across all phosphorus sources, it appeared possible to reach the lake loading targets with appropriate application of BMPs. However, since this exercise was conducted at the major-basin scale, there is no specific prescription as to where BMPs should be applied. It is through the development of the Tactical Basin Plans that more precise opportunities for BMPs can be identified and prioritized for implementation.

The LC TMDL will be implemented through a series of permit programs as well as identification of site specific BMPs outside the scope of specific programs, many guided by the content of the Tactical Basin Plans. While many programs will be "self-implementing", in many instances, application will proceed in a two-step process of first knowing "where to look" for opportunities followed secondly by "what to do". Many of the phosphorus reduction programs require an initial "assessment" phase to identify what BMPs may already exist on the landscape and where others need to be placed. In some instances, the Tactical Basin Plans can aid prioritization areas of "where to look" first such as expected high phosphorus producing areas. After the assessment phase, BMP implementation can be prioritized and carried forward. Additionally, the Tactical Basin Plans can identify known beneficial projects, the "what to do", prioritize them for funding so that implementation can be expedited, and also tracked transparently.

The LC TMDL also incorporates an "Accountability Framework" that aims to ensure that phosphorus reduction actions are being implemented at a sufficient pace to see results in the lake. While the specific timeline for lake improvement isn't specified by the TMDL, an estimate of the predicted phosphorus reduction needs to be identified within each Tactical Basin Plan on a 5-year rotating basis. Estimating the potential phosphorus reductions expected from site specific actions is one way of determining if the level of effort is sufficient compared to the overall TMDL goals. This portion of the Tactical Basin Plan attempts to provide that estimate of phosphorus reduction reasonably expected from actions taken in specific areas across the basin, specific to source types and regulatory program.

In conjunction with Tactical Basin Planning is a project implementation tracking system that VTDEC is also developing. This system intends to track implementation of projects across all sectors and apply an expected phosphorus reduction estimate to each. Over time, as projects are continually implemented, a more precise estimate of cumulative **actual** phosphorus reductions can be reported rather than relying on estimates of **potential** actions.

Several useful modeling products were used to spatially represent where LC TMDL reductions will be most effectively targeted to implement the TMDL. The underlying data from which many of the following analyses originate is the EPA SWAT model (Soil and Water Assessment Tool). This model was developed to estimate phosphorus loading from the Lake Champlain watershed from various land use sectors for development of the TMDL. Discrete SWAT models were calibrated and validated for each of the Hydrologic Unit Code – level 8 (HUC8) watersheds as well as for direct drainages to the lake. Three additional tools were developed from the SWAT modeling results: the HUC – level 12 (HUC12) Tool, the BMP Scenario Tool, and the Clean Water Roadmap which downscales the SWAT modeling from the HUC12 scale to the catchment level. In the analyses that follow, varying geographic scales are used, depending on the source sector; Figure TMDL1 displays these geographic scales. In order of decreasing size, they are the HUC8, HUC12, and catchment scales.

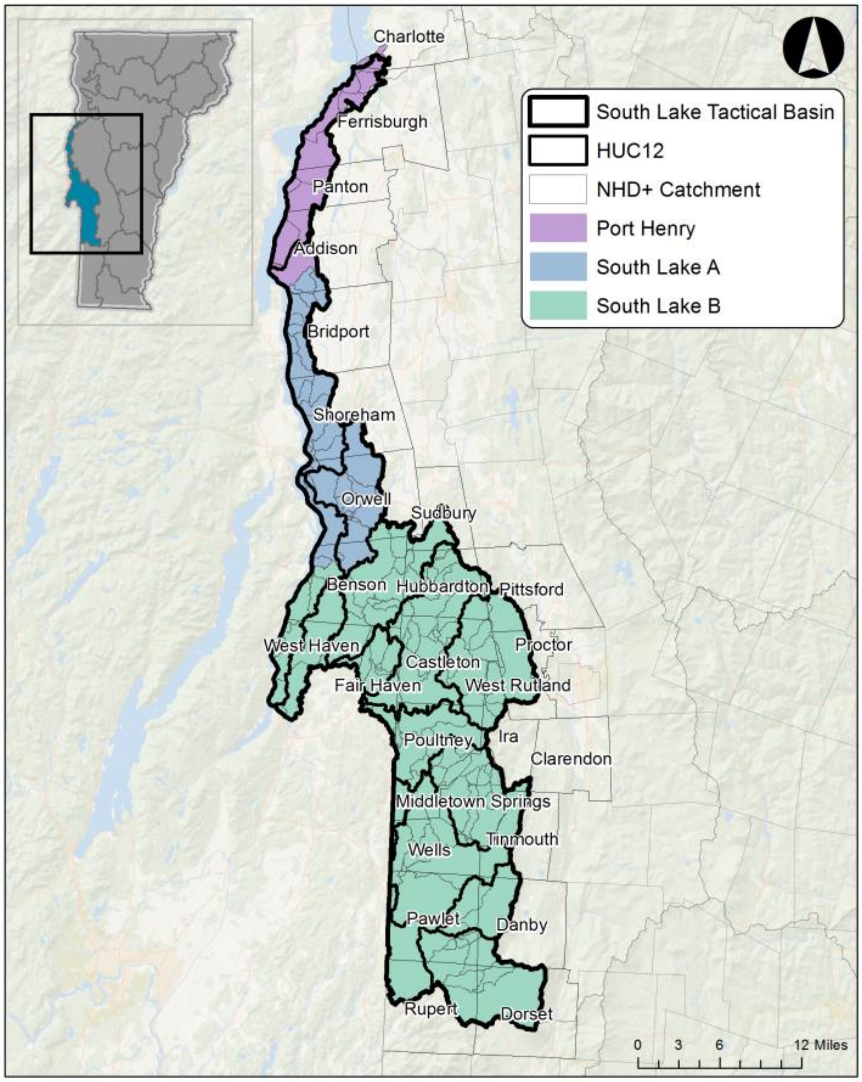


Figure TMDL1. Comparison of HUC8, HUC12, and catchment watershed scales in the South Lake Basin.

HUC12 Tool

The HUC12 Tool (Figure TMDL2) is a Microsoft Excel spreadsheet that displays SWAT estimates of total phosphorus (TP) loading at a HUC12 scale for each lake segment. TP loading estimates (kg/yr) in the HUC12 Tool are summarized by general land use category for each HUC12 in a lake segment basin (Table TMDL1). In addition, detailed annual load (kg/yr) and areal loading rate (kg/ha/yr) estimates can be displayed by land use for each HUC12 watershed. This more detailed information includes the minimum, maximum, mean, median, 25th percentile, and 75th percentile loading rates per hectare for each land use category. In this way, TP loading magnitudes can be compared across all HUC12 watersheds in a lake segment basin as well as different land use categories within a HUC12.

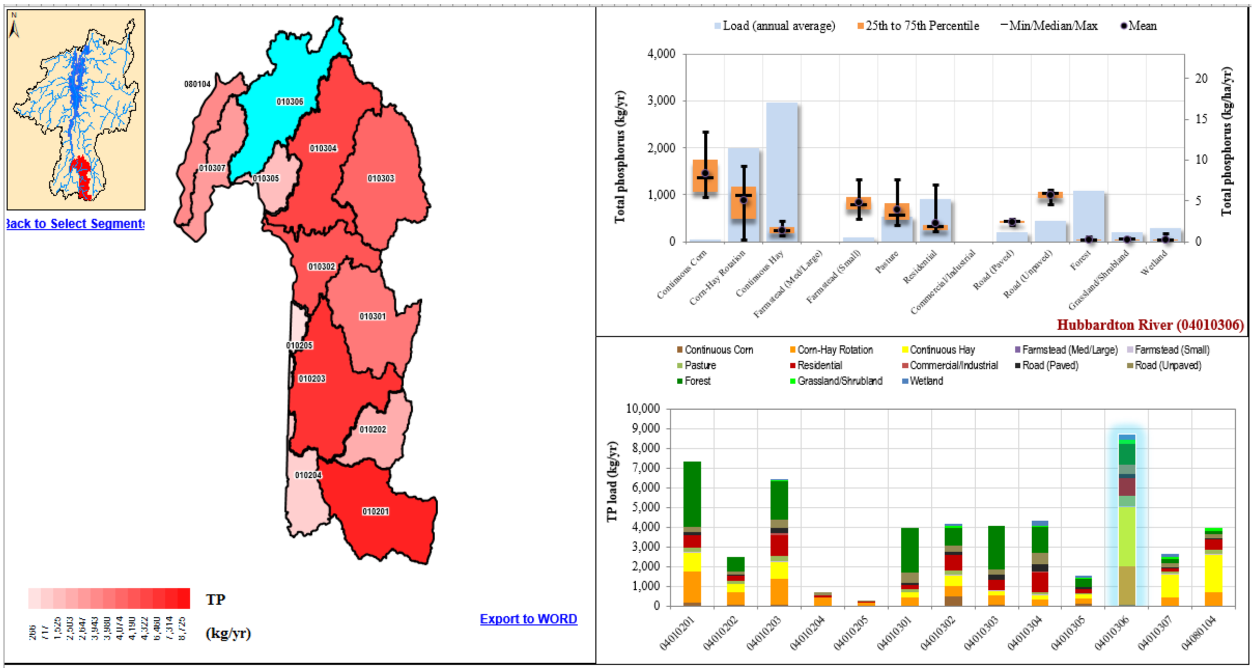


Figure TMDL2. Screenshot of HUC12 Tool display for South Lake "B" lake segment.

The Hubbardton River HUC12 is highlighted.

Table TMDL1. General land use categories in the HUC12 Tool.

HUC12 Tool Land Use Categories	
Continuous Corn	Residential
Corn-Hay Rotation	Commercial/Industrial
Continuous Hay	Road (Paved)
Farmstead (Med/Large)	Road (Unpaved)
Farmstead (Small)	Forest
Pasture	Wetland

BMP Scenario Tool

This Microsoft Excel based tool allows users to apply BMP scenarios at the lake segment basin scale to evaluate the phosphorus load reduction potential of various management actions. The Scenario Tool uses SWAT model results and estimates of BMP efficiencies to answer questions such as: what is the expected phosphorus reduction if this BMP is applied to 60% of the applicable area in a lake segment basin? BMP suitability in a basin is based on SWAT model inputs such as land use, soil type, and slope. Multiple

BMPs can be 'applied' in a basin, and BMP scenarios can be evaluated for a range of loading sources: developed lands, forests, agricultural lands, unpaved roads, and streambank erosion. This functionality allows users to evaluate whether a specific management plan has the potential to meet the TMDL loading targets for Lake Champlain. Stored scenarios can be compared and contrasted with tabular and visual summaries. The tool also contains extensive summary tables and figures of TMDL targets and existing source loads.

Clean Water Roadmap Tool

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

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

What follows below - through a series of discussion, tables, and graphics - is an expression of the TMDL reductions required in as site-specific manner as currently possible. Many of these expressions rely on modeled information that are limited by certain spatial extents even though some sector analyses may be more developed based on the currently available data. Because of this, the summing of loading results across different sectors may not "add up" to overall basin loading estimates but are sufficient for planning-level analyses. In some instances, this information will aid the "where to look" aspect of planning while other instances provide the "what to do". Over time, additional assessment information will more accurately inform the identification of BMP opportunities and it is the goal of the Tactical Basin Plans to present the most up-to-date information available to facilitate implementing the LC TMDL.

TMDL allocations for the South Lake (A and B) and Port Henry segment of Lake Champlain

Table TMDL2 below provides the final phosphorus allocations and the resulting reductions required for the South Lake segments of Lake Champlain. These values are taken directly from the final LC TMDL and the Phase I Implementation Plan (2015). For the South Lake "B" segment, where the achievement of the total loading capacity will be extremely challenging, EPA's Scenario Tool indicated that the maximum amount of BMP implementation possible within the watersheds will be necessary to meet the total loading capacity (in combination with applicable WLAs). Therefore, EPA set the allocations based on phosphorus reductions simulated to result when a very extensive suite of management practices are implemented within each sector. For South Lake B, where the largest overall reduction is needed (relative to the other two lake segments), the allocations reflect a 47% reduction from streambanks, a 40% reduction from forest lands, and a 63% reduction from agricultural sources.

Table TMDL2. Summary table of allocations for the South Lake (A and B) and Port Henry segments of Lake Champlain.

Source	Category	Allocation category	Total allocation (MT/yr.)	% reduction required for basin (South Lake A-B)	% reduction required for basin (Port Henry)	Analysis*
Forest	All lands	Load	**SL-A** = 0.5 **SL-B** = 13.6 **PH** = 0.4	**SL-A** = 5 **SL-B** = 40	5	Figure LA-1 Tables LA-1, 2
Stream Channels	All streams	Load	**SL-A** = 0 **SL-B** = 8.3 **PH** =0	**SL-B** = 46.7	---	---
Agriculture**	Fields/pastures	Load	**SL-A** = 18.6 **SL-B** = 22.1 **PH** = 5.7	**SL-A** = 62.9 **SL-B** = 62.9	62.9	Figures LA-2, 3 Tables LA-3, 4, 5
	Production Areas	Wasteload	**SL-A** = 0.4 **SL-B** = 0.43 **PH** = 0.05	**SL-A** = 80 **SL-B** = 80	80	Tables WLA-1, 2
Developed Land	Summary		**SL-A** = 2.3 **SL-B** = 9	**SL-A** = 18.1	7.6	Tables WLA-3, 4, 5, 6

			PH =0.7	**SL-B** = 21.1		Figures WLA-1, 2
	VTrans owned roads and developed lands	Wasteload		---		Figure WLA-3 Table WLA-7
	Roads MRGP	Wasteload		---		Figure WLA-4 Tables WLA-8, 9
	MS4	Wasteload		---		Table WLA-10
	Larger unregulated parcels	Wasteload		---		Table WLA-11
Wastewater	WWTF discharges	Wasteload	**SL-A** = 0.1 **SL-B** = 0.6 **PH** = 0	0	0	Table WLA-12
	CSO discharges	Wasteload	**SL-A** = 0 **SL-B** = 0 **PH** =0	0		NA

* **The "Analysis" column identifies more detailed sector-specific analyses found later in this section.**

**** Additional agricultural source load reduction percentages were applied equally to the South Lake B and South Lake A watersheds since both watersheds have common characteristics and influence the loads that would achieve the phosphorus criterion in the South Lake A segment.**

Figure TMDL3 below illustrates the required level of TP reductions identified in the above table at the the catchment-scale. The transition from blue to red indicates a greater level of TP reduction across all catchments, as prescribed for all land use sectors across the basin. For example, for any given catchment, the TMDL reduction percentage is applied to each appropriate land use sector, based on the TMDL reductions required for that sector (Table TMDL2, above). Then, all reductions are summed for the catchment and displayed on a relative loading scale. It should be noted that this representation treats all lands in each land use sector equally in its required reduction, which therefore gives a relative sense of the magnitude of potential opportunities for phosphorus reduction.

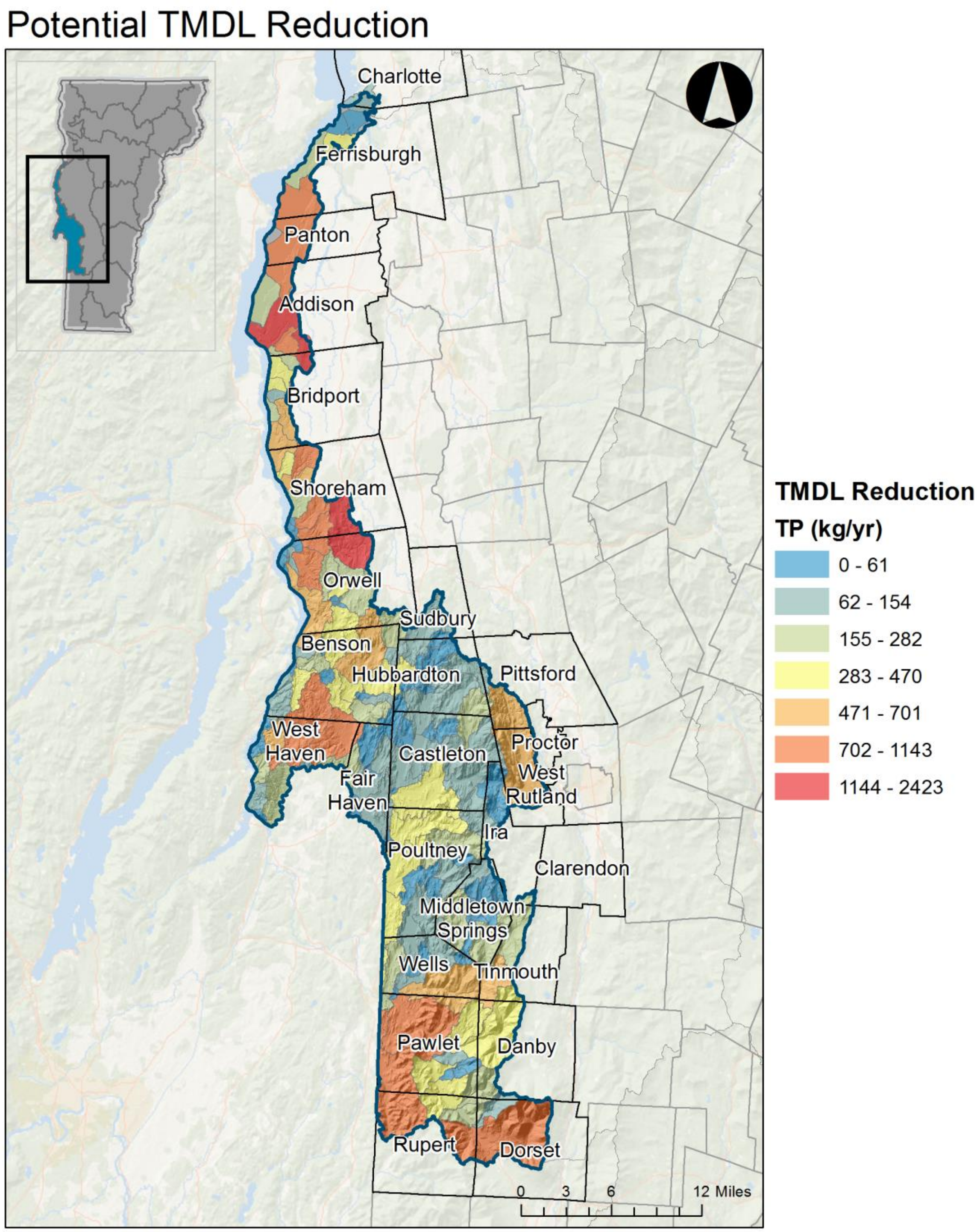


Figure TMDL3. The necessary TP reductions specified by the TMDL if applied uniformly across the entire South Lake Basin (including the Port Henry segment), at the catchment scale.

Within the basin, the top 20 catchments with the greatest overall identified TP reductions are identified in Table TMDL3. The catchments are located by the primary town they occur in and primary waterbody they discharge to. The total TMDL reduction is broken down by each land use sector. If the total required LC TMDL reductions were applied to these top 20 catchments, which make up ~10% of the total number of catchments, then 53% of the overall needed basin reduction would be realized. For context, there are 198 total individual catchments in the South Lake Basin.

Table TMDL3. Catchments with the highest TP export by land use.

Catchment ID	Town Name	Primary Receiving Waterbody	Ag Reduction (kg/yr)	Developed Land Reduction (kg/yr)	Farmstead Reduction (kg/yr)	Forest Reduction (kg/yr)	Potential TP Reduction (kg/yr)
10312606	Orwell	East Creek	2330	49	42	2	2423
10311408	Addison	McKenzie Brook-Lake Champlain	2150	11	30	1	2192
10311370	Bridport	McKenzie Brook-Lake Champlain	1891	9	4	0	1905
10313592	Dorset	Headwaters Mettawee River	486	90	4	562	1143
10312278	Shoreham	McKenzie Brook-Lake Champlain	1061	10	1	0	1073
10312294	Shoreham	McKenzie Brook-Lake Champlain	1034	19	11	1	1065
10312708	Orwell	East Creek	1026	9	12	1	1048
10311380	Ferrisburgh	Hoisington Brook-Lake Champlain	968	18	5	1	992
10312670	West Haven	Poultney River-Head of Lake Champlain	851	51	15	69	986
10311384	Panton	Hoisington Brook-Lake Champlain	944	11	12	1	967
10312416	West Haven	Hubbardton River	850	45	9	38	942
10313588	Rupert	Indian River	670	65	19	166	921
10313558	Pawlet	Wells Brook-Mettawee River	646	67	17	148	877
10311402	Addison	McKenzie Brook-Lake Champlain	855	6	10	0	872
10312608	Shoreham	McKenzie Brook-Lake Champlain	806	20	8	0	835
4578882	Charlotte	Hoisington Brook-Lake Champlain	778	16	13	3	811
10312266	Bridport	McKenzie Brook-Lake Champlain	694	6	0	1	701
4578822	Charlotte	Hoisington Brook-Lake	673	9	12	1	695

Catchment ID	Town Name	Primary Receiving Waterbody	Ag Reduction (kg/yr)	Developed Land Reduction (kg/yr)	Farmstead Reduction (kg/yr)	Forest Reduction (kg/yr)	Potential TP Reduction (kg/yr)
		Champlain					
10313548	Wells	Wells Brook-Mettawee River	409	71	6	177	663
10314366	Orwell	Charter Brook-Lake Champlain	590	31	21	4	646
	Percent of total TP reduction if all sector allocations are applied to these catchments *represent approximately half of the target load reduction needed to meet allocations						**53%***

Limiting Phosphorus Losses from Managed Forest

Vermont adopted rules in 1987 for Acceptable Management Practices (AMPs) for Maintaining Water Quality on Logging Jobs in Vermont. The AMPs are intended and designed to prevent any mud, petroleum products and woody debris (logging slash) from entering the waters of the State and to otherwise minimize the risks to water quality. The AMPs are scientifically proven methods for loggers and landowners to follow for maintaining water quality and minimizing erosion.

The Vermont Department of Forests, Parks, and Recreation (FPR) updated the AMPs effective as of October, 22, 2016. Key modifications include:

- Require compliance with standards set forth in the VVTDECStream Alteration General Permit for actions including the installation and sizing of permanent stream crossing structures on perennial streams.
- Strengthen standards pertaining to temporary stream crossing practices on logging operations. The proposed standards include:
    - Better management of ditch water on approaches to stream crossings. The proposal is to prohibit drainage ditches along truck roads from terminating directly into streams and to specify a minimum distance for installing turn-outs. Drainage ditches approaching stream crossings must be turned out into the buffer strip a minimum of 25 feet away from the stream channel, as measured from the top of the bank.
    - Better management of surface water runoff from skid trails, truck roads and temporary stream crossings on logging operations. The proposal is to prevent surface runoff from entering the stream at stream crossings from skid trails and truck roads and to specify a minimum distance for installing surface water diversion practices, such as drainage dips. Surface

runoff is to be diverted into the buffer strip at a minimum distance of 25 feet from the stream channel, as measured from the top of the bank.

  - Better management of stream crossings after logging. The proposal is to prevent erosion and to specify a minimum distance from the stream for diverting runoff. Upon removal of the temporary stream crossing structures, the site is to contain water bars 25 feet from the stream channel on downhill approaches to the stream crossing to divert runoff into the buffer to capture sediment before entering the stream. Additionally, all exposed soil, at a minimum of 50 feet on each side of the crossing, must be stabilized with seed and mulch according to application rates specified in the AMPs.

- Include a new AMP to address the management of petroleum products and other hazardous materials on logging operations. Such materials must be stored in leak-proof containers, place outside of buffer strips, and must be removed when logging is completed.
- Enhanced stream buffer guidance in the AMPs and established metrics for minimum residual stand density, stand structure and crown cover.
- Enhanced options and guidance with metrics provided for soil stabilization to establish temporary and permanent ground cover.
- Better clarification provided for selection and spacing of water diversions on skid trails and truck roads both during and immediately after logging.
- Increased seeding/mulching of exposed soil adjacent to streams and other bodies of water from 25 feet to 50 feet.

For the South Lake "B" segment of Lake Champlain, an overall TP reduction target of 40% has been allocated to all forest lands (for South Lake "A" and Port Henry segments, the overall TP reduction target of 5% has been allocated to all forest lands). Based on documentation that the primary sources of phosphorus from forested areas are forest roads and harvest areas, and that AMPs are being revised to address better management of road erosion and harvest areas to avoid water quality impacts, EPA suggests the 5% reduction called for in the Reasonable Assurance scenario is easily supported.

Based on watershed modeling in support of the TMDL, the catchments are displayed in Figure LA-1 in order of increasing TP export – from blue to red. While TP loading rates are generally low in forested areas, there are situations which could exacerbate loading. Gleaned from the modeling input data, areas of steep slopes and thin soils could be most problematic for forest road building and harvest activity. It is these areas that could receive the most activity oversight to control erosion.

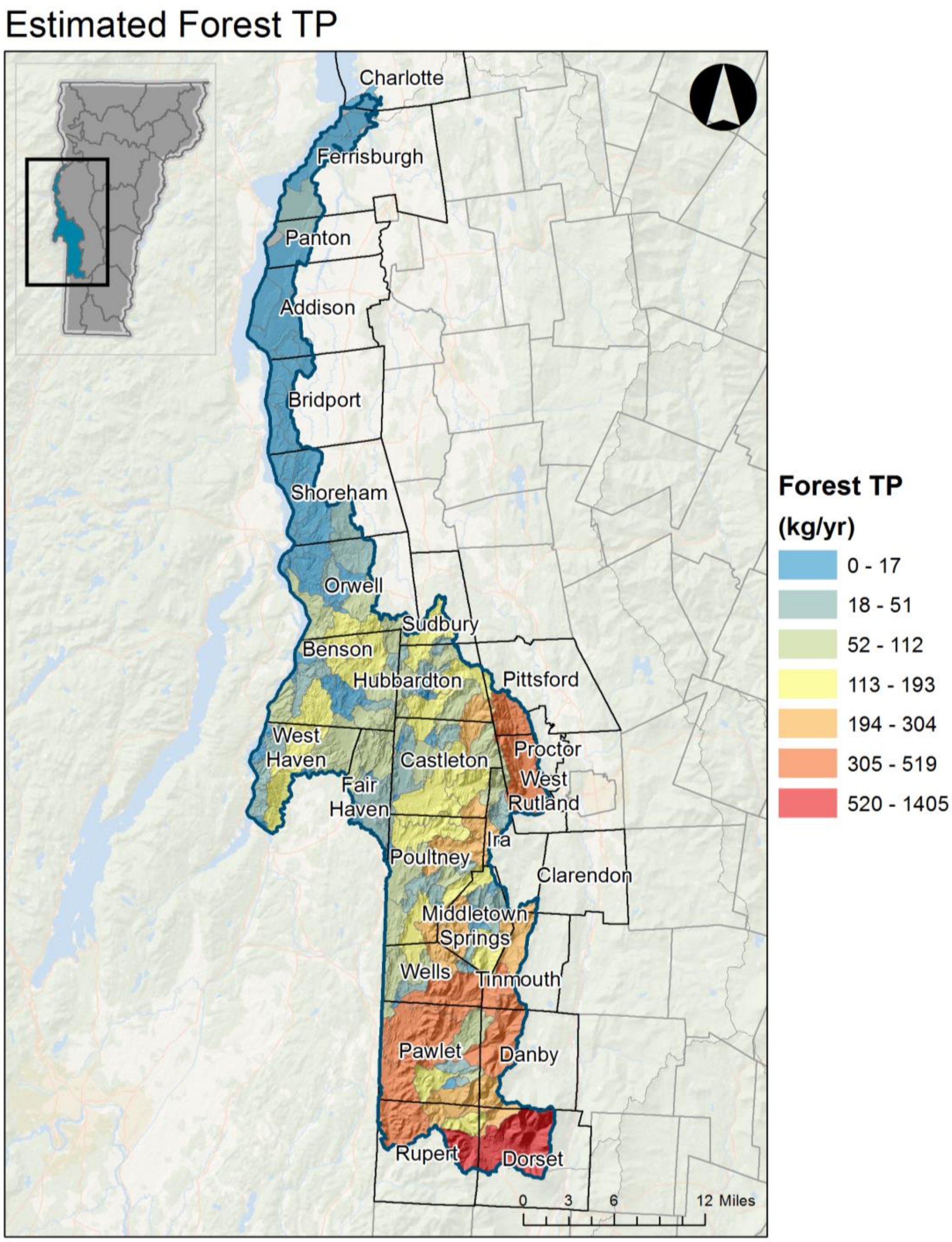


Figure LA-1. Estimated forest TP loading for the South Lake Basin at the catchment scale.

The mapped catchment and HUC12 scale TP export is also shown in Tables LA-1 and LA-2. Table LA-1 identifies the highest-loading catchments in Figure LA-1 by town and lists the forest load as well as the potential phosphorus load reduction if the respective lake segment reduction targets were applied. Since all of these catchments are in the South Lake B segment, the target forest reduction in these areas is 40%. However, actual reductions based on adherence to the Accepted Management Practices could perhaps be greater in these areas if export rates are actually higher. Table LA-2 provides similar data for the top 5 exporting HUC12s. If allocated reductions were completely applied to these top four HUC12s, approximately 25% of the necessary reductions from forest land could be realized.

Table LA-1. The top 4 modeled catchments for forest TP load export (orange and red catchments in Figure LA-1).

Catchment ID	Town Name	Primary Receiving Waterbody	Forest TP (kg/yr)	Potential TP Reduction (kg/yr)
10313592	Dorset	Headwaters Mettawee River	1405	562
10312658	West Rutland	Headwaters Castleton River	518	207
10313548	Wells	Wells Brook-Mettawee River	442	177
10313588	Rupert	Indian River	415	166
	Percent of total TP reduction if sector allocations are applied to these catchments			25%

Table LA-2. Summary table of top TP forest export HUC12s.

HUC12 Waterbody	Forest (kg/yr)	Potential TP Reduction (kg/yr)
Headwaters Mettawee River	3313	1325
Headwaters Poultney River	2268	907
Headwaters Castleton River	2225	890
Wells Brook-Mettawee River	1988	795
Castleton River	1334	534
Percent of total TP forest reduction necessary if sector allocations are applied to these HUC12		75%

Reducing Phosphorus Attributable to Unstable Stream Channels

The Lake Champlain Phase I Implementation Plan recognizes that we will never achieve the load reduction targets for unstable streams if we focus entirely on restoration (manipulation-type) activities. If the river corridors along our incised and straightened stream channels are not protected from encroachment, they will be developed, and the potential for restoration would be lost forever. River corridor and floodplain protection ensure that the desired channel evolution, stream equilibrium, and natural floodplain function can take place whether it be from restoration activities or through the natural channel forming processes that occur during floods. Further, the estimation of precise subwatershed phosphorus loadings from stream channels would be a scientifically tenuous proposition at any scale smaller than that established by the TMDL. As such, this Tactical Basin Plan relies on the identification of high-priority subwatersheds where Stream Geomorphic Assessments indicate the highest likelihood for phosphorus reductions thru the pursuit of dynamic stream equilibrium. These are shown in Chapter 2 of this Plan, in the Implementation Table summary in Chapter 5, and also in the online Watershed Projects database.

VTDEC has developed a methodology to document long-term achievement of the TMDL allocation for stream channels. This methodology serves as a surrogate for long-term physico-chemical monitoring that would be required for each restorative practice type were it possible to isolate cause and effect at this functional level of assessment—which it is not. This tracking approach follows the methodology used by Tetra-Tech to develop the load and load-reduction calculations for unstable streams by evaluating how different practices affect the evolution of Vermont's incised streams to an idealized condition where stream equilibrium is achieved and the stream has access to its floodplain at the (~2-yr) channel forming flow. Is has been documented that under these ideal geomorphic and hydraulic conditions we see significant capture and storage of fine sediment and phosphorus.

The Stream Equilibrium (SE) Tracking Method starts by establishing a total watershed deficit where the existing condition is subtracted from the ideal condition and a total watershed sum is derived by adding the deficit that is calculated for each reach in the watershed. The deficit for each reach is comprised of two components, one to track restoration activities and another to track corridor and floodplain protection activities. This is a novel approach because most tracking tools focus entirely on activities that manipulate the environment to achieve restoration. The total watershed deficit is envisioned to be calculated as follows:

Figure 19. Stream Equilibrium – Watershed Deficit Calculator

$$\sum_{\text{All Reaches}} \frac{\text{Channel Width} \times \text{Reach Length} \times \text{Confinement Deficit (ideal – existing)} \times \text{Channel Evolution Deficit (ideal – existing)}}{\text{Reach Sensitivity Value}}$$

Plus

$$\sum_{\text{All Reaches}} \frac{\text{Channel Width} \times \text{Reach Length} \times \text{Reach Protection Deficit (ideal – existing)}}{\text{Reach Sensitivity Value}}$$

The SE tracking method includes spatial and temporal factors that recognize the value of larger floodplains along lower gradient reaches and the influence that erodibility (as a function of channel boundary and bed load characteristics) has on the time frame at which floodplain accessibility might be achieved. For deficit reduction associated with active restoration there is the opportunity to evaluate projects that remove encroachments, thereby changing the stream confinement ratio (so essential to the achievement of an equilibrium channel slope) and the evaluation of projects that directly affect channel dimensions, roughness, channel evolution stage and slope. The deficit reduction associated with reach protection projects is evaluated for the strength (standards and longevity) of the land use and channel management restrictions that are put into place.

Data to support the scoring is largely available in the Vermont Stream Geomorphic Assessment database. The land protection scoring will be developed from different existing GIS data layers, and finally, a restoration practice scoring matrix will be developed to be able to score each type of project pursued on the ground by the VANR and its partners.

Controlling Phosphorus from Agriculture

Load Allocation

In the Lake Champlain TMDLs, all permissible nonpoint source agricultural land phosphorus loads are considered part of the load allocation. As such, this section describes the estimated phosphorus loading areas in the basin, potential reductions based on the Reasonable Assurance Scenario, as well as the regulatory programs or provisions that are part of the load allocation for agricultural lands. The latter includes the Required Agricultural Practices for regulated Small Farms; Large and Medium Farm Permits; and lessons learned from the North Lake (Champlain) Farm Survey. Additionally, other, non-regulatory activities that are aimed at reducing phosphorus loading from the agriculture sector will be discussed in this section as well.

Estimated Phosphorus Loading

Estimated modeled phosphorus loading from agricultural land uses is given in Figure LA-2 at both the catchment and HUC-12 scales. Another representation of the modeled TP export map is given in Table LA-3 below. The top twenty TP export catchments are listed and are associated with the town in which they occur. The TP reduction amount is simply calculated by applying the 62.9% reduction allocation as expressed in the TMDL for the entire basin. This ranking provides the general reduction opportunities as they exist across the landscape but actual practice implementation will vary across catchments as practical assessment information is obtained. Figure LA-3 presents the total phosphorus load and projected reduction, by agricultural land-use type, for the 13 HUC12-scale watersheds that comprise the South Lake Basin.

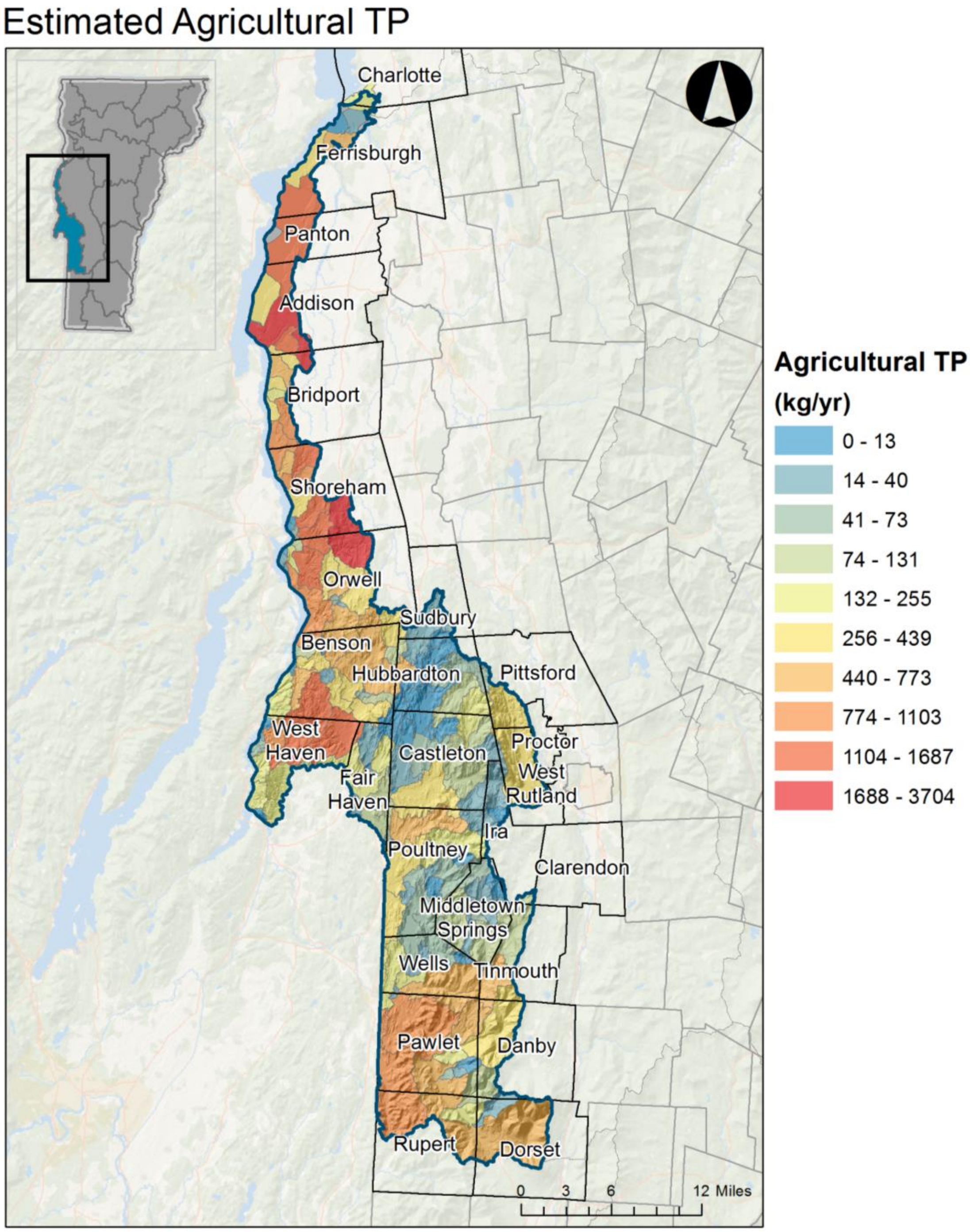


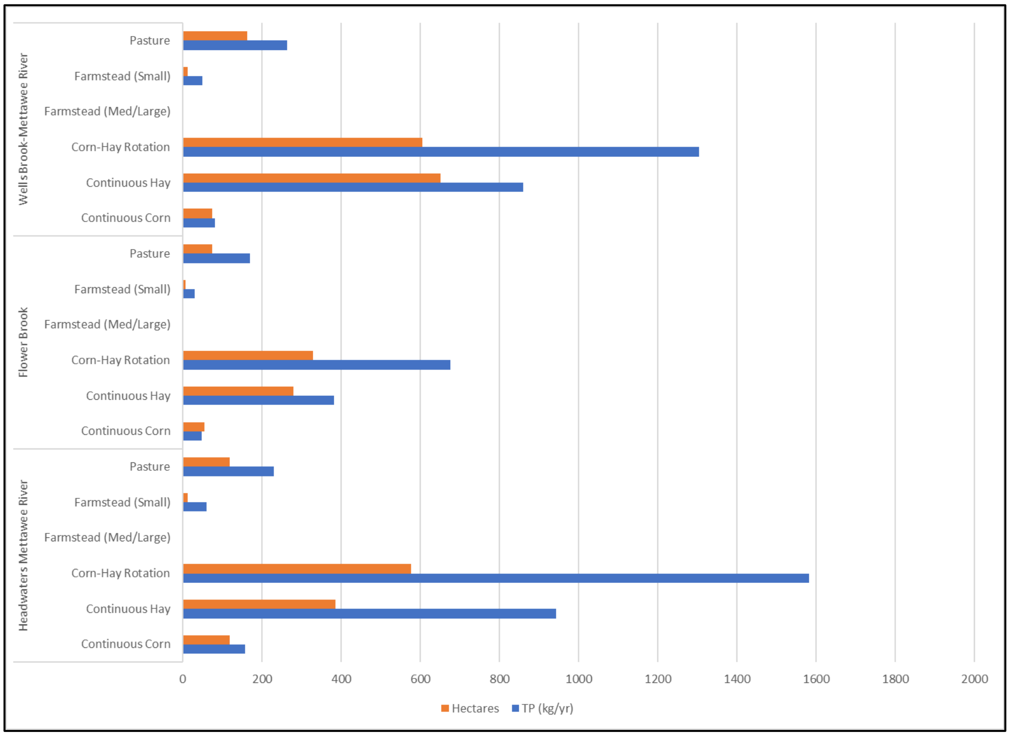
Figure LA-2. Estimated agricultural TP export by catchment. Bolded watershed outline represents HUC12 watersheds.

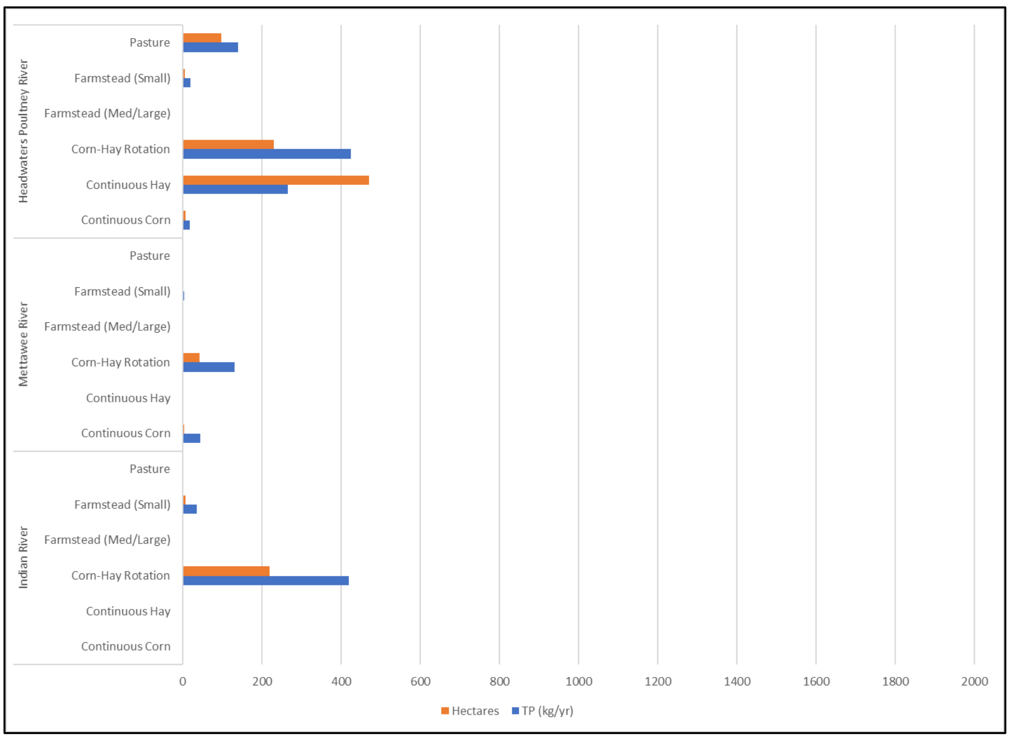
Table LA-3. Catchments with the highest estimated TP agricultural export (non-farmstead).

Catchment ID	Town	Primary Receiving	Ag TP (kg/yr)	TP Reduction based

	Name	Waterbody		on overall basin agricultural load allocation (kg/yr)
10312606	Orwell	East Creek	3704	2330
10311408	Addison	McKenzie Brook-Lake Champlain	3418	2150
10311370	Bridport	McKenzie Brook-Lake Champlain	3006	1891
10312278	Shoreham	McKenzie Brook-Lake Champlain	1687	1061
10312294	Shoreham	McKenzie Brook-Lake Champlain	1644	1034
10312708	Orwell	East Creek	1631	1026
10311380	Ferrisburgh	Hoisington Brook-Lake Champlain	1539	968
10311384	Panton	Hoisington Brook-Lake Champlain	1500	944
10311402	Addison	McKenzie Brook-Lake Champlain	1360	855
10312670	West Haven	Poultney River-Head of Lake Champlain	1353	851
10312416	West Haven	Hubbardton River	1351	850
10312608	Shoreham	McKenzie Brook-Lake Champlain	1282	806
4578882	Charlotte	Hoisington Brook-Lake Champlain	1238	778
10312266	Bridport	McKenzie Brook-Lake Champlain	1103	694
4578822	Charlotte	Hoisington Brook-Lake Champlain	1070	673
10313588	Rupert	Indian River	1066	670
10313558	Pawlet	Wells Brook-Mettawee River	1027	646
10314334	Bridport	McKenzie Brook-Lake Champlain	956	601
10314366	Orwell	Charter Brook-Lake Champlain	938	590
10314344	Shoreham	McKenzie Brook-Lake Champlain	917	577
Percent of total TP reduction if sector allocations are applied to these catchments				**62.9**

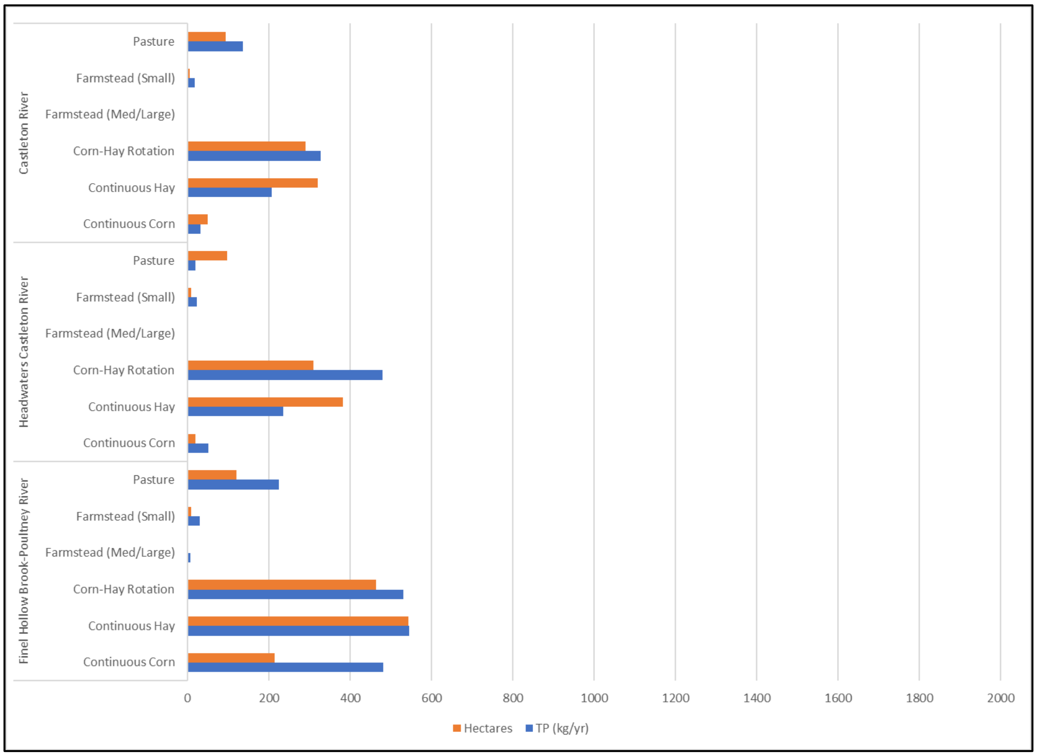
SWAT loading estimates and areas for agricultural sources in the South Lake "B" HUC12 watersheds (4 separate graphics) – Mettowee River HUC-12 watersheds:





SWAT loading estimates and areas for agricultural sources in the South Lake "B" HUC12 watersheds (4 separate graphics) – Poultney River HUC-12 watersheds

(including the Castleton and Hubbardton River sub-watersheds):



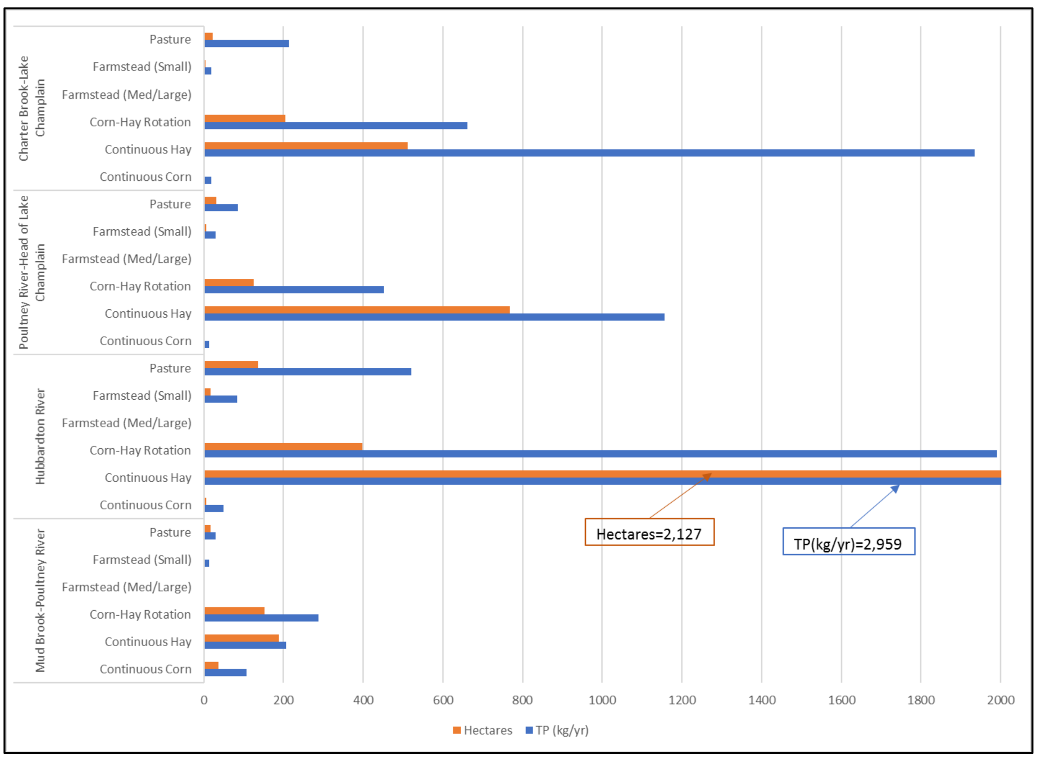


Figure LA-3. SWAT loading estimates and areas for agricultural sources in the South Lake "B" HUC12 watersheds (4 separate graphics).

Table LA-4 provides information regarding agricultural practice efficiencies that were used to estimate the necessary TMDL reductions as presented in the Scenario Tool.

Table LA-4. TP reduction efficiencies associated with BMPs as represented in the SWAT-based Scenario Tool

BMP Type	Minimum % Efficiency	Maximum % Efficiency	Average % Efficiency	Efficiency Source
Barnyard Management	80.00	80.00	80.00	Literature
Change in crop rotation	19.49	28.11	25.26	SWAT
Conservation tillage	10.00	50.00	27.50	SWAT
Cover crop	25.00	30.00	28.33	SWAT
Crop to Hay	0.00	80.00	64.17	SWAT
Ditch buffer	51.00	51.00	51.00	Literature
Fencing/livestock exclusion without riparian buffer	55.00	55.00	55.00	SWAT
Fencing/livestock exclusion with riparian buffer	73.45	73.45	73.45	SWAT
Grassed Waterways	20.00	68.20	38.95	SWAT
Reduced P manure	0.30	17.79	4.95	SWAT
Riparian buffer	41.00	41.00	41.00	SWAT

Required Agricultural Practices and Permit Programs

The Required Agricultural Practices (RAPs) and existing Medium and Large farm permit programs set baseline farm management practices to ensure environmental protection. Medium and Large farm permits have been in place for nearly 10 years, but the RAPs (formally the Accepted Agricultural Practices) have been in place as the current regulatory standard since 2006 and are in the process of being revised. This revision is expected to result in a significant increase in conservation practice implementation over the next few years. The proposed changes to the RAPs that are expected to result in the greatest impact include:

- Nutrient Management Planning and Implementation on All Farms
- Creation of Small Farm Certification Program
- Stabilization of Ephemeral Gullies
- 10 ft. grassed filter strips on all field ditches
- Increase in grassed filter strip and manure spreading setback width from 10ft to 25ft on surface waters for small farms (already 25ft requirement for Medium and Large Farms)
- Establishment of cover crops on fields containing frequently flooded soils

- Increased manure spreading ban duration on fields containing frequently flooded soils
- Increase in grassed filter strip and manure spreading setback from 25ft to 100ft on surface waters adjacent to fields with a slope greater than 10%
- Reduction in maximum soil erosion rates by ½ on small farms
- Increased setbacks for construction of waste storage facilities from surface water (50' to 200')
- Increase setbacks for unimproved stacking of ag wastes from surface water (100' to 200')
- Livestock exclusion from production areas
- Partial livestock exclusion in pastures

It is impossible for us to estimate the exact impact that these rules will have, because doing so would require a detailed understanding of the current management on all farms. However, we are confident that as a result of this rule we will see a dramatic increase in the implementation of Nutrient Management Plans, Cover Crops, Grassed Waterways, and Grassed Filter Strips and Riparian Buffers. Any of these practices that are implemented as part of the many existing financial assistance programs will be tracked and reported on in the next planning cycle. Finally, through the creation of the Small Farm Certification program, inspections will be conducted on every small farm that meets the certification thresholds over the next seven years at minimum. Act 64 shortened the inspection cycle on medium farms from 5 to 3 years, and with the additional staffing the Agency received last year has allowed the Agency to perform more comprehensive inspections on medium and large farm facilities. The Agency will continue to perform annual inspections on large farm operations and the regulatory inspections on small and medium farms, all of which will result in a significant increase in compliance with the management practices set forth in the permit programs and the RAPs.

Lessons Learned from the North Lake Farm Survey

A North Lake Farm Survey was conducted in 2015 and 2016 in the Missisquoi and St. Alban's Bay watersheds. The complete analysis from this survey will be completed in 2017, but a preliminary analysis using this data from the Missisquoi Bay watershed revealed the types of compliance challenges many farms are facing. While the Agency has not conducted a full assessment of all farms in the South Lake Basin, we expect that the larger trends found would apply to farms in the South Lake Basin.

Vermont Environmental Stewardship Program

Starting in 2017, the Agency of Agriculture will pilot a Vermont Environmental Stewardship Program that will recognize and certify farmers who achieve high standards pertaining to sediment and nutrient management, pasture condition, and soil health. This program is designed to increase the recognition of farms that manage their lands in a way that provides environmental benefits, with the goal of fostering a shift toward more ecologically based farm management in the agricultural community. The pilot is expected to launch in in 2017 with 10-12 farms, with the full program starting in 2019.

Wasteload Allocation

In this section, a description of the applicable agricultural phosphorus runoff control regulations will be provided. In this instance, the only separable-applicable regulatory program is the NPDES Confined Animal Feeding Operation permit. As this program at present does not provide coverage for any Vermont facilities, the tabular representation will provide information regarding the numbers of LFO and MFO permitted farms. As mentioned earlier, a small farm certification program is being created that will bring many farms into a permitted program, but the exact number of farms for each watershed has not been estimated at this point. Table WLA-1 shows the number of LFO and MFO permitted facilities in the South Lake Basin by HUC12.

Table WLA-1. Permitted LFO and MFOs in the South Lake Basin by HUC12.

HUC12 Number	HUC12 Name	LFOs	MFOs
041504010204	Indian River	0	0
041504010205	Mettawee River	0	0
041504080104	Charter Brook-Lake Champlain	0	0
041504080304	McKenzie Brook-Lake Champlain	11	3
041504080602	Hoisington Brook-Lake Champlain	4	2
041504010203	Wells Brook-Mettawee River	2	0
041504080301	East Creek	3	1
041504010201	Headwaters Mettawee River	0	0
041504010202	Flower Brook	0	0
041504010301	Headwaters Poultney River	0	0
041504010302	Finel Hollow Brook-Poultney River	0	0
041504010303	Headwaters Castleton River	0	0
041504010304	Castleton River	0	0

HUC12 Number	HUC12 Name	LFOs	MFOs
041504010305	Mud Brook-Poultney River	0	0
041504010306	Hubbardton River	0	0
041504010307	Poultney River-Head of Lake Champlain	0	0
	Total:	20	6

Table WLA-2 shows the estimated TP farmstead export for each HUC-12. It is important to note that the farms counted are the primary facilities, and that other facilities are often associated with the primary facilities but are captured under the same permit.

Table WLA-2. SWAT estimated farmstead loading for the South Lake Basin HUC12s (all estimates are kg/yr)

HUC 12 NAME	Farmstead (Med/Large)	Farmstead (Small)	Total	Overall 80% TMDL Reduction
Indian River		35	35	28
Mettawee River		5	5	4
Charter Brook-Lake Champlain		20	20	16
McKenzie Brook-Lake Champlain*				
Hoisington Brook-Lake Champlain	18	35	53	42
Wells Brook-Mettawee River		50	50	40
East Creek	184	184	368	294
Headwaters Mettawee River		60	60	48
Flower Brook		31	31	25
Headwaters Poultney River		19	19	15
Finel Hollow Brook-Poultney River	8	30	38	30
Headwaters Castleton River		24	24	19
Castleton River	1	25	26	21
Mud Brook-Poultney River		13	13	10
Hubbardton River		84	84	67
Poultney River-Head of Lake Champlain		29	29	23
*The East Creek HUC-12 includes the McKenzie Brook HUC-12 for SWAT modelling purposes only		**Total**	**855**	**684**

Controlling Phosphorus from Developed Lands

In the LC TMDLs, all permissible developed land phosphorus loads are considered part of the wasteload allocation. As such, this section describes the four regulatory programs identified to address phosphorus and other impairment pollutant discharges from developed lands. They are the: Transportation Separate Storm Sewer System Permit (TS4); Municipal Roads General Permit; Municipal Separate Storm Sewer Permit; and, the so-called Operational Three-acre Impervious Surface Permit.

As a generalized summary, Table WLA-3 indicates which regulatory program applies to which jurisdiction and the estimated modeled load for that jurisdiction where it is able to be determined.

Table WLA-3. Total Load and the Regulatory Programs applicable in each jurisdiction

<table>
<tr><th rowspan="2">Jurisdiction</th><th rowspan="2">Load reduction target (%)</th><th colspan="4">Applicable Regulatory Program to address Phosphorus</th></tr>
<tr><th>TS4</th><th>MRGP</th><th>MS4</th><th>Three-acre designation</th></tr>
<tr><td>VTrans/State highways</td><td rowspan="4">SL-A = 18.1
SL-B = 21.1
PH = 7.6</td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>MS4 municipalities</td><td></td><td></td><td>N/A</td><td>✓</td></tr>
<tr><td>MRGP</td><td></td><td></td><td>N/A</td><td>✓</td></tr>
<tr><td>All other non-MS4 municipalities</td><td></td><td>✓</td><td></td><td>✓</td></tr>
</table>

Prior to discussing the permitting regulatory authorities and their specific areas of application, modeled loading across the entire basin can be visualized in Figure WLA-1. This map represents estimated annual phosphorus loading at the catchment scale with municipal boundaries overlain. This estimate includes loading from all areas of developed lands including roads and low and high density development. These areas are further described in the following Table WLA-4, whereby the top 20 TP loading catchments are presented. The last column shows the amount of TP reduced if the basin-wide developed lands TMDL allocation of 18.1% (South Lake A), 21.1% (South Lake B), and 7.6 % (Port Henry) were applied to each of these catchments. Summarized at the bottom is the percentage, 52%, of total TP reduction from developed lands identified in the TMDL that could be realized if the developed lands TMDL reduction of 18.1% (South Lake A), 21.1% (South Lake B), and 7.6 % (Port Henry) were applied

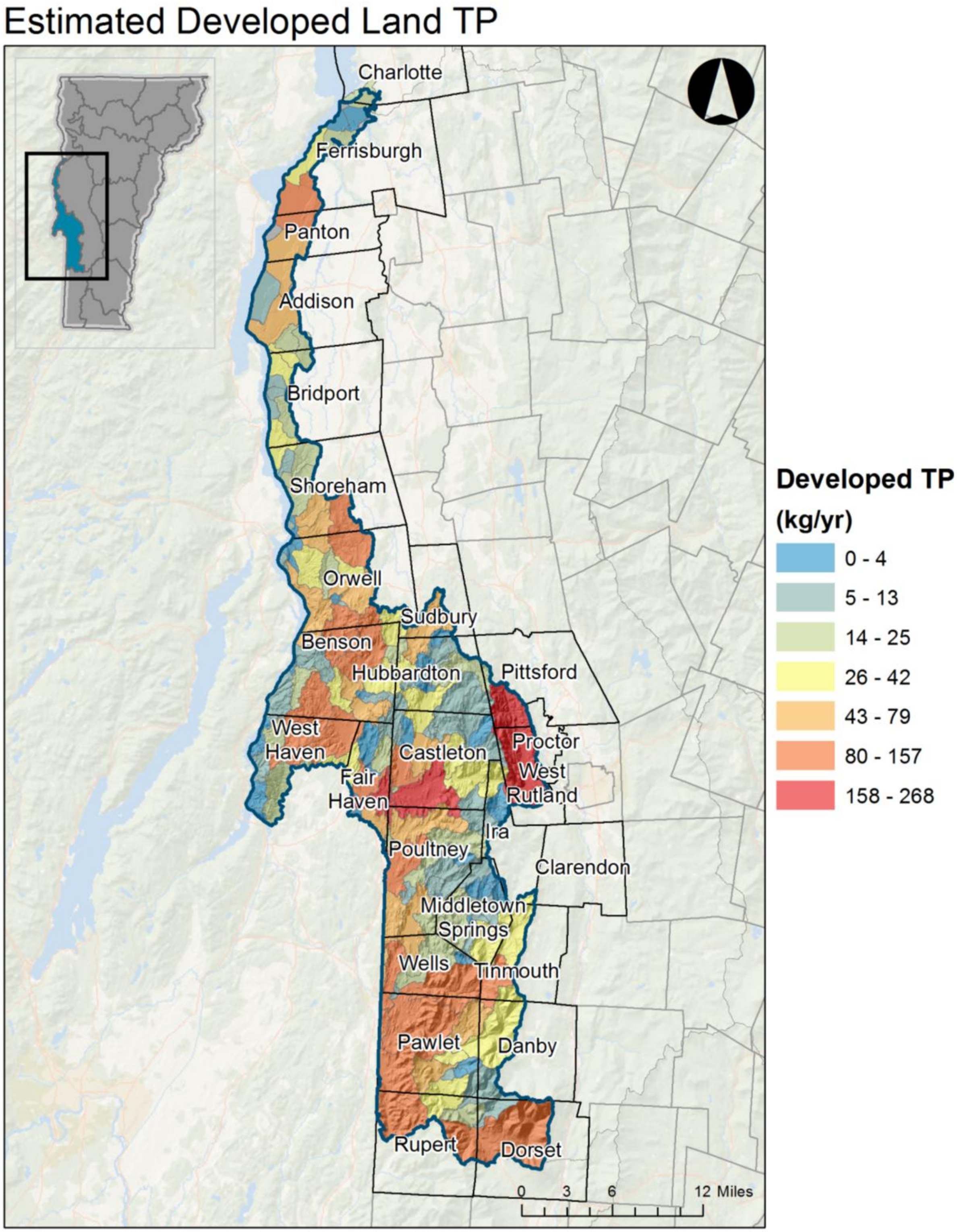


Figure WLA-1. Total developed land load from all sources in the South Lake Basin, at the catchment scale.

Table WLA-4. Catchments with the highest estimated TP developed lands export. Catchments are associated with individual towns if the majority of the area of that catchment occurs within a given town boundary.

Catchment ID	Town Name	Primary Receiving Waterbody	Developed Lands TP Load (kg/yr)	Developed lands TP reduction (% reduction specific to each lake segment) based on overall TMDL basin allocation (kg/yr)
10312658	West Rutland	Headwaters Castleton River	268	56
10312434	Castleton	Castleton River	185	39
10312686	Fair Haven	Castleton River	175	37
10313592	Dorset	Headwaters Mettawee River	157	33
10312702	Poultney	Finel Hollow Brook-Poultney River	147	31
10311380	Ferrisburgh	Hoisington Brook-Lake Champlain	147	11
10312606	Orwell	East Creek	141	26
10312432	Fair Haven	Mud Brook-Poultney River	134	28
10312416	West Haven	Hubbardton River	130	27
10313558	Pawlet	Wells Brook-Mettawee River	130	27
10313588	Rupert	Indian River	119	25
10312622	Benson	East Creek	112	20
10312630	Benson	Hubbardton River	111	23
10313552	Wells	Wells Brook-Mettawee River	109	23
10313548	Wells	Wells Brook-Mettawee River	105	22
10312670	West Haven	Poultney River-Head of Lake Champlain	101	21
10312810	Castleton	Castleton River	92	19
4578882	Charlotte	Hoisington Brook-Lake Champlain	86	7
10311408	Addison	McKenzie Brook-Lake Champlain	79	6
10312460	Poultney	Finel Hollow Brook-Poultney River	68	14
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments				**52%**

Phosphorus Loading from Roads

Currently, TP loading estimates for roads only exist from the SWAT model which distinguishes only between paved and unpaved roads. Unfortunately, two of the primary phosphorus reduction regulatory programs related to roads, the MRGP and the TS4, are defined by more narrow parameters than just paved and unpaved. For example, the MRGP will apply to municipally managed roads, and require applicable practices to be applied to all roads that are "hydrologically-connected" to waterbodies, while the TS4 permit will only apply to state-managed roads.

Derived directly from the SWAT loading estimates, Figure WLA-2 identifies the range of catchment TP loading from roads, both paved and unpaved, across the South Lake Basin. A further breakdown of loading estimates is presented in Tables WLA-5 and WLA-6 whereby the top twenty highest roads loading catchments, paved and unpaved, are shown respectively along with the TP reduction necessary to comply with the developed lands allocation of 18.1% (South Lake A), 21.1% (South Lake B), and 7.6 % (Port Henry). If the necessary reduction were achieved for all these catchments, approximately 44% and 47% of the roads allocation for paved and unpaved roads respectively could be realized. However, for each catchment or municipality these are not actual allocations but rather opportunities. Actual reductions will be accounted for as the essential roads permits are implemented.

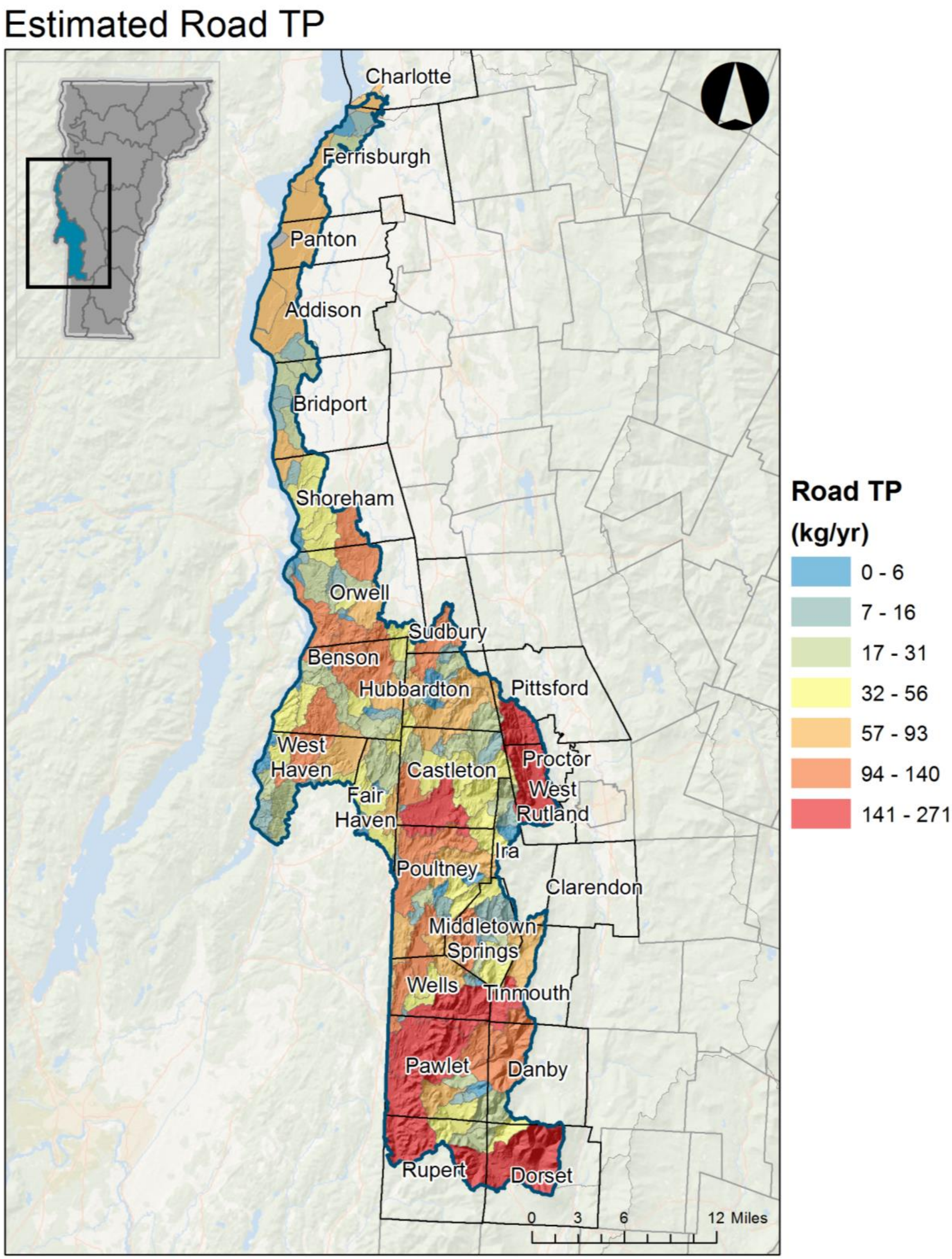


Figure WLA-2. Estimated SWAT loading from all paved and unpaved roads in the South Lake Basin at the catchment scale. Bolded lines represent the HUC12 watersheds.

Table WLA-5. Catchments with the highest estimated TP export from paved roads.

Catchment ID	Town Name	Primary Receiving Waterbody	Paved TP Load (kg/yr)	Paved TP Reduction (kg/yr)
10312460	West Rutland	Headwaters Castleton River	160	33.7
10312460	Dorset	Headwaters Mettawee River	117	24.6
10312460	Castleton	Castleton River	110	23.1
10312460	Wells	Wells Brook-Mettawee River	101	21.4
10312460	Pawlet	Wells Brook-Mettawee River	92	19.4
10312460	Rupert	Indian River	89	18.7
10312460	Orwell	East Creek	82	14.9
10312460	West Haven	Poultney River-Head of Lake Champlain	80	17.0
10312460	Castleton	Castleton River	79	16.7
10312460	Poultney	Wells Brook-Mettawee River	75	15.9
10312460	Sudbury	Hubbardton River	72	15.2
10312460	Poultney	Finel Hollow Brook-Poultney River	71	15.0
10312460	Benson	East Creek	66	12.0
10312460	Benson	Hubbardton River	66	13.9
10312460	Poultney	Finel Hollow Brook-Poultney River	66	13.9
10312460	Danby	Flower Brook	64	13.5
10312460	Orwell	Charter Brook-Lake Champlain	61	11.0
10312460	Charlotte	Hoisington Brook-Lake Champlain	60	4.5
10312460	West Haven	Hubbardton River	60	12.6
10312460	Middletown Springs	Headwaters Poultney River	57	12.1
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments				**45%**

Table WLA-6. Catchments with the highest estimated TP export from unpaved roads.

Catchment ID	Town Name	Primary Receiving Waterbody	Unpaved TP Load (kg/yr)	Unpaved TP Reduction (kg/yr)
10313548	Wells	Wells Brook-Mettawee River	45	9.5
10312606	Orwell	East Creek	38	6.9

10312670	West Haven	Poultney River-Head of Lake Champlain	37	7.7
10313588	Rupert	Indian River	35	7.5
10312460	Poultney	Finel Hollow Brook-Poultney River	32	6.8
10312658	West Rutland	Headwaters Castleton River	32	6.7
10313592	Dorset	Headwaters Mettawee River	32	6.7
10312434	Castleton	Castleton River	29	6.2
10312326	Orwell	East Creek	25	4.6
10313408	Wells	Wells Brook-Mettawee River	24	5.1
10312622	Benson	East Creek	24	4.4
10312388	Hubbardton	Castleton River	22	4.7
10313552	Wells	Wells Brook-Mettawee River	22	4.7
10313380	Middletown Springs	Headwaters Poultney River	22	4.6
10313402	Tinmouth	Headwaters Poultney River	22	4.5
10312498	Poultney	Finel Hollow Brook-Poultney River	21	4.5
10313558	Pawlet	Wells Brook-Mettawee River	21	4.3
10314366	Orwell	Charter Brook-Lake Champlain	20	3.5
10312630	Benson	Hubbardton River	19	4.0
10312810	Castleton	Castleton River	19	4.0
Percent of total sector TP reduction if necessary sector allocations are applied to these catchments				**19%**

In order to derive more detailed loading source estimates than those given above, it was necessary to apply a secondary analysis to the initial SWAT loading estimates. To further break down the SWAT loading data for paved and unpaved roads, the extent of VTrans-managed and municipal-managed paved roads was derived from a more detailed GIS analysis than that used in the model. Through this analysis, the estimated load was apportioned at a somewhat finer level. Although, when combining the separate data sources to estimate loads, there are unavoidable inconsistencies that become apparent. For example, there is not an exact fit between the input roads data for the two methods and therefore results don't necessarily align. At this time and with the tools available, these issues are inherent in the analysis. However, it's believed that they provide good planning level information when considered across the entire basin.

State Managed Roads (Transportation Separate Storm Sewer System General Permit – TS4)

The TS4 is a new stormwater permit for all of VTrans owned and controlled infrastructure. As part of the permit, VTrans will develop comprehensive Phosphorus Control Plans (PCPs) for their developed land in each lake segment. This includes state roads, garages, park and rides, welcome centers, airports and sand and gravel operations. The plans will require inventories of all regulated surfaces, establishment of baseline phosphorus loading per lake segment, and a prioritized schedule for implementation of BMPs to achieve the lake segment percent phosphorus reductions.

To begin this assessment, VTDEC estimated the miles of state roads per HUC12 in the South Lake Basin, given in Figure WLA-3 and which is also reflected in Table WLA-7. In order to provide some estimate of the overall basin loading at the bottom of the table, the hybrid analysis mentioned above was utilized with all the inherent inconsistencies. The noted load and estimated reduction provide a reasonable planning level loading

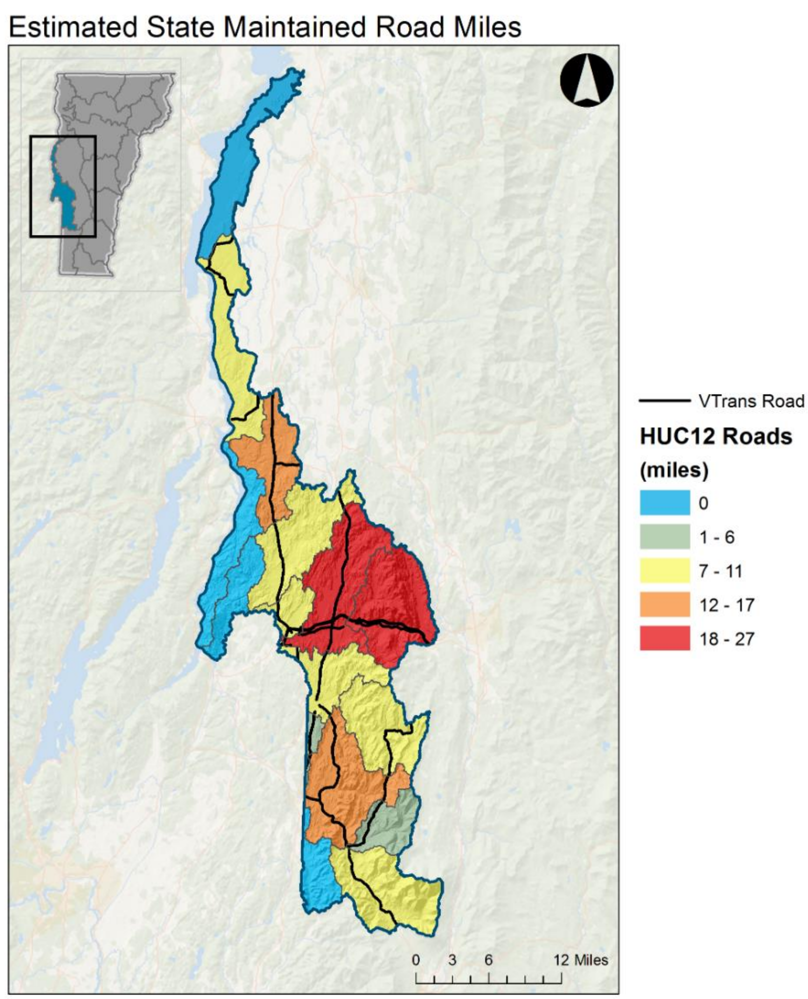


Figure WLA-3. Estimated mileage of state-managed roads summarized by HUC12 in the South Lake Basin.

estimate. As the TS4 permit evolves, VTrans will further delineate the number, location, and condition of drainage from state roads along with other non-road infrastructure.

Table WLA-7. Estimated miles for State-managed highways (this does not include other VTrans owned and controlled infrastructure)

HUC 12	River Name	State managed road miles
041504010204	Indian River	0.0
041504010205	Mettawee River	4.3
041504080104	Charter Brook-Lake Champlain	0.0
041504080304	McKenzie Brook-Lake Champlain	11.4
041504080602	Hoisington Brook-Lake Champlain	9.7
041504010203	Wells Brook-Mettawee River	18.3
041504080301	East Creek	10.0
041504010201	Headwaters Mettawee River	8.2
041504010202	Flower Brook	5.6
041504010301	Headwaters Poultney River	7.2
041504010302	Finel Hollow Brook-Poultney River	8.4
041504010303	Headwaters Castleton River	25.2
041504010304	Castleton River	29.6

041504010305	Mud Brook-Poultney River	10.9
041504010306	Hubbardton River	8.4
041504010307	Poultney River-Head of Lake Champlain	0.0
Total miles VTrans managed roads		**157.2**
Total estimated P load from VTrans managed roads		**1305**

Municipal Managed Roads (Municipal Roads General Permit)

The Municipal Roads General Permit is a new stormwater permit for all Vermont cities and towns that is intended to achieve significant reductions in stormwater-related erosion from municipal roads, both paved and unpaved. The permit will require each municipality to develop a road stormwater management plan to bring road drainage systems up to basic maintenance standards to stabilize conveyances and reduce erosion. The road management plan will require an inventory of municipal roads and current conditions, an identification of potential road best management practices (BMPs), and a prioritized implementation schedule to achieve the road standards. Implementation of the Municipal Roads General Permit by each municipality is estimated to achieve between 7.6% to 21.1 % depending to which lake segment the municipality drains.

The following maps and tables were developed to assist municipalities in setting priorities through the road management planning process. In order to break some of the basin roads loading data down to a town scale, the sum of loading from the catchments within that town needs to be calculated. Figure WLA-4 shows the primary watershed catchments within each town. For these calculations, a given catchment is associated to any given town if the majority of that catchment falls within that town. While not a perfect fit, it does provide a reasonable estimate of the modeled TP load for any given municipality. Based on this association of catchments related to towns, VTDEC was able to estimate the TP load coming from both paved and unpaved roads in each of the towns, shown in Table WLA-8. As towns implement road management plans and stabilize road networks, VTDEC will be able to use this data to estimate the reductions in TP loading and confirm progress in meeting the LC TMDL.

Figure WLA-4. Association of catchments to towns in the South Lake Basin

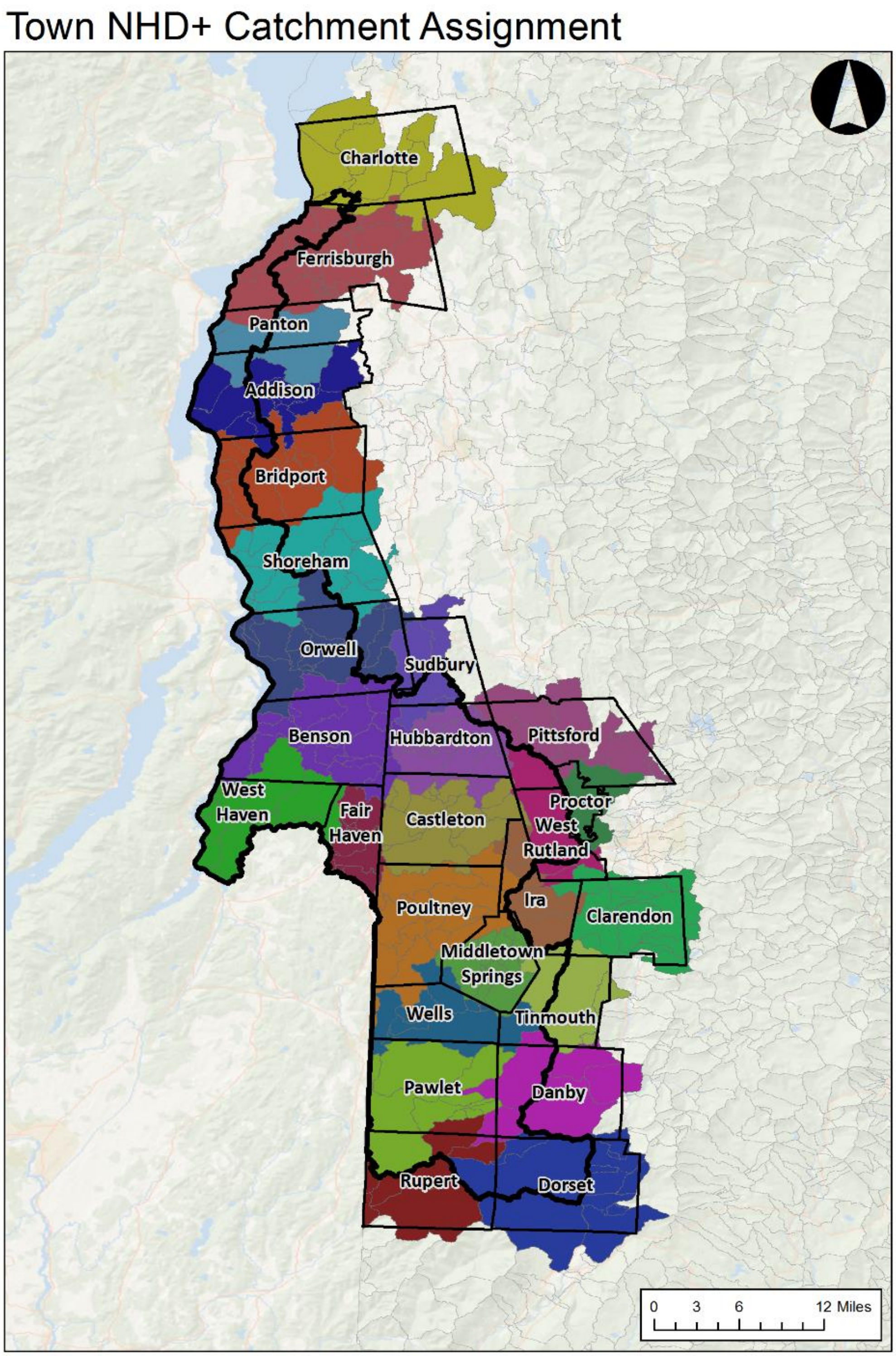


Table WLA-8. SWAT loading for all non-VTrans managed roads occurring in each municipality (non-MS4)

Town	Municipal Paved Roads (kg/yr)*	Unpaved Roads (kg/yr)
Addison	41.62	8.12
Benson	184.35	127.30
Bridport	91.48	35.82
Castleton	200.85	102.37
Charlotte	34.11	41.91
Danby	57.61	18.24
Dorset	93.17	36.16
Fair Haven	95.54	24.80
Ferrisburgh	115.45	39.49
Hubbardton	120.71	57.34
Ira	0	4.79
Middletown Springs	76.16	66.04
Orwell	174.65	105.92
Panton	44.45	9.35
Pawlet	51.34	52.21
Poultney	221.85	119.95
Rupert	88.65	47.23
Shoreham	75.6	57.39
Sudbury	52.62	17.89
Tinmouth	20.33	21.51
Wells	104.06	108.48
West Haven	153.58	81.34
West Rutland	109.68	31.63
Total loading from all roads (kg/yr)		**3423**
Total reduction dependent of lake segment % of allocation of reduction (kg/yr)		

**these include a small proportion of paved private roads*

VTDEC developed remote sensing information for municipalities to initially identify hydrologically-connected road segments that have the potential to be at risk of erosion and may be a source of sediment and phosphorus pollution to surface waters. This estimated mileage, along with more detailed town maps, will help municipalities establish initial town road inventories and prioritize improvements. Results of this analysis are given in Table WLA-9. It should be noted that mileages are given for the entirety of each town, whether or not the whole town or just a part of it is in the basin.

Table WLA-9. Estimated mileage of hydrologically connected municipal road miles by town. These do not include state managed or private roads.

Town	Hydrologically-connected municipal road miles
Addison	17.71
Benson	26.16
Bridport	27.28
Castleton	29.89
Charlotte	25.04
Clarendon	25.35
Danby	29.89
Dorset	22.56
Fair Haven	19.7
Ferrisburgh	38.03
Hubbardton	18.33
Ira	8.45
Middletown Springs	16.71
Orwell	20.38
Panton	14.42
Pawlet	20.86
Pittsford	27.59
Poultney	43.37
Proctor	14.91
Rupert	26.78
Shoreham	21.06
Sudbury	9.01
Tinmouth	14.17
Wells	19.51
West Haven	19.08
West Rutland	21.38
Total municipal HCR segments	**577.62**

Municipal Separate Storm Sewer Systems (MS4)

The Municipal Separate Storm Sewer System permit is a permit for municipalities with census designated urbanized areas and stormwater impaired watersheds. Under the MS4 permit, those designated municipalities will be required to develop a comprehensive phosphorus control plans (PCP) to achieve the percent phosphorus reduction for their respective lake segment, on all developed land within the municipality. These municipalities will not need separate permit coverage under the Municipal Roads General Permit or the "3-acre designation," as these requirements will be incorporated into the phosphorus control planning within the municipality. The PCPs will include requirements to inventory all developed land within the municipality, estimate phosphorus loading from developed land, and identify BMPs and an implementation schedule to achieve the required reductions. However, currently there are no MS4 communities in the South Lake Basin.

Operational three-acre impervious surface permit program

The Stormwater Program will issue a general permit by January 2018 that will include a schedule by which owners of three or more acres of impervious surface will need to obtain permit coverage. Following issuance of the general permit, the Program will identify and notify affected owners. An impervious surface will require coverage under the three-acre permit if it is not covered under a permit that incorporates the requirements of the 2002 Vermont Stormwater Management Manual (VSMM).

It is anticipated that the "three-acre impervious surface" program will address the developed lands phosphorus reductions necessary to achieve the TMDL that are not addressed by other developed lands programs. Ongoing tracking of implementation will be used to verify this projection. If additional reductions in phosphorus are required to implement the TMDL, developed lands permitting requirements may be adjusted accordingly, including requiring projects with less than three acres of impervious surface to obtain permit coverage.

An initial estimate of parcels containing three or more acres of impervious was completed by TetraTech, Inc. with funding from EPA (Table WLA-11).

Table WLA-11. Estimated three-acre parcels and associated impervious cover for South Lake Basin towns*

Town	Parcels (#)	Impervious (acres)
Castleton	11	71.41
Charlotte	0	0.00
Dorset	1	6.09
Fair Haven	7	41.62
Ferrisburgh*	1	4.18
Middletown Springs	2	6.55
Pawlet	2	11.10

Poultney	8	43.03
Rupert	1	4.60
West Rutland	4	26.95
Total	**37**	**215.53**

*** The Ferrisburgh parcel drains to two lake segments**

The initial estimate of the three-acre parcel coverage will require additional screening by VTDEC prior to notification of the affected parties. The analysis does not yet identify which impervious surfaces have permit coverage that incorporates the requirements of the 2002 VSMM. VTDEC will also identify eligible impervious surfaces from existing permits that were not identified in the Tetra Tech analysis because the impervious surface is located on more than one parcel.

Controlling Phosphorus from Wastewater Treatment Facilities and Other Industrial Discharges

This section provides additional information to readers regarding wastewater treatment facilities in the Lake Champlain Basin. As of the issuance of this Plan, all facilities are presently operating under administrative continuance of existing permits, which were issued in conformance with the allocations in place under the remanded 2002 LC TMDL. The 2016 Lake Champlain TMDL did not alter the allowable phosphorus discharge loads from WWTFs that discharge to the South Lake segments (A & B) of Lake Champlain, and as such, no specific requirements for upgrade are addressed by this Plan. This does not eliminate requirements for ongoing operation and maintenance of these facilities, nor scheduled engineering performance reviews required of all WWTF in Vermont. The municipal wastewater discharge permits in place in the Basin are shown in Table WLA-12. As part of a necessary refinement of the facility-specific phosphorus wasteload allocations, the WSMD, with assistance from certain municipalities, is conducting an extensive sampling effort to document the current loading conditions for phosphorus, and determine the “reasonable potential” that WWTP's have to cause or contribute to downstream water quality impairment. In addition, the approved 2016 LC TMDL presents a wasteload allocation for phosphorus loads, to which each facility in the basin will adhere (Table TMDL2).

Table WLA-12. Summary of permit requirements for the wastewater treatment facilities in the South Lake Champlain lake segments (A, B, and Port Henry).

Facility (permit ID)	Permit expiration date	Planned permit re-	Design flow MGD	IWC* 7Q10 /LMM	Current permitte d load (mt/yr P)	TMDL Allocated Wasteload (mt/yr P)	Current Percent of Design	Treatment type	Receiving water

		issuance year					Flow (YEAR)		
Benson 3-1166	12/31/2011	2017	0.018	0.73/0.21	0.122	0.122	40.0% (7/2016 – 6/2017)	Aerated lagoon	Trib to Hubbardton River
Castleton 3-1238	12/31/2008	2017	0.480	0.15/0.04	0.397	0.397	48.8% (7/2016 – 6/2017)	Sequential batch reactor	Castleton River
Fair Haven 3-1307	9/30/2009	2017	0.500	0.09/0.02	0.414	0.414	27.9 (7/2016 – 6/2017)	Activated sludge	Castleton River
Orwell 3-1214	6/30/2012	2017	0.033	impound	0.228	0.228	34.8% (7/2016 – 6/2017)	Aerated lagoon	South Fork East Creek
Pawlet 3-1220	9/30/2008	2017	0.040	0.07/1.0	0.276	0.276	16.8 % (7/2016 – 6/2017)	Rotating biological contact	Indian RIver
Poultney 3-1231	3/31/2010	2017	0.500	0.29/0.08	0.414	0.414	35.4% (7/2016 – 6/2017)	Sequential batch reactor	Poultney River

** Instream Waste Concentration – or the proportion of river flow at lowest base (7Q10) and low median monthly (LMM) flow attributable to discharge, for the facility design flow. Note that the IWC is specific to the flow of receiving water.*

[1](The Fair Haven collection system does have one CSO that is basically inactive. It may not technically be a CSO as they separated their system many years ago.)

Facility Specific Information

Benson

The Town of Benson operates an aerated lagoon facility (two primary and one secondary) that provides secondary treatment and chlorine disinfection of municipal wastewater that discharges to an unnamed tributary to the Hubbardton River.

Castleton

The Town of Castleton operates a municipal wastewater treatment facility that provides secondary treatment employing a sequential batch reactor process followed by ultraviolet disinfection that discharges to the Castleton River.

Town of Castleton municipal sewer service is currently available on the east shore of Lake Bomoseen, including Bomoseen village and extending as far north as the Crystal Beach/ Crystal Haven area. An engineering facilities plan (Aldrich & Elliot, 2013) for the east shore of Lake Bomoseen recommends extension of sewer service to Crystal Heights, an existing suburban style street of about 14 homes. This street is located near Crystal Beach, but higher and further away from the lake, on the east side of Route 30. The facilities plan also addresses the Floating Bridge Road area at the north end of Lake

Bomoseen, in Castleton, but it does not recommend sewer extension to that area, because of high cost.

The west shore of Lake Bomoseen currently lacks municipal sewer service. The engineering feasibility study report discusses options for sewer service for the west shore, and does not recommend a municipal sewer extension on the west shore, because of high cost. Municipal sewer service now extends only to Hydeville, at the south end of the lake. The feasibility report also addresses cluster options for decentralized wastewater treatment, but ultimately recommends a "homeowner awareness" (aka "best fit") model, because of shallow ledge, shallow groundwater, setback distances, etc. The Kehoe State Conservation Camp already has an onsite system on the best soils for wastewater treatment on the west shore.

Fair Haven

The Town of Fair Haven operates a wastewater treatment facility utilizing an oxidation ditch. The secondary treated wastewater is disinfected using chlorine, dechlorinated and discharged to the Castleton River. In 2000, the facility was upgraded to include phosphorus removal.

Orwell

The Town of Orwell operates an aerated lagoon that provides secondary treatment and chlorine disinfection of municipal wastewater that discharges to the South Fork of East Creek.

Pawlet

The Town of Pawlet operates a wastewater treatment facility that employs a rotating biological contact system. Secondary treatment wastewater is disinfected using ultraviolet light and discharged to the Indian River. Wastewater enters a parallel series of two septic tanks, passes through a series of four aerated equalization tanks and onto the RBC unit. Wastewater then enters the clarifier, is disinfected in the disinfection chamber and is discharged.

Poultney

The Village of Poultney operates a wastewater treatment facility that receives residential and commercial wastewater from the Village of Poultney. The system includes sequential batch reactors with phosphorus removal and disinfection using ultraviolet light that discharges to the Poultney River.

Summary

The information provided in the foregoing provides the best-available information regarding the locations of the South Lake Basin where phosphorus loading is modeled to be greatest. This information is provided by source sector, and tied to the regulatory programs that are highlighted by Act 64 to compel phosphorus pollution reductions for each sector. An important consideration in the development of this modeling analysis is the pace at which the expected reductions may be achieved from any given sector. Generally, the Lake Champlain TMDL is envisioned to be implemented over a 20-year timeframe. Figure TMDL 4 provides a hypothetical representation of the pace at which nutrient reductions may be achieved, informed by the timelines during which each regulatory program is being put into place.

The capability for the State to compel reductions in the first five-year iteration of this tactical plan cycle is limited by the timelines set forth by Act 64 for the establishment and promulgation of the permit programs. and the availability of funding. In the first instance, 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. Further, in order for those plans to be implemented, there needs to exist funding to support implementation of the specific projects. Figure TMDL 4 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. The following link provides access to the database resources discussed in this Plan:

[VTDEC Watershed Projects Database and Tracking System](#)

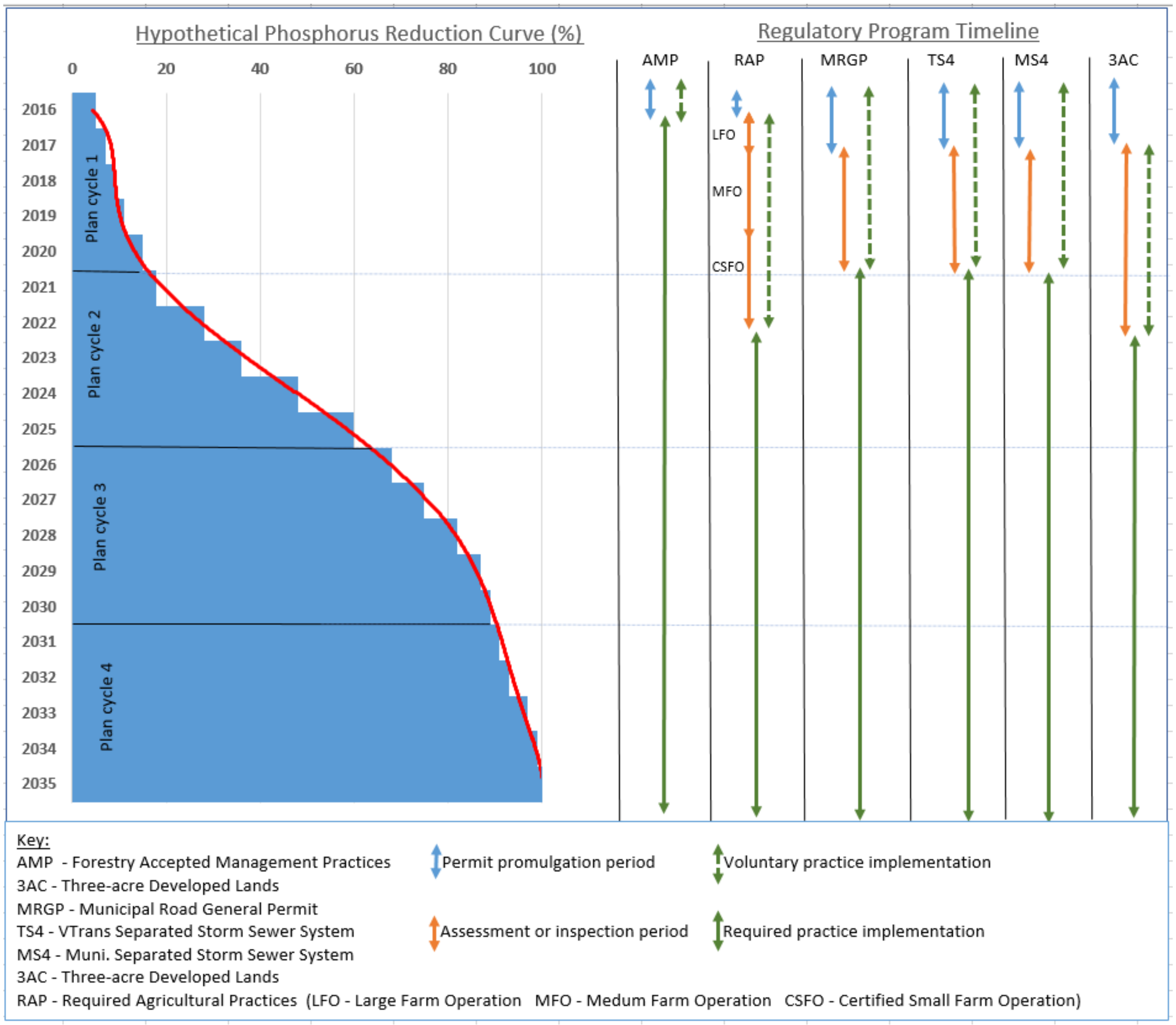


Figure TMDL4. Theoretical phosphorus reduction, relative to the load and wasteload reductions required by the LC TMDL. The timelines for regulatory programs are also shown.

In regards to funding, this current tactical basin plan cannot yet articulate a precise estimation of the total cost of implementation to achieve the full completion of TMDL activities. However, the following information provides a cost perspective based on a statewide view of clean water funding needs, and also a sector-specific estimated cost per unit reduction for phosphorus.

The State of Vermont Treasurer's report (2017) describes the full costs of implementing Act 64 to achieve clean water for the entire State of Vermont. Figures available as of this writing suggest a total statewide cost of $2.31B, and a total gap, derived from currently available clean water funding, of $1.34B.

From the perspective of sector-specific costs, Figure TMDL5, adapted from the Phase I Plan, presents useful practice-level cost estimates. These latter estimates indicate a gradient of cost efficiency, with highest efficiencies associated with agricultural practices, followed by roads, developed lands, and wastewater infrastructure.

Over the course of this tactical basin plan lifecycle, as projects are documented as a result of assessments, they will be entered into the implementation tracking system, and incremental, project-level costs can begin to be aggregated.

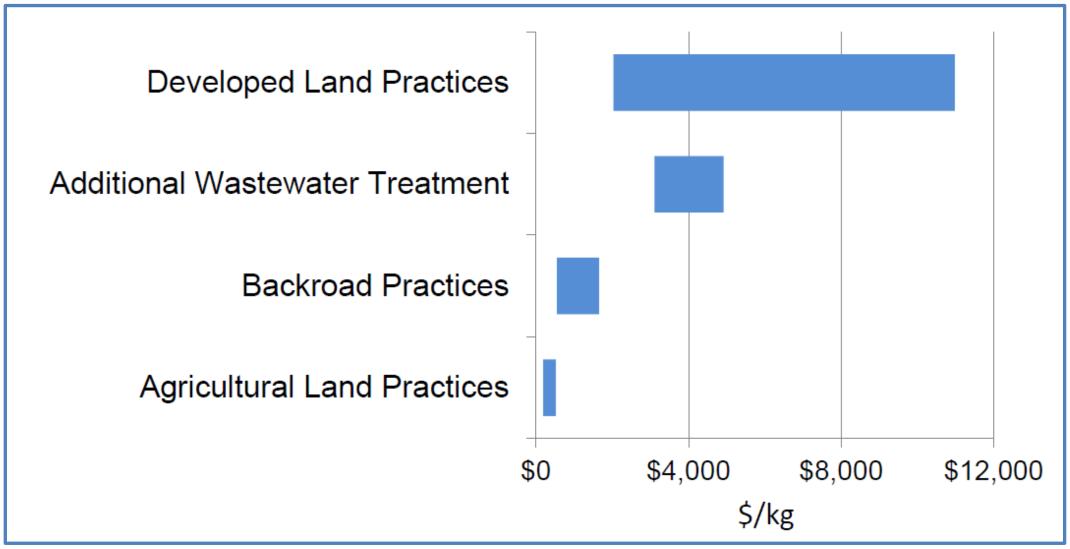


Figure TMDL 5. General costs of practices, by land use sector, expressed by kilogram of phosphorus reduced.

As has been described in this Chapter, a robust phosphorus reduction tracking approach is being put into place to document implementation of on-the-ground practices and projects. It is through this system that accurate phosphorus reduction projections, and documented accomplishments will be tracked. These accomplishments will be reported publicly, as required by Act 64 on an annual basis. As of this writing, the modeling and projected phosphorus reductions shown by this Chapter are the best information available to Vermonters, but remain a starting point. Future iterations of the South Lake Champlain Basin Tactical Basin Plan will provide augmented specificity in regards to phosphorus reductions achieved, reductions planned, costs, and as appropriate, success stories documenting incremental water quality improvement.

Chapter 4 - Management Goals for Surface Waters in the Southern Lake Champlain Basin

The protection or improvement of water quality and water-related uses can be promoted by establishing specific management goals for particular bodies or stretches of water. The management goals describe the values and uses of the surface water that are to be protected or achieved through appropriate management. In Chapter 2 of this plan, a number of waters were identified as being of notable high quality. These, as well as other unique areas, may be candidates for establishing alternate management goals or augmented protections through one of the processes that are further described below.

- Opportunities for reclassification of waters
- Identification of existing uses
- Opportunities for designation of Outstanding Resource Waters.
- Classification of wetlands
- Designation of waters as warm and cold-water fisheries.

The Agency of Natural Resources is responsible for determining the presence of existing uses on a case by case basis or through basin planning, and is also responsible for classification or other designations. Once the Agency establishes a management goal, the Agency manages state lands and issues permits to achieve all management goals established for the associated surface water. Before the Agency recommends management goals through a classification or designation action, input from the public on any proposal is required and considered. The public may present a proposal for establishing management goals for Agency consideration at any time. When the public develops proposals regarding management goals, the increased community awareness can lead to protection of uses and values by the community and individuals.

Public involvement is an essential component to restoring and protecting river and lake ecology. The Vermont Water Quality Standards state "Public participation shall be sought to identify and inventory problems, solutions, high quality waters, existing uses and significant resources of high public interest." Emphasis on the identification of values and expectations for future water quality conditions can only be achieved through public contributions to the planning process.

A. Class A(1), A(2) and B Waters

Presently in all basins across Vermont, waters above 2,500 feet in elevation are classified as A(1) by Vermont statute. In the Southern Lake Champlain Basin, the only A(1) waters currently classified include those above 2,500 feet in elevation. The management objective for A(1) waters is to maintain their natural condition. VTDEC has a handful of streams that are candidates for reclassification to Class B(1), and potential candidates that may attain Class A(1) biological integrity contingent on future sampling efforts

Surface waters used as public water supplies are classified A(2). The only class A(2) waters in Basin 2/4 that is currently actively used is Inman Pond and its watershed including Sucker Creek.

B. Existing Uses

There are many identified special uses, features, and values of the Southern Champlain Basin and its numerous tributaries including waterfalls, cascades, whitewater boating stretches, and swimming holes. All surface waters in Vermont are managed to support uses valued by the public including swimming, boating, and fishing. The degree of protection afforded to these uses is based on the water's class as described above. In particular surface waters, however, the existence of uses is protected absolutely if the Agency of Natural Resources identifies them as existing uses under the anti-degradation policy of the Vermont Water Quality Standards. Specifically, this means that an existing use may not be eliminated by the issuance of a permit or other action where compliance with the Water Quality Standards is assessed (VTDEC Anti-degradation Procedure, 2012). The Agency identifies existing uses of particular waters either during the basin planning process or on a case-by-case basis during application reviews for state or federal permits. During the Southern Lake Champlain Basin planning process, VTDEC has identified:

- The existing use of the waters for swimming;
- The existing use of waters for boating;
- The existing use of the water for water supply, and
- The existing use of water for recreational fishing.

It is DEC's long-standing stipulation that all lakes and ponds in the basin have existing uses of swimming, boating and fishing. During the planning process, VTDEC has collected sufficient information to identify the existing uses listed in Appendix A. The list is not meant to be exhaustive. The public is encouraged to nominate other existing uses, which may be included in the basin plan or catalogued for a more thorough investigation when an application is submitted for an activity that might adversely affect the use. The list of Existing Uses is found in Appendix A.

C. Outstanding Resource Waters

In 1987, the Vermont Legislature passed Act 67, "An Act Relating to Establishing a Comprehensive State Rivers Policy." A part of Act 67 provides protection to rivers and streams that have "exceptional natural, cultural, recreational or scenic values" through the designation of Outstanding Resource Waters (ORW). Depending on the values for which designation is sought, ORW designation may protect exceptional waters through the permits for stream alteration, dams, wastewater discharges, aquatic nuisance controls, solid waste disposal, Act 250 projects and other activities.

As indicated in Section 2.B., the lower Poultney River has been designated as an outstanding resource water for natural, cultural and scenic values. At the present time there are no other ORW designations in the Southern Champlain Basin or candidates that were brought forth during the planning process, for this basin plan.

D. Other High Quality Waters

Many of the Southern Champlain Basin's rivers and streams, lakes and ponds, and wetlands currently achieve a very high quality of water and aquatic habitat and are exceptional places to swim, fish, boat, and otherwise enjoy. Some of these are identified in Chapter 2 (above). In addition to protecting and improving water resources by managing stressors, there is the opportunity to protect surface waters by identifying and documenting the very high quality and preserving those conditions or features through various classifications or designations. Several statewide references and reports available to the exceptional ecological quality or recreational uses of Vermont surface waters. A major new resource, ANR's BioFinder, provides a statewide application identifying surface water and riparian areas with a high contribution to biodiversity.

Class 1 Wetland Designation

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

Class I: Exceptional or irreplaceable in its contribution to Vermont's natural heritage and therefore, merits the highest level of protection

Class II: Merits protection, either taken alone or in conjunction with other wetlands

Class III: Neither a Class I nor Class II wetland

There is currently one Class I wetland in the Southern Champlain Basin. The Dorset Marsh lies at the headwaters of both the Batten Kill and the Mettowee and is one of very few "Class I" wetlands in Vermont. As part of the development of this tactical basin plan, a handful of wetlands were identified that warrant further study for Class I potential. These wetlands are also listed below. As part of the implementation of this tactical basin plan, the Department will develop and implement procedures and documents to enable submission, evaluation, and implementation of petitions to classify wetlands as Class I. Those wetlands that satisfy criteria for designation may be proposed for such designation through Departmental rulemaking authority, and as consistent with the Vermont Wetland Rules.

Wetlands in the Southern Champlain basin that warrant further study for Class I potential include the East Creek wetlands in Orwell and Benson (South Branch), and Wards Marsh Complex in West Haven.

Fish Habitat Designations

Warm Water Fish Habitat

All wetlands and the following waters are designated as warm water fish habitat for purposes of the Vermont Water Quality Standards:

- All waters west of Vermont Route 22A
- Austin Pond, Hubbardton
- Beebe Pond, Hubbardton
- Billings Marsh Pond, West Haven
- Burr Pond, Sudbury
- Coggman Pond, West Haven
- Echo Lake (Keeler Pond) Hubbardton/Sudbury
- Half Moon Pond, Hubbardton
- Hinkum Pond, Sudbury
- Lake Hortonia, Hubbardton/Sudbury
- Inman Pond, Fair Haven
- Lily Pond, Poultney
- Little Pond, Wells
- Love’s Marsh, Castleton
- Mill Pond (Parson’s Mill Pond), Benson
- Northeast Developer’s Pond, Wells

- Old Marsh Pond, Fair Haven
- Pine Pond, Castleton
- Poultney River from Carvers Falls in West Haven to its confluence with Lake Champlain
- Sunrise Lake, Benson/Orwell

The WQS specifies a lower minimum dissolved oxygen concentration than waters in the remainder of the basin, which are Cold-Water Habitat.

- No changes to warm water fish habitat designations are proposed at this time.

Cold Water Fish Habitat

All waters not designated as warm water fish habitat above are designated as cold-water fish habitat for the Southern Lake Champlain Basin, as noted in the Vermont Water Quality Standards, 2016 No changes to cold-water fish habitat designations are proposed in this basin plan at this time.

E. Irrigation and Animal Watering

Irrigation and animal watering are considered designated uses under the Vermont Water Quality Standards. Designated use means any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in sections 3-02(A), 3-03(A), and 3-04(A) of the Water Quality Standards (2016).

Water from the Southern Lake Champlain Basin system is an important resource for agriculture. While all livestock require watering, vegetables, orchards, berries, and nursery stock are also supported by irrigation. In 2007, combined total water withdrawals for animal watering and irrigation accounted for 12% of the total water withdrawals by all uses in Addison and Rutland counties (statewide, agriculture accounted for 2%). The majority of water withdrawals are for public supply, domestic, industrial and thermoelectric uses.

F. Water Quality Monitoring Projects (McKenzie Brook watershed)

The McKenzie Brook Watershed is located in southwestern Addison County, Vermont. McKenzie Brook is a lake direct watershed comprised of several smaller tributaries (also referred to as a HUC-12 watershed) which includes drainage areas on the New York side of the Lake (including McKenzie Brook). There are two major tributaries that drain into Lake Champlain on the Vermont side: Hospital Creek and Whitney Creek. The

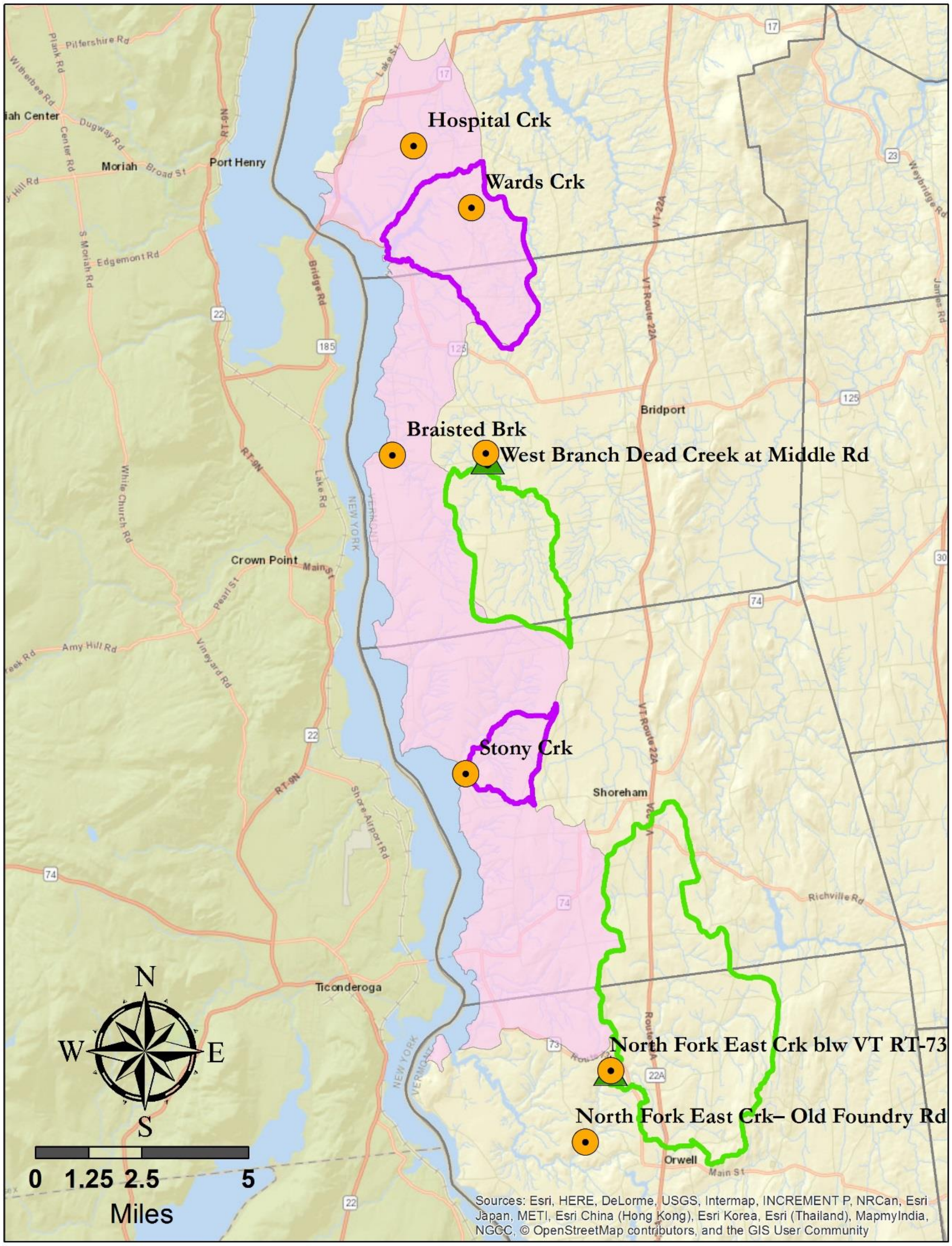
Vermont portion of the watershed extends from Hospital Creek in the north to, but not including, East Creek in the south. The total watershed area in Vermont is 21,221 acres. The area of the Lake that the McKenzie Brook Watershed drains to (South Lake A) has some of the highest total phosphorus concentrations of any Lake segment. The average annual concentration is __. The phosphorus target for this section of lake is 25 ug/l.

The overarching purpose of this monitoring project is to expand upon previous monitoring efforts in a coordinated fashion. This will be achieved by gathering streamflow and precipitation information and enhancing water quality sampling activities through flow-dependent sampling during the non-winter periods of 2017 and 2018. These data will be used to document existing conditions with respect to flows and loading of nutrients. A "Quality Assurance Project Plan" (also known as a QAPP) has been developed for the streamflow and precipitation monitoring aspects of the project. Data collected under these plans will allow us to estimate initial phosphorous loading and establish baseline water quality conditions in subwatersheds in the McKenzie Brook Watershed in Vermont. In-stream sampling will be conducted in six watersheds: East Creek, Stony Creek, Braisted Brook, Wards Creek, Hospital Creek, and Dead Creek.

The data generated by projects under this QAPP will serve the following uses:

- Development of a relationship between flow variability and phosphorus/nutrient loading
- Describe water quality conditions at specific locations
- Identify potential source(s) of elevated nutrients, turbidity and pathogens in this region; (as an ongoing but related water quality monitoring project);
- Support BMP design and outreach by partner agencies including Vermont Agency of Agriculture, UVM Extension, USDA FSA/ NRCS as stipulated in Required Agricultural Practices (e.g., livestock exclusion).

Figure 20. presents the McKenzie brook monitoring locations.



Map of water quality monitoring locations (orange points). Streamflow gages (triangle) and subwatersheds (polygons) are in green. Purple subwatersheds are potential locations for precipitation gages and supplementary discharge

measurements. Pink area is Vermont portion of McKenzie Brook HUC-12 subwatershed

Chapter 5 – South Lake Champlain Implementation Table - Protection and Remediation Actions

The Tactical Basin Plan addresses all impaired, stressed and altered waters (Tables 8 and 10) in the basin as well as protection needs for high quality waters; however, a central focus of the plan is also the identification of specific priority actions to reduce nutrient and sediment loading in priority catchments as part of the effort to meet the Lake Champlain Phosphorus TMDL goals and objectives (refer to the "South Lake Champlain Tactical Basin Plan Overview" on page 11). The list of actions covers future assessment and monitoring needs, as well as implementation projects that protect or remediate waters and related education and outreach. Table 12 is a summary of priority actions from nearly 100 individual project entries in the online Watershed Projects database. Action items in the implementation table summary are supported by the phosphorus loading reduction targets set forward in the Lake Champlain TMDL as well as the statewide Surface Water Management Strategy. As projects are developed, priority for funding will be given to those projects that achieve a high phosphorus removed benefit per cost ratio. Additionally, projects that provide co-benefits (i.e. flood resiliency, water quality improvement, water resource protection, aquatic organism passage) will receive additional consideration for prioritization.

A. Coordination of Watershed Partners

There are several active organizations undertaking watershed monitoring, assessment, protection, restoration, and education and outreach projects in the South Lake Basin. These partners are non-profit, private, state, and federal organizations working on both private and public lands. Partnerships are crucial in carrying out non-regulatory actions to improve water quality. Partners active in working with farms in the basin through the Regional Conservation Partnership Program including NRCS, AAFM, OCNRCD, VDEC, UVM Extension Service, Middlebury College, and the Champlain Valley Farmers Coalition (CVFC).

Finally, the Regional Planning Commissions (Addison and Rutland) are coordinating efforts with VTDEC by providing consistent and coordinated outreach regarding the Vermont Clean Water Act (VCWA) and related State water quality statutes and programs, and by carrying forth the specified tasks outlined by 10 V.S.A. § 1253d(3).

This coordinated partnership allows for the support of municipalities and partner organizations with the following:

- prioritizing water quality investments articulated by tactical basin plans,
- identifying within tactical basin plans beneficial proposed State or municipal policy changes,
- assistance in carrying forth those recommendations,
- assisting in monitoring progress towards meeting water quality goals consistent with the State Surface Water Management Strategy.

Regional Planning Commissions ensure that basin planning activities are coordinated and integrated with transportation and hazard mitigation activities, and complementary local (municipal) and regional water quality improvement efforts.

Lake Implementation Teams

Recent water quality management efforts on lake water quality issues had led to the formation of "Lake Implementation Teams," comprised of members from South Lake Basin lake associations – Lake Bomoseen and Lake Saint Catherine (including the Little Lake Saint Catherine Conservation Fund), town representatives (including Castleton, Hubbardton, Poultney, and Wells), the Poultney Mettowee Natural Resource Conservation District (PMNRCD), Rutland Regional Planning Commission, UVM Sea Grant, and VTDEC staff (Lakes and Ponds and MAP Programs). Each of the two lake implementation teams meet periodically to promote education and outreach events, review ongoing monitoring and assessment efforts, participate in planning, and move high priority projects to implementation. The outcome(s) of these efforts has also led to the development of lake watershed management plans for each lake basin that frame out specific strategies and actions to address lake basin specific issues.

Since the formation of these teams in 2016, several meetings have been convened to discuss policy and management approaches to address aquatic plant management and water quality issues within each lake as well as to conduct and review the results of lake watershed stormwater assessments, including high priority municipal road projects.

In 2016, the PMNRCD was awarded an Ecosystem Restoration Program (ERP) grant to conduct a Stormwater Master Plan (SWMP) for the Lake Bomoseen watershed, including Sucker Brook, a high priority sub-basin for sediment and nutrient reduction. Several high priority projects have been identified during that assessment process, and a couple of those projects are moving forward to the design and implementation phases. High priority projects identified via the Lake Bomoseen watershed (including the Castleton River headwaters) stormwater master planning assessment have been and will be incorporated into the Watershed Projects Database and referenced here in the South Lake Champlain Tactical Basin Plan in order to implement nutrient and sediment reduction projects that will ultimately benefit the South Lake Champlain lake segments as well.

As of the drafting this Basin Plan, the PMNRCD had just also received an ERP grant to conduct a similar SWMP for the Lake Catherine basin, and to look for opportunities to mitigate the effects of stormwater runoff from roads, large impervious areas, and from lakeshore residential properties.

We have continued to hold monthly meetings in coordination with each lake association, town representatives, the Poultney Mettowee NRCD, Rutland RPC, UVM-Sea Grant, and landowners to address multiple lake assessment and management topics including but not limited to stormwater, roads, aquatic plants, shoreline stabilization, wetlands, boat traffic, and municipal government involvement. The recent (July 2017) Lake Bomoseen Green Stormwater Infrastructure workshop and Lake Saint Catherine Lakewise workshop were included as a 2017 Vermont "Clean Water Week" events.

B. Basin 2-4 Implementation Table Summary

The Poultney and Mettowee Rivers, and the Lower Champlain Direct drainages are collectively called Basin2-4 by VTDEC. The process for identifying priority actions in these basins are the result of a comprehensive compilation and review of both internal ANR monitoring and assessment data and reports, and those of our watershed partner organizations described in Chapters 2 and 3. The monitoring and assessment reports include, but are not limited to, stormwater mapping and master planning reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, hazard mitigation plans, agricultural modeling and assessments, road erosion inventories, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

A summary of priority actions to address water quality in the Basin 2-4, organized by basin wide actions and major sub-basin actions, are identified in Table 12. The on-going detailed list of actions can be viewed via the online Watershed Projects Database. The following tables serve to identify high priority implementation actions and tasks that provide opportunities for all stakeholders in surface water management across each major river basin to pursue and secure technical and financial support for implementation. In order for these priorities to be achieved, partners and stakeholders must help to carry out the actions identified in the basin plan.

Table 12. Implementation Table - summary of priority actions

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
Strategies to address runoff from Developed Lands. Priority Sub-basins include high phosphorus export watersheds in the South Lake Champlain Basin include the Castleton River, Poultney River (focus on mainstem reaches and Mud Brook), East Creek, Mettowee River (focus on Wells Brook) and lake watersheds with elevated nutrient levels or increasing trends. See Figure WLA-1 and Table WLA-4			
1. Map parcels that will come under the 3 acre stormwater permit in the basin and do outreach to landowners that will be required to seek permit coverage.	land erosion, channel erosion, encroachment	VDEC, RRPC, Basin Towns	CWIP, TBP
2. Complete Stormwater Master Plans for the towns of Castleton, Fair Haven, Poultney, and West Rutland. Identify highest priority projects for implementation	land erosion, channel erosion, encroachment	PMNRCD, RRPC, Basin Towns	CWIP, ERP
3. Develop 90% designs for the highest priority projects identified in the Lake Bomoseen (Town of Castleton) and Lake Saint Catherine (Towns of Wells and Poultney) Stormwater Master Plans	land erosion, channel erosion, encroachment	PMNRCD, Basin Towns	CWIP, ERP
4. Create a Southern Champlain Stormwater Collaborative to implement a stormwater outreach effort to make landowners aware of stormwater BMPs to support implementation of town GSI practices, and to create local expertise in implementing GSI practices in the basin that can be shared with partners. Support coordinated funding of stormwater implementation.	Nutrients, land erosion, channel erosion, encroachment	PMNRCD, VDEC, RRPC, Towns, Lake Associations	CWIP, ERP
5. Implement the high priority projects identified in SWMPs and where comprehensive designs have been developed as appropriate. Engage volunteers in installing practices and host GSI tours to expand understanding of techniques.	Nutrients, land erosion,	PMNRCD, VDEC, RRPC, Towns, Lake Associations	CWIP ERP
6. Identify and correct potentially failed septic systems identified by IDDE assessment.	Pathogens, nutrients	VDEC, Basin Towns (Pawlet)	CWSRLF
7. Support brownfields restoration efforts that mitigate surface water pollution generated from these sites.	Toxics	RRPC, Towns	EPA

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
Strategies to address runoff from Lakeshore Developed Lands. Priority sub-basins include lakes with increasing nutrients trends or elevated levels (including Beebe, Bomoseen, Saint Catherine, and Sunrise) and lake watersheds elevated nutrient levels including Billings Marsh and Coggman Ponds.			
8. Complete annual Lake Wise trainings to develop capacity for local partners to evaluate properties for Lake Wise Assessments.	Nutrients, land erosion, encroachment	VDEC, PMNRCD, Local Lake Wise Partners	
9. Complete Lake-Watershed Stormwater Masterplan and *Lakewise* assessments for Beebe, Bomoseen, Burr, Hortonia, Saint Catherine, Sunrise or other stressed lakes where there is local support to identify and implement priority projects.	Nutrients, land erosion, encroachment	PMNRCD, LBA, LSCA, LSCCF, LHPOA, VDEC, FOVLAP, Lake and Watershed Associations.	CWIP, ERP
10. Use the Lake Implementation Team planning and assessments to initiate *Lakewise* Mentoring to share *Lakewise* expertise between Lake Associations, and to support shared technical resources and coordinated grant funding for BMP implementation.	Nutrients, land erosion, encroachment	PMNRCD, LBA, LSCA, LSCCF, LHPOA, VDEC, FOVLAP, Lake and Watershed Associations	CWIP, ERP
11. Implement priority projects identified in *Lakewise* assessments	Nutrients, land erosion, encroachment	PMNRCD, LBA, LSCA, LSCCF, LHPOA, VDEC, FOVLAP, Lake and Watershed Associations	CWIP, ERP
12. Complete *Lakewise* assessments and implement priority projects at Bomoseen State Park to increase the visibility of BMP practices and *Lakewise* program.	Nutrients, land erosion, encroachment	VDEC, VDFPR, PMNRCD	CWIP, ERP
13. Develop and evaluate the new lake watershed assessment process to identify and address shoreland and lake sources of nutrients to upland lakes.	Nutrients, land erosion, encroachment	PMNRCD, LBA, LSCA, LSCCF, LHPOA, VDEC,	CWIP, Watershed grants

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
		FOVLAP, Lake and Watershed Associations	
Strategies to address runoff from Municipal Roads. Priority areas shown in Figure WLA-2 and Tables WLA-5 and WLA-6			
14. Complete outreach to towns and communities about new MRGP regulations through workshops and individual meetings with selectboards.	land erosion, channel erosion, encroachment	ACRPC, RRPC, VTrans, PMNRCD, OCNRCD, DEC, Vermont Local Roads	CWIP, ERP, Better Roads Program
15. Develop regional collaboration for completing assessments to meet Municipal Road General Permit (MRGP) requirements and help towns prioritize implementation of projects that address road segments with significant water quality impacts.	land erosion, channel erosion, encroachment	ACRPC, RRPC, VTrans, PMNRCD, OCNRCD, DEC, Vermont Local Roads	CWIP, ERP, Better Roads Program
16. Update regional road erosion inventory template to incorporate MRGP requirements and to better highlight projects with largest water quality benefits along with town transportation needs.	Nutrients, land erosion, channel erosion, encroachment	ACRPC, RRPC, VTrans, PMNRCD, OCNRCD, DEC, Vermont Local Roads	CWIP, ERP, Better Roads Program
17. Develop capacity through existing transportation planning organizations or private consultants to support towns in completing at least 5 Road erosion inventories and capital budgets per year.	Nutrients, land erosion, channel erosion, encroachment	ACRPC, RRPC, VTrans, PMNRCD, OCNRCD, DEC, Vermont Local Roads	CWIP, ERP, Better Roads Program
18. Through the monthly Road Foreman meetings, provide ongoing support for towns in implementing priority road projects with the most significant water quality benefits	Nutrients, land erosion, channel erosion, encroachment	ACRPC, RRPC, VTrans, PMNRCD, OCNRCD,	CWIP, ERP, Better Roads Program

Strategies	**Stressor Addressed**	**Partners (see Partners)**	**Funding (see** Appendix I**)**
through Better Roads grants and other funding sources.		DEC, Vermont Local Roads	
19. Complete ANR Bridge and culvert surveys in the East Creek and other Lower Champlain Direct watersheds and work with towns to replace structures identified in these and earlier assessments as barriers to AOP and or that are geomorphically incompatible.	Channel erosion, encroachment	ACRPC, VTrans, OCNRCD, DEC, Vermont Local Roads	VBR, CWIP, ERP, (for geomorphically incompatible structures)
Strategies to address runoff from State Transportation Infrastructure Priority Sub-basins include high phosphorus export watersheds in the South Champlain Basin in Figure WLA-3 with a focus on the Castleton River Basin, and Table WLA-8.			
20. Implement six minimum control measures required in the State TS4 permit.	land erosion, channel erosion, encroachment	VTrans,	VTrans
21. Complete assessments necessary to support the development of a phosphorus control plan for the South Champlain Basin early in the next TS4 permit cycle.	land erosion, channel erosion, encroachment	VTrans	VTrans
22. Identify funding to complete "Park and Ride" stormwater treatment practices.	Channel erosion, encroachment	VTrans	VTrans, ERP
23. Develop and implement stormwater treatment practices to treat runoff from Route 30 to mitigate stormwater runoff from entering Lakes Bomoseen and Saint Catherine (including Little Lake).	Nutrients, land erosion	VTrans, Basin Towns (Castleton, Hubbardton, Poultney, and wells)	VTrans, ERP,
Strategies to address runoff from Agricultural lands. Priority sub-basins include high phosphorus export watersheds shown in Figures LA-2 and LA-3 and Table LA-3, Impaired Steams (due to agricultural sources wholly or in part) include the McKenzie Brook tributaries, East Creek, the Hubbardton River, Mettowee River, and Indian River.			
24. Create "South Lake" farmer workgroup to support the implementation of RAPs, BMPs, and effective workshops and outreach efforts.	Nutrients, land erosion, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM,	CWIP, ACAP

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
		USDA-NRCS, VDEC	
25. Host annual workshops on improving soil health and new RAPs.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	RCPP, USDA, ERP, CWIP
26. Create tracking system for certified small farms that need NMPs or that have up-to-date NMPs, schedule to keep these up-to-date.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	RCPP, ERP, CWIP
27. Support 8 farmers per year in developing Nutrient Management Plans (NMPs) through UVM Extension's Digging In course and the development of NMPs for all certified farms through NRCS CAPS funding.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	RCPP, EQIP, ACAP
28. Support the development of NMPs for certified farms that are not interested in Digging in Course through NRCS CAPS funding.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD	RCPP, EQIP, ACAP
29. Generate funding so that UVM-Extension, NRCD staff, and partners can continue to work with priority farms on implementing NMPs once these have been completed to installing practices to address issues identified in NMP and LTPs.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	RCPP, USDA, ERP, ACAP, AAFM BMP
30. Include local dairy nutritionist in the (proposed) South Lake agricultural workgroup and to support partners in make the bridge from NMP to feed & forage management.	nutrients	UVM Ext. PMNRCD, OCNRCD	RCPP, ACAP
31. Evaluate additional BMPs that could be used on hay land to reduce loading from this land use. Options to evaluate include injection, timing of application, or use of Aerway. Provide outreach to farmers to support effective BMPs that are identified.	Land erosion, nutrients	UVM Ext. PMNRCD, OCNRCD, AAFM	RCPP, USDA, ERP, ACAP, AAFM BMP

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
32. Work with farmers to do demonstrations and trials on different cover crops, rotations and manure management scenarios such as rotation of annual Italian grass.	Land erosion, nutrients	UVM Ext. PMNRCD, OCNRCD, AAFM	RCPP, USDA, ERP, ACAP
33. Develop a practical farm stormwater BMPs for farms and provide technical and financial support for farms to implement these to address stormwater runoff from impervious surfaces in farm production areas.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, VDEC	ACAP, EQIP, RCPP, AAFM BMP, ERP
34. Increase the availability of equipment available for rental or through custom operators to allow farmers to follow NMPs including equipment to measure crop yields, manure application rates, take soil samples, and to implement practices such as no till drills, manure injectors, tine weeder air seeders.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	AAFM BMP. RCPP, DEC, ACAP
35. Promote existing programs and develop additional programs to reduce financial match requirements for farmers to implement priority water quality improvement practices in coordination with Farm Viability Program.	Land erosion, nutrients, channel erosion	PMNRCD, OCNRCD, AAFM, USDA-NRCS, VVTDEC	NRCS CSP, ACAP, RCPP, VHCB
36. Develop equine specific programing including support for installing horse manure compost bins and making pasture improvements.	Land erosion, nutrients	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	ACAP, EQIP, RCPP, AAFM BMP
37. Complete targeted water quality sampling on 5-10 farms to help identify source areas and evaluate nutrient reductions achieved through BMP implementation.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, VDEC	CWIP (LaRosa Partnership Grants), ACAP
38. Publish success stories where farmers have installed BMP practices and seen improved farm operations and improved water quality conditions.	Land erosion, nutrients, channel erosion	UVM Ext. PMNRCD, OCNRCD, AAFM, USDA-NRCS, VDEC	CWIP, NRCS
39. Increase the participation of Dairy Farms in the basin in the Caring Dairy Program, as well as new AAFM Vermont Environmental	Land erosion, nutrients,	PMNRCD, OCNRCD, AAFM	Caring Dairy Program, AAFM

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
Stewardship program to highlight farms with good water quality practices.	channel erosion		
40. Increase the participation of Farm Viability in working with farms that are the focus of BMP implementation efforts in target watersheds to complete a cash flow analysis or develop a full business plan.	Land erosion, nutrients, channel erosion	Farm Viability, PMNRCD, OCNRCD, AAFM, NRCS, NOFA VT	VHCB
41. Develop Farm Conservation Corp program to support implementation of BMP practices which can be done efficiently by hand labor.	Land erosion, nutrients, channel erosion	VDEC, VYCC, GMC	ERP
Strategies to address runoff from Forest Lands. Priority sub-basins include high phosphorus export watersheds shown in Figure LA-1			
42. Support local land trusts and conservation organizations in conserving forest blocks that are important for protecting water quality in headwater streams.	land erosion, channel erosion, encroachment	Lake and Watershed Associations, VRC, ANR, TNC, VLT	CWIP/ ERP, VHCB, Hills and Hollows
43. Coordinate workshops on minimizing water quality impacts of maple sugaring operations. Consider GSI/ infiltration BMPs to mitigate changes in hydrology due to RO water discharges	land erosion, channel erosion	VT Woodlands Association, VT Coverts, VFPR, Vermont Maple Sugar Makers' Association	CWIP, NRCS
44. Host workshops on the new AMPs, as well as resources available for addressing logging road issues which could be held at local lumberyards	land erosion, channel erosion	VT Woodlands Association, VT Coverts, VFPR, PMNRCD, OCNRCD	RCPP, CWIP
45. Use Lidar data when available to identify gullies that may have been caused by historical logging operations to evaluate restoration potential.	Land Erosion, Channel erosion	UVM, ANR,	CWIP/ ERP

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
46. Continue to support local skidder bridge rental program and increase usage of bridges.	Channel erosion, land erosion	VFPR, PMNRCD, OCNRCD	CWIP/ ERP
Strategies to address unstable stream channels and improve aquatic habitat. Priority Sub-Basins include Poultney (lower) and Castleton Rivers.			
47. Complete Phase 2 SGA and River Corridor Plans for identified reaches in the South Lake Basin.	Channel erosion, encroachment	VDEC, PMNRCD, Towns	CWIP/ ERP
48. Complete assessments along the Poultney River reaches to evaluate the status of sediment stressed condition and the contribution of stream channel erosion to this condition as well as town interest in river corridor zoning. Update Phase 2 SGA (2006) if justified based on this evaluation.	Channel erosion, encroachment	VDEC, PMNRCD, GMC, Town of Poultney	CWIP/ ERP
49. Complete preliminary engineering for projects identified in existing and new SGA assessments, B&C inventories, and River Corridor Plans. Complete project datasheets with preliminary project descriptions and constraints for high priority projects.	Channel erosion, encroachment	VDEC, PMNRCD	CWIP/ ERP
50. Complete priority river corridor easement projects along priority tributary reaches where the greater stream equilibrium can be achieved through river corridor easements and/ or the purchase of adjacent riparian lands.	Channel erosion, encroachment	VDEC, VFW, PMNRCD, VRC, VLT	CWIP/ ERP, VHCB
51. Continue buffer plantings along rivers in priority locations through CREP, Trees for Streams program, and USFWS buffer planting efforts	Channel erosion, encroachment, land erosion, nutrients	VDEC, VFW, PMNRCD, OCNRCD, TNC, USDA-NRCS, AAFM, USFWS, Towns	CWIP/ ERP, CREP, USFWS-PFS, VWG
52. Enhance USFWS, USFS, and USDA-NRCS Programs to encourage more efficient means to convert and revegetate cleared lands to floodplain forest.	Channel erosion, encroachment,	USDA-NRCS, USFS, USFWS, VDEC, PMNRCD	VHCB, Federal cost-share programs

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
	land erosion, nutrients		
53. Coordinate outreach to basin towns on adopting River Corridor Zoning.	Channel erosion, encroachment	VDEC, PMNRCD, RRPC, Lake and Watershed Associations, Towns	CWIP/ TBP, HMF
Strategies to support wetland restoration and protection			
54. Continue outreach to landowners of wetlands identified as priority restoration sites – with a focus on lands with new landowners, actively being conserved or where landowners are making changes in land management	Channel erosion, encroachment	USDA-NRCS, PMNRCD, OCNRCD, NRCS	WREP, CREP, CWIP/ ERP, LCBP
55. Flag wetland restoration opportunities when landowners contact wetland ecologists looking to buy or sell a property that really can't be built on to promote wetland restoration programs.	Channel erosion, encroachment	PMNRCD, OCNRCD, USDA-NRCS,	LCBP
Strategies to address loading from Wastewater treatment facilities (see Table WLA-12)			
56. Review WWTF facilities in the South Lake Basin and issue permits that meet these new phosphorus limits. Support towns pursuing P optimization, expansion projects, and upgrades	Nutrients	VDEC, Towns in the Basin	USDA-Rural Development, CWSRLF
57. Document the current loading conditions for phosphorus, and determine the "reasonable potential" that WWTF's have to cause or contribute to downstream water quality impairment	Nutrients	VDEC, Towns	VVTDEC
Strategies to address flow altered waters. Priority streams include North Breton Brook (Pelletier Dam) and the Castleton River			
58. Identify non-functioning dams that are creating geomorphic (e.g., sediment) discontinuity and aquatic organism/ fish passage barriers and pursue removal and other AOP passage projects	Flow Alteration	ANR (FED, DFW, DEC)	CWIP/ ERP, TU, USFWS-EBTJV

Strategies	Stressor Addressed	Partners (see Partners)	Funding (see Appendix I)
59. Review status of other flow-altered waterbodies and, where necessary, take steps toward restoring more natural water level fluctuations and downstream flows	Flow Alteration	VDEC, VDFW, Lake and Watershed Groups, Towns	VDEC
Strategies to address Aquatic Invasive Species			
60. Hold an annual Vermont Invasive Patrollers (VIP) training in the basin to support the establishment of VIP programs for lakes and ponds in the basin.	Aquatic Invasive Species	VDEC, Lake and Watershed Groups, FOVLAP	VTDEC
61. Support new and existing greeter programs for lakes and ponds including greeter programs on waters with invasive species to provide information to recreational users to encourage actions to prevent waterbody to waterbody transport.	Aquatic Invasive Species	VDEC, Lake and Watershed Groups, Towns	ANC Grant-in-Aid, LCBP
62. Support the purchase and use of decontamination equipment by greeter programs to increase the effectiveness of spread prevention programs including the use of VVTDECportable decontamination unit in the basin when available to target large fishing events along with other spread prevention priorities.	Aquatic Invasive Species	VDEC, Lake and Watershed Groups, Towns	ANC Grant-in-Aid, LCBP
63. Continue to refine Eurasian watermilfoil spread prevention strategy for Basin lake greeter programs with decontamination unit, public education campaign and signage, as well as policy options to increase use of decontamination unit to prevent spread out of Basin lakes infested with aquatic invasive species	Aquatic Invasive Species	Lake and Watershed Groups Towns, VDEC	ANC Grant-in-Aid, Watershed Grants, LCBP
64. Keep abreast of aquatic invasive plant research in other states and encourage research on spread prevention and control options as well as impacts of invasives on Basin lakes including fish communities through Department of Fish and Wildlife assessments.	Aquatic Invasive Species	VDFW, VDEC, Lake and Watershed Groups, Communities	ANC Grant-in-Aid, Watershed Grants

Strategies	**Stressor Addressed**	**Partners (see Partners)**	**Funding (see** Appendix I**)**
65. Sample for zebra mussels, Asian clams, quagga mussels, and spiny waterflea in lakes in the Basin.	Aquatic Invasive Species	VDEC,	VTDEC
66. Support active invasive species control programs with priorities going to those which have the greatest chance of keeping an invasive species population under control.	Aquatic Invasive Species	Colleges and Universities, VDFW, VDEC, Lake and Watershed groups	ANC Grant-in-Aid, LCBP
Priorities for Future Monitoring and Assessment			
67. Conduct biomonitoring and/or water quality monitoring on streams that have met "very good" or "excellent" criteria in order to identify candidates for reclassification	Protection	VTDEC, PMNRCD, Lake and Watershed groups	VTDEC, LaRosa

List of Acronyms:

319	Federal Clean Water Act, Section 319
604(b)	Federal Clean Water Act, Section 604b
AAFM	Agency of Agriculture, Food, and Markets
AAPs	Accepted Agricultural Practices
ACRPC	Addison County Regional Planning Commission
AEM	Agricultural Environmental Management
AEP	American Electric Power
AMA	Agricultural Management Assistance Program
AMPs	Acceptable Management Practices (for logging)
ANR	Agency of Natural Resources
ANS	Aquatic Nuisance Species
AOP	Aquatic Organism Passage
ARS	Agricultural Resource Specialists
BASS	VTDEC Biomonitoring and Aquatic Studies Section
B&C	Bridge and Culvert
BBR	Better Backroads
BMP	Best Management Practices
CCPI	Cooperative Conservation Partnership Initiative
CRP	Conservation Reserve Program
CREP	Conservation Reserve Enhancement Program
CWICNY	Champlain Watershed Improvement Coalition
CWSRF	Clean Water State Revolving Fund
VTDEC	Vermont Department of Environmental Conservation
DFPR	Vermont Department of Forests, Parks and Recreation
DFW	Vermont Department of Fish and Wildlife
DPW	Department of Public Works
DWSRF	Drinking Water State Revolving Fund
EBTJV	Eastern Brook Trout Joint Venture
EQIP	Environmental Quality Incentive Program
EPA	Environmental Protection Agency
ERP	Ecosystem Restoration Program
EU	Existing Use
FAP	Farm Agronomic Practices
FEH	Fluvial Erosion Hazard
FERC	Federal Energy Regulatory Commission
FPR	Department of Forests, Parks, and Recreation
FSA	Farm Service Agency (USDA)
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
GMC	Green Mountain College
IDDE	Illicit Discharge Detection (and) Elimination
LCBP	Lake Champlain Basin Program
LCC	Lake Champlain Committee
LCLGRPB	Lake Champlain Lake George Regional Planning Board
LCRA	Lake Champlain Restoration Association
LFO	Large farm Operation

LID	Low Impact Development
LiDAR	Light Detection and Ranging
LIG	Local Implementation Grants (LCBP)
LIP	Landowner Incentive Program
LTP	Land Treatment Planner
LWD	Large Woody Debris
MAPP	Monitoring, Assessment and Planning Program
MFO	Medium Farm Operation
NEMO	Nonpoint Education for Municipal Officials
NMP	Nutrient Management Plan
NEGEF	New England Grassroots Environmental Fund
NFWF	National Fish and Wildlife Foundation
NOFA	Northeast Organic Farming Association of Vermont
NPDES	National Pollution Discharge Elimination System
NPS	Non-point source pollution
NRCD	Natural Resource Conservation District
NRCS	Natural Resources Conservation Service
(NY) DEC	New York Department of Environmental Conservation
OCNRCD (VT)	Otter Creek Natural Resource Conservation District
ORW	Outstanding Resource Water
PDM	Pre-Disaster Mitigation
PFW	Partners for Fish and Wildlife
PMNRCD (VT)	Poultney Mettowee Natural Resource Conservation District
RRPC	Rutland Regional Planning Commission
R, T&E	Rare, Threatened and Endangered Species
RCP	River Corridor Plan
RMP	River Management Program
RPC	Regional Planning Commission
SEP	Supplemental Environmental Program
SFO	Small Farm Operation
SGA	Stream Geomorphic Assessment
SPA	Source Protection Area
SVNMP	Southern Vermont Nutrient Management Program
SWCD (NY)	Soil and Water Conservation District (New York)
SWMP	Stormwater master plans
TFS	Trees for Streams
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TU	Trout Unlimited
USDA	United States Department of Agriculture
USDA – NRCS	US Department of Agriculture – Natural Resource Conservation District
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
USGS	United States Geological Survey
UVA	Use Value Appraisal program, or Current Use Program
UVM	University of Vermont
VAAFM	Vermont Agency of Agriculture, Food and Markets

VABP	Vermont Agricultural Buffer Program
VANR	Vermont Agency of Natural Resources
VDEC	Vermont Department of Environmental Conservation
VDHP	Vermont Department of Historic Preservation
VDH	Vermont Department of Health
VEM	Vermont Emergency Management
VFB	Vermont Farm Bureau
VFWD	Vermont Fish and Wildlife Department
VGS	Vermont Geological Survey
VHCB	Vermont Housing and Conservation Board
VHQW	Very high quality waters
VINS	Vermont Institute of Natural Science
VIP	Vermont Invasive Patrollers
VLCT	Vermont League of Cities and Towns
VLRP	Vermont Local Roads Program
VLT	Vermont Land Trust
VRC	Vermont River Conservancy
WWLG	Warm water low gradient

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Glossary

10 V.S.A., Chapter 47 - Title 10 of the Vermont Statutes Annotated, Chapter 47, Water Pollution Control, which is Vermont's basic water pollution control legislation.

Accepted Agricultural Practices (AAP) - land management practices adopted by the Secretary of Agriculture, Food and Markets in accordance with applicable State law.

Acceptable Management Practices (AMP) - methods to control and disperse water collecting on logging roads, skid trails, and log landings to minimize erosion and prevent sediment and temperature changes in streams.

Aquatic biota - all organisms that, as part of their natural life cycle, live in or on waters.

Basin - one of fifteen planning units in Vermont. Some basins include only one major watershed after which it is named such as the Lamoille River Basin. Other Basins include two or major watersheds such as the Poultney/ Mettawee Basin.

Best Management Practices (BMP) - a practice or combination of practices that may be necessary, in addition to any applicable Accepted Agricultural or Silvicultural Practices, to prevent or reduce pollution from nonpoint source pollution to a level consistent with State regulations and statutes. Regulatory authorities and practitioners generally establish these methods as the best manner of operation. BMPs may not be established for all industries or in agency regulations, but are often listed by professional associations and regulatory agencies as the best manner of operation for a particular industry practice.

Classification - a method of designating the waters of the State into categories with more or less stringent standards above a minimum standard as described in the Vermont Water Quality Standards.

Designated use - any value or use, whether presently occurring or not, that is specified in the management objectives for each class of water as set forth in §§ 3-02 (A), 3-03(A), and 3-04(A) of the Vermont Water Quality Standards.

Existing use - a use that has actually occurred on or after November 28, 1975, in or on waters, whether or not the use is included in the standard for classification of the waters, and whether or not the use is presently occurring

Fluvial geomorphology - a science that seeks to explain the physical interrelationships of flowing water and sediment in varying land forms

Impaired water - a water that has documentation and data to show a violation of one or more criteria in the Vermont Water Quality Standards for the water's class or management type.

Improved Barnyards - a series of practices to manage and protect the area around the barn, which is frequently and intensively used by people, animals, or vehicles, by controlling runoff to prevent erosion and maintain or improve water quality. Practices may include: heavy use area protection, access roads, animal trails and walkways, roof runoff management, and others.

Mesotrophic – An intermediate level of nutrient availability and biological productivity in an aquatic ecosystem.

Natural condition - the condition representing chemical, physical, and biological characteristics that occur naturally with only minimal effects from human influences.

Nonpoint source pollution - waste that reaches waters in a diffuse manner from any source other than a point source including, but not limited to, overland runoff from construction sites, or as a result of agricultural or silvicultural activities.

pH - a measure of the hydrogen ion concentration in water on an inverse logarithmic scale ranging from 0 to 14. A pH under 7 indicates more hydrogen ions and therefore more acidic solutions. A pH greater than 7 indicates a more alkaline solution. A pH of 7.0 is considered neutral, neither acidic nor alkaline.

Point source - any discernible, confined and discrete conveyance including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which either a pollutant or waste is or may be discharged.

Reference condition - the range of chemical, physical, and biological characteristics of waters minimally affected by human influences. In the context of an evaluation of biological indices, or where necessary to perform other evaluations of water quality, the reference condition establishes attainable chemical, physical, and biological conditions for specific water body types against which the condition of waters of similar water body type is evaluated.

Riparian vegetation - the native or natural vegetation growing adjacent to lakes, rivers, or streams.

Sedimentation - the sinking of soil, sand, silt, algae, and other particles and their deposition frequently on the bottom of rivers, streams, lakes, ponds, or wetlands.

Thermal modification - the change in water temperature

Turbidity - the capacity of materials suspended in water to scatter light usually measured in Jackson Turbidity Units (JTU). Highly turbid waters appear dark and "muddy."

Waste Management System -a planned system in which all necessary components are installed for managing liquid and solid waste, including runoff from concentrated waste areas and silage leachate, in a manner that does not degrade air, soil, or water resources. The purpose of the system is to manage waste in rural areas in a manner that prevents or minimizes degradation of air, soil, and water resources and protects public health and safety. Such systems are planned to preclude discharge of pollutants to surface or ground water and to recycle waste through soil and plants to the fullest extent practicable.

Water Quality Standards - the minimum or maximum limits specified for certain water quality parameters at specific locations for the purpose of managing waters to support their designated uses. In Vermont, Water Quality Standards include both Water Classification Orders and the Regulations Governing Water Classification and Control of Quality.

Waters - all rivers, streams, creeks, brooks, reservoirs, ponds, lakes, springs and all bodies of surface waters, artificial or natural, which are contained within, flow through or border upon the State or any portion of it.

Watershed - all the land within which water drains to a common waterbody (river, stream, lake pond or wetland)

Southern Lake Champlain Basin Plan Appendices

Appendix A. Existing Use Tables

Appendix B. Review of Town Plans and Zoning Regulations

Appendix C. Lakes and Ponds Assessment for the Southern Champlain Basin

Appendix D. Detecting and Eliminating Illicit Discharges in Rutland County to Improve Water Quality

Appendix E. USDA-NRCS Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed (May, 2016)

Appendix F. Lake Assessment, Management, and Implementation Plan (example: Lake Bomoseen)

Appendix G. Southern Champlain Basin River Corridor Planning Summaries and High Priority Project Recommendations

Appendix H. Regulatory and Non-regulatory Programs that contain BMPs Applicable to Protecting and Restoring Waters in the Southern Champlain Basin

Appendix I. Southern Champlain Basin Plan Public Comments and Responsiveness Summary

Appendix A – Existing Use Tables

Determination of existing uses of waters for swimming in the Southern Champlain Basin (Basins 02/04)

Surface Water	Location of Use	Watershed	Town(s)	Basis for Determini
Poultney River	Multiple access locations	Poultney River	Tinmouth, Middletown Springs, Poultney, Fair Haven, West Haven	Multiple access loca Road and Bay Road from the D&H Rail
Beebe Pond	Route 30	Castleton River	Hubbardton	Multiple access loca
Black Pond	Black Pond Rd	Castleton River	Hubbardton	Regular access from
Breeze Pond	Black Pond Rd			
Lake Bomoseen	Crystal Beach (municipal public beach), Lake Bomoseen State park, multiple access	Castleton River	Castleton, Hubbardton	
Burr Pond	Burr Pond Rd	Hubbardton River	Sudbury	
Glen Lake	Multiple access locations off Moscow Rd	Castleton River	Castleton	
Halfmoon Pond	Half Moon State Park	Castleton River	Castleton	
Hinkum Pond		Hubbardton River	Sudbury	
Lake Hortonia	Multiple access locations off Routes 30 and 140	Hubbardton River	Sudbury, Hubbardton	Multiple access loca
Perch Pond	Multiple access locations off Perch Pond Rd	Hubbardton River	Benson	
Spruce, Doughty	Pond Woods WMA	Hubbardton River	Benson, Orwell	
Sunrise Lake	Access from Sunset Lake Rd	Hubbardton River	Benson, Orwell	
Sunset Lake	Access from Sunset Lake Rd	Hubbardton River	Benson	
Castleton River	Multiple access locations	Castleton River		Multiple access loca
Mettowee River	Multiple access locations Button Falls, Blossoms Corner	Mettowee River	Dorset, Rupert, Pawlet, Wells	Multiple access loca
Lake Saint Catherine	VT DFW Boat Access Area, Lake Saint Catherine State Park	Mettowee River	Poultney	Lake Saint Catherin State VDFW Access
Little Lake	VT DFW Boat Access Area		Wells	Access from Lake S
Lily Pond	VT DFW Boat Access Area		Poultney	Access from Lake S
Flower Brook	Multiple access locations			Multiple access loca
Wells Brook	Multiple access locations			Multiple access loca
Indian River	Multiple access locations			
Lake Champlain	Multiple access locations		Benson, Bridport, Orwell, Shoreham, West Haven	

Determination of existing uses of waters for fishing in the Southern Champlain Basin (Basins 02/04)

Surface Water	Location of Use	Watershed	Town(s)	Basis for Determini

Poultney River	Multiple access locations	Poultney River	Tinmouth, Middletown Springs, Poultney, Fair Haven, West Haven	Multiple access loca Road and Bay Road from the D&H Rail
Beebe Pond	Route 30	Castleton River	Hubbardton	Multiple access loca
Austin Pond	Hortonia Rd	Castleton River	Hubbardton	Access from Horton
Echo Lake	Route 30	Castleton River	Hubbardton	Access location alon
Roach Pond	Hortonia Rd	Castleton River	Hubbardton	Access from Horton
Burr Pond	VDFW access	Hubbardton River	Sudbury	Burr Pond Rd (inclu
Glen Lake	VDFW access	Castleton River	Castleton	Multiple access loca state VDFW access)
Halfmoon Pond	Half Moon State Park	Castleton River	Castleton	
Hinkum Pond		Hubbardton River	Sudbury	
Lake Hortonia	Multiple access locations off Routes 30 and 140	Hubbardton River	Sudbury, Hubbardton	Multiple access loca (including state VD Access RD, and the
Perch Pond	Multiple access locations off Perch Pond Rd	Hubbardton River	Benson	
Spruce, Doughty	Pond Woods WMA	Hubbardton River	Benson, Orwell	
Sunrise Lake	Access from Sunset Lake Rd	Hubbardton River	Benson, Orwell	
Sunset Lake	Access from Sunset Lake Rd	Hubbardton River	Benson	
Castleton River	Multiple access locations	Castleton River		Multiple access loca
Mettowee River	Multiple access locations Button Falls, Blossoms Corner		Dorset, Pawlet, Rupert, Wells	Multiple access loca VDFW Access Area
Lake Saint Catherine	VDFW access			Multiple access loca Area and Lake Sain
Little Lake	VDFW access			Access from former
Lily Pond	VDFW access			
Flower Brook	Multiple access locations			
Wells Brook	Multiple access locations			
Lake Champlain	Multiple access locations VDFW access			Benson Landing F& (George Davis) Acc Orwell.
East Creek	Multiple access locations VDFW/VWA access	East Creek	Benson, Orwell	East Creek Wildlife located in west cent Orwell and Benson. and is in two separa most easily accessed via the mouth of Eas The southern parcel Mt. Independence R Road. A small porti refuge and is clearly The 419 acres comp State of Vermont an & Wildlife Departm

Determination of existing uses of waters for public water supplies in Southern Champlain (Basin 02-04)

Surface Water	Watershed	Town	Basis for Determining the Presence of an Existing Use
Inman Pond	Poultney River	Fair Haven	Designated A2 - 6/15/67 - 79 acres (Pond only) Inman Pond and all waters within its watershed in Fair Haven.
Sucker Brook	Poultney River	Fair Haven	Sucker Creek (0.6 mile) - Sucker Creek and all waters within its watershed upstream of the Howard Dam and Sheldon Dam, both of which are located in Fair Haven.

Determination of existing uses of waters for recreational boating in Southern Champlain (Basin 02-04) – Flat water

Surface Water	Watershed	Town	Basis for Determining the Presence of an Existing Use
All lakes and ponds in the basin	Basin-wide		Designated use
Lower Poultney River	Poultney	West Haven	Designated use, widely observed existing use, school programs
Castleton River	Poultney	West Rutland, Ira, Castleton, Fair Haven	widely observed existing use, school program
Lower East Creek	East Creek	Orwell	widely observed existing use, school program
Lake Champlain	Champlain Basin	West Haven, Benson, Orwell, Shoreham, Bridport, Addison, Panton, Ferrisburgh	VDFW access areas, designated use, widely observed existing use

(1) Jenkins and Zitka, The Waterfalls, Cascades, and Gorges of Vermont, VTANR, 1988.

Determination of existing uses of waters for recreational boating in Southern Champlain (Basin 02-04) – Whitewater

Surface Water	Watershed	Town	Basis for Determining the Presence of an Existing Use
Mettowee River	Mettowee	Pawlet/ Wells	Listed on VPA website from Route 30 to Route 153

(2) Jenkins and Zitka, The Whitewater Rivers of Vermont, VTANR, 1992.

Appendix B – Assessment of Basin Towns for Water Quality Protection

Towns in the Basin (wholly or partly):

NAMES	County	RPC	NFIP Participant	Lake over 20 acres	Building_setback_from_stream_lake	Lakeshore_buffer_width	Stream_buffer_width
Addison	Addison	AC	yes	yes	100 ft		
Benson	Rutland	RR	yes	yes	75 ft		
Bridport	Addison	AC	yes	yes			
Castleton	Rutland	RR	yes	yes			
Cornwall	Addison	AC	yes	yes			
Danby	Rutland	RR	yes	yes			
Fair Haven	Rutland	RR	yes	yes	50 ft		
Hubbardton	Rutland	RR	yes	yes	25 ft	25 ft	
Middletown Springs	Rutland	RR	yes	no			
Orwell	Addison	AC	yes	yes	50 ft	50 ft	
Panton	Addison	AC	yes	yes			
Pawlet	Rutland	RR	yes	no			
Poultney	Rutland	RR	yes	yes	50 ft		
Poultney Village	Rutland	RR	yes	no			
Rupert	Bennington	BC	yes	no			
Shoreham	Addison	AC	yes	yes	20 ft		
Tinmouth	Rutland	RR	no	yes	50 ft		
Wells	Rutland	RR	yes	yes			
West Haven	Rutland	RR	yes	yes	200 ft		
West Rutland	Rutland	RR	yes	no			50 ft
Whiting	Addison	AC	no	no			

- Addison
- Benson
- Bridport
- Castleton
- Danby
- Dorset
- Fair Haven
- Ferrisburgh
- Hubbardton
- Ira
- Middleton Springs
- Orwell
- Panton
- Pawlet
- Pittsford
- Poultney
- Rupert
- Shoreham
- Sudbury
- Tinmouth

- Wells
- West Haven
- West Rutland

Appendix C - Lakes and Ponds Assessment for the Basin

LakeID	Water Quality Score	Biology Score	Unusual Natural Scenic Feature Score	Combined	BestLake Score	Best Lake Category	Comments
HINKUM		4	5	9	5	1	Top ~5% "best lakes" - overall score; Top ~5% "best lakes"- UNSF
PERCH (BENSON)	4	4		8	5	1	Top ~10% "best lakes"- overall score; Top ~10% "best lakes"- water quality
SPRUCE (ORWELL)		4	4	8	5	1	Top ~10% "best lakes"- overall score; Top 20% for biodiversity
HALF MOON	4	3	0	7	5	1	Top ~20% "best lakes"- overall score; Top ~10% "best lakes"- water quality
INMAN	2	3	2	7	5	1	Top ~20% "best lakes"- overall score
GLEN	0	4	2	6	5	1	Large and diverse plant community present at N end of N. arm. Natural Heritage rare plant site there. ...
OLD MARSH	2	4		6	5	1	Top 20% for biodiversity
SUNRISE		4	2	6	5	1	Top 20% for biodiversity; Presence of Utricularia gibba (VT threatened). Scenic lake bottom noted along south shore.
BOMOSEEN		5		5	5	1	Top 5% for biodiversity
HOUGH		5		5	5	1	Top 10% for biodiversity
LOVES MARSH	2	3		5	5	1	
SUNSET (BENSON)		2	3	5	5	1	
BEEBE (HUBDTN)		4		4	5	1	Top 20% for biodiversity
BURR (SUDBRY)	0	4		4	5	1	
ECHO (HUBDTN)	0	4		4	5	1	
HORTONIA		4		4	5	1	
LILY (POULTY)		4		4	5	1	
LITTLE (WELLS)		4		4	5	1	
ST. CATHERINE		4		4	5	1	
COGGMAN	0	2		2	5	1	
ROACH		2		2	5	1	
CHOATE	0	1		1	5	1	
DOUGHTY		1		1	5	1	
HALFMOON		1		1	5	1	
MILL (BENSON)		1		1	5	1	
MUD (BENSON)		1		1	5	1	
BULLHEAD (BENSON)	0			0	1	5	
MUD (ORWELL)				0		NR	

Appendix D – Detecting and Eliminating Illicit Discharges in Rutland County to Improve Water Quality

Seven towns participated in the Rutland County Illicit Discharge Detection and Elimination (IDDE) Project: Benson, Castleton, Fair Haven, Poultney, Proctor, Wallingford, and West Rutland (Appendix C). The goal of the project was to improve water quality by identifying and eliminating contaminated, non-stormwater discharges entering stormwater drainage systems and discharging to the Otter Creek, the Poultney River, and their tributaries. The geographic scope included the entire extents of the municipal closed drainage systems in these towns. Prior to this assessment, the Vermont Department of Environmental Conservation (DEC) prepared stormwater infrastructure maps for all seven towns. This infrastructure mapping was used to plan the assessment in each town and to guide further investigations in systems with suspected illicit discharges.

The results of the IDDE assessment work for the Poultney River Basin (including the Castleton River) that include the towns of Benson, Castleton, Fair Haven, Poultney, and West Rutland are included here.

Table 1. Summary of stormwater drainage systems assessed in 2013

Town	Closed Drainage Systems Assessed	Suspected Illicit Discharges	Confirmed Illicit Discharges
Benson	6	0	0
Castleton	26	1	0
Fair Haven	36	5	4
Poultney	16	1	1
West Rutland	64	4	1
Total	**148**	**11**	**6**

BENSON

No illicit discharges were confirmed in the stormwater system.

CASTLETON RESULTS

Of the 26 stormwater drainage systems assessed in Castleton, an illicit discharge was suspected in only one, system CA180 (see description below). Through extensive bracket sampling, the apparent contamination (ammonia) in this system was determined to be of natural origin. Therefore, there were no confirmed illicit discharges in Castleton.

FAIR HAVEN RESULTS

Of the 36 stormwater drainage systems assessed in Fair Haven, an illicit discharge was suspected in five. An Illicit discharge was definitively identified in four of these systems. The fifth system, FH080, appears to intercept a small flow of treated municipal water; however, detailed water leak detection is beyond the scope of this study.

Actions:

- FH280 - Town of Fair Haven to address an illicit connection to system - badly leaking house sewer lateral.
- FH350 - Town of Fair Haven to address failed septic system upstream of the M&B Snack Bar property as the source of elevated *E. coli* in the stream.

POULTNEY RESULTS

Of the 16 stormwater drainage systems assessed in Poultney, an illicit discharge was suspected in only one, system PY140. Further investigation of this system confirmed the presence of an illicit discharge of sanitary wastewater in this system, but did not resolve a specific source. Town of Poultney is currently conducting an alternatives analysis for a stormwater project intended to alleviate drainage problems on York Street, provide stormwater treatment, and eliminate the problematic section of repurposed sanitary sewer now discharging at PY140.

WEST RUTLAND RESULTS

Of the 64 stormwater drainage systems assessed in West Rutland, an illicit discharge was suspected in four. Upon further investigation, no illicit discharges were found in three of these systems. Only system WR460 had a confirmed illicit discharge and this has reportedly been resolved.

Appendix E - Resource Assessment and Watershed Level Plan for Agriculture in the McKenzie Brook Watershed, Addison County, Vermont (USDA-NRCS, 2017)

Note: Pictures, Maps, and Graphs have been omitted from this version

Prepared By; USDA/NRCS Colchester, VT, May 2016

Table of Contents:

NEPA Concerns and Compliance

Local Watershed Team Actions and Outcomes

Field Scale Land Cover and Resource Maps

Local Watershed Team Action Plan

Tracking Database

Background and Purpose of Plan

These watershed plans were developed by NRCS in Vermont to address the need for more effective practice implementation of conservation plans on agricultural lands in the Lake Champlain Basin. Past conservation practice implementation efforts have been broad in scope and have not resulted in any significant improvements in water quality. In response to the pending new phosphorus TMDL for Lake Champlain and due to the availability of increased NRCS funding for the next five years, NRCS in Vermont has decided to use a more strategic and focused process for conservation practice implementation. Under this new process NRCS will collaborate with the Vermont Department of Environmental Conservation (VTDEC) to contribute information to the agricultural sections of Tactical Basin Plans (TBP's). These agricultural watershed plans will provide a comprehensive inventory of land use and resource conditions in each of the targeted watersheds. This information will then be used by local NRCS staff and partners working in each watershed to identify and target specific farms and fields for further resource assessment and for the development of practice alternatives.

Local Watershed Teams will be initially established by NRCS in each watershed, but eventually they will be directed by an appropriate local partner to bring all agricultural partners together to work in a coordinated and strategic effort. The Local Watershed Teams will determine the length of the project for each watershed and what amount of phosphorus reduction they would like to achieve during that time period. These Teams will also identify objectives to meet their goals and a detailed action plan supporting these objectives. The timeline and amount of practice implementation may be determined to some extent by the amount of funds likely to be available and the staff available to implement the Local Watershed Team Action Plan.

These watershed plans will also include the results of an analysis to establish phosphorus reduction goals (in lbs/yr) for each of the targeted watersheds using existing EPA tools such as the EPA HUC-12 Tool for the Lake Champlain Basin. The percent reduction in phosphorus load identified by EPA for the larger HUC-8 watershed will be used to calculate the required phosphorus load reduction for each HUC-12 watershed. Currently, EPA has proposed phosphorus reduction goals for our four targeted watersheds that range from 35 to 83 percent, although at this time the TMDL is not finalized and these reduction goals could still change.

Based on the required reduction for each of the targeted watersheds, an example conservation practice scenario will be developed. This scenario will include a suite of individual practices, and systems of practices, that when implemented will reduce phosphorus loading from the agricultural lands by the required amount for each of the targeted watersheds. The new EPA Scenario Tool will be used to develop this example suite of practices that meet the TMDL goal for agriculture in each of the watersheds. The Local Watershed Teams will modify this list of selected practices and the amount applied based on their more detailed assessment of the watershed and their locally developed goals. The amount of estimated phosphorus reduction from implemented practices will be tracked on an annual basis. It is important to note that the phosphorus reduction amounts achieved by these specific practices are an estimate based on some fairly general modeling assumptions. These modeled loading reductions can be helpful in establishing goals for a watershed and for the tracking of progress. However, these numbers are not necessarily accurate in a way that they could be used for regulatory purposes.

Resource Inventories

A variety of watershed land and farm assessments were undertaken in order to provide resource condition information on a watershed scale to the Local Watershed Teams, NRCS staff and partners. These various data layers can be used individually or in combination with each other to help the Local Watershed Teams and conservation planners to target areas for further on the ground assessment and then if appropriate, conservation practice implementation. Due to the

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large extent of information that could be potentially developed and the short time frame in which the data is needed, we have prioritized the development of the data layers to some extent based on feedback from local NRCS staff.

For each data layer a short narrative will describe the data set, briefly how it was generated, show a watershed wide map of the data, a more detailed example map, and some tabular or graphical summary data when appropriate. Suggestions will also be provided how this data layer might be used in conjunction with other data layers. All applicable NRCS offices will be provided GIS based electronic files of each data layer for them to use in their more detailed assessments.

Watershed Overview

The McKenzie Brook Watershed is located in southwestern Addison County Vermont. Since McKenzie Brook is a lake direct HUC-12 it includes drainage areas on the New York side of the Lake (including McKenzie Brook). There are two major tributaries that drain into Lake Champlain on the Vermont side: Hospital Creek and Whitney Creek. On the Vermont side the watershed extends from Hospital Creek in the north to, but not including, East Creek in the south. The total watershed area in Vermont is 21,221 acres. The area of the Lake that the McKenzie Brook Watershed drains to (South Lake A) has some of the highest total phosphorus concentrations of any Lake segment. The phosphorus target for this section of Lake is 25 ug/l.

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Figure 1 – Map of the McKenzie Brook Watershed

The McKenzie Brook Watershed is very rural with a significant amount of land in agriculture. Data from the National Cropland Database (NCD 2011, Figure 2) estimates that 28% of the watershed is in annual cropland and 48% is in pasture or hayland, for a total of 76% in agriculture. Only about 10% of the watershed is forested and about 5.5% of the watershed is in a developed use. The McKenzie Brook watershed is probably one of the most intensive agricultural watersheds in Vermont.

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Figure 2 – Landcover in the McKenzie Brook Watershed, 2011 NCD

Farmsteads

The Farmstead Maps show the location of each active farmstead within the McKenzie Brook Watershed. The identification of farmsteads was conducted by visual interpretation of the 2014 NAIP imagery. Farmstead boundaries were based on the visual identification of structures and heavily disturbed ground surface. As can be seen in Figure 3, there were a total of 47 active farmsteads identified in the McKenzie Brook Watershed in 2014. There is one LFO in the watershed, 10 of the farms are MFOs' and the remaining 33 farmsteads are small farms. These maps can be used to ensure that all farmsteads in the watershed are reviewed on the ground for potential waste management issues and to help identify farmsteads with potential resource concerns such as improperly constructed and/or maintained heavy use areas.

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Figure 3 – Farmstead Locations in the McKenzie Brook Watershed

6

Figure 4 shows an example Farmstead Map for a location that has several barns, a manure storage facility and some heavy use areas, but shows no visible resource concerns. The close proximity of the manure pit to a surface ditch might warrant an onsite visual assessment of any potential resource concerns.

Figure 4 – Example Farm Scale Farmstead Map

Annual Cropland and Hayland

One of the basic pieces of information need for agricultural watershed planning is the extent and types of land cover in the watershed. Annual cropland and hayland were visually identified in the McKenzie Brook Watershed using 2014 NAIP imagery. As such the land cover is a "snapshot in time" since many crop and hay fields are rotated between annual crops, such as corn, and hay.

Figure 5 shows the location and extent of corn land and hayland in the McKenzie Brook Watershed. There was a total of 5,523 ac. of annual crops (mostly corn) and 7169 ac. of hay in the McKenzie Brook Watershed in 2014. This comprises a total of 60% of the 21,222 ac. watershed. Pasture in the watershed has not been mapped at this time.

7

Figure 5 – Location and Extent of Annual Cropland and Hayland in the McKenzie Brook Watershed

8

Field scale maps can be produced by conservation planners are working in the watershed. Figure 6 shows an example of a field scale map for annual cropland and hayland. The Annual Cropland and Hayland Maps can be used alone or overlain with other several data layers such as the Erosion and Runoff Risk Potential to evaluate specific fields for erosion and runoff risk. It is important to remember that these Annual Cropland and Hayland Maps represent land cover in 2014 and many of these fields may be in a corn/hay rotation.

Figure 6 – Example Field Scale Map of Annual Cropland and Hayland

An additional analysis was performed to identify farm fields continuously planted to annual crops such as silage corn (Figure 7). These fields were visually identified using five years of aerial imagery (2009, 2011, 2013, and 2014). There is an estimated 1,759 acres of continuous cropland identified in the McKenzie Brook Watershed (32% of total cropland). The remaining cropland is in rotation, mostly with hay.

Fields in continuous annual crops are likely to exhibit a number of resource concerns. These fields may have higher erosion rates, depleted organic matter, and higher nutrient application rates, among other concerns. For this reason these fields should be prioritized for more detailed onsite evaluations. Any fields identified as continuous cropland and have a high Erosion and Runoff Risk Potential should be considered as especially vulnerable to significant resource concerns.

9

Figure 7 – Map of Cropland in Continuous Annual Tillage

10

Cropland and Steep Slope Adjacency

The streams and rivers in the McKenzie Brook Watershed are fairly deeply incised without a significant amount of available floodplain. This results in steep slopes along the waterways up to the edges of adjacent fields. These areas are prone to the development of gully erosion due to the steep slopes and the erosive nature of the soils in the watershed. These gullies often first form in the woods or on non-ag land adjacent to fields and then with time head cut into the crop fields.

The map in Figure 8 depicts areas of steep slopes (>8%) that are adjacent to cropland in the McKenzie Brook Watershed. These maps were developed using DEM data and a flow accumulation model. As part of the field assessment these areas should be visually checked to identify any areas with significant gully erosion. Individual field scale maps such as the one shown in Figure 9 can be developed for this purpose.

Figure 8 – Steep Slopes Adjacent to Cropland in the McKenzie Brook Watershed

11

Figure 9 – Filed Scale Map of Areas of Steep Slope that are Adjacent to Cropland

Wetland Restoration

The Restorable Wetland data layer was developed by a variety of government agencies and private consultants in 2007. The main data input layers were: Hydric Soils, Land-use / Land-cover data from 2002 showing open land, slopes under 5%, and National Wetland Inventory data showing disturbed wetlands. Once appropriate restoration sites had been delineated using GIS analysis, these areas were then run through a prioritization model that ranked the sites based their potential to retain phosphorus. Four prioritization categories for restoration were chosen: highest, high, moderate, and low. For further details on how the data layer was developed refer to the "Lake Champlain Wetland Restoration Plan" report.

Since this data is now 9 years old, land use changes have occurred over this time period. The data was edited to remove sites that contained house sites. The e911 "esites" data for 2015 was used to remove those areas that now show homes within the restorable wetlands. Additionally, State Land that was also excluded from the data layer, since it is likely a functional wetland and not in private ownership. The extent and location of potentially restorable wetland areas is shown in Figure 10. These areas are located on private land and may have historic significant drainage and other modifications. These areas would only be available for restoration under a voluntary restoration program such as the Wetland Reserve Easement Program. Using field scale maps such as in Figure 11, it will be necessary for on-site investigation to insure that they are eligible and capable of being restored to natural wetland conditions.

12

Figure 10 - Watershed Scale Map of Potentially Restorable Wetlands

13

Figure 11 - Example Field Scale map of Potentially Restorable Wetlands

The map in Figure 10 identifies over 2,500 ac. of potentially restorable wetland in the McKenzie Brook Watershed. As can be seen in Figure 12 over three quarters of this area (2,400 ac.) is categorized as having the highest restoration potential. The site specific restoration data as shown in Figure 11 could be overlain with crop and hayland data or other information such as tract information to further assess its viability for restoration.

14

Figure 12 - Summary of Potentially Restorable Wetland Classes

Erosion and Runoff Risk Potential

A GIS model was constructed to estimate the risk of erosion and runoff from farm fields based on four factors. The factors included were the K value, hydrologic soil group and flooding potential of the soil map unit, as well as the slope, based on Digital Elevation Model (DEM) data. The categories in the Erosion and Runoff Potential Maps are meant to represent the relative risk of sheet and rill erosion and runoff occurring from specific fields or portions of fields without any consideration of the current cropping system or conservation practices used on the field. As can be seen in Figure 13 a moderate portion of the fields in the McKenzie Brook Watershed have been identified having a high or very high risk for erosion and runoff. The majority of these high risk fields are located in the southern portion of the watershed. Figure 14 provides an example of the type of field level maps that can be produced from this data. It is important to note that in many situations it is only a portion of a field that is identified as having high or very high risk.

15

Figure 13 - Watershed Scale Map of Erosion and Runoff Risk Potential

16

Figure 14 - Example Field Scale Erosion and Runoff Risk Potential Map

Farm Ditches

Field ditches are common on agricultural land throughout the Lake Champlain Basin in Vermont. These waterways have the potential to readily transport both sediment and nutrients to streams and rivers. Under the new Required Agricultural Practices recently passed by the State Legislature these ditches will likely be required to have a 10 ft wide vegetated buffer adjacent to them. As such it will become important to know the location of these ditches to ensure that the farmer has opportunities to install buffers. Figure 15 shows the location of fields in the McKenzie Brook Watershed that have either interior ditches or ditches adjacent to them. Of the 1,042 crop and hay fields in the McKenzie Brook Watershed about 374 of them appear to have a ditch of some type. We are currently developing ditch network maps for the McKenzie Brook Watershed. Once completed this mapping will allow for the production of field scale maps showing ditch locations as shown in Figure 16.

17

Figure 15 - Map of Fields with Ditches in the McKenzie Brook Watershed

18

Figure 16 - Example Field Scale Ditch Map

Riparian Buffer Gaps

Riparian corridors were evaluated in the McKenzie Brook Watershed to determine locations where adequate riparian buffers were lacking. The identification of these riparian buffer gaps was based on visual interpretation of 2014 aerial imagery and channel width information from the Vermont Department of Environmental Conservation (VTDEC) Rivers Program database. Riparian zones were evaluated to determine if at least a 25 foot wide vegetated buffer was present, either herbaceous or woody. Twenty-five feet was used as the minimum requirement since the NRCS practice standard for Filter Strip requires a minimum of 25 ft and the practice standard for Riparian Forest Buffer requires a minimum of 35 ft.

A total of 343 miles of streambank (both sides of the stream) were evaluated. Of these, 201 miles of streambank have an adequate buffer and 73% of these are woody buffers. However, it was estimated that 142 miles of streambank in the McKenzie Brook Watershed do not have an adequately vegetated riparian buffer. It may be useful to overlay the Riparian Buffer Map data with continuous cropland and/or the erosion and runoff risk potential data. These areas may exhibit greater rates of erosion and runoff and would be a priority for well vegetated riparian buffers.

19

Figure 17 – Map of Riparian Buffer Gaps

20

Conserved Farmland

In partnership with other groups such as the Vermont Land Trust, the Vermont Housing and Conservation Board has operated a farmland conservation program in Vermont since 1987. NRCS has contributed significant funds to this program over the years through what is now called the Agricultural Easement Program. In some areas large, contiguous blocks of conserved farmland are forming. The map in Figure 18 shows conserved farmland in the McKenzie Brook Watershed. A total of 13,550 ac. of farmland have been conserved to date in this watershed. Conserved farmland maps can help direct funds and efforts of programs such as the Regional Conservation Partnership Program (RCPP) and other water quality initiatives.

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Figure 18 – Conserved Farmland in the McKenzie Brook Watershed

22

Watershed Phosphorus Reduction and Practice Implementation Goals and Projected Costs

EPA has proposed phosphorus reduction goals for all the HUC-8 watersheds or lake segments in the Lake Champlain Basin. The current phosphorus reduction goal for the McKenzie Brook Watershed is 36% overall for all land uses. EPA has assigned a targeted reduction of 60% for agriculture in the Watershed. NRCS has attempted to use the TMDL goals and EPA developed tools to estimate phosphorus loads and reductions to the extent possible. This includes use of the new EPA HUC-12 Tool and the EPA BMP Scenario Tool. All costs are based on NRCS payment schedules, except for a couple of situations where estimated practice costs were developed (ex. average farmstead wide practice costs).

Watershed Phosphorus Reduction Goals for Agriculture

Watershed phosphorus reduction goals for agriculture were estimated using the EPA HUC-12 Tool. This tool provides an estimate of phosphorus loading for each land cover type at the HUC-12 level. Phosphorus loading from continuous corn, crop/hay rotation, continuous hay, pasture and farmland were totaled from the HUC-12 Tool to determine the total estimated phosphorus loading from agriculture. The needed amount of phosphorus reduction in lbs/yr was then estimated by multiplying the total agricultural load by the percentage reduction determined by EPA to be necessary for agriculture in the watershed. Table 1 provides the necessary load reductions for the four targeted watersheds. For the McKenzie Brook Watershed the total agricultural loading was estimated to be 43,246 lbs/yr, the reduction goal at this time was set to be 60%, and the resulting agricultural phosphorus reduction goal for the McKenzie Brook Watershed was estimated to be 29,966 lbs/yr. The McKenzie Brook Watershed has the highest P loading rate and P reduction goal of the four watersheds, by a factor of almost 2.

Table 1 – Agricultural Phosphorus Reduction Goals for the Four Targeted Watersheds 2016 Priority Watershed Estimated Ag Phosphorus Loadings and Targeted Reductions August, 2015 - Draft

Watershed Name	Watershed Area (acres)	Total Estimated Ag P Loading (lbs/yr)	TMDL Reduction Goal	Ag P Reduction Goal (lbs/yr)
Rock River	22,743	19,248	83%**	15,976
Pike River	25,088	9,599	83%**	7,967
St. Albans Bay	33,515	23,047	35%	8,066
McKenzie Brook	21,222	43,276*	60%	25,965

Appendix F. Lake Assessment, Management, and Implementation Plan (example: Lake Bomoseen)

Elements of a Lake Watershed Assessment and Management Plan (DRAFT) *for consideration and inclusion in the South Lake Champlain Tactical Basin Plan* (October 2017)

Role of Lake Implementation Teams

Recent water quality management efforts on lake water quality issues had led to the formation of "Lake Implementation Teams," comprised of members from South Lake Basin lake associations – Lake Bomoseen and Lake Saint Catherine (including the Little Lake Saint Catherine Conservation Fund), town representatives (including Castleton, Hubbardton, Poultney, and Wells), the Poultney Mettowee Natural Resource Conservation District (PMNRCD), Rutland Regional Planning Commission, UVM Sea Grant, and VTDECstaff (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 has also led to the development of lake watershed management plans for each lake basin that frame out specific strategies and actions to address lake basin specific issues.

Since the formation of these teams in 2016, several meetings have been convened to discuss policy and management approaches to address aquatic plant management and water quality issues within each lake as well as to conduct and review the results of lake watershed stormwater assessments, including high priority municipal road projects.

In 2016, the PMNRCD was awarded an Ecosystem Restoration Program (ERP) grant to conduct a Stormwater Master Plan (SWMP) for the Lake Bomoseen watershed, including Sucker Brook, a high priority sub-basin for sediment and nutrient reduction. Several high priority projects have been identified during that assessment process, and a couple of those projects are moving forward to the design and implementation phases. High priority projects identified via the Lake Bomoseen watershed (including the Castleton River headwaters) stormwater master planning assessment have been and will be incorporated into the Watershed Projects Database and referenced here in the South Lake Champlain Tactical Basin Plan in order to implement nutrient and sediment reduction projects that will ultimately benefit the South Lake Champlain lake segments as well.

As of the drafting this Basin Plan, the PMNRCD had just also received an ERP grant to conduct a similar SWMP for the Lake Catherine basin, and to look for opportunities to mitigate the effects of stormwater runoff from roads, large impervious areas, and from lakeshore residential properties.

We have continued to hold monthly meetings in coordination with each lake association, town representatives, the Poultney Mettowee NRCD, Rutland RPC, UVM-Sea Grant, and landowners to address multiple lake assessment and management topics including but not limited to stormwater, roads, aquatic plants, shoreline stabilization, wetlands, boat traffic, and municipal government involvement. The recent (July 2017) Lake Bomoseen Green Stormwater Infrastructure workshop and Lake Saint Catherine Lakewise workshop were included as a Vermont "Clean Water Week" events.

The goal of the Lake Implementation Team(s) is to improve water quality conditions throughout each lake watershed, which will also have the intended effect of improving in-lake conditions. The objectives and actions needed to meet this goal are:

1. Guide project development and implementation for each lake watershed assessment and management plan which will have the dual purpose of implementing the Lake Champlain Phosphorus TMDL.

2. Promote and manage education and outreach efforts;

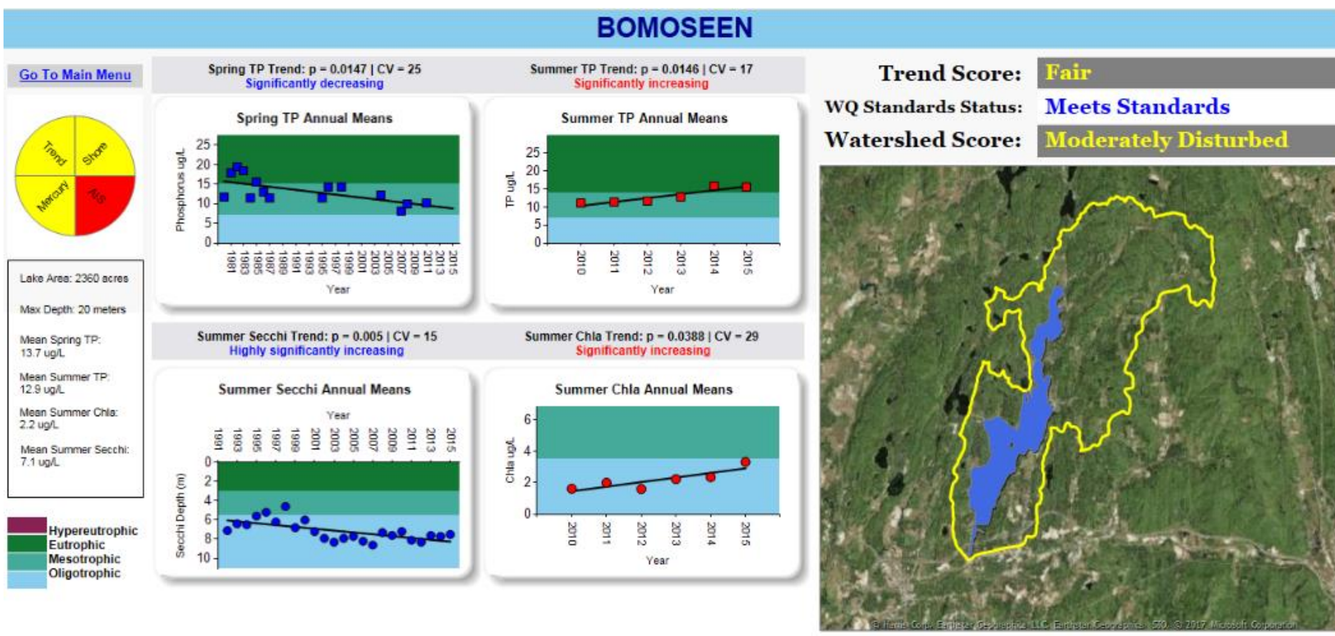
3. Track progress toward meeting water quality improvement goals for each in-land lake within the South Lake Basin

4. Serve as a conduit for information about the requirements under the Vermont Clean Water Act in order to meet Champlain TMDL Implementation Plan goals and objectives via this process among local, regional, and state organizations.

Lake Bomoseen DRAFT Management Plan

- Strategies and Actions to Protect, Maintain, Enhance, and Restore Lake Bomoseen Water Quality
- Identify Study Area (i.e., lake watershed, sub-basin tributaries, within 250' of shoreline, etc.)
    - GIS map based overview of the lake watershed and significant features such as major tributaries (including river corridors), floodplains, wetlands, roads (and hydrologically-connected road segments), soils, steep slopes, land use/ land cover – including large impervious areas.
- Develop Goals for Lake, Shoreland, Tributaries & Watershed
- Identify both near and long term goals for water quality improvement (restoration) and protection. Determine high priority objectives such as:
- Vision of the in-lake condition in X years
- Objectives for improving shoreline and near shore condition (within 250')
- Objectives for improving watershed condition
- Objectives/ actions for protecting headwaters (e.g., Giddings Brook, etc)

- Identify Water Resources (base maps)
    - Tributaries – sub-basins of focus (e.g., Sucker Brook, Giddings Brook)
    - Wetlands (e.g., north lake)
    - Ditch/ road networks (hydrologically connected road segments) Intermittent flows
    - Flow paths (on private roads, wood roads, etc.)
    - Slope/ contours
- Data Library – Assessments, Plans, Maps, etc
- Inventory of Current Conditions
- Lake Water Quality Data (examples included below):



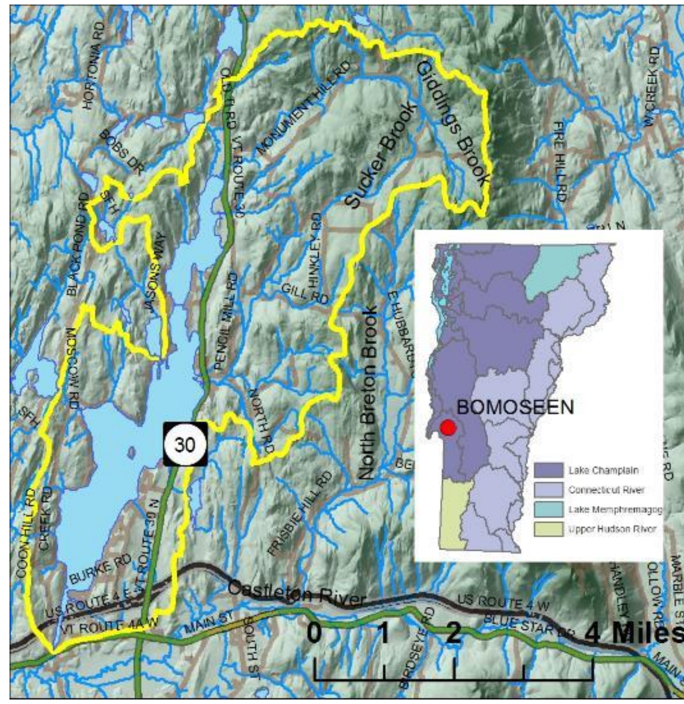
LAKE BOMOSEEN – Lay Monitoring Information

Castleton and Hubbardton, VT

Lay Monitor: Frank Giannini

Alfred S Kosloffsky

Former Lay Monitors:	James P & Kathy Leamy



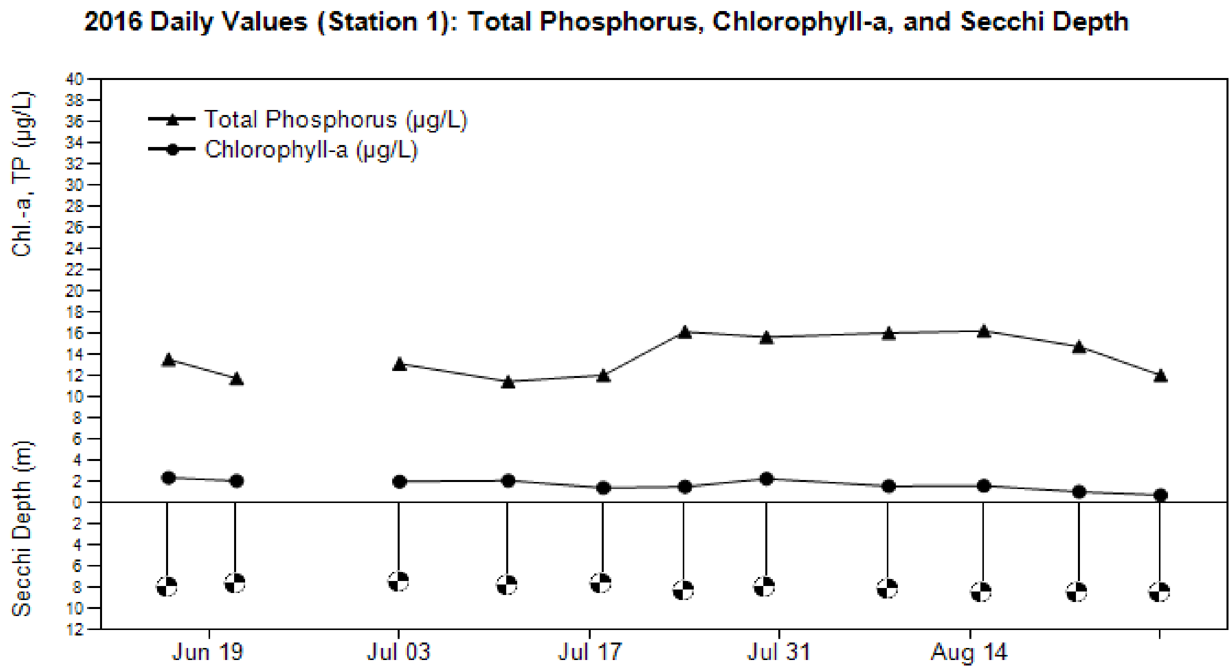
Physical

Lake Bomoseen is a large, warmwater lake.

Lake Surface Area:	2,360	acres	
Drainage Basin Area:	23,630	acres	
Ratio (Basin/Lake):	10:1		
Maximum Depth:	65	ft	(19.8 m)
Mean Depth:	27	ft	(8.2 m)

2016 Summary (Station 1)

Parameter	Days	Min	Mean	Max
Secchi (m)	11	7.6	8.1	8.6
Chl-a (µg/L)	11	0.8	1.7	2.4
Summer TP (µg/L)	11	11.5	13.9	16.3


2016 Daily Values (Station 1): Total Phosphorus, Chlorophyll-a, and Secchi Depth
Total Phosphorus (µg/L)
Chlorophyll-a (µg/L)
Chl.-a , TP (µg/L)
Secchi Depth (m)
Jun 19
Jul 03
Jul 17
Jul 31
Aug 14

LAKE BOMOSEEN

Annual Data (Station 1)

Year	Days Sampled	Secchi (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
1979					19.0
1980					9.0
1981					21.0
1982					20.0
1983					19.0
1984					13.0
1985					16.0
1986					14.0
1987					11.0
1992	11	7.1			
1993	12	6.4			
1994	11	6.5			
1995	11	5.6			11.3
1996	11	5.2			13.7
1997	13	6.2			

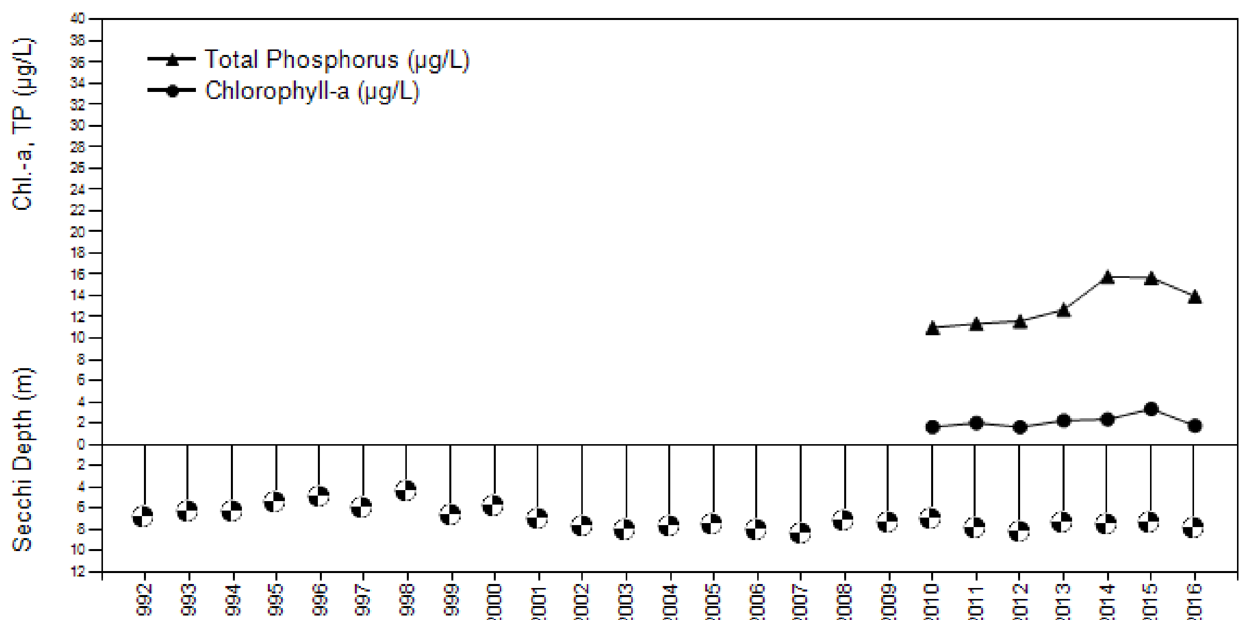
Annual Data (Station 1)

Year	Days Sampled	Secchi (m)	Chloro-a (µg/l)	Summer TP (µg/l)	Spring TP (µg/l)
1998	13	4.6			15.3
1999	13	6.8			
2000	12	6.0			
2001	9	7.2			
2002	11	7.9			
2003	13	8.3			
2004	12	7.9			13.0
2005	14	7.7			
2006	13	8.2			
2007	10	8.6			8.0
2008	11	7.3			12.0
2009	9	7.6			
2010	10	7.2	1.6	11.0	
2011	11	8.1	2.0	11.4	9.9
2012	10	8.4	1.6	11.6	
2013	10	7.6	2.2	12.7	
2014	9	7.7	2.3	15.8	
2015	10	7.5	3.3	15.7	

2016	11	8.1	1.7	13.9

Trophic State	Mean Secchi Clarity (m)	Mean Chlorophyll-a (µg/L)	Mean Total Phosphorus (µg/L)
Oligotrophic	> 5.5	< 3.5	< 7.0
Mesotrophic	3.0 - 5.5	3.5 - 7.0	7.0 - 14
Eutrophic	< 3.0	> 7.0	>14

Summer Annual Means (Station 1): Total Phosphorus, Chlorophyll-a, and Secchi Depth



- Municipal Road Erosion Inventory

  1. Castleton: A consultant has been hired by the town to do road erosion inventory. This inventory was initiated on Monday 8/14.

  2. Hubbardton: RRPC intern completed field portion in July, 2017.

- Land Use/Land Cover Data (change over time)
- LiDAR and mapping/ modeling
- Agricultural activities (mostly in the northern/ eastern portions of the lake watershed)
- Development, including discharges, sanitary and septic surveys
- Geomorphic Assessments and River Corridor Plans (Sucker Brook – SGA "lite")
- MAPP/ BASS/ PMNRCD Water Quality Data
- Aquatic Organism Passage Studies (TNC)
- Forestry data (forest roads, log landings)
- Fish & Wildlife data - Fisheries
- Imagery for sedimentation or land changes
- Discharges and stormwater permits
- Hazardous Waste sites
- Water Resource Alteration (flow, aquatic nuisance species)
- Wetland Resources (Vermont Significant Wetland Inventory, etc)

Other Resource Assessments:

- Identify Previous Restoration/Outreach Projects Lake Association (LBA, LBPT) Basin Plan Management Plans (LBA mission and purpose)
- Road, bridge and culvert assessments and upgrades
- LEAP, LakeWise or lakeshore projects
- Stormwater Master Plans (e.g., Bomoseen watershed and Castleton)
- Illicit Discharge Detection & Elimination Surveys (e.g., Castleton)
- Analysis of Existing Conditions and Gaps in Data
- Use of modeling tools (e.g., Clean Water Roadmap)
- List of Action Items to Address Identified Problems
- Prioritization of projects based on benefits, costs, and support
- Additional monitoring and assessment needs
- Water quality monitoring
- Biological surveys
- Stream geomorphic assessment
- Stormwater master planning
- Watershed based actions/ projects

- Municipal road and driveway projects (see 2016 SWMP)
- Map of Hydrologically Connected Road segments
- Incorporate relevant road and driveway projects into the Watershed Projects Database to be queued up for funding.
- Large impervious area stormwater retrofits
- Shoreline based actions/ projects
- Lakewise assessments
- Incorporate Lake Wise projects into the Watershed Projects Database
- Shoreline buffer projects

Appendix G- Basin River Corridor Management Plan Summaries and High Priority Recommendations

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
Castleton River/ Poultney	Town of Castleton Corridor Plan	Ira Birdseye tributary - remove berm/ restore floodplain (similar to Gully Brook project)/ T2.12	VDEC, Town, landowners/ ERP	Restoration	High
Castleton River/ Poultney	Town of Castleton Corridor Plan	Conserve functioning wetland and remove former Ski Area access road/ T2.12	Landowner, NRCS/ ERP, WHIP	Wetland Conservation	Medium
Castleton River/ Poultney	Town of Castleton Corridor Plan	Restore channel access to flood chutes and floodplain southwest of current channel /T2.11-B	Landowner, NRCS/ ERP, WHIP	Active Channel Restoration	Medium
Castleton River/ Poultney	Town of Castleton Corridor Plan	Possible removal of historic dam just downstream of North Bretton Brook Confluence/ T2.09	Landowner, TU, USFWS/EBTJV, ERP, WHIP	Dam Removal	Medium
Castleton River/ Poultney	Town of Castleton Corridor Plan	Passive geomorphic approach to conserve ample woody vegetation prevent future encroachments where the Castleton River is undergoing active lateral adjustments and attenuating sediments/ T2.09	Landowner, NRCS, ANR-RMP, VRC/ ERP,	Corridor Conservation	Medium
Hubbardton/ Poultney	Hubbardton River Debris Project Summary	Reforesting riparian corridor along the river mainstem and creating engineered log (debris) jams to simulate to the function of large woody debris in the system: trapping sediment, aggrading the river channel, and eventually reducing channel instability	Landowner, TNC, VDFW, USFS/ ERP, TU, USFS (EBTJV)	Active Channel Restoration	Medium
Poultney	Poultney River Corridor Plan	Restore incised reach, remove berm. Analyze active vs. passive	WSMD-RMP, landowners/ ERP	Restoration	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
		approach, Study watershed scale stressors, Pursue landowner agreements, Complete more detailed survey & design, Secure funding/ M02			
Poultney	Poultney River Corridor Plan	Protect River Corridor. Riparian restoration (plant buffers). Pursue landowner agreements, Secure funding/ M03	WSMD-RMP, landowners/ ERP	Riparian Corridor Protection and Restoration	High
Poultney	Poultney River Corridor Plan	Protect River Corridor. Riparian restoration (plant buffers), Remove/Replace old abutments Structures. Pursue town &/or VTRANS agreements, Complete more detailed survey and design, Analyze property protection & bed stabilization measures needed./ M06	WSMD-RMP, Vtrans, town of _ landowners/ ERP	Riparian Corridor Protection and Restoration	High
Poultney	Poultney River Corridor Plan	Protect River Corridor. Potential Restoration/Protection – Restore incised reach. Project to remove berm, replace old abutments /structures. Pursue town &/or VTRANS agreements, Complete more detailed survey and design, Analyze property protection & bed stabilization measures needed. Secure funding/ M09	WSMD-RMP, Vtrans, town of Poultney landowners/ ERP	Riparian Corridor Protection and Restoration	High
Poultney	Poultney River Corridor Plan	D&H Rail Trail Bridge resizing - Pursue town &/or VTRANS/ VANR agreements, Complete more detailed survey and design, Analyze property protection &	WSMD-RMP, DFPR, Vtrans, town of Poultney, landowners/ ERP	Restoration	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
		bed stabilization measures needed- Secure funding/ M10			
Poultney	Poultney River Corridor Plan	Protect River Corridor. Potential Restoration/Protection – Restore Aggraded Reach – Stabilize Stream Banks (M14A), Restore incised reach (M14C). Project Remove berm (M13), Replace (resize) bridge. Pursue town &/or VTRANS agreements, Complete more detailed survey and design, Analyze property protection & bed stabilization measures needed.- Analyze watershed scale stressors, Pursue landowner agreements, Complete more detailed survey & design, Secure funding/ M14	WSMD-RMP, Vtrans, town of _ landowners/ ERP	Riparian Corridor Protection and Restoration	High
Poultney	Poultney River Corridor Plan	Remove Structures (Old Abutment) – Daisy Hollow, Pursue landowner agreements, Pursue town &/or VTRANS agreements, Complete more detailed survey and design, Analyze property protection & bed stabilization measures needed, secure funding./ M16B	WSMD-RMP, Vtrans, town of Middletown Springs, landowners/ ERP	Restoration	High
Beaver Brook/ Mettowee	Mettowee River Corridor Plan	BMP improvements needed for conventional dairy to install livestock fencing along streams, barnyard roof gutter diversion and manure management structure needed/ M05T03.02S01.02,	NRCS, VAAFM, WSMD-ERP, landowners	Restoration (water quality) with Exclusion Fencing, Clean Water Diversion,	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
		Beaver Brook Unnamed Tributary to Beaver Brook		Alternative Manure Management	
Mettowee	Mettowee River Corridor Plan	Livestock exclusion fencing and stream crossing were completed in September, 2013/ Mettowee River, M07 downstream of Sykes Hollow Brook confluence, M08 upstream, and Sykes Hollow Brook M07T04.01	AAFM Livestock Exclusion funding, Landowners, PMNRCD, Southern Vermont Nutrient Management Program (SVNMP)	Restoration (water quality) with Exclusion Fencing, stream crossing	Completed
Flower brook/ Mettowee	Mettowee River Corridor Plan	Protection of a critical sediment attenuation area at the Flower Brook/Beaver Brook confluence/ Flower Brook M05T03.02, downstream of the confluence M05T03.03, upstream of the confluence M05T03.02S01.01, Beaver Brook	Landowners, PMNRCD, Vermont Land Trust (VLT), VT Agency of Natural Resources (ANR)/ Conservation Reserve Program/ Conservation Reserve Enhancement Program (CRP/CREP), VANR Ecosystems Restoration Program (ERP),	Protection	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Exclusion Fencing Clean Water Diversion/ Unnamed Tributary to Flower Brook Tributary to upstream end of reach M05T03.01C	Landowners, PMNRCD, Southern Vermont Nutrient Management Program (SVNMP)/ AAFM Livestock Exclusion funding, CREP	Restoration (water quality) with Exclusion Fencing, buffer planting	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
Mettowee	Mettowee River Corridor Plan	Chop and Drop, adding large woody debris to attenuate sediment and nutrients in the headwater reaches/ Mettowee River headwaters M15 and M16	PMNRCD, USFS, VANR/VDFW	Restoration (geomorphic and aquatic habitat)	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Lilly Hill Road, Danby - Stormwater Back road drainage improvement/ Flower Brook, which flows to the Mettowee River Upstream end M05T03.04	Danby Road Crew, PMNRCD, VTANR/ Better Back Roads Grant, ANR Ecosystems Restoration Program, VCF Lake Champlain and Tributaries Grant, LCBP Pollution Prevention Grant	Restoration (geomorphic and aquatic habitat)	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Pawlet Village Stormwater/septic Assessment	Town of Pawlet, PMNRCD, DEC-FED	Restoration (water quality)	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Flower Brook headwaters additional assessment/gully stabilization	WSMD-RMP, Vtrans, town of Pawlet, landowners/ ERP	Restoration (geomorphic and aquatic habitat)	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Waite Farm Resource Concerns (multiple)	Vermont Land Trust (VLT), VT Agency of Natural Resources (ANR)/ Conservation Reserve Program/ Conservation Reserve Enhancement Program (CRP/CREP), VANR	Restoration (water quality) with Exclusion Fencing, buffer planting	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
			Ecosystems Restoration Program (ERP), VAAFM BMP Program		
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Tree plantings	PMNRCD Trees for Streams, USDA-NRCS, VAAFM (CRP/ CREP)	Restoration (geomorphic and aquatic habitat)	High
Flower Brook/ Mettowee	Mettowee River Corridor Plan	Woodlawn NPS AG project	VT Agency of Natural Resources (ANR)/ Conservation Reserve Program/ Conservation Reserve Enhancement Program (CRP/CREP), VANR Ecosystems Restoration Program (ERP), VAAFM BMP Program	Restoration (water quality) with Exclusion Fencing, buffer planting	High
Sykes Hollow Brook/ Mettowee	Mettowee River Corridor Plan	Assessment and potential stabilization combined with forestry BMPs/ Sykes Hollow Brook flows to the Mettowee River, reach 07 M07T04.02-03 and upstream headwaters	Landowners, PMNRCD, VTANR/ Vermont ANR Watershed Grants, Ecosystem Restoration Grants, Vermont Community Foundation (Lake Champlain and Tribs or Innovations and Collaborations Grant), Lake	Restoration and assessment	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
			Champlain Basin Program		
Mettowee	Mettowee River Corridor Plan	Culvert Replacement projects (multiple) – Mettowee headwaters, Dorset Hollow/ M14	Landowners, PMNRCD, Town of Dorset, USFS, VTANR/ State Revolving Loan Fund, ERP, VCF, LCBP, USFWS, VFWS, Trout Unlimited, Orvis	Restoration (geomorphic compatibility, AOP)	High
Royce Brook/ East Creek	East Creek Corridor Plan	Culvert Replacement - Brown Lane culvert is undersized-width is only 45%of the bankfull channel width/ T4.02S2.02 #2 Royce Brook (Orwell)	VTDEC, Town of Orwell/ ERP	Active Restoration Structure Retrofit/ Replacement	High
North Fork, East Creek	East Creek Corridor Plan	Natural attenuation site and an easement would help to mitigate the sediment passing through upstream transport converted reaches/ T4.03 #1 North Fork (Orwell)	VRC, VTDEC, Landowner	Passive Restoration/ Corridor Conservation	High
North Fork, East Creek	East Creek Corridor Plan	Corridor protection will enable sediment that is transported from upstream reaches to settle out before entering reach T4.04/ T4.07 #1	VRC, VTDEC, Landowner	Passive Restoration/ Corridor Conservation	High
North Fork, East Creek	East Creek Corridor Plan	Corridor protection will enable sediment that is transported from upstream reaches to settle out in developing meanders/ T4.08 #1 Entire reach, right and left banks	VRC, VTDEC, Landowner	Passive Restoration/ Corridor Conservation	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
Orwell Village trib, East Creek	East Creek Corridor Plan	Corridor protection will enable sediment that is transported from upstream reaches to settle out in developing meanders/ T5.01-A #1	VRC, VTDEC, Landowner	Passive Restoration/ Corridor Conservation	High
Orwell Village trib, East Creek	East Creek Corridor Plan	Culvert Replacement - North Orwell Road crossing at the upstream segment break with T5.01C/ T5.01-B #1 - Orwell Village Tributary	VTDEC, Landowner, NRCS, US F&W	Active Restoration/ Structure Replacement	High
Doughty Hill Tributary/ East Creek	East Creek Corridor Plan	Corridor protection will enable sediment that is transported from upstream reaches to settle out in developing meanders/ T7.01A #2 and T7.01B#1	VTDEC, Landowner, NRCS, US F&W	Passive Restoration/ Corridor Conservation	High
Cranberry Swamp, East Creek	East Creek Corridor Plan	Riparian buffer project with native woody vegetation in areas lacking canopy cover. Increase the buffer width between the adjoining landuses and the channel/ T9.01B #1	VTDEC, OCNRCD, Landowner	Passive Restoration/ Corridor Conservation	High
Cranberry Swamp, East Creek	East Creek Corridor Plan	Culvert Replacement - Replace the culvert with a new structure (culvert or bridge) which is adequately sized and aligned to the stream/ T9.01B #3	VTDEC, Landowner	Active Restoration/ Structure Replacement	High
EC Wetland Addendum	East Creek Corridor Plan	Greatest potential acreage identified for potential wetland restoration and do not have buffer planting projects underway/ T4.02, S2.02 Royce Brook	NRCS, VTDEC, Landowner/ WRP, ERP	Wetland restoration	High

River/ Basin	Corridor Plan	Action/ Reach	Partners/ Funding	Project type	Priority
EC Wetland Addendum	East Creek Corridor Plan	Greatest potential acreage identified for potential wetland restoration and do not have buffer planting projects underway/ T5.01A Orwell Village Trib.	NRCS, VTDEC, Landowner/ WRP, ERP	Wetland restoration	High

Appendix H - Regulatory and Non-regulatory Programs Applicable to Protecting and Restoring Waters in Basin 2-4

The Vermont Surface Water Management Strategy maintains a continually updated roster of regulatory and non-regulatory technical assistance programs.

Regulatory programs may be accessed at:

http://www.vtwaterquality.org/wqd_mgtplan/swms_appA.htm

Non-regulatory programs may be accessed at:

http://www.vtwaterquality.org/wqd_mgtplan/swms_appD.htm

Appendix I – Overview of Funding Sources Identified in the Implementation Table

Funding sources are continually changing. The table in this section represents a compilation of known funding sources as of November 2017. Please notify the Watershed Management Division of other relevant surface water improvement funding sources.

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
WSMD	319 Nonpoint Source Grant	Restore water quality in waters threatened by non-point sources	emily.bird@vermont.gov
WSMD	Ecosystem Restoration Program Grant	Environmental remediation, protection and runoff mitigations, P loading, Ag land enhancement, nonpoint source	emily.bird@vermont.gov
F+W	VT Watershed /License Plate	Enhance/restore water resources, restore or protect fish and wildlife habitat, education, cultural resources, reducing P loading	emily.bird@vermont.gov
WSMD	Aquatic Nuisance control	Available for municipalities; priority to new infestations, second to controlling infestations or prevention, third to ongoing maintenance.	Perry.Thomas@vermont.gov
FED	The Vermont Planning Advance Program	For planning community water resources; sewage, drinking water, feasibility studies for the aforementioned works. *Funds currently available.*	Bryan.Redmond@vermont.gov
FED	CWSRF	For WWTF construction, sewer works, stormwater mgmt. facilities. Available to municipalities Currently, funds available for planning and final design applications are accepted on a rolling basis. Funds will be available for construction projects later this year but all new projects will need to go through planning and design prior to approval. Currently there are some subsidy opportunities of up to 50% on planning and final design activities. There is also a call out for the next month for asset management grants.	terisa.thomas@vermont.gov
FED	Unsafe Dam State Revolving Fund	Available for dam removal, either 100% loan or 75% loan and 25% grant funding (if breaching or removing—maintenance or reconstruction are eligible for loan only). Generally $50,000 cap, may be expanded.	Benjamin.Green@vermont.gov
FED	DWSRF	Public and private drinking water utilities are eligible for this funding. Can be used for easements that help with drinking water quality.	Ashley.Lucht@vermont.gov
WSMD	Regional Conservation Partnership Program (NRCS)	Projects related to soil and water quality, flood prevention, water resource conservation, reducing runoff and irrigation improvement. Available to state, farmers' cooperatives, municipal water orgs, orgs with a history of working with farms, and higher education organizations. Pre-proposals already submitted for this calendar year.	RCPP@wdc.usda.gov
VFWD	Clean Vessel Act Grant	Grants for public or private marinas or a state, county/municipal org for installing or upgrading pumpout stations or dump stations, or projects related to boating septic waste. Due August 15, grant covers up to 75 percent of the project.	Mike.Wichrowski@vermont.gov

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
AAFM	BMP financial assistance	Financial assistance for up to 90 percent cost share on NRCS approved practices on production areas, up to 50 percent on non-production areas. Can be coupled with federal NRCS funds. Available to growers in the state of Vermont/livestock producers or private land holders	Jeff.Cook@vermont.gov
AAFM	CREP Grants	Available to landowners for land in ag use, that is adjacent to a perennial stream or waterway. Cost share may cover 90-100 percent of funding needed for swales, vegetated buffers, filter strips, livestock fencing, etc.	
AAFM	Various Farm Agronomic Practices	Funds for practices that restore soil quality and enhance water quality by reducing runoff. Includes grants for educational activities and cover cropping (paid by acre). Usually due one month prior to implementation, available to growers and livestock owners.	Jeff.Cook@vermont.gov
NRCS	EQIP	Provides assistance in the form of reimbursement up to $ 300,000 for projects that conserve agricultural or forested land, or other wildlife habitat. Project can only be started AFTER contract with NRCS signed for funding. Priority given to historically underserved customers and projects which address significant resource concerns	http://www.nrcs.usda.gov/getstarted Contact local NRCS field office
ACCD	Municipal planning grants	Municipalities eligible, priority given to those in historic settlement pattern—villages and town centers. Joint applications may be accepted. Funding provided for meetings, hearings, workshops, conservation work, legal fees, easements, administrative materials, research, inventories and mapping, and payment for support staff.	annina.seiler@vermont.gov
WSMD	Flood Mitigation Assistance Grant Program	State government applies for FEMA funding, which local governments may then access by working as "subapplicants". Project must support the flood hazard portion of State, tribal, or local mitigation plans to meet the requirements outlined in 44 CFR Part 201 Mitigation Planning. Funds are only available to support communities participating in the National Flood Insurance Program (NFIP).	ned.swanberg@vermont.gov
DEM	Hazard mitigation Grants	Provides funding for land acquisition, infrastructure projects, flood planning. State, local government and non-profits eligible. Communities must have a FEMA approved and adopted local mitigation plan to be eligible. Funds not currently available but possibly in future.	lauren.oates@vermont.gov

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
LCBP	Local Implementation Grants	Grants for Lake Champlain basin bioremediation and pollution control/ environmental improvement. State, interstate, and regional water pollution control agencies, and public or nonprofit agencies, institutions, and organizations are eligible to receive grants from EPA through this program.	Jeanne Voorhees
AAFM	Water Quality Grant	For Water Quality projects initiated by VAAFM. Can be applied for through a RFP opportunity.	
Foundation	Vermont Community Foundation	"Small and Inspiring" grants: connect people to each other through volunteer work or community-building efforts connect people to the environment around them in new ways	Kim Haigis, khaigis@vermontcf.org
Foundation	Vermont Community Foundation	"Lamoille County and Beyond: Green Mountain Fund" serving children, elderly and family services, education, environment, sustainability, and the arts in Lamoille County and other parts of the Northeast Kingdom.	Kim Haigis, khaigis@vermontcf.org
Foundation	Vermont Community Foundation	"Upper CT River Mitigation and Enhancement Fund" river restoration work in the upper Connecticut River Watershed; wetland restoration, protection, and enhancement; and shoreline protection. Region: Connecticut River watershed upstream of the confluence of the White River and the Connecticut River at White River Junction, Vt. and West Lebanon, N.H.	Kim Haigis, khaigis@vermontcf.org
Foundation	Vermont Community Foundation	Lake Champlain Tributaries and Restoration Fund: protection, restoration, and enhancement of Lake Champlain's ecosystem.	Kim Haigis, khaigis@vermontcf.org
Foundation	Vermont Community Foundation	Special and Urgent Needs- helps Vermont nonprofits with unexpected expenses that impact their ability to meet their mission. A SUN grant can help an organization manage an unbudgeted, unforeseen, and time-sensitive emergency or take advantage of an unanticipated opportunity that will enhance its work.	Kim Haigis, khaigis@vermontcf.org
Foundation	Vermont Community Foundation	"Kelsey Trust" Lake Champlain and Tributaries protection. We are particularly interested in programs aimed at protecting Lake Champlain and its tributaries, the Green Mountains, and the Adirondacks. LOI needed	Kim Haigis, khaigis@vermontcf.org

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
VTrans	Transportation Alternatives	F. Any environmental mitigation activity, including pollution prevention and pollution abatement activities and mitigation to-- (i) address stormwater management, control, and water pollution prevention or abatement related to highway construction or due to highway runoff, including activities described in sections 133(b)(11), 328(a), and 329; or (ii) reduce vehicle-caused wildlife mortality or to restore and maintain connectivity among terrestrial or aquatic habitats. (iii) Construction of salt sheds is eligible under the environmental mitigation category. Eligibility for salt sheds will be considered on a case by case basis based on proximity of the existing storage location to a major water body (generally within 50 ft.). We recommend reviewing eligibility with VTrans prior to application submittal.	Scott Robertson, P.E. Telephone: (802) 828-5799 Fax: (802) 828-5712 E-mail address: scott.robertson@vermont.gov
VTrans	Better Roads	Funding to support municipal road projects that improve water quality and result in maintenance cost savings. The grant funds are provided by VTrans and the Vermont Agency of Natural Resources. The Vermont Better Roads Program's goal is to promote the use of erosion control and maintenance techniques that save money while protecting and enhancing Vermont's lakes and streams. Funds, subject to availability, will be distributed as grants to municipalities to address town erosion problems.	Alan.may@vermont.gov
VTrans	Category (A) planning grants	Road Inventory and Capital Budget Planning (Maximum Grant Amount $8,000). Road erosion reduction requires planning and budgeting to implement road improvements that also result in cost savings. Eligible projects under this category must include: (1) Inventory of roads and/or culverts and identification of road related erosion and/or stormwater problems affecting water quality in a particular watershed or the whole town. (2) Sites identified must then be prioritized by problem area for future repair. (3) The final step is the development of a capital budget plan to correct these problems over a specific period of time.	Alan.may@vermont.gov

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
VTrans	Category (D) culvert upgrade grants	Structures or culverts that carry streams or rivers must have accompanying documentation showing consultation with an ANR River Management Engineer and/or Army Corps Engineer indicating use or nonuse of river management standards prior to submittal of application.	Alan.may@vermont.gov
VTrans	Category B – Road Erosion	Correction of a Road Related Erosion Problem and/or Stormwater Mitigation/Retrofit for both gravel and paved roads	Alan.may@vermont.gov
VTrans	The Category (C) bank stabilization	Stream and river/road conflicts must have accompanying documentation showing consultation with an ANR River Management Engineer and/or Army Corps Engineer indicating use or non-use of river management standards prior to submittal of applicatio	Alan.may@vermont.gov
Foundation	Joe W. & Dorothy Dorsett Brown Foundation	Environmental research; housing for the homeless; support for organizations that care for the sick, hungry or helpless; religious and educational institutions; as well as organizations and groups concerned with improving our local communities. Within these areas, the focus is primarily on alleviating human suffering. Secondary consideration includes cultural, spiritual, educational, or scientific intiatives.	bethbuscher@thebrownfoundation.org 504-834-3433
Foundation	Weyerhaeuser Giving Fund	The fund helps cultivate growing minds and bodies, promote sustainable communities, and nourish the quality of life in these Weyerhaeuser communities. The Foundation's main funding areas are: affordable housing and shelter, education and youth development, environmental stewardship, human services, civic, and cultural growth.	253-924-3658 anne.leyva@weyerhaeuser.com
Foundation	The Dale & Edna Walsh Foundation	DEW contributes to medical, relief, welfare, education, community service, ministries and environmental programs, and arts organizations. All organizations must submit a letter of inquiry (LOI) to be considered for funding.	775-200-3446 info@dewfoundation.org
Foundation	Toolbox for Education Grants	Lowe's Charitable and Educational Foundation . Giving on a national basis in areas of company operations; giving on a national basis for the Outdoor Classroom Grant Program and Lowe's Toolbox for Education to support parks and playgrounds and organizations involved with K-12 education, environmental beautification, environmental education, home safety, and community development. No support for schools	1-800-644-3561 ext. 7 info@toolboxforeducation.com

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
		established less than two years ago for Lowe's Toolbox for Education. Pre-schools are not eligible.	
Foundation	Captain Planet Foundation	The foundation supports projects that: 1) Promote understanding of environmental issues; 2) Focus on hands-on involvement; 3) Involve children and young adults 6-18 (elementary through high school); 4) Promote interaction and cooperation within the group; 5) Help young people develop planning and problem solving skills; 6) Include adult supervision; 7) Commit to follow-up communication with the foundation.	404-522-4270 grants@captainplanetfdn.org
Foundation	G. Unger Vetlesen Foundation	Giving on a national basis. Foundation established a biennial international science award for discoveries in the earth sciences; grants for biological, geophysical, and environmental research, including scholarships, and cultural organizations, including those emphasizing Norwegian-American relations and maritime interests. Support also for public policy research and libraries. No grants to individuals. A Letter of Inquiry must be submitted before a full proposal will be considered.	212-586-0700 contact@vetlesenfoundation.org
Foundation	Max and Victoria Dreyfus Foundation, Inc.	Giving on a national basis to support museums, cultural, and performing arts programs; schools, hospitals, educational and skills training programs, programs for youth, seniors, and the handicapped; environmental and wildlife protection activities; and other community-based organizations and their programs. Organizations seeking support from the Foundation may submit a letter of request, not exceeding three pages in length, which includes a brief description of the purpose of the organization, and a brief outline of the program or project for which funding is sought.	202-337-3300 info@mvdreyfusfoundation.org
Foundation	American Honda Foundation	The American Honda Foundation engages in grant making that reflects the basic tenets, beliefs and philosophies of Honda companies, which are characterized by the following qualities: imaginative, creative, youthful, forward-thinking, scientific, humanistic and innovative. We support youth education with a specific focus on the STEM	310-781-4091 ahf@ahm.honda.com

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
		(science, technology, engineering and mathematics) subjects in addition to the environment.	
Foundation	Dr. Scholl Foundation	In general the Foundation guidelines are broad to give them flexibility in providing grants. Applications for grants are considered in the following areas: Education, Social Service, Healthcare, Civic and Cultural, and Environmental.	1033 Skokie Blvd., Suite 230, Northbrook, IL 60062 847-559-7430
Foundation	The Andrew W. Mellon Foundation	Giving nationally on a selective basis for higher education and scholarship, scholarly communications and information technology, art history, conservation, and museums, performing arts, conservation and the environment.	212-838-8400 inquiries@mellon.org
Foundation	The Xerox Foundation	The foundation supports: Education/Workforce Preparedness, Science/Technology, Employee/Community Affairs, and Environmental Affairs. Grants are made only to organizations that have been granted exemption from Federal Income Tax under Section 501 (c)(3) and ruled to be publicly supported under Section 509(a) of the Internal Revenue Code.	203-849-2453
Foundation	Lintilhac Foundation	Giving primarily in north central VT, including Chittenden, Lamoille, and Washington counties supporting medical education programs, health services, community development, civic projects, and educational institutions. Support also for local scientific, environmental, and educational issues. Grants given for building/renovation, curriculum development, equipment, general/operating support and seed money. No support for religious organizations. No grants to individuals.	886 North Gate Road, Shelburne, VT United States 05482-7211 (802) 985-4106 lint@together.net
Foundation	Perkins Charitable Foundation Educational Grants	Giving nationally, primarily in CA, CT, FL, MA, MT, OH, RI, VA, and VT for education, the arts, environmental conservation, animals, wildlife, health and medical care, and children, youth and social services. No grants to individuals.	1030 Hanna Bldg. , 1422 Euclid Ave., Cleveland, OH United States 44115-2001 (216) 621-0465

Category (State, Fed., Foundation)	Grant Name	Funding Type	Contact
Foundation	Fields Pond Foundation, Inc.	The Fields Pond Foundation awards grants to projects and programs primarily in Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont. The primary mission of Fields Pond Foundation is to provide financial assistance to nature and land conservation organizations that are community-based and that serve to increase environmental awareness by involving local residents in conservation issues.	781-899-9990 info@fieldspond.org
DOI	Rivers, Trails and Conservation Assistance Program	Applications for Rivers, Trails and Conservation Assistance program are competitively evaluated based on how well the applications meet the following criteria: 1. The project has specific goals and results for conservation and recreation expected in the near future. 2. Roles and contributions of project partners are substantive and well-defined. 3. There is evidence of broad community support for the project.	Jennifer Waite jennifer_waite@nps.gov (802) 457-3368, ext 221
Foundation	Waterwheel Foundation Grants	The WaterWheel Foundation was created by Phish in 1997 to oversee the band's various charitable activities. The primary effort then and now is our Touring Division, though in keeping with our "Local" mission we also support Vermont-based non-profits and others in need.	ww@phish.com or write to WaterWheel, PO Box 4400, Burlington VT 05406-4400.

Appendix J - Basin Plan Public Comments and Responsiveness Summary

Placeholder for anticipated Responsiveness Summary