Preliminary WORKING DRAFT July 2018

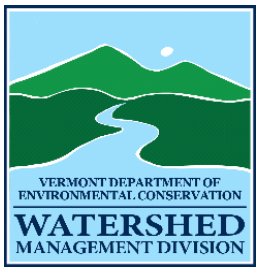
July 23 Comments on Tables
by Albrecht, CCRPC

Vermont Agency of Natural Resources

Watershed Management Division

Winooski River

TACTICAL BASIN PLAN



Condition of Specific Water Resources

Impaired Waters and Priority Surface Waters

The VDEC uses monitoring and assessment data[1] to assess individual surface waters in relation to Vermont Water Quality Standards as outlined in the 2016 DEC Assessment and Listing Methodology. The four categories used to assess Vermont's surface water are **full support, stressed, altered** and **impaired**[2]. Waters that currently support designated and existing uses and meet water quality standards are placed into the full support or stressed categories. Waters that do not support uses and do not meet standards are placed into the altered or impaired category.

Table 4 lists the known stressed, impaired or altered waterbodies in Basin 8. These priority waters comprise the 303(d) List of Impaired Waters and List of Priority Surface Waters Outside the Scope of 303(d). The location of these waters are mapped in Figures 2, 3, 4 and 5. A more detailed description of monitoring results for each water is located in the Vermont Integrated Watershed Information System, online data portal.

The Tactical Basin Plan addresses the stressors (Table 3) and resulting pollutants degrading the listed waters in Table 4 through geographically specific actions. Chapter 5 includes a summary of actions that are included inte Watershed Projects Database. The types of actions prescribed stem from the stressor specific practices outlined in the Vermont Surface Water Management Strategy. Additional monitoring and assessment needs are outlined in Tables 4, 6 and 11.

Table 14. Basin 8 2016 Impaired, stressed and altered waters list and planned management interventions. See also Water Quality Assessment Maps .

Commented [DA1]: I 'm wondering if this table could be subdivided into three separate tables, one for each region; lower, mid, upper.

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[3][4]
VT08-01 Winooski River, mouth to Winooski dam	10.5 miles Impaired Part A List	E. coli/Pathogens	Burlington CSOs	See Vermont CSO policy

[1] Appendix A of the Vermont DEC Water Quality Monitoring Strategy 2011-2020
[2] The 2016 DEC Assessment and Listing Methodology page 13 provides definitions for full support, stressed, altered and impaired waters.
[3] The ANR's strategy for addressing each stressor is described in the Vermont Surface Water Management Strategies, at this link
[4] Also See Lake Champlain P TMDL

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[3][4]
VT08-02 Sunnyside Brook (Trib 8 to Sunderland Brook)	1.2 miles Impaired Part A List	Chloride/Toxics	From industrial and commercial land runoff	Developing Chloride TMDL
VT08-02 Muddy Brook Trib#4 & Trib to Trib#4	0.9 miles Impaired Part A List	Chloride/Toxics	From industrial and commercial land runoff	MS4 permit condition will require Chloride reduction plan
VT08-02L01 Shelburne Pond	452 acres Impaired Part A List	Phosphorus/Land erosion	Landuse	See Lake Champlain P TMDL
VT08-05 Winooski River above Montpelier WWTF discharge	2.0 miles Impaired Part A List	E. coli/Pathogens	Montpelier CSOs	See Vermont CSO policy
VT08-07 Winooski River, Plainfield	0.7 miles Impaired Part A List	E. coli/Pathogens		Work with landowners to identify sources and continue to support water quality monitoring
VT08-07 Winooski River, Marshfield, rm 72.8 up to Mollys Brook	10.0 miles Impaired Part A List	E. coli/Pathogens		Work with landowners to identify sources and continue to support water quality monitoring
VT08-09 Winooski River, Cabot, Mollys Falls Brook up to rm 83.8	1.0 miles Impaired Part A List	E.coli/Pathogens		EPA approved TMDL March 8, 2001 - 2013 IDDE in Cabot found no source. Monitor for E. coli
VT08-11L02_02 Waterbury Reservoir littoral area	100 acres Impaired Part A List	Sediment/flow alteration	Fluctuation of water levels	401 Water Quality Certification issued in 2014 but awaiting full implementation. See Flow Alteration section for more information
VT08-12 Inn Brook, Stowe	0.3 miles Impaired Part A List	Iron/Toxics	Iron seeps from soils disturbed during development	Parent material is iron rich. Stream runs thru culvert under parking lot, nothing planned until redevelopment of area occurs
VT08-12 Big Spruce Brook, Stowe	0.5 miles Impaired Part A List	Iron/Toxics	Iron seeps from soil disturbance during development	Outside of Stowe Mt water quality remediation plan because in steep ravine with limited access for remediation.
VT08-13 Lower North Branch Winooski River, Montpelier	1.0 miles Impaired Part A List	E. coli/Pathogens	Montpelier WWTF collection system passes combined sewer overflows	See Vermont CSO policy
VT08-16 Gunner Brook, below Farwell St. Dump, Barre	0.5 miles Impaired Part A List	sediment, metals, nutrients, storm-water in lower	Farwell St. Landfill leachate, surface runoff from developed area	No additional site monitoring at the Farwell Dump since 2012.

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[3][4]
		section/land erosion		
VT08-20 Clay Brook, Waitsfield	0.5 miles Impaired Part A List	stormwater, iron/Land Erosion	Ski area development: stormwater runoff, erosion from construction activities & gravel parking lot; increased peak stormwater flows	Stream buried in culvert. Difficult remediation until redevelopment of area
VT08-02 Tributary to Winooski River, South Burlington	0.4 miles Impaired Part B List	Metals/Toxics	South Burlington landfill leachate	Active monitoring. VDEC ordered landfill facility closed and capped. Capping occurred in 1992. The facility's post-closure court order requires water quality monitoring and maintenance of the site. Water quality sampling is conducted semiannually to determine effectiveness of treatment. Water quality improvement is expected over time as water quality treatment & site management continues.
VT08-08 Muddy Brook in East Montpelier	0.1 miles Impaired Part B List	Iron/Toxics	Central Vermont landfill leachate	VDEC ordered landfill closed and capped in 1993. Due to the slumping of the capping soils in 2001, the original clay cap was removed, the landfill was re-graded, and a synthetic cap was installed along with a new toe drain and gas collection system. The landfill's post-closure court order requires water quality monitoring & maintenance of the site. Currently volume of water collected in the drains is significantly less than previously reported.
VT08-12 BIG SPRUCE BROOK, RM 0.2 TO RM 0.3, Stowe	RM 0.2 TO RM 0.3 Impaired Part B List	Sediment, Iron/Land Erosion	SEDIMENT IMPACTS, IRON SEEPS	Stowe Mt. Resort WQRP and Big Spruce Iron Seep Remediation Plan

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[3][4]
				(changes to 2018[5] list will move this out of Part B and added to the other reach noted above)
VT08-12 West Branch Little River, rm 7.5 to 8.0, Stowe	0.5 miles Impaired Part B List	sediment, stormwater runoff/Land Erosion	Ski area development, road	Stowe Mt. Resort WQRP
VT08-16 Trib #23 to Stevens Branch below Williamstown WWTF outfall	0.5 miles Impaired Part B List	Nutrients/Nutrient Loading	Williamstown WWTF discharge to small receiving water	Outfall to be moved to the Stevens Branch with WWTF refurbishment. Will monitor wq
VT08-01 Winooski River, mouth to Winooski Dam	10.5 miles Impaired Part D List	Mercury/Toxics	Atmospheric deposition	EPA approved regional mercury TMDL on 12/20/20, 2007. Vermont DOH advisory
VT08-02 Allen Brook, rm 2.4 to rm 5.0 Talcott Rd, Wiliston	2.6 miles Impaired Part D List	Stormwater/urbans stressors[6]	urban and suburban runoff	EPA approved TMDL in 8/2008, see Chapter 3.
VT08-02 Allen Brook, , Williston	2.6 miles Impaired Part D List	E. coli/Pathogens		EPA approved TMDL in 9/2011. See Chapter 3.
VT08-02 Sunderland Brook, rm 3.5 to rm 5.3, Colchester	1.8 miles Impaired Part D List	Stormwater/Urban stressors	urban and suburban runoff	EPA approved TMDL in 8/2008 - see Chapter 3 for work planned
VT08-02 Centennial Brook, mouth to rm 1.2, South Burlington	1.2 miles Impaired Part D List	Stormwater/Urban Stressors	urban and suburban runoff	EPA approved TMDL in 9/2007- see Chapter 3.
VT08-02 Morehouse Brook, mouth to rm 0.6, Winooski and Colchester	0.6 miles Impaired Part D List	Stormwater/Urban Stressors	urban and suburban runoff	EPA approved TMDL in 9/2007- see Chapter 3
VT08-09 Winooski River Cabot village	1.0 miles Impaired Part D List	E. coli /Pathogens	Residential direct discharges &/or failed septic systems.	EPA approved TMDL 3/8/2001. Straight pipes eliminated, but LaRosa program sampling suggests another NPS. See Chapter 3.
VT08-10 Huntington River, Huntington	0.5 miles Impaired Part D List	E. coli/Pathogens	Possible failing septic systems and other unknown sources;	EPA approved TMDL in 9/2011. see Chapter 3.

[5] The WSMD will release a draft 2018 303(d) and the State priority surface waters lists in late spring. This table will be revised at that time to reflect changes from the 2016 list.
[6] Urban stressors that result in sedimentation, phosphorus or stormwater include: Land Erosion, Channel Erosion, Nutrient Loading

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[3][4]
VT08-18 Mad River, mouth to Moretown	6.2 miles Impaired Part D List	E, coli/Pathogens	Possible failing septic systems and other unknown sources;	EPA approved TMDL in 9/2011. See Chapter 3.
VT08-01 Winooski River, lower section	x.x miles Altered Part E List	Locally abundant Eurasian watermilfoil growth/Invasive Species		No control
VT08-02L01 Shelburne Pond, Shelburne	452 acres Altered Part E List	Curly-leaf pondweed/Invasive Species		VFWD confirmed in 1996; no control
VT08-11L02_02 Waterbury Reservoir littoral area	100 acres Altered Part E List	Brittle naiad/Invasive Species		No Control.
VT08-04 Joiner Brook, Bolton	2.9 miles Altered Part F List	Artificial and insufficient flow/Flow Alteration	Bolton Valley water withdrawal	Non-supp 2.9 mi (5.7 mi total length). All flow altered waters should be more closely reviewed and steps identified to ensure protection of resource.
VT08-05 Winooski River at & above Middlesex 2 dam	2.0 miles Altered Part F List	De-watering of bypass, impound-ment, fluctuation causing stream-bank erosion/ Flow Alteration	Middlesex #2 hydro	Unlicensed facility
VT08-06 Tyler Brook, below Waterbury Village water withdrawal	0.1 miles Altered Part F List	Artificial and inadequate flow/ Flow Alteration	Waterbury water supply withdrawal	Unlicensed facility (In 2018 list: Part E, F will be updated,
VT08-06 Merriam Brook below Waterbury Village water withdrawal	0.1 miles Altered Part F List	Artificial and inadequate flow/ Flow Alteration	Waterbury water supply withdrawal	WSID #5284 - Waterbury village water
VT08-09 Mollys Falls Brook, Cabot	2.0 miles Altered Part F List	Artificial flow condition, bypass waterfall, temp/ Flow Alteration and Thermal Stress.	Mollys Falls Hydro	Unlicensed facility; A Public Utilities Commission Certificate of Public Good review is underway, with VTANR input to address flow, water level, and water temperature issues.

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[34]
Sucker Brook below Peacham Pond, Peacham	1.0 miles Altered Part F List	Artificial flow condition/ Flow Alteration	Mollys Falls Hydro	Unlicensed facility; A Public Utilities Commission Certificate of Public Good review is underway, with VTANR input to address flow, water level, and water temperature issues.
VT08-09L05 Peacham Pond, Peacham	340 acres Altered Part F List	Water level fluctuation/ Flow Alteration		Unlicensed facility; A Public Utilities Commission Certificate of Public Good review is underway, with VTANR input to address flow, water level, and water temperature issues.
VT08-09L05 Mollys Falls Reservoir, Cabot	397 acres Altered Part F List	Water level fluctuation/ Flow Alteration		Unlicensed facility; A Public Utilities Commission Certificate of Public Good review is underway, with VTANR input to address flow, water level, and water temperature issues. Vermont Lay Monitoring program will adopt as a site in 2018
VT08-11 Lower Little below hydro dam, Waterbury	2.6 miles Altered Part F List	Artificial flow condition / Flow Alteration		Section 401 wq cert. Issued in 2014; FERC has yet to issue new license for the project which will delay construction until 2017
VT08-11L02 Waterbury Reservoir	839 acres Altered Part F List	Water level fluctuation / Flow Alteration		Section 401 wq cert. Issued in 2014; ferc has yet to issue new license for the project which will delay construction until 2017

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[34]
VT08-16 Benjamin Falls Brook, from Berlin Pond to mouth, Berlin	0.6 miles Altered Part F List	De-watering of brook/ Flow Alteration	Montpelier & Berlin water supply with-drawals	WSID #5272
VT08-20 Mill Brook, Fayston	2.1 miles Altered Part F List	Artificial and insufficient flow/ Flow Alteration	Mad River Glen snow-making water withdrawal	Partial support 2.1 mi (5.9 mi total length)
VT08-20 Slide Brook, Fayston	0.8 miles Altered Part F List	Artificial and insufficient flow/ Flow Alteration	Mount Ellen snowmaking water with-drawal	Non-support 0.8 mi (3.4 mi total length)
VT08-01 Winooski River, mouth to Alder Brook	21.2 miles Stressed	Sediments, nutrients, temp., stormwater, toxic compounds/Urban stressors,Thermal stress, Toxics	Developed land runoff, agriculture, industry	See Lake Champlain P TMDL
VT08-04 Goose Pond Brook, mouth to head-waters. Bolton	1.5 miles Stressed	Acidity	Atmospheric deposition	2016 chemistry and 2017 biomonitoring data suggest acid stress. Collect data from one more monitoring event to confirm
VT08-05 Winooski River, below Middlesex dam & above Montpelier CSOs	11.0 miles Stressed	sediment, nutrients, storm-water runoff/ Urban Stressors	Developed land, transportation, channelization	See Lake Champlain P TMDL
VT08-06 Graves Brook, mouth upstream	0.3 miles Stressed	Sediment/Urban stressors, Encroachment	Residential, ag, riparian encroachment	See Lake Champlain P TMDL
VT08-06 Thatcher Brook, Waterbury	10.0 miles Stressed	Sediment/Channel Erosion	Morphological instability from past channelization, etc.	See Lake Champlain P TMDL River corridor easements planned. See Mid Winooski River Corridor Plan
VT08-07 Winooski River below Marshfield 6 hydro	10.0 miles Stressed	low d.o/Flow alteration.	Dissolved oxygen problems from hypolimnetic withdrawal of unlicensed hydro dam	See Flow Alteration section. Unlicensed facility; A Public Utilities Commission Certificate of Public Good review is underway, with VTANR input to address flow, water level, and water temperature issues.

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[34]
VT08-07 Winooski River, Stevens Branch up to Mollys Falls Brook	20.4 miles Stressed	sediment, turbidity, nutrients, physical alterations, E. coli/land erosion, channel erosion, thermal stress	Streambank erosion, road runoff, channel in-stability	See Lake Champlain P TMDL
VT08-08 Blanchard Brook, Montpelier	0.3 miles Stressed	unknown		(in 2018 list: Will be moved to Impaired status and investigated for lack of buffer. Fish community "fair" and "poor" in 2013 and 2014)
VT08-09 Winooski River, from Mollys Falls Brook upstream	6.0 miles Stressed	Sediment/Channel erosion, Encroachment	Streambank erosion, lack of riparian vegetation, physical alterations	See Lake Champlain P TMDL
VT08-11 Gold Brook, mouth to headwaters, Stowe	5.0 miles Stressed	sediment, physical alterations/Land erosion, Channel erosion, Encroachment	Land development, roads, former mining	See Lake Champlain P TMDL
VT08-11 Little River, from West Branch down to Reservoir	5.5 miles Stressed	urban runoff, sediment/Urban Stressors	Channel instability, channel manipulation, urban/suburban development	See Lake Champlain P TMDL
VT08-12 Little River, upstream of the West Branch confluence	3.3 miles Stressed	sediments, nutrients, E. coli/Urban Stressors, Pathogens	Land development, agricultural runoff; morphological instability (west br upstream to sterling brook)	See Lake Champlain P TMDL
VT08-12 Little Spruce Brook, Stowe	0.1 miles Stressed	sediment, physical alteration/Urban Stressors	Ski area development	Stowe Mt. Resort WQRP
VT08-12 Long Trail Tributary, Stowe	0.1 miles Stressed	sediment, acidity/Urban stressors, y	development	Further assessment. pH shock in springtime
VT08-12 Sterling Brook, Morristown	7.0 miles Stressed	acidity	Low alk conditions, moderately sensitive to acid rain	Sampling results from 1984. WSMD ABN will confirm or update status as resources permit
VT08-12 West Branch Little River, rm 7.0 to 7.5	0.5 miles Stressed	Sediment/Urban Stressors	Impacts may be related to past construction erosion	Continue monitoring and Stowe Mt. Resort WQRP benefits

Waterbody or River Segment and Town	Status	Pollutant /Stressor	Source	Planned actions, see also actions associated with Stressors[34]
VT08-12 West Branch Little River, rm 8.0 to headwaters	x.x miles Stressed	sediment, acidity/Urban Development		need further assessment; pH shock in springtime. WSMD ABN will confirm or update status as resources permit
VT08-13 Hancock Brook, Worcester	4.0 miles Stressed	acidity	Low alk conditions, moderately sensitive to acid rain	Biomonitoring planned
VT08-13 Minister Brook, Worcester	3.0 miles Stressed	acidity	Low alk conditions, moderately sensitive to acid rain, gravel road runoff	Biomonitoring planned
VT08-14 Kingsbury Branch, from outlet of North Montpelier Pond to mouth	3.5 miles Stressed	elevated temperatures/Flow Alteration	Warm water discharges from pond	Unlicensed. Project is operated under a FERC exemption.
VT08-15 Jail Branch, Barre City and below	1.5 miles Stressed	Sediment, nutrients, E. coli/Urban Stressors	Land development; erosion/sedimentation; urban runoff	(Possible change to unstressed in 2018 list)
VT08-15 Jail Branch, Washington/Orange area	x.x miles Stressed	E. coli/Pathogens	Elevated bacteria levels; source(s) unknown	(Possible change to unstressed in 2018 list)
VT08-16 Stevens Branch, Barre	5.8 miles Stressed	Sediment, nutrients, E. coli/Urban Stressors	Urban runoff including suspected floor drains from commercial buildings on river	See Lake Champlain P TMDL
VT08-17 Dog River, Riverton canoe access downstream ½ mile, Berline	0.5 miles Stressed	E.coli/Pathogens	Elevated e. Coli	Review with AAFM
VT08-18 Mad River, Warren dam up to Route 100	0.5 miles Stressed	Sediment/Land Erosion, Channel Erosion	Morphological instability; contributions from nearby gravel/sand pit	Continue monitoring. Talk to someone about gravel/sand pit

Additional Lake and Pond Assessment Results

In addition to the 303(d) List of Impaired Waters and List of Priority Surface Waters in Table 4 above, the Vermont Lake Score Card summarizes the overall conditions of each lake in Vermont (Table 5).

The Vermont Inland Lake Score Card provides information about four key aspects of lake health: nutrients, aquatic invasive species, shoreland and lake habitat, and mercury pollution. Links embedded in the Score Card open deeper views into the underlying data.

Table 25. Inland Lake Score Card information for 51 Basin 8 lakes

Commented [DA2]: Could this table be reformatted so it Sorts on the basis sub-basin and then sort again by Town rather than Lake ID. Also, it might be good to separate out the data for Lower Winooski and Upper Winoosk and put that in the end since that is not Lake Data

The water quality condition is represented by different colors: Blue = Good Conditions; Yellow = Fair/Stressed Conditions: Red = Poor/Impaired/Altered Conditions; Blank = assessment needed.

Water Quality Status key: pH = acid sensitive (low alkalinity), TP = total phosphorus, Flow = water level manipulation, DO = dissolved oxygen, Cl = chloride

Aquatic Invasive Species key: EWM = Eurasian water milfoil, CLP = curly leaf pondweed, EF = European frog bit, BN = brittle naiad.

Lake ID	Lake Area (acres)	Town	Water Quality Trend	Water Quality Status	Aquatic Invasive Species	Mercury in Fish Tissue	Shoreland & Habitat	Waters' Disturbed
BAILEY	17	Marshfield						
BAKER (BRKFLD)	35	Brookfield						
BANCROFT	14	Plainfield						
BEAVER (ROXBRY)	10	Roxbury		pH				
BERLIN	293	Berlin			EWM			
BLISS	46	Calais		TP				
BLUE	6	Calais						
BLUEBERRY	48	Warren						
BOLSTER	5	Barre Town						
BUCK	39	Woodbury						
CHAPELS	2	East Montpelier						
COITS	40	Cabot						
CRANBERRY MEADOW	28	Woodbury						
CURTIS	72	Calais		TP				
CUTTER	16	Williamstown						
DOBSON	9	Woodbury						
DRY	2	Northfield						
EAST CALAIS MILL;	6	Calais						
FELCHNER;	12	Northfield						
FOREST (CALAIS)	133	Calais						
GILLETT	30	Richmond		Sed, pH				
GOODALL	7	Woodbury						
GOOSE	2	Bolton						
GOSLANT	5	Peacham						
GREENWOOD	96	Woodbury						
HALFMOON COVE	14	Colchester		TP				
HARDWOOD	49	Elmore		pH				
HAWKINS	9	Calais						
HORN OF THE MOON	10	East Montpelier						

Lake ID	Lake Area (acres)	Town	Water Quality Trend	Water Quality Status	Aquatic Invasive Species	Mercury in Fish Tissue	Shoreland & Habitat	Waters' Disturbed
KNOB HILL	16	Marshfield						
LAIRD	12	Marshfield						
LEECH	4	Woodbury						
LIGHT TROUT CLUB	7	Moretown						
LILY PAD	2	Colchester						
LIMEHURST	13	Williamstown						
LITTLE (CALAIS)	7	Calais						
LITTLE (ELMORE)	14	Elmore		pH				
LITTLE MUD (WOODBY)	10	Woodbury						
LONG MEADOW;	7	Calais						
LOWER ORANGE	8	Orange						
LOWER WINOOSKI;	4	Winooski		TP, Cl				
LOWER WORCESTER	35	Worcester		pH				
MANSFIELD	38	Stowe		pH				
MARTIN;	28	Williamstown						
MIDDLE WOODBURY;	9	Woodbury						
MIRROR	85	Calais						
MOLLYS	38	Cabot						
MOLLYS FALLS	397	Cabot		Flow				
MUD (WOODBY)-SE	18	Woodbury						
NELSON (EMONTP)	10	East Montpelier						
NORTH KING	3	Woodbury						
NORTH MONTPELIER	72	East Montpelier		TP, Sed	EWM			
OAK HILL;	8	Williston						
ORANGE;		Orange						
PAINE;		Northfield						
PEACHAM	340	Peacham		Flow				
PECKS	16	Barre Town						
PIGEON	69	Groton		pH				
PRESTON	9	Bolton						
RICHARDS;	14	Marshfield						
RICHMOND	24	Richmond		pH				
ROBINSON;	7	Northfield						
ROSS;		Morristown						
ROULEAU	1	Williamstown						
RUSS	7	Elmore		pH				
SABIN	142	Calais		DO, Sed				
SCHWARTZ;		Morristown						

Lake ID	Lake Area (acres)	Town	Water Quality Trend	Water Quality Status	Aquatic Invasive Species	Mercury in Fish Tissue	Shoreland & Habitat	Waters' Disturbed
SHELBURNE	452	Shelburne		TP, DO	CLP, EWM, EF			
SMITH (WOODBY)	4	Woodbury						
SODOM	21	East Montpelier						
SOUTH KING	4	Woodbury						
SOUTH WOODBURY;	6	Woodbury						
STERLING	8	Cambridge		pH				
TABER;		Stowe						
TABOR	5	Calais						
THURMAN W. DIX	123	Orange						
TURTLEHEAD	69	Marshfield		pH				
UNION;		Northfield						
UPPER WINOOSKI;	10	Winooski		TP, Cl				
UPPER WORCESTER	11	Worcester						
VALLEY	88	Woodbury		TP, DO				
WALTON	13	Woodbury						
WATERBURY	839	Waterbury		Flow, sed. pH	BN			
WATSON	11	Calais						
WEST HILL	46	Cabot		Flow				
WHEELER (WOODBY)	4	Woodbury						
WHEELOCK	4	Calais						
WHITCOMB	1	Williamstown						
WILLIAMSTOWN-NE;	7	Williamstown						
WOODBURY;		Woodbury						
WRIGHTSVILLE	190	East Montpelier		Flow, pH				

Stressors, Pollutant and Project Identification

In addition to supporting surface water assessments to identify water quality degradation or reference conditions[7], VDEC and partners (Appendix A) support assessments that can lead to a better understanding of the stressor or pollutants and therefore initiate appropriate remediation efforts. The assessments described in this

[7] Appendix A of the Vermont DEC Water Quality Monitoring Strategy 2011-2020

section cover most landuse activity in the basin as well as the physical condition of river corridors.

During the tactical basin planning process, assessments are considered along with modeling results (see end of Chapter for more explanation on modeling analyses) to prioritize geographic areas for project development and to identify priority projects for inclusion in the Tactical Basin Plan's Watershed Projects Database (Chapter 5). These projects can then be used to help meet regulatory requirements or support voluntary efforts. Specific assessment needs for each subwatershed are included in Tables 4 and Table 11.

Water Quality Monitoring by Citizen Groups

In addition to data collected by VDEC staff, data collected on streams and lakes by volunteer monitoring groups is assessed in the TBPs (see Table 6). The results can be important for identifying stressors and sources.

The VDEC supports volunteer water quality monitoring effort through the LaRosa Partnership Program, which provides VAEL chemical and bacterial analyses services to the volunteer groups through a grant program. The most common parameters requested include total and dissolved phosphorus, total nitrogen and total suspended solids. The presence of pathogens is also test for by a subset of this group.

Table ~~36~~. Volunteer monitoring groups collecting water quality data to support Winooski Basin planning (LaRosa Partnership Program funded) (See Figure 6)

Volunteer Monitoring Groups
Huntington River Conservation Partnership
Friends of the Mad River
Williston Conservation Commission
Upper Winooski Joint Conservation Commissions
Four Rivers Winooski Partnership
Chittenden County Stream Team

In Basin 8, the LaRosa Partnership program assists watershed groups and municipalities in sampling sites throughout the Basin. Once the samples are analyzed,

the lab organizes all volunteer water quality monitoring data for easy downloaded to an excel file available to groups for use in their annual reports. Data and reports can be found at the LaRosa Volunteer Monitoring webpage.

A summary of the water quality data in Table 6 includes prioritization of areas for focus of efforts to reduce phosphorus loading. (In development)

Stream Geomorphic Assessments

Geomorphic assessments measure and assess the physical dynamics of an entire watershed or collection of river reaches. See Vermont River Management Section - Geomorphic Assessment for more information.

The majority of the lower reaches of the assessed tributaries in Basin 8 (Table 7) are in disequilibrium evidenced by channel incision and subsequent ongoing planform adjustments. These adjustments result in a significant amount of legacy phosphorus and sediment loading to the basin's waterbodies from the eroded stream channels (Lake Champlain Basin Program, 2011). In the Basin, the most common causes of in-channel erosion are dams, diversions, culverts, and channelization practices, such as dredging, berming, and armoring. An additional source is the increased discharge of stormwater associated with increased development (impervious surfaces) within the watershed.

During the tactical basin planning process, projects from the Stream Geomorphic Assessments are reviewed and all priority river protection and restoration projects are included in the Watershed Projects Database (Chapter 5).

Restoration projects aim to restore lateral and longitudinal connectivity of rivers that will enhance floodwater storage in floodplain, reduce channel scour, and reduce sedimentation and phosphorus loadings to receiving lakes. See below for list of priorities in the basin:

Commented [DA3]: Need some sort of Table Heading here

Priority Streams	*Priority Actions*	*Rationale*
upper Winooski main stem, Pekin Brook, Upper Stevens Branch, Little, Mad and Huntington Rivers.	River Corridor protection	most at risk for movement (disequilibrium) based on high level of sensitivity and floodplain disconnection.
Little River	Floodplain restoration	the stressor, channel erosion, results in a loss of floodplain connection, sending fine

		sediment particles into the Winooski.
Allen Brook, Mad River, Upper Winooski, Dog River	Riparian Plantings	mature woody buffer can establish itself without significant loss from channel erosion. High potential for overland runoff exists
Huntington River	Riparian Plantings with large setback to accommodate lateral instability	High potential for overland runoff exists and

Culvert and bridge replacement to conform with the geomorphic condition of streams will be mostly limited to deteriorating structures because of the significant cost to the towns. Towns will be assisted by the Chittenden County, Central Vermont and Lamoille Regional Planning Commission and the Northern Vermont Development Association in prioritizing and planning for expense.

Table ~~4~~7. Stream Geomorphic Assessments and River Corridor Plans for Basin 8. Except where noted, all streams are moving towards planform stability with channel erosion and encroachment as the primary stressors.

Commented [DA4]: While I know alphabetical makes it easy to sort, for the public, having this organized by lower, middle and upper would read better

Stream or River	*Report date*	*Report Link*	*Summary of Findings/project priorities*
Alder Brook	12/01/2006	Alder Brook Phase 1 and 2 SGA	Landslide prone below Rte. 15: manage stormwater and protect corridor (upper) where not protected through wetland rules
Allen Brook	4/11/2008	Allen Brook Watershed Departure Analysis and Project Identification Summary	address encroachments and stormwater: River corridor protection[8], Riparian plantings, stormwater management
Dog River	3/01/2009	Dog River Corridor Plan	Thermal stress from lack of buffer and widened stream: Riparian plantings and focus river corridor easements outside of bedrock-

[8] River corridor protection can include river corridor easements, adequate sizing of culverts as well as municipal regulations for flood resilience.

Stream or River	Report date	Report Link	Summary of Findings/project priorities
			controlled areas
Huntington River	9/14/2009	Huntington River Watershed Corridor Plan	Riparian plantings, river corridor protection
Huntington River	12/01/2005	Huntington River Watershed Phase 1 SGA	See above
Huntington River	1/01/2006	Phase 2 SGA Huntington River Watershed	See above
Kingsbury Branch	10/01/2008	Kingsbury Branch of the Winooski River Watershed River Corridor Plan	Geomorphic condition protection by bedrock and VT wetland Rules. Limited actions needed
Pekin Brook	6/02/2010	Pekin Brook Corridor Plan, Calais, VT	River corridor protection,
Little River	6/28/2010	Little River Corridor Plan	River corridor protection, relocate or upgrade infrastructure in river corridor
Mad River	1/01/2008	Mad River Headwaters Phase 2 SGA	See below
Mad River	3/01/2008	Mad River Phase 1 and 2 SGA	See below
Mad River	4/20/2018	Moretown, Vermont Phase 2 Geomorphic Assessment & River Corridor Plan	Livestock exclusion, floodplain/stream restoration, river corridor protection and buffer plantings
Mad River	1/01/2008	Upper Mad River Corridor Plan	River corridor protection and riparian buffer plantings
Morehouse			Stormwater management. consider gully restoration and culvert replacement
Muddy Brook	2/01/2008	Muddy Brook Phase 1 and 2	River corridor protection in upper watershed (existing wetlands). Upper area protected by wetland, relocate or upgrade infrastructure in lower river corrider: Stormwater management, riparian plantings,
North Branch Winooski	3/01/2009	North Branch Winooski Corridor Plan	Bed rock gorges protects geomorphic condition. Protect depositional areas between bedrock-controlled areas.
North Branch	5/01/2007	North Branch Winooski Phase	See above

Stream or River	*Report date*	*Report Link*	*Summary of Findings/project priorities*
Winooski		1 SGA	
North Branch Winooski	3/01/2007	Upper Winooski Watershed, North Branch and Lower Stevens Branch Phase 1 SGA	See above
Richmond tribs	9/01/2007	Winooski River tributaries in Richmond Phase 1 SGA	Encroachment: upgrade culverts, riparian plantings
Stevens Branch	3/01/2009	Stevens Branch and Jail Branches of the Winooski River Corridor Plan	Jail Branch: Landslide prone - manage stormwater at top of bank, and new development Stevens Branch – River corridor protection
Stevens Branch	4/01/2004	Stevens Branch in Williamstown and Barre City Phase 2 SGA	See above
Sucker Brook	10/01/2007	Sucker Brook Phase 1 and 2 SGA	River corridor protection (not high priority) where not already confined by ravines, riparian plantings, address stormwater
Sunderland Brook		Find Phase 2 report	River corridor protection and floodplain restoration in agricultural areas, address stormwater
Little River Main Stem	6/28/2010	Little River Corridor Plan	River Corridor Protection and riparian planting
West Branch Little River	10/12/2010	Upper West Branch Little River Corridor Plan, Stowe, VT	Stormwater management and Encroachment: work with landowners to reduce infrastructure conflicts
West Branch Little River	5/01/2007	West Branch Little River in Stowe Corridor Plan	Encroachment: work with landowners to reduce infrastructure conflicts
West Branch Little River	11/01/2005	West Branch Little River Phase 2 SGA	See above
Winooski - Cabot	3/30/2006	Phase 2 SGA, Winooski River Watershed, Town of Cabot, VT	See below
Winooski - Cabot	6/01/2006	Winooski River in Cabot Corridor Plan	Temperature: plant and protect riparian buffers

Stream or River	Report date	Report Link	Summary of Findings/project priorities
Winooski - Cabot	11/01/2004	Winooski River in Cabot Phase 1 SGA	See above
Winooski - Cabot	12/01/2006	Winooski River in Cabot Phase 2 SGA	See above
Winooski - Montpelier to Cabot	3/19/2014	Great Brook River Corridor Plan	Encroachment: address infrastructure conflict, increase wetland in headwaters,
Winooski - Montpelier to Cabot	1/01/2008	Upper Winooski Corridor Plan	Temperature: riparian plantings and river corridor protection
Winooski - Montpelier to Cabot	4/01/2007	Upper Winooski Phase 2 SGA	See above
Winooski - Montpelier to Cabot	3/31/2010	Upper Winooski River: Plainfield to Montpelier, River Corridor Plan	Temperature: riparian plantings and river corridor protection
Winooski Mid, Alder to Montp	2/01/2009	Joiner Brook, Bolton River Corridor Plan	Geomorphic condition is good to fair with good riparian buffers. Snowmaking weir causing sediment accumulation upstream. Stormwater management
Winooski Mid, Alder to Montpelier	6/01/2007	Mid-Winooski Watershed Chittenden, Washington, and Lamoille Phase 1 SGA	See below
Winooski Mid, Alder to Montp	12/15/2015	Middle Winooski River Corridor Plan	River corridor protection, riparian planting
Winooski, Mouth to Alder Brook	8/01/2006	Lower Winooski Phase 1 and 2 SGA	Bedrock controlled with large wetland within river corridor: restore and protect wetlands

Landslide Inventory

The Washington County Phase 1 Hazard Map, 2017 and Report identifies landslide sites (modern and ancient) and area of steep slopes. The expected completion date for a

similar study in Chittenden County is 2018. The VDEC Geology Program supports these studies as part of the current State Hazard Mitigation Plan recommendation to map landslides gullies, and other slope instability hazards. (http://vem.vermont.gov/plans/SHMP).

The WSMD Geology program will continue to add to the inventory through input from the public. An online reporting form will be publicized by the program: http://dec.vermont.gov/geological-survey/hazards/landslides

Towns may also request a more detailed level of mapping to help inform the town planning and project review process from the Department of Public Safety.

The Washington County Phase 1 Hazard Report includes the following summary:

1. The landslides are principally caused by
    a. Over steepen slopes during the flash floods that results in fluvial erosion of banks and stream beds.
    b. Decreases in shear strength of soils due to increases in soil water pore pressures due to the heavy rainfall.
2. Stormwater discharges may have destabilized or at least exacerbated the instability of gullies.
3. The detailed and periodic updates of (Phase 2) stream geomorphic data from the Vermont Rivers Program is critical to understanding the patterns of stream channel adjustment that are underway in the river corridors as it allows consideration of how the slopes had changed over time. It would be highly desirable to have Phase 2 data available for the streams in any areas where landslide mapping is to be undertaken.

Stormwater Master Plans and Mapping

Stormwater runoff from developed areas carries pollutants to streams, as well as increasing stream flows, which in turn erodes the stream channel. The Department of Environmental Conservation (VDEC) has supported town stormwater mapping and stormwater master plans as well as illicit discharge detection to help both with regulatory requirements and voluntary efforts. The town reports can be found at the

associated links above. Road runoff in each town will be addressed through the MRGP (see Chapter 4).

An overview of needs for identify stormwater projects in Basin 8 towns are provided in Table 6.

Commented [DA5]: Table below needs Number and Title

. *Town*	*Status*
Williamstown and village, Waterbury Village, and Stowe	Need Hybrid site & community retrofit Stormwater Master Plan with green stormwater infrastructure (GSI) stormwater management
See Appendix C	Stormwater Master Plans completed. Flow Restoration Plans developed for stormwater impaired streams in MS4 communities.
Remaining towns (as well as all towns in watershed)	SMP not needed. Roads are the predominant source of stormwater, which will be addressed through the State general permit, aka Municipal Roads General Permit (MRGP)-for discharges of regulated stormwater from municipal roads,

Lake Shoreland Protection and Restoration

The Vermont Lakes and Ponds Management and Protection Program (VLPP) evaluates all Vermont lakes for nutrients trends, aquatic invasive species, shoreland and lake habitat, mercury contamination and provides scores using the Vermont Inland Lake Score Card[9]. Additional information about lakes collected by VLPP can be found here, including overall water quality, shoreline condition, biodiversity and unusual or scenic features. The following table lists lakes for the agency's focuses based on the overall conditions of the lake (see rationale) as well as the actions that would be considered appropriate for addressing the identified condition.

Priority actions for priority lakes and ponds based on VLPP evaluations

Commented [DA6]: Table needs Number

Priority Lakes/Ponds	*Priority Action*	*Rationale*

[9]Using Google Earth, viewers can select from more than 800 lakes in the state and learn about four key aspects of lake health: nutrients, aquatic invasive species, shoreland and lake habitat, and mercury pollution. Links embedded in the Score Card open deeper views into the underlying data

Green Wood, Woodsbury	Shoreline protection	High ranking for all other critera
See table in assessment	Shoreline protection	Existing shoreline condition is Fair
Forest Pond, Calais; Blueberry, Warren, North Montpelier Pond, Peacham and Woodbury Pond	Watershed assessment and work to address sediment	Poor (Forest Pond) to Fair water quality trends
Buck and Pigeon, Turtlehead, and Berlin Pond	Protection	Ranked with top 25% of Best lakes in Vermont based on high scores which include criteria for water quality, biodiversity and unusual or scenic features
Mansfield, Shelburne and Thurman W. Dix Reservor	Protection	Lakes with unusual, scenic or natural features
	Lake Wise Program	

Wetland Restoration

The 2007 VT Agency of Natural Resources' Lake Champlain Basin Wetland Restoration Plan and 2016 updates includes the identification and prioritization of wetlands in the Vermont portion of the Lake Champlain Basin with the greatest potential for P removal through restoration. The plan identified the need for a higher percentage of wetland restoration needs in Basin 8 compared to other areas. The plan identified over X potential restoration sites for a total of over X acres for restoration within the Winooski Basin, which is X% of the total number of sites identified in the Plan.

The Vermont Wetlands Program also collects bioassessment data to assess the health of Vermont wetlands. Based on a 2017 analysis of bioassessment data, the **principal factors that correlate with poor wetland condition are**:

- presence of invasive species,
- disturbance to the wetland buffer or surrounding area,
- disturbance to wetland soils, and
- disturbance to wetland hydrology (how water moves through a wetland) through ditching, filling and draining.

Wetlands in remote areas and at high elevations tend to be in good condition, with the most threatened wetlands occurring in areas of high development pressure and exhibiting habitat loss.

The Bioassessment Program has conducted 218 detailed vegetation plots in wetlands throughout the state. The Winooski watershed includes 12 vegetation plots.

Surveys are primarily conducted on a rotating basis by watershed, and the Winooski River Basin will be surveyed in more detail with the next rotation in 2020.

In addition to detailed vegetation plots, the Wetlands program initiated rapid assessments of wetlands using the Vermont Rapid Assessment Method (VRAM) in 2017. A total of 24 VRAM assessments have been conducted thus far in Basin 8. Current pattern of conditions for this watershed mirrors much of the rest of the State: A clear pattern emerged in this watershed (and in the rest of Vermont) where high- elevation, small wetlands are often in excellent condition, but floodplain wetland complexes low in the watershed are often in poor condition and heavily impacted by human use (but also offer a great deal of restoration potential). Future VRAM analyses will also be completed by organizations and individuals.

Flow Alteration

Flow alteration is any human-induced change in the natural flow of a river or stream or water level of a lake or reservoir. Flow alteration is associated with instream structures and practices that regulate flows or water levels or withdraw water, i.e., activities that obstruct, dewater, or artificially flood aquatic and riparian habitats. Regulating flows impacts habitat and water quality, including changes to temperature and water chemistry (e.g., pH, dissolved oxygen, and toxicity), which may significantly lower habitat suitability for certain aquatic organisms. Flow alteration can also occur due to small-scale practices such as road culverts and ditches, up to large-scale dams, reservoirs and irrigation networks.

The Department of Environmental Conservation reviews hydroelectric generating dams as a flow alteration activity and issues a certification pursuant to Section 401 of the Clean Water Act (CWA) that the project as operated meets the Vermont Water Quality Standards. Table 8 includes a list of currently operating hydroelectric generating dams in the Basin. The surface waters impounded by and downstream of these facilities are classified to maintain designated uses at a Class B(2) level of quality.

Flow assessments

Managing water levels in a stream to meet human needs for property protection or a water source can compete with the need to protect aquatic habitat. Assessments have identified flow alterations that the VDEC addresses to ensure compliance with the Vermont Water Quality Standards as well the Vermont Surface Level Rules either through regulatory processes or as owner of a dam (see also Watershed Projects Database)

A list of flow altered waters are included in Table 4.

Table 58. Hydroelectric generating dams in Basin 8. See below for additional information.

Commented [DA7]: Suggest re-organizing on basis of lower, middle, upper

Dam	*River*	*Comments*	*Ownership*
Montpelier No. 4	Winooski River		Winooski Hydroelectric Co
Winooski One	Winooski River		Winooski One Partnership
Marshfield No. 6	Mollys Brook	FERC Unlicensed project . DEC reviewing application for Certificate of Public Good (CPG).	Green Mountain Power Corp
Bolton Falls No. 1	Winooski River	Entering 2nd year of FERC relicensing. Will conduct studies 2018 field season	Green Mountain Power Corp
North Montpelier Pond	Kingsbury Branch		Kingsbury Branch Hydroelectric Co.
Essex No. 19	Winooski River		Green Mountain Power Corp
Middlesex No. 2	Winooski River	Unlicensed facility. Fragments and degrades fisheries habitat	Green Mountain Power Corp
Moretown No. 8	Mad River	FERC relicensing process initiated recently	Ampersand Moretown Hydro, LLC
Northfield Mills	Dog River		Nantana Mill Partnership
Gorge No. 18	Winooski River	Unlicensed and ANR issued a Certificate of Public Good in 2012 after outstanding issues addressed during proceedings.	Green Mountain Power Corp
Ladds Mill	North Branch Winooski River		Worcester Hydro Co.
Peacham Pond	Sucker Brook	Unlicensed, Hydropower storage for Marshfield no. 6.	Green Mountain Power Corp
Wrightsville	North Branch Winooski River	also flood control. Project in the FERC relicensing process. Studies will likely begin summer 2018	State of Vermont – VDEC owns dam. Washington Electric Coop owns and operates the hydro.
Waterbury	Little River	Section 401 wq certification appl'n under review by VDEC. Also flood control	State of Vermont – VDEC. Green Mountain Power Corp. owns and operates the hydro

Additional information about four of the above hydrodam facilities follows, including an assessment provided by the ANR Fish & Wildlife Department (2017 Upper Winooski Fisheries Assessment):

Marshfield 6 and Peacham Pond Dams

Molly's Brook enters the Winooski in Marshfield, and flows from Peacham Pond and Molly's Falls Reservoir. These two ponds and Molly's Brook have been used as part of an unlicensed hydroelectric operation since 1927. Annual winter drawdowns in both Molly's Falls Reservoir and Peacham Pond impact littoral habitat (Ladago, 2017) and elevated water temperatures, decreased dissolved oxygen, and altered flows have been observed downstream of the impoundments as a result of these operations. The GMP hydro-electric generation results in extreme daily fluctuations in flow as well as rapid temperature changes of >5°F (Kirn 2017). GMP is currently seeking a Certificate of Public Good to repair the dam and will need to meet Vermont Water Quality Standards to move forward. VFWD (Vermont Fish and Wildlife Department) and VDEC (Vermont Department of Environmental Conservation) are working to improve facility operations to decrease impacts to water quality and aquatic populations.

Wrightsville

In Middlesex, the North Branch is impounded to create Wrightsville Reservoir. Elevated downstream temperatures due to a surface water releases are magnified by a loss of diurnal cooling within the reservoir. These factors likely limit the ability of the North Branch to sustain wild trout and other cold-water fish species below the reservoir (Kirn 2017). Poor recruitment of largemouth bass within the reservoir may reflect the impact of water level fluctuations during and following spawning and a lack of aquatic vegetation growth within the reservoir.

Waterbury

Downstream of Waterbury Dam, the river supports wild brown and rainbow trout. The populations are limited by regular and extreme flow and temperature fluctuations associated with the hydroelectric release. As part of a recently issued Section 401 water quality certificate and FERC license, flow and temperature below the dam is expected to improve beginning in May 2018. Once the tainter gates and spillway of the dam are repaired, the winter drawdown will be eliminated, and run-of-river operation will occur. Until this repair, a phased approach (currently providing an increase in minimum flows downstream of the dam) should improve the overall health of the fishery and surrounding ecosystem.

Stage 2 of the 402 Water Quality Certification will begin this May. Green Mountain Power has replaced the turbine runner and constructed the bypass valves so that the project will operate in run-of-river between May 15 – December 31. Drawdown and limited peaking is allowed from January 1 – March 30; refill is allowed between April 1 – May 14. Stage 3 true run-of-river operations will begin year-round when tainter gates are replaced.

Other Dams

While some of the dams in the Basin provide power generation (Table 8) and recreational opportunities, and can be aesthetically or culturally important, others may be obsolete, providing little or no public benefit, or constituting a hazard. Removal of dams provides benefits to stream stability and run of stream opportunities for boating as well as aquatic organism passage. Removal is considered when dams no longer provide benefits and/or have become structurally unsafe. Table 9 includes a list of dams in the basin that may no longer be serving a useful purpose, and have ranked as having significant ecological impact in an analysis by The Nature Conservancy[10]. A few are in the process of being removed, but most will require further evaluation and consultation with the owner before it can be determined if it is a good candidate for removal. If the owner is interested in removal, state funding may be available for the removal project.dams that could be considered for removal. These are also included in the Watershed Projects Database.

Table ~~6~~9. Dams with high potential for removal based on landowner and community interest, expected resource improvement (TNC rank[11]) and dam hazard class.

State ID	*Dam Name*	*Stream*	*TNC rank*	*Dam Hazard Class[12]*	*Comments*
13.01	Brooklyn Street	Stevens Branch	high	3	

Commented [DA8]: Re-organize on basis of lower, middle, upper

Commented [DA9R8]: Also, add a column for Town

[10] The Nature Conservancy (TNC) has developed a dam screening tool to prioritize removal based on ecological benefits:
: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=414a9dc9540247ae92acd48f64f1290b

[11] The Nature Conservancy (TNC) has developed a dam screening tool to prioritize removal based on ecological benefits:
: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=414a9dc9540247ae92acd48f64f1290b

[12] Dam Hazard Class: The hazard class is based upon the potential of damage or loss of life if the dam were to fail and is not related to the condition of the dam, which could be an indication of the potential to

State ID	Dam Name	Stream	TNC rank	Dam Hazard Class[12]	Comments
13.02	Habbep	Stevens Branch		3	
14.04	Jockey Hollow	Stevens Branch		3	
32.06	Wardner Pond	Sunny Brook			
39.04	Clarks Saw Mill	Winooski River		3	Active removal project
63.02	Duxbury Mill	Crossett Brook		3	
123.04	Laird Pond	Nasmith Brook	High		
131.01	Lane	North Branch Winooski River	High	3	
131.05	Trestle	North Branch Winooski River		3	Higher priority if Lane Shops Removed
143.05	Cross Bros.	Dog River	high	3	VFWD involved in active removal project supported by the owner, Town of Northfield
143.09	Cooks Mill	Sunny Brook	high		
	Stony Brook	Stony Brook			VFWD involved

fail. A hazard class of 3 indicates a low hazard to downstream uses were the dam to fail. For more detailed explanation, see DEC dam-safety inspection program.

State ID	Dam Name	Stream	TNC rank	Dam Hazard Class[12]	Comments
155.01	Old Batchelder Mill	Winooski River	high	3	Town residents are approaching the selectboard
199.04	Moscow Mills	Little River		3	ANR received informal inquiry about dam from Stowe Electrical Department to develop a hydroelectric project.
223.03	Warren Village	Mad River	high	3	
255.04	Chandler Sawmill	Minister Brook	high	3	Located at Natural falls/Partially Breached/ sediment barrier

Table 7~~10~~. Dams in VDEC records that may not exist. Need to assess status.

Commented [DA10]: See previous comment

State ID	Dam Name	Stream	TNC ranking	Dam Hazard Class	Comments
65.05	East Montpelier	Winooski River	medium		Appears to be gone
20.04	Montpelier Reservoir (Lower)	Benjamin Falls Brook			Intact/in use?
20.09	Montpelier Reservoir (Upper)	Benjamin Falls Brook			Intact/in use?
40.01	Nelson Pond	Mirror Lake-TR			Intact/in use?
40.02	Sabin Pond	Kingsbury Branch	high	3	Intact/in use?
40.16	Maple Corners	Curtis Pond Brook		3	Intact/ in use?
132.03	Eight Trout Club	Welder Brook	medium		Intact/in use?

255.06	Worcester-6	North Branch Winooski River	high		Appears to be gone

Hazardous Waste Sites and Landfills

Locations and additional information about hazardous waste sites and brownfields in the Basin 8 can be viewed on the ANR Natural Resources Atlas. Information for a specific site can be accessed through the ANR Environmental Tool Hazardous Site List. Detailed description of sites that may have the potential to contaminate surface waters are included in the DEC Basin 8 Water Quality Assessment Reports.

In Basin 8, leachate from three closed landfills, Farwell dump, the Central Vermont landfill, and South Burlington landfill are included as possible sources of impairment to three surface waters: Gunner Brook, Muddy Brook in East Montpelier and tributary to the Winooski (VT08-02) (see Table 4).

The potential for hazardous waste sites to leach will increase with inundation as well as proximity to surface waters. Large floods may result in adjustment of river channels that could increase potential for release of hazardous waste into surface waters. Towns may be interested in listing hazardous waste sites that sit within the river corridor in municipal hazard mitigation plans.

VDEC is continuing to monitor many of these sites thorough its biological monitoring program.

Modeling Tools to Identify Remediation and Protection Efforts

The Department of Environmental Conservation and its partners use modeling techniques to predict sources of pollutants, estimate pollutant loads and also to identify where practices might be most effective at addressing the pollutant. Modeling tools play a significant role in the development of the Lake Champlain Phosphorus TMDL Phase II planning-level "sub-allocations." They are used to estimate phosphorus loads to lakes and rivers from specific geographic areas and landuse activities, as well as to determine effective practices (also known as a best management practices) for addressing load reductions from a specific landuse activity within a subbasin or even more specific geographic areas. The models and the results are included in Chapter 3's section about the Lake Champlain Phosphorus Phase II.

Modeling can never achieve a 100% accurate representation of actual conditions on the ground. For that reason, model estimates are always compared against observed values to assess fit. The assessments and plans described at the beginning of Chapter 2 are

based on the results of field work and therefore include those observed values. The results from observations, monitoring, assessments, and modeling are used in the development of the management actions in this plan (see Watershed Projects Database).

Modeling tools, complemented by site visits to verify conditions, can be used by technical staff in developing proposals for landowners or by programs to support planning, (e.g, estimate load reductions from BMPs, see below).

The following modeling or data analyses listed below have and will continue to be part of the process for identifying the efficacy of actions included in the Watershed Projects Database along with the assessments and plans described earlier in this chapter. The modeling tools are described in more detail in Chapter 3 or Appendix B and include information about how the information will be made available to any organization responsible for assisting in BMP implementation.

The following modeling tools and other assessments used to identify remediation and protection actions are described in greater detail in Chapter 3 or Appendix B:

- SWAT model
- HUC12 Tool
- EPA Scenario Tool
- Lake Champlain BMP Accounting and Tracking Tool (LC BATT)
- Clean Water Road Map Tool
- Floodplain restoration

Water Quality Monitoring and Assessment Needs

In addition to waters identified as needing further monitoring and assessment in Table 4, Table 11 includes additional monitoring and assessment needs based on conclusions from assessments previously described in this chapter or the results of the VDEC MAPP monitoring work[13] or the ANR Department of Fish and Wildlife. In large part, the locations listed below are identified for the purpose of collecting information that would support reclassification of one or more designated use to a higher class of protection.

[13] The use of macroinvertebrate and fish communities to assess water quality and uses is described in the Vermont Water Quality Standards as well as the 2016 DEC Assessment and Listing Methodology

Table 8~~11~~. Additional proposed monitoring and assessment needs to inform remediation or protection strategies.

Commented [DA11]: See previous comment on organization of tables

Water body	*Town*	*Assessment Goal*	*Existing data supporting goal*	*Monitoring needs*
Minister Brook	Worcester	Determine condition based on aquatic life support (ALS)	Stressed due to acid, low spring pH	Macroinvertebrates and fish
Hancock Brook	Worcester	Determine condition based on aquatic life support	Stressed due to acid for ALS, low spring pH, 2005 macroinvertebrates and fish Good	Macroinvertebrates and fish updated
Little River	Waterbury	Determine condition	stressed: so, instability still an issue.	Review geomorphic condition. Macroinvertebrate and fish data
Upper Winooski (btw Marshfield and Cabot Creamery)	Cabot	Determine condition	2015 and 2016 data above Cabot WWTF shows *Excellent* macroinvertebrates, but this area is currently listed as stressed	Macroinvertebrate and fish data
Upper Winooski – ¼ mile below Cabot WWTF	Cabot	Determine condition	macroinvertebrate – 2015 data = *Very Good*.) Recovered from spill	Macroinvertebrate and fish data
Upper Winooski – Molly Falls, brook – Upper area of brook	Cabot	Determine condition	Macroinvertebrate good in lower brook nearer to confluence (RM 0.1, RM 0.5); Indeterminate Fair/Good closer to Rez at RM 1.5. Fish fail at 1.5 and 0.5. VDFW data shows increased temp.	Macroinvertebrate and fish data
Main stem - Upper Winooski to Essex	Cabot to Essex	Determine condition	Macroinvertebrates are good or above, nothing has failed except after Cabot Creamery spill.	Macroinvertebrate data (river too wide to collect fish data).
Great Brook	Plainfield	Confirm that geomorphic issues	Geomorphic assessment	Macroinvertebrates and fish data

Water body	*Town*	*Assessment Goal*	*Existing data supporting goal*	*Monitoring needs*
		are resulting in ALS degradation.		
Gunner Brook - RM 1.1 to mouth.	Barre	Determine condition	Macroinvertebrates/ fish results variable btw poor and good. Macroinvertebrates better than fish. The fish might be stressed due to invasive rainbow.	Macroinvertebrate and fish. Review Toxins data
Stevens Branch – Rm 4.9 and downstream	Barre	Determine condition	Landscape suggests degraded conditions	Macroinvertebrate /fish data
High Brook bridge, Welder Brook, and Folsom Brook	Waitsfield, Moretown	Determine condition	based on review of FMR volunteer data that has identified these as relatively high pollutant loads	Macroinvertebrate /fish data
Chase Brook	Fayston	Determine condition	upstream activity (Sugarbush North) 2006 data good.	Macroinvertebrate /fish data
Clay and Rice Brooks	Waitsfield	Determine condition	part of the Stormwater Master Plan for Sugarbush with consultant monitoring	Macroinvertebrate /fish data
Joiner Brook	Bolton	Determine condition	check impact of development	Macroinvertebrate /fish data
Cobb Brook	Huntington	Determine Condition	Huntington Conservation Commission requested assessment	Macroinvertebrate /fish data
Huntington River	Huntington	Determine condition	Texas Hill Road is steep and could contribute sediment. Macroinvertebrates very good to excellent and fish good condition.	Macroinvertebrate /fish data
Muddy Brook	Williston	Determine condition	Landuse suggests stressors beyond listed area	Macroinvertebrate /fish data

Water body	*Town*	*Assessment Goal*	*Existing data supporting goal*	*Monitoring needs*
Blanchard Brook	South Burlington	Identify stressors	Will be listed for stormwater and temperature in 2018	Macroinvertebrate /fish data
Sand Hill Brook VT08-04	Essex	Confirm as Class B(1) for aquatic biota and wildlife	2015 macroinvertebrate =*Very Good*, fish=*Excellent*	Macroinvertebrate /fish data
Jug Brook VT08-09:	Cabot	Confirm as Class B(1) for aquatic biota and wildlife	Might meet B1 depending on whether final criteria allow two individual sample sites with only 1 sample to meet criteria (RM 1.4 & 3.0)	Macroinvertebrate /fish data
Pinnacle Brook VT08-12:	Stowe	Confirm as Class B(1) for aquatic biota and wildlife	Data from 2012-2016 shows very good or better macroinvertebrates Try to sample in 2018.	Fish data
Orange Brook VT08-15:	Orange	Confirm as Class B(1) for aquatic biota and wildlife	Low gradient, Very Good macroinvertebrates in 2013. an additional Very Good or better macroinvertebrate assessment.	Macroinvertebrate data
Upper Stevens Branch VT08-16:	Williams-town	Confirm as Class B(1) for aquatic biota and wildlife	RM 11.9 fish and macroinvertebrates were Very Good in 2015	Macroinvertebrate /fish data

Water body	*Town*	*Assessment Goal*	*Existing data supporting goal*	*Monitoring needs*
Freeman Brook VT08-20:	Warren	Confirm as Class B(1) for aquatic biota and wildlife	Based on macroinvertebrate/fish data	Macroinvertebrate/fish data
Lincoln Brook VT08-20:	Warren	Confirm as Class B(1) for aquatic biota and wildlife	very good for macroinvertebrate/fish in 2015.	Macroinvertebrate/fish data
Gleason Brook	Duxbury	Explore for reclassification to A1	Landscape would support, part of Camels Hump State Park. Part of management plan's Natural Area down to 900 ft.	Macroinvertebrate/fish data
Trib to Woodbury Lake (across from DFW boat access)	Woodbury	Explore for Class B1 for aquatic biota and wildlife	Mouth of tributary provides habitat for X mussel	Macroinvertebrate/fish data
Mill Brook	Jericho	Explore for Class B1 for aquatic biota and wildlife	Based on macroinvertebrate/fish data	Macroinvertebrate/fish data

Priority Subbasins for Remediation

The assessment results described throughout this Chapter as well as the EPA and state-listed waters (Table 4) provide a basis for identifying priority stressors in subbasins (Table 12) for remediation. These priority subbasins have been identified as providing significant phosphorus and sediment loads to the watershed and/or need protection for purposes of flood resilience. In addition, assessments have provided information about appropriate strategies and actions to address stressors. The actions in the Watershed Projects Database were informed by these priority actions.

Table 9~~12~~. Strategies to address priority stressors in subbasins.

Subbasin Waterbody Name[14]	*Streams*	*Priority Stressor/Concern*	*Priority Strategy*
Lower Winooski River mainstem		Urban development stressors and toxins[15] agriculture, chlorides	Support MS4 permit implementation, Education/Outreach to encourage implementation of best practices by private landowners (E/O)
Tributaries to Lower Winooski	Centennial, Sunderland, Allen, Morehouse~~Sucker, Alder and Muddy Brook~~	Urban Development stressors, chlorides, agriculture	Support MS4 permit implementation especially Flo Restoration Plans and Phospho Control Plans, stormwater management to reduce landslide, E/O , protect/enhance river corridors
Tributaries to Lower Winooski	Sucker, Alder and Muddy Brook	Urban Development stressors, chlorides, agriculture	Support MS4 permit implementation especially Phosphorus Control Plans, stormwater management to reduce landslide, E/O , protect/enhance river corridors
Lower Mid-Winooski River mainstem -the confluence of Alder Brook to the confluence of the Little River		Temperatures sustained from smaller streams despite Bolton and Waterbury dam, road stormwater, agriculture	Protect/enhance River corridor, manage stormwater, agric. BMP
Tributaries to Lower Mid-Winooski	Mill, Johnnie, Duck, Joiner, Pinneo, Preston, Gleason	Roads, landslide activity, these streams currently protect temp. of main stem. Trout/salmon spawning habitat	Driveway E/O and Road management, Protect/enhance River corridor

Commented [DA12]: Suggest splitting this table into separate tables based upon TMDL status rather than lumping together

Commented [DA13]: Is Agriculture really a Priority Stressor on these MS4 impaired streams? If not, delete

[14] To identify the towns encompassed by each of the subbasins, please see Water Quality Assessment Maps.

[15] Urban development stressors: land erosion, nutrient loading, channel erosion, pathogens, Thermal stress; encroachment
Agricultural stressors: land erosion, nutrient loading, channel erosion, pathogens, Thermal stress

Subbasin Waterbody Name[14]	*Streams*	*Priority Stressor/Concern*	*Priority Strategy*
Huntington River	Cobb Brook, Hollow Brook	Pathogens, temperatures (limit spawning habitat), geomorphic instability, agric. runoff, septic. Protect swimming holes	Driveway E/0, support town floodplain protection, Protect/enhance river corridor. Manage stormwater and streams to reduce landslide/gully
Upper Winooski River mainstem	from confluence of Stevens Branch to confluence of Molly's Bk	Geomorphic instability: cutting through old lake terraces, dams and lack of riparian buffer result in thermal modification. Pathogens from village centers; Flood resilience	Forest integrity E/O, grazing workshops, Protect/enhance river corridor, stormwater management including IDDE in villages
Tributaries to Upper Winooski	Great Brook (Plainfield), & Nasmith, Creamery, Mallory Bennett, Sodom Pond,Guernsey Brook	Geomorphic instability, landslides and gullies Protect trout habitat Flood resilience	Forest integrity, river corridor easements, road and bridge work, Protect/enhance river corridor, manage stormwater and streams to reduce landslide/gully
Winooski River headwaters	from confluence of Molly's Brook to its headwaters and tributaries incl. Mollys, Jugg and Sucker Brooks	Temperatures (Dams), Stormwater from villages, agriculture. Pathogens Flood resilience	Forest integrity E/O, agriculture BMP, including hay field management and woody riparian buffer
Kingsbury Branch Winooski River	including the tributaries Buck Lake Brook, Pekin Brook, Dugar, Still	Protection of lakes/ponds. N. Montpelier pond dam increases temperature although Dugar & Pekin brook provide cold water to Pond. Geomorphic instability although Kingsbury protected by ledge/wetland. Agric in Pekin Brk & Kingsbury trib	Driveway E/O, lake shore protection and BMPs; River corridor protection on Pekin Brook. Forest integrity E/O.
Tributaries to Upper Mid-Winooski	Graves (Thatcher,) Jones Brook (Great),Herring Brooks.	Forested except for Thatcher (urban development). Private and town road runoff.	Waterbury village stormwater management; driveway E/0

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Subbasin Waterbody Name[14]	*Streams*	*Priority Stressor/Concern*	*Priority Strategy*
Lower Little River		Geomorphic instability, Japanese Knotweed on river banks. Temperature main stem, Development in upper watersheds.	Protect River corridor: Protection of headwaters streams. and plantings
Upper Little River	West Branch little river; gold brook; Miller brook, Moss Glen Brook	Geomorphic instability, temperature, development in upper watershed. Agric. cropland near Stowe.	Stormwater management, Protect/enhance river corridor, include berm removal. Transportation resilience plan, Agric field BMPs
Upper Mid-Winooski River mainstem	from the confluence of the Little River to the confluence of Stevens Branch	CSO pathogens, stormwater runoff	Support permits, GSI in Montpelier
Jail Branch Winooski River		Toxins, agric. impacts in upper, Temperature, stormwater,	Stormwater management, protect river corridor
Stevens Branch Winooski River	Gunner Brook); Pond Brook (drains Berlin Pond so flow regulation)	Toxins, stormwater, Temperature; Gunnar brook - important spawning habitat for cold water fishery, but geomorphic instability – road conflicts	Stormwater management, flood resilience practices,
Dog River		Pathogens, temperature, geomorphic instability, urban stormwater, floodplain protection;	Stormwater management, protect/enhance river corridors, agricultural BMPs
Mad River mainstem		Geomorphic instability, flood resilience, pathogens from farms (septic? , roads. Lack riparian buffers	Agric field BMPs, flood resilience ; protect/enhance river corridors
Lower Mad River tributaries		Steep slopes and erodible soils intensify erosion; high road density, geomorphic instability. Pathogens, Agriculture. Dowsville wild native brook trout	Agriculture BMPs, Silvicultural BMPs, road E/Os, flood resilience ; protect/enhance river corridors.

Subbasin Waterbody Name[14]	*Streams*	*Priority Stressor/Concern*	*Priority Strategy*
Upper Mad River tributaries		Steep slopes and erodible soils intensify erosion; high road density, geomorphic instability. above Warren -wild native brook trout	Manage developed land stormwater. Silvicultural BMPs, flood resilience ; protect/enhance river corridors
North Branch Winooski River		Protection of streams, address road runoff and structures, address logging roads	Protect/enhance river corridor, driveway workshops, remediate logging roads

Chapter 3 –Addressing Stressors and Pollutants through TMDLs and Regulatory Programs

Regulatory programs play a significant role in addressing pollutants and stressors responsible for degraded water quality. The ANR's and the Agency of Agricultural, Food and Markets' regulatory programs that are associated with water resource protection are described in Appendix A of the Vermont Surface Water Management Strategy, and in this Chapter.

The passage of Act 64 in 2015 resulted in the creation of the State's Clean Water Initiative Program (CWIP). The CWIP provides additional resources toward sediment and phosphorus reduction, based upon the assessments and integrated implementation table action (Watershed Projects Database) in this Tactical Basin Plan. The goals of the Initiative are to satisfy the State's legal obligations under both the Vermont Clean Water Act and the federal Clean Water Act. At the highest level, priorities include:

- Implementing Agriculture Best Management Practices
- reating Stormwater Runoff and Erosion from Developed Lands
- Installing Pollution Controls on State and Municipal Roads
- Restoring and Protecting Natural Infrastructure (e.g., wetlands) for Flood Resiliency and Water Quality Improvements
- Increasing Investments in Municipal Wastewater Treatment Infrastructure

As of July 1, 2014, changes to land use within 250 feet of a lake's mean water level (also known as the Protected Shoreland Area) - any new development, redevelopment, or

vegetation removal - may require a permit. Shoreland Permits are issued under 10 V.S.A Chapter 49A, Subsections 1441–1449.

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

- Required Agricultural Practices
- Town road permit
- VTrans road permit
- Management of stormwater on under or un-treated 3-acre parcels

The new and existing regulations will be important tool that ensure Vermont's water quality standards are met. While the Watershed Projects Database (see Chapter 5) includes numerous actions that will be implemented on a voluntary basis, other actions will be required by permits. Partners as well as VDEC will support education and outreach efforts to facilitate regulatory compliance. As appropriate, Clean Water Initiative funding may provide municipalities and landowners with financial and technical assistance to develop and implement requirement management plans under the new permits.

Total Maximum Daily Load Implementation Plans are also products of regulatory requirements. Some of the waterbodies in the Winooski River Basin do not currently meet Vermont Water Quality Standards for bacteria, mercury and/or phosphorus. Water Quality Standards assure that beneficial uses of the river and tributaries, such as swimming, fish consumption and fish habitat, are protected. When water quality standards are not met, the federal Clean Water Act requires states to establish a Total Maximum Daily Load (TMDL) for polluted waters.

A TMDL is the maximum amount of a pollutant a water body can receive without violating water quality standards. The plan specifies an acceptable level of pollutant in the water, identify sources of that pollutant in the watershed, and set an allowable allocation for each of the pollutant's sources so that they cumulatively do not exceed the accepted level. Vermont develops implementation plans for each waterbody with a TMDL that provides reasonable assurance that the waterbody will meet goals by a specific date. Basin 8 includes surface waters with TMDLs for Mercury, bacteria, phosphorus and agricultural sources of pollutants (see Table 3).

The mercury TMDL will be addressed through EPA's efforts to control emissions from Vermont and other states. The other TMDLs are addressed through implementation plans developed by ANR and approved by EPA. These TMDLs and associated

implementation plans are explained in further detail below. The bacterial TMDLs will be met in part by the Lake Champlain phosphorus TMDL. In addition, the development of the agricultural TMDLs are under contract and will build off the Lake Champlain TMDL development process (see below).

Vermont TMDLs for Stormwater Impaired Waters and related regulations

Seventeen of Vermont's waters are listed as "impaired," primarily due to urban stormwater runoff. These waters fail to meet the Vermont Water Quality Standards based primarily on biological monitoring data. For more information on the development of the stormwater TMDLs for these waters, see the Stormwater TMDL page.

Lowland "Urban" Watersheds

Commented [DA15]: This section should be fleshed out and made more prominent by inclusion of Table showing the 4 impaired streams , which towns are affected, the date of the respective FRP and the status of PCP development for each of the MS4 towns in the watershed.

Remediation of the twelve (four in Winooski Basin) urban stormwater-impaired waters has commenced through a combination of permits issued pursuant to Vermont's federally delegated National Pollutant Discharge Elimination System (NPDES) permitting program. These permits include a reissued and enhanced NDPES permit for small municipal separate storm sewer systems (MS4s), which was issued on December 5, 2012. Under the reissued permit, MS4 permittees must develop a Flow Restoration Plan for any stormwater impaired water to which they discharge. A computer-based best management practice decision support system (BMPDSS) was developed by TetraTech and is being used by VDEC to help affected MS4 communities to identify different BMP options and associated costs. In Basin 8, Centennial Brook, Allen Brook, Sunderland Brook, Morehouse Brook are urban stormwater impaired waters. All MS4 permittees in the Winooski Basin have completed Flow Restoration Plans and are currently planning for and implementing projects (see Appendix C). Projects that are competitive for DEC Ecosystem Restoration Program (ERP) grant funds based on phosphorus removal efficiencies and readiness for implementation are included in the Watershed Projects Database (WPD). The Winooski River Watershed Summary, Vermont Clean Water Initiative 2017 Investment Report includes a summary of stormwater projects completed with ERP funding.

Flood Resilience Efforts

As part of its effort to address climate change, the Agency is working with communities to enhance their flood resilience. Working towards resilience means both proactively reducing vulnerabilities to flooding and flood damage and improving response and recovery efforts when flood events do occur, so that communities bounce back quickly from natural resource, social and economic impacts. Reducing vulnerabilities includes efforts to diffuse stormwater flows from buildings, over roads, especially in areas with slope and erodible material.

The importance of flood resilience was highlighted in the aftermath of tropical storm Irene and other recent flooding events across Vermont. Act 16, effective July 2014, requires municipal and regional plans to incorporate a "flood resilience" component.

Flood Hazard Regulations

VDEC's efforts to help towns improving flood resilience has included mapping local flood hazard areas, identifying flood attenuation zones (including floodplains, river corridors, forests and wetlands) and recommending specific actions and policies to towns that will help protect these areas and reduce the risks facing existing development. All available information is located on VDEC's Flood Ready website, including River Corridor Protections Summary Report and Expanded Community Reports.

Figure 26 identifies the towns in the Basin that have adopted municipal river corridor and floodplain protection bylaws to date. Appendix D provides additional information on municipal level flood resilience and water resource protection.

All communities in Basin 8 have bylaws in place that allow them to participate in the National Flood Insurance Program. X communities – have adopted standards to protect Special Flood Hazard Areas from new encroachments.

Because these communities acted to protect flood hazard areas at a time when river corridor maps were not yet available they are recognized as providing river corridor protection based on the best available data.

Under the criteria for Vermont's Emergency Relief and Assistance Fund (ERAF) the actions of the towns shown in Figure 26 as having adopted the bylaws to date, except Elmore and East Montpelier, are recognized as proving river corridor protection on an "interim" basis. The VDEC and RPCs will work with these towns, to assist them in meeting qualifications for permanent status, allowing them to receive enhanced cost

share under the Emergency Relief and Assistance Fund. Elmore and East Montpelier have met qualifications for permanent status.

Hazard Mitigation Plan

The Regional Planning Commissions may also help towns increase flood resilience through development of a Hazard Mitigation Plan. This may include adding in locations of hazardous waste sites within a river corridor. In addition, the locations of landslide prone areas, provide an understanding of potential landslide activities, which may also be used to plan to reduce infrastructure damage with proactive placement of new development.

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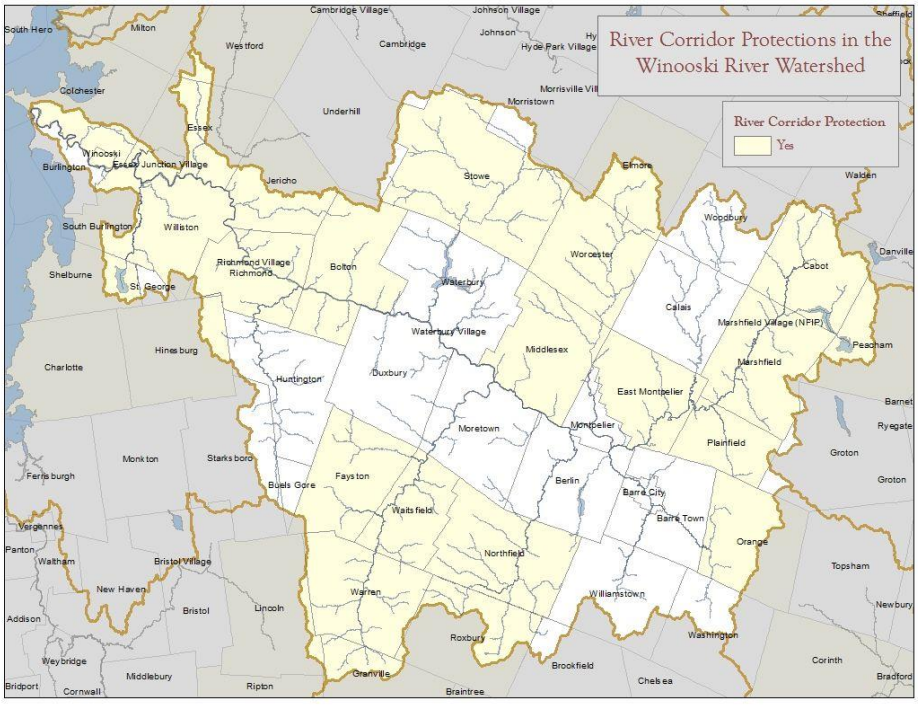

Communities with River Corridor Protections have adopted bylaws that specifically protect River Corridors. Except for Elmore and East Montpelier, all of these communities have only Interim Protections, which indicates that they acted before 2015 to protect Special Flood Hazard Areas and/or a limited Fluvial Erosion Hazard Area where River Corridor maps were not available yet

Figure 1~~2~~6. Status of river corridor and floodplain protection bylaws in Basin 8 municipalities.

Vermont Economic Resiliency Initiative (VERI)

The VERI Project Report aims to help municipalities take steps to reduce and better manage their flood risks. Barre city and town were included in the study as it was identified as one of Vermont's top 32 communities where economic activity and associated infrastructure are at high risk of flooding.

The VERI report for Barre City and Town include 5 projects that also provide for water resource and water quality protections and are therefore included in the watershed projects database. Implementation is under way with the city managing the federal buy out of at-risk housing along the Gunner's Brook and floodplain restoration.

The project was led by the Agency of Commerce and Community Development, working with the Agencies of Natural Resources and Transportation, Regional Planning Commissions, and consulting river scientists. The report was prepared by the Vermont Agency of Commerce and Community Development in partnership with the Two Rivers-Ottauquechee Regional Commission using Federal funds under award 01-79-14251 from the Economic Development Administration, U.S. Department of Commerce.

Chapter 5- Implementation: Protection and Remediation Actions

The Tactical Basin Plan addresses all impaired, stressed and altered waters (Table 4) in the Basin as well as protection needs for high quality waters; however, the focus of the plan is the identification of specific priority actions to reduce nutrient and sediment loading in priority subbasins as part of the effort to meet the Lake Champlain Phosphorus TMDL goals. The list of actions covers future assessment and monitoring needs (Table 11), as well as implementation projects that protect or remediate waters and related education and outreach.

Action items are supported by the objectives in the Lake Champlain Phosphorus TMDL Phase I Implementation Plan as well as the Statewide Surface Water Management Strategy. The actions are located in the Watershed Projects Database and summarized in Table 37

The objectives and strategies specific to the plan are identified in Table 36. A summary (Table 37) of the Watershed Projects Database is intended to present a broad view of the project entries in the database. VDEC and its partners (Appendix A) will proceed to make progress in all areas of the summary table.

The process for identifying priority actions were 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 (see Appendix A). The monitoring and assessment reports include, but are not limited to, stormwater mapping reports, geomorphic assessments, river corridor plans, bridge and culvert assessments, Hazard Mitigation Plans, agricultural modeling and assessments, road erosion inventories, TMDL reports, biological and chemical monitoring, lake assessments, fisheries assessments, and natural communities and biological diversity mapping.

The Watershed Projects Database, the Summary of the Implementation Actions (Table 37), along with Appendix A are resources to Basin 8 stakeholders in their efforts to pursue and secure technical and financial support for implementation of high priority projects. Together, these resources include location information, project description, the source of the project if an assessment supports the project, any partners that may have expressed interest in implementing the project, and potential funding sources. The database allows for the addition of new actions as VDEC identifies them with the assistance of partners. It is envisioned that the action items currently in the database as of the signing of the plan will be accomplished within the next five years as resources allow.

Table 1036. Objectives of Tactical Basin Plan to meet goals for the plan

Plan Objectives	Focus Areas (not to exclude work in other areas)	Strategies
Implement agricultural BMPs	Winooski Main stem, Little River, Mad, Dog and Huntington rivers	Complete surveys of farm needs; Increase USDA funds through RCPP grant; provide case managers to operators to assist with resource assessment and applications; provide modeling analysis to identify most effective BMP
Manage Stormwater	MS4 entities, towns with stormwater master plans and road erosion inventories,	Identify projects through Stormwater Master Plan Assessments, Road Erosion Inventories (REI); provide technical assistance to towns. Support MS4 municipalities and non-municipal MS4s in their work to develop and implement Flow Restoration Plans and Phosphorus Control Plans as well as projects identified by REI.
Protect and remediate river corridors	Upper Winooski Main Stem, West Branch, Thatcher Brook, North Branch, Mad and Dog Rivers	Corridor protection Riparian buffer/ Floodplain restoration, dam removal, and review of permits to ensure adequate flows
Remediate logging roads and landings	Kingsbury Branch, Upper Winooski, North Branch, Mid Winooski tributaries	Promote programs that protect riparian forests, identify old logging roads and landings for remediation with high erosion potential.
Restore wetland and floodplains	Great Brook (Plainfield or Middlesex?)	Work with TNC and USFWS to identify and restore candidates
Identify and Protect High Quality Lakes	Kingsbury Branch	Continue to collect monitoring data to confirm as high-quality lakes.
Protect and remediate lake shorelands	Kingsbury Branch	Shoreland protection, education and outreach about shoreland restoration practices, contractor certification through the Natural Shoreland Erosion Control Certification program

Plan Objectives	Focus Areas (not to exclude work in other areas)	Strategies
Reduce the spread of Aquatic Invasive Species	Kingsbury Branch	Provide education and outreach to boaters to reduce spread; provide technical and financial resources to assist with spread prevention.
Increase knowledge of water quality conditions in the Basin	See Table 11	Support watershed groups, NRCDs, Regional Planning Commissions and MS4 permitees.
Address Toxics	Lower Winooski	Encourage winter maintenance plans that reduce chloride use
Identify streams for reclassification		Continue to collect macroinvertebrate and fish data to support reclassification efforts

VDEC will track progress through both implementation progress and monitoring results. Lake Champlain BMP Accounting and Tracking Tool (BATT) will be used to track implementation of projects across all sectors and apply an expected phosphorus reduction estimate to each. Annually, VDEC will summarize the progress in each basin, including the Winooski. The report will include projects implemented and total of phosphorus reduced. The 2017 report is currently available here as part of the Vermont Clean Waters Initiative Annual Investment Report.

Over time, as projects are continually implemented, a more precise estimate of cumulative phosphorus reductions can be reported rather than relying on estimates of potential actions. Chapter 2 includes a description of monitoring programs available to VDEC.

In the instance that the pollution reductions are inadequate, based on the monitoring data, but the implementation progress is adequate, based on project tracking and modeling (Appendix B), adaptive management will be required.

With regard to education and outreach efforts, workshops and participants at events supported through the Act 64, will be tracked and reported in the Vermont Clean Water Initiative Program annual report to the Legislature.

It is VDEC's goal to prioritize staff time and direct internal and external grant funding opportunities towards the recommended actions. These actions include all water media

within the Basin and all the spectrums of land use that could potentially impact water quality and aquatic habitat. It is our hope that these tables outline priorities that are realistic to implement over a five-year period, noting that there are many unforeseen variables, like landowner willingness and funding availability.

Table 1137. Summary of Implementation Actions (Watershed Projects Database). The objectives (yellow)and strategies supporting priority actions in Basin 8. The on-going detailed list of actions can be viewed via Watershed Projects Database)

Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
AGRICULTURE: Implement BMPs						
	Phase II priority catchments for agricultural land Table 17	**Expand small farm NMP development courses** and workshops, trainings for farmers, manure applicators and technical service providers	TMDL Phase I	Nutrients, pathogen	VACD, UVM extension,	
	Phase II priority catchments for agricultural land Table 17	**Increase inspections in priority catchments/watersheds**: target implementation based upon the results	TMDL Phase I	Land erosion, nutrients, pathogens	AAFM,	
	Phase II priority catchments for agricultural land Table 17	**Increase implementation in priority catchments/watersheds**: 1.Provide farms with access to case managers to increase conservation practice implementation through participation in State and federal financial and technical assistance programs; 2 provide modeling analyses as needed to identify most effective BMPs	TMDL Phase I	Land erosion, nutrients, pathogens	AAFM, VDEC,	RCPP, USDA
	Phase II priority catchments for agricultural land Table 17	**Increase technical assistance in priority catchments/ watersheds**: work with farms, including vegetable farms, to meet RAP and adopt BMPs	TMDL Phase I	Land erosion, nutrients, pathogens	WRCD, VACD	RCPP, USDA
	Phase II priority catchments for agricultural land Table 17	**Pilot the Environmental Stewardship Program** to incentivize additional practice adoption	TMDL Phase I	Land erosion, nutrients, pathogens	VAAFM	RCPP, USDA
	Phase II priority catchments for agricultural land Table 17	**Create grassed waterways program** Target funding to critical source areas in coordination with partners	TMDL Phase I	Land erosion, nutrients, pathogens	UVM extension	RCPP, USDA
	Phase II priority catchments for agricultural land Table 17	Evaluate additional BMPs that could be used on pasture land to reduce loading from this land use. Options to evaluate include prescribed pasture practices. Provide outreach to farmers to support implementation of prescribed pasture practices. Provide financial support to purchase fences		Land erosion, nutrients, pathogens	UVM extension, WNRCD, WNRCS, AAFM	USDA, ERP, ACAP, AAFM BMP
	Phase II priority catchments for agricultural land Table 17	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. In addition, equipment options to implement BMPs would include crop and grassland no till drills, Crop and grassland manure injectors, and tine weeder air seeders.		Land erosion, nutrients, pathogens	UVM extension, WNRCD, WNRCS, AAFM	NRCS CSP, ACAP, VHCB

[16] High priority catchments identified in Phase II content which provides the highest phosphorus loading for a particular sector.
[17] See Appendix A for additional description of partners

Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
	Phase II priority catchments for agricultural land Table 17	Develop and provide support for equine specific programing including support for installing horse manure compost bins and making pasture improvements		Land erosion, nutrients, pathogens	UVM extension, WNRCD,	ACAP, EQIP, AAFM BMP
Upper Winooski	In addition, Colchester	Provide technical and financial resources to farms that aren't large enough to meet AAFM Small Farm Operation definations		Land erosion, nutrients, pathogens	WNRCD	
	Phase II priority catchments for agricultural land Table 17	Complete targeted water quality sampling on 3 farms to help identify source areas and evaluate nutrient reductions achieved through BMP implementation.		Land erosion, nutrients, pathogens	WNRCD, VDEC	VDEC LaRosa Partnership
STORMWATER: Reduce pollutants and volume						
Lower Winooski	MS4 entities	**Support the development and implementation of Phosphorus Control Plans and implementation of the Flow Restoration Plans and Road Erosion projects Support Rethink Runoff E/O effort.**		Land erosion, nutrients, pathogens	VDEC, CCRPC	CWIP
Stevens Branch, West Branch	Williamstown, Stowe,	**Provide technical assistance** to identify and prioritize stormwater management projects. Use stormwater plan template developed by VDEC	TMDL Phase I	Land Erosion, Channel erosion, pathogens	VDEC, CVRPC,	CWIP
Multiple	See Appendix C	**Support implementation of high priority projects in stormwater master plans**	TMDL Phase I	Land Erosion, Channel erosion, pathogens	VDEC, CCRPC, CVRPC, LRPC	CWIP
Basin wide	See top 10 prioritized road projects in town road erosion inventories as well Phase II priority catchments for roads (Tables 23 and 24)	Support implementation of Municipal Roads General Permit: ~~h~~**Help municipalities control runoff from hydrologically-connected gravel and paved roads:** implement road assessment protocol to assist with prioritization; provide technical and financial resources to assist with implementation; provide guidance on implementation projects within 250 feet of lakes; ~~implement Municipal Roads General Permit.~~	TMDL Phase I	Land Erosion	CCRPC, CVRPC, LRPC. NVDA, VTrans, WNRCD, VDEC, Municipalities	CWIP
All	Phase II priority catchments for developed land, Table 22	**Support municipal stormwater regulation adoption, include incorporation of LID and GSI practices; Implement "Three-acre" permit, including the green schools initiative to help schools meet the three-acre permit**	VDEC	Land erosion, nutrients, Channel erosion, pathogens	Municipality, CCRPC, CVRPC, LRPC, NVDA, VDEC,	CWIP
		Implement six minimum control measures required in the State TS4 permit	TMDL Phase I	land erosion, channel erosion,	VTrans	VTrans
		Develop and begin implementation of a phosphorus control plan early in the next TS4 permit cycle	TMDL Phase I	land erosion, channel erosion,	VTrans	VTrans

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Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
See VTrans road erosion inventory (not completed yet)	Phase II priority catchments for paved roads (Table 23)	**Intercept and treat runoff from agricultural and silvicultural land before it reaches VTrans right of way**	VDEC	Land Erosion, Channel erosion, pathogens	AAFM, NRCS, WNRCD,	USDA, ERP
~~Stevens Branch~~ Basin-wide	Phase II priority catchments for develop land, Table 22.	**Support brownfields restoration efforts that mitigate surface water pollution generated from these sites.**	VDEC	Toxics, Land Erosion, Channel erosion, pathogens	CCRPC, CVRPC, LR~~C~~PC, towns	VDEC, EPA
Stevens Branch, Sunny Brook, Lower Winooski tributaries	Barre city, Montpelier, MS~~3~~4 entities	Provide education on winter maintenance strategies to businesses and towns to reduce use of Chlorides.	VDEC	Toxics	UVM Sea Grant, WNRCD, towns, CCRPC, CVRPC, LCPC	LCBP
	Phase II priority catchments for develop land, Table 22.	**Support stormwater management education for private landowners, including private drive ways (http://dec.vermont.gov/sites/dec/files/wsm/erp/docs/VT_Guide_to_Stormwater_for_Homeowners_DRAFT.pdf and Lake Wise reports**	VDEC	Land erosion, channel erosion	UVM Sea Grant, WNRCD	LCBP
RIVER CORRIDOR: Reach stream equilibrium and flood resilience						
See River Corridor plan table 7		**Implement high priority projects identified in River corridor plans**	TMDL Phase I	Channel erosion, flood resilience, thermal modification	VDEC, FWR, FMR, WNRCD, municipalities	CWIP
Mid and Upper Winooski tributaries	Potential B1 for fishing watersheds	**Replace geomorphologically and aquatic organism passage (AOP) incompatible culvert and bridges:** RPCs work with towns to identify, add to capital budget, seek additional funding sources	DEC	Channel erosion, flood resilience	CCRPC, CVRPC, LCPC municipalities , VTrans,	federal hazard mitigation funds, Municipalities, VTrans
See River Corridor plan table 7	See WPD	**Increase River Conservation Easements**: support projects which incorporate channel management and riparian buffer Provisions in areas where protection does not otherwise exist.	TMDL Phase I	Channel erosion, flood resilience, thermal modification	VDEC, VRC, VLT, WNRCD	CWIP
	Towns with interim ERAF status	**Enhance the Flood Resilient Communities Program** with funding and technical assistance incentives for municipalities. Encourage towns with provisional ERAF status to meet current standards	TMDL Phase I	Channel erosion, flood resilience	VDEC, CCRPC, CVRPC, LCR~~R~~PC, UVM Sea Grant	State of Vermont
All	All	**Support studies to investigate benefits of removal of dams listed in Table 9 and where landowner interest exists, remove.**	VDEC	Channel erosion, encroachment, thermal modification	VDEC, TU	CWIP, LCBP, Watershed Grant

Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
See Landslide Inventory Map, 2017	Middlesex, Plainfield, Calais, Warren, Jericho, Bolton,	Assist towns in accessing and understanding use of the Vermont Geological Survey's landslide inventory to benefit local Hazard Mitigation Plan as well as preventing landslides through protection	VDEC	Land Erosion, encroachment	CCRPC, CVRPC, LCRPC	FEMA (for Hazard Mitigation)
FISHERIES HABITAT: Restore complexity and diversity (see also above for addressing AOP and Thermal Modification						
Mad and Dog River		Remediate habitat in highly degraded areas and/or areas where extensive channel management occurred by adding woody debris	VDFW	Channel erosion	VFWD, TU, VTrans,	
Mid Winooski tributaries, Winooski headwaters, Mad River, Dog River, Huntington	See high quality waters map for potential B1 for fisheries watershed	Protect water quality and riparian characteristics in subwatersheds that protect salmon and brook trout habitat. Use community interest in salmon and/or brook trout to engage community in watershed protection actions			TU, USFW, FWD	USFWS
FOREST MANAGEMENT: Abate soil erosion						
All	Phase II priority catchments for forested land (Table 16)	Identify eroding, abandoned and retired forest roads, skid trails and log landings to assist in identification of remediation projects	VDEC, TMDL Phase I	Land erosion	DFPR	RCPP
All	Phase II priority catchments for forested land (Table 16)	Prioritize work with landowners based on contribution of erosion features on logging roads to water quality impairment, use of roads to manage a sugarbush. Provide technical and financial assistance.	TMDL Phase I	Land erosion	State foresters, DFPR	RCPP
All	All	Provide loggers with access to bridges to reduce floodplain encroachment and improve AOP, including renting portable skidder bridges or promote building and ownership of bridges by logging as part of their general practices. In addition, DFPR will continue renting larger temporary bridges, which provide a larger opening than the skidder bridge and can handle logging trucks.	DFPR	Land erosion, Channel erosion	Fontaine Lumber, DFPR, WNRCDs, VACD	CWIP
All	All	Enhance forest cover to improve watershed health by promoting the use of Ecologically Sensitive Treatment Areas for managed forest in current-use.	Phase I TMDL	Land erosion, Channel erosion	DFPR	
Winooski headwaters, North Branch, Kingsbury Branch,	Berlin, Middlesex	Protect forestland through support of the working landscape as well as conservation to protect community valued ecosystem services. Use Vermont Cover to identify priority forest areas for protection, encourage towns to protect forested area in watershed of water supplies, direct outreach to landowners of large forested tracks under or eligible for current use	ANR, CVRPC	Land Erosion	CVRPC, FWR, VLT,	ACCD -VHCB programs; High Meadows(2017 grant)
WETLANDS: Protect and restore						
		Collect additional information on Shelburne Pond, Essex Alder Brook (Essex and Milton), Upper Gleason (Duxbury), Berlin Pond (Berlin), Kettle Pond south (Marshfield and Groton , Lanesboro Bog (Marshfield) and Mud Pond (Williston) to determine potential as Class I wetland	TMDL Phase I, VDEC	Protection	VDEC,	
Lower Winooski		**Prioritize restoration of wetland and floodplain projects** on agricultural lands with highest potential for phosphorus retention and sediment attenuation. VDEC has mapped priority areas for projects,	VDEC	pathogens, land erosion, nutrients, channel erosion	VDEC, USFWS,	USDA, RCPP, CWIP

Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
		Prioritize restoration and protection of wetlands, as well as floodplain forests, and river corridors based on potential to filter out pollution. See Water Quality Blueprint for specific areas: https://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/vermont/freshwater/nature-based-solutions-for-clean-water.xml	VDEC, TNC	land erosion, nutrients, channel erosion	VDEC, TNC,	ERP, ACCD-VHCB
LAKE and SHORELINE: Protect and restore						
Kingsbury Branch	Calais, East Montpelier, Woodbury, including Greenwood Lake	Promote the Lake Wise Program's online resources to encourage lake-friendly shoreline property maintenance	TMDL Phase I	Shoreline encroachment, land erosion	UVM Sea Grant, VDEC	LCBP, Watershed Grants, CWIP
All	Greenwood Lake	Promote contractor and partner participation on the Natural Shoreland Erosion Control Certification Program			UVM Sea Grant, VDEC	
Kingsbury Branch	Calais, East Montpelier, Woodbury	Incorporate materials specific to spiny water flea into signs, greeter program. Place spiny water flea spread prevention information at all lake accesses	VDEC	Aquatic invasive species	VDEC, lake associations	LCBP
See Table 4 for lakes altered by Eurasian watermilfoil		Support community's efforts to control Eurasian watermilfoil	VDEC, lake assn.	Aquatic invasive species	VDEC	AIS grant-in-aid program
Kingsbury Branch	Curtis Pond	Grow the access greeter program at Curtis Pond to include other local lakes	VDEC, lake assn.	Aquatic invasive species	VDEC	
All		Assist development of a cyanobacteria (blue-green algae) volunteer monitoring program and response plan	VDEC	Land erosion, channel erosion, nutrient loading	VDEC, VDH, LCC, municipalities, LCBP	VDEC, VDH staff time
Kingsbury Branch?	Buck, Pidgeon, Coits, Turtlehead	Recruit lay monitors for collecting water quality data on high priority lakes			VDEC Lay monitoring program, residents	VDEC
All	All	Support community efforts to protect lake shoreland	Partner s	Encroachment, land erosion	Watershed groups, NGOs, FOLAP	
Other						
Entire Basin	See Table 30	Review WWTF facilities in the Winooski Basin and issue permits that meet these new phosphorus limits. Support towns pursuing phosphorus optimization, expansion projects, and Upgrades	VDEC FED	Pathogens, nutrients	VDEC, municipalities	USDA-Rural Development, Clean Water State Revolving Funds

Priority Subbasin	Priority Towns/catchments[16]	Strategies	Source	Stressor addressed	Partners[17]	Funding (see also VSWMS Appendix D)
	All	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	VDEC	Nutrients	VDEC, towns	VDEC
Kingsbury Branch, Jail Branch	See Table 11	Monitor and assess surface waters to gain better understanding of condition and potential pollution sources, including internal phosphorus loading in lakes. In addition, monitor for pathogens at swimming areas and report to community.	VDEC	Pathogens, land erosion, channel erosion	VDEC, watershed groups,	VDEC including LaRosa Partnership Program, Lay Monitoring Program
Huntington River, Kingsbury Branch, Jail Branch		Provide septic system maintenance education to homeowners	Partners	Pathogen	UVM Sea Grant, WNRCD, VDEC	
	See Table 11	Conduct biomonitoring and/or water quality monitoring on streams that have met "very good" or "excellent" criteria to identify candidates for reclassification	VDEC	Protection	VDEC	VDEC
		Assist land managers in reducing use of toxins that adversely impact aquatic biota	Partners	Toxins	LCBP	

List of Acronyms

319 -Federal Clean Water Act, Section 319
604(b) -Federal Clean Water Act, Section 604b
ANR -Vermont Agency of Natural Resources
AMP -Acceptable Management Practice
AIS -Aquatic invasive species
AOP -Aquatic Organism Passage
BR - Backroads grant
BMP -Best Management Practice
CCRPC-Chittenden County Regional Planning Commission
CVRPC-Central Vermont Regional Planning Commission
CWSRF -Clean Water State Revolving Fund
CREP -Conservation Reserve Enhancement Program
CWA-Federal Clean Water Act
CWI – Clean Water Initiative
DWSRF -Drinking Water State Revolving Fund
ERP – Ecosystem Restoration Program grant
EQIP -Environmental Quality Incentive Program
E/O – Education & Outreach
EU -Existing Use
FEH -Fluvial Erosion Hazard
FERC -Federal Energy Regulatory Commission
FOVLAP – Federation of VermontLakes and Ponds
FSA -Farm Service Agency (USDA)
GSI- Green Stormwater Infrastructure
IDDE – Illicit Discharge Detection and Elimination
LCPC-Lamoille County Planning Commission
LID -Low Impact Development
MAPP -Monitoring, Assessment and Planning Program
MS4-Municipal Separate Storm Sewer System
NPDES -National Pollution Discharge Elimination System
NPS -Non-point source pollution
NRCD -Natural Resource Conservation District
NRCS -Natural Resources Conservation Service
ORW -Outstanding Resource Water
PDM -Pre-Disaster Mitigation
RAP – Required Agricultural Practices
RCP -River Corridor Plan
RCPP – NRCS Regional Conservation Partnership Program
RMP -Vermont WSMD River Management Program
RPC -Regional Planning Commission
SGA -Stream Geomorphic Assessment
TBP – Tactical Basin Plan
TMDL -Total Maximum Daily Load
TNC-The Nature Conservancy
TU-Trout Unlimited
USDA -United States Department of Agriculture
USEPA -United States Environmental Protection Agency
USFWS -United States Fish and Wildlife Service
UVM -University of Vermont
VAAFM -Vermont Agency of Agriculture, Food and Markets
VDEC - Vermont Department of Environmental Conservation
VDFPR -Vermont Department of Forests, Parks and Recreation
VFWD – Vermont Fish and Wildlife Department
VTrans -Vermont Agency of Transportation
VDH -Vermont Department of Health
VGS - Vermont Geological Survey
VIP -Vermont Invasive Patrollers
VLCT -Vermont League of Cities and Towns
VLT -Vermont Land Trust
VRC-Vermont River Conservancy
WSMD – VDEC Watershed Manager Toxics

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Glossary

Please see http://dec.vermont.gov/sites/dec/files/documents/WSMD_swms_Glossary.pdf

Winooski Tactical Basin Plan Appendices

Appendix A – Partners

All of the following organizations and agencies contributed to the development of the Winooski Tactical Basin Plan and/or will assist in the plan's implementation

Group Name	*Association*	*Description*
Regional Planning Commissions (RPC): Chittenden County (CCRPC); Central Vermont (CVRPC); Lamoille (LCPC); Northeastern Vermont Development Association (NVDA);	Regional	Statutory partners to the basin planning process, and help towns to complete road erosion inventories, stream geomorphic assessments, and stormwater master plans in addition to helping towns update their regulations to protect water quality. As part of the implementation of Act 64 (Sec. 43), VDEC has contracted with RPCs to fulfill the specific roles and responsibilities around the development of tactical basin plans that should substantially enhance VDEC's ability to reach municipalities and other relevant stakeholders. Further, the contracted activities are developing augmented capacity in RPCs to support water quality protection and restoration.
Natural Resource Conservation Districts (NRCD): Franklin County (FNRCD); Winooski(WNRCD); Lamoille (LCCD)		Statutory partners to the basin planning process, playing a critical role in implementing actions identified in basin plans. They also partner with Regional Planning Commissions on stormwater master planning, river corridor assessments, and road erosion assessments. NRCDs also work with the agricultural community to identify and assess natural resource concerns and implement farm BMPs to protect water quality.
Friends of the Huntington River and the Huntington Conservation Commission	Non-profit	A community group focused on reducing bacterial loads in the Huntington River. They support water
Friends of the Mad River	Local non-profit	A private, non-profit organization committed to protecting, improving and enhancing the ecological, recreational, and community values of the Mad River and its watershed
Friends of the Winooski River	Local non-profit	Their mission is to safeguard and enhance the natural resources of the Winooski River watershed in order to create a healthy balance with its human communities. The Friends support restoration projects, monitoring, partnerships, education and outreach.
Lake Champlain Committee	Local non-profit	A bi-state organization that is solely dedicated to protecting Lake Champlain's health and accessibility. The committee uses science-based advocacy, education, and collaborative action to protect and restore water quality, safeguard natural habitats and ensure recreational access. The program is also the home organization for the Lake Champlain Paddlers' Trail, providing a safe, recreational corridor for human-powered craft on the lake. The Lake Champlain Committee also leads citizen- based efforts to conduct blue-green algal surveillance and reporting for Lake Champlain and adjacent waterbodies. These efforts are coordinated with ANR and the VT Department of Health

Group Name		*Association*	*Description*
Lake Champlain Basin Program		Non-profit	a congressionally designated initiative to restore and protect Lake Champlain and its surrounding watershed. The program works with partners in New York, Vermont, and Québec to coordinate and fund efforts to address challenges in the areas of phosphorus pollution, toxic substances, biodiversity, aquatic invasive species, and climate change. The LCBP also administers the Champlain Valley National Heritage Partnership, which builds appreciation and improves stewardship of the region's rich cultural resources by interpreting and promoting its history
Lake Champlain Sea Grant		University	develops and supports research, outreach and education programs to empower communities, businesses and other stakeholders in the Lake Champlain Basin to make informed decisions regarding the management, conservation, utilization and restoration of their aquatic resources for long-term environmental health and sustainable economic development
Rethink Runoff		Regional	Partnership of twelve MS4 permitees in Chittenden County administered by Chittenden County RPC to implement regional effort to meet permitees' obligation under Minimum Measure #1 (Public Education & Outreach) and Minimum Measure #2 (Public Participation/Involvement). See www.rethinkrunoff.org
Vermont Youth Conservation Corps (VYCC)		Statewide non-profit	The VYCC works on Class IV road projects by assessing and implementing BMPs in high risk areas. The role of the VYCC in helping to implement actions in the basin plan continues to evolve as funding and needs change.
USDA Natural Resources Conservation Service (NRCS)		Federal	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		Municipal	46 Vermont towns are located entirely or partially in the watershed: 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.
VT Agency of Natural Resources (ANR) Internal Partners	Fish and Wildlife (VFWD); Forests, Parks and Recreation (VFPR); Environmental Conservation (VDEC)	State	All Departments within ANR (Fish & Wildlife Department, Forest, Parks, and Recreation, and VDEC) 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 includes staff from FWD, FPR, and VDEC. Long Range

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Group Name		Association	Description
			Management Plans of state-owned properties include restoration and protection of water resources.

Appendix B - Modeling Tools and Assessments for Identifying Remediation and Protection Efforts

Tool	*Description and Use*	*User*	*Info available in following format*	*Use/ BMP*[18]
SWAT model	Model used to estimate phosphorus (P) loading in the Lake Champlain watershed. Discrete SWAT models were calibrated/validated for each HUC8 watershed and direct drainage. P estimates based on land use, soil type, slope, climate, and other variables. Used in development of the TMDL.	ANR, NRCS	Tables, figures, maps	Prioritize areas of high P loading; identify potential BMPs at watershed scale.
HUC12 Tool	Summary of SWAT P estimates by general land use sector. Reported at HUC12 (subbasin) scale for each lake segment basin.	ANR	Tables, figures	Compare loading estimates across land use sectors at HUC12 scale.
EPA Scenario Tool	Used to evaluate scenarios for P reduction in the Lake Champlain watershed based on SWAT estimates of P loading and BMP efficiencies. Identifies potential load reductions based on the type and coverage of specified BMPs.	ANR – (LC P TMDL[19])	Tables, figures, maps	Evaluate impact of various BMP implementation scenarios.
Clean Water Roadmap Tool	A partnership between VT DEC, Keurig-Green Mountain Coffee Roasters, the Nature Conservancy (TNC), and other stakeholders. The overall goal 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 DEC's Tactical Basin Plan implementation tables and tracking systems. The CWR can be used to identify priority areas and actions for Lake Champlain phosphorus reductions.	by regional planners, the public, and VDEC staff	A map-based application that allows users to click on a specified watershed and receive a summary report of relevant best management practices (BMPs)	The CWR will provide a description of one way the Lake Champlain TMDL phosphorus reductions can be achieved, largely based on EPA's reasonable assurance scenario.

[18] Best Management Practice
[19] Lake Champlain Phosphorus TMDL

Lake Champlain BMP Accounting and Tracking Tool (LC BATT)	The Watershed Projects Database tracks project implementation and the LC BATT calculates P loading reductions for implemented BMPs.	ANR (LC P TMDL)	Report	Track implemented BMP reductions relative to TMDL goals.
Prioritizing agricultural fields for BMP	Process that uses SWAT and associated tools to develop a list of priority P loading sectors at NHD+ catchment (sub-HUC12) scale. Identify potential BMPs and/or other management actions.	case managers; NRCS, NRCD; UVM extension	Maps	Identify priority areas and potential BMP implementation.
Prioritizing Riparian Buffer Enhancement	Combines NRCS estimates of buffer gaps with stream and watershed characteristics to prioritize riparian planting efforts.	NRCS, Partners that plant trees,	NRCS has developed for Rock and Pike River. Develop for other priority basins based on partner interest and data availability	Identify areas for riparian plantings
Field gully identification	Model framework that uses high-resolution elevation data to predict gully locations. Predicted gullies can be checked against aerial imagery and/or land use data to identify locations in agricultural lands. Under RAPs/AAPs, farmers are responsible for addressing field gullies. Restorations of edge of field gullies may also be eligible for funding.	AAFM, case managers, NRCS	Maps	Develop for priority areas. Dependent on availability of LiDAR.

Floodplain restoration	Projects are identified using stream geomorphic assessment data as well as site visits to confirm conditions. Priority sites include high incision rate in stream channel, but small watersheds to limit amount of land needed to restore flood plain, which would be more amendable to agricultural landowners.	ANR	Develop for priority areas where hydrology significantly altered by ditching/tile drains; dependent on landowner interest	Flood plain restoration; two-tiered ditch
Wetland restoration	In 2007, Agency of Natural Resources (ANR) released the Lake Champlain Wetland Restoration Plan, which identified opportunities to restore wetlands and the benefits they provide. These sites are now being targeted by the NRCS Wetland Reserve Program. VDEC will create site profiles for high ranking wetland restoration sites. In addition, The Nature Conservancy will also provide resources for ecological restoration, including wetlands.	ANR, NRCS, USFWS	Maps	Wetland restoration

Hydrologically Connected Roads Layer	A data layer on the ANR atlas which identifies road segments by erosion risk to surface waters as well as potential hydrologic connectivity. Road projects may be further prioritized by finding documented points of stormwater input to rivers using Stream Geomorphic Assessments. High priority road remediation sites will likely include hydrologically connected segments on steep slopes, where significant road-related erosion is present, and/or where road BMPs are currently lacking or insufficient.	ANR, municipalities, VTrans	Data layer on ANR Atlas; list of priority road segments	Road BMPs include: grass and stone-lined drainage ditches, the installation of properly sized drainage culverts, culvert header and outlet stabilization, road crowning, regular catch basin clean outs and street sweeping, and addressing erosion from municipal sand piles. The Interim Guidance for completing municipal road erosion inventories and capital budgets 2016-2018 (June 2, 2016, VDEC Municipal Roads Program) outlines the steps for developing the list of priority road segments for remediation.
Culvert replacement and prioritization	Prioritization of municipal culvert replacement using VTrans culvert database. Criteria include structural integrity, conformance with geomorphology, and aquatic organism passage. The NRPC and NVDA both assist towns with prioritizing as well as financial budgeting through use of a capital budget. The VTrans culvert database will be provided to towns as a resource	Municipalities with help from RPC	List of culverts by town; prioritization based on aquatic organism passage	VTrans culvert database will be provided to towns as a planning resource.

Appendix C Winooski Basin Towns with Stormwater Master Plans/FRP

Chittenden County				Central Vermont Counties			
Town	**SWMP / FRP †**	**Year filed**	**Projects Identified ***	**Town**	**SWMP Completed**	**Year**	**# of High Priority Projects Identified**
Burlington	Centennial Brook FRP	2016	3	**Barre City**	Y	2017	5
				Barre Town	Y	2017	5
Burlington	Englesby Brook FRP	2016	29	**Berlin**	Y	2017	5
				Cabot	N		
Burlington	Potash Brook FRP	2016	1	**Calais**	In progress	2018	
Colchester	Morehouse Brook FRP	2016	2	**Duxbury**	In progress	2018	
Colchester	Sunderland Brook FRP	2016	1	**East Montpelier**	In progress	2018	
Essex	Sunderland Brook FRP	2016	4	**Fayston**	In progress	2018	
Essex/UVM	Sunderland Brook FRP	2016	1	**Marshfield**	N		
Essex Junction	Sunderland Brook FRP	2016	1	**Middlesex**	N		
Colchester/VAOT	Sunderland Brook FRP	2016	1	**Montpelier**	Y		
Essex Junction	Indian Brook FRP	2016	7	**Moretown**	In progress	2018	
Essex	Indian Brook FRP	2016	4	**Northfield**	Y	2011	4
VAOT	Indian Brook FRP	2016	1	**Orange**	N		
Essex/EJ/VAOT	Indian Brook FRP	2016	2	**Plainfield**	Y	2017	5
Jericho	Town-wide SWMP	2017	21	**Roxbury**	N		
Richmond	Town-wide SWMP	2018	21	**Waitsfield**	In progress	2018	
Shelburne	Munroe Brook FRP	2016	33	**Warren**	In progress	2018	
VAOT	Munroe Brook FRP	2016	2	**Washington**	N		
South Burlington	Bartlett Brook FRP	2016	15	**Waterbury**	N		
				Williamstown	N		
VAOT/private	Bartlett Brook FRP	2016	1	**Woodbury**	In progress	2018	
South Burlington	Centennial Brook FRP	2016	5	**Worcester**	N		
So.Burl / BTV	Centennial Brook FRP	2016	8				
So.Burl / VAOT	Centennial Brook FRP	2016	3				
So.Burl/Burl./UVM	Centennial Brook FRP	2016	1				
South Burlington	Englesby Brook FRP	2016	3				
South Burlington	Potash Brook FRP	2016	97				
UVM	Potash Brook FRP	2016	3				
BTV Airport	Potash Brook FRP	2016	1				
VAOT	Potash Brook FRP	2016	6				
Underhill	Town-wide SWMP	2018	20				
Williston	Allen Brook FRP	2016	30				
Winooski	Morehouse Brook FRP	2016	8				

** town-wide SWMP projects could include more than 1 watershed*
† Flow Restoration Plan (FRP) projects identified refer to locations; may need more than one "project" at location
Also, some FRP projects may have already been designed or completed as of March 2018

Appendix D –Status of flood resilience and water quality protection at municipal level

Chittenden County							
Green = muni proofread data	Status	**Bolton**	**Buels Gore**	**Burlington**	**Colchester**	**Essex**	**Essex Jnctn**
National Flood Insurance Program (NFIP)	**Enrolled?**	Y	Not required	Y	Y	Y	Y
Road and Bridge Standards	**Adopted?**	N	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	**Adopted?**	Y	Y	Y	Y	Y	Y
River Corridor Protection	**Adopted?**	Early Adopter	N	N	Early Adopter	Early Adopter	Early Adopter
Comments on River Corridor Protection		reluctant to adopt VTRANS Muni Road & Bridge stand'ds = cost	no floodplain, minimal RC, no incentive to adopt		Also designated CRS community		
ERAF	**Percent**	7.5	12.5	12.5	17.5	17.5	17.5
Flood Hazard By-law	**Adopted?**	Y	N	Y	Y	Y	Y
	Comment	Y	No (see row 7)	Y	Y	y	Y
Flood Resilience in Town Plan	**Completed?**	Yes	In process	Yes	Yes	Yes	Yes
	Comment		Plan expired in 2012; CCRPC staff are drafting a new one.				
Municipal By-law or Zoning District for Water Resource Setback	**River/Stream**	Y		Y	Y	Y	Y
	Comment	Winooski River has a 150 ft setback. Named Stream/brook has a 100 ft setback. or streams has a 50 ft setback.		Named Streams has a 100 ft setback. minor streams have a 50 ft setback. Winooski River has a 250 ft setback.	River = 250 ft setback. Streams = 85 ft setback. NOTE: 250 ft back from mean water mark on Winooski & Lamoille River creates no-build buffer 100 ft fr mean water mark.	Streams has a 50 ft setback.	Streams has a 50 ft setback.
	Wetland	Y		Y	Y	Y	
	Comment	50 ft		Wetland has a 100 ft setback.	50 ft setback.	Class II wetlands has a 50 ft setback.	
	Lake/Pond	Y		Y	Y	Y	
	Comment	Named Pond = 200 ft setback. or pond = 50 ft setback.		Lake Champlain = 250 ft setback. minor lake/pond = 50 ft setback.	Lake, Pond = h 250 ft setback.	Lakes/Ponds/Reservoirs over .5 ac = 150 ft setback.	

Chittenden County					
Green = muni proofread data	**Hinesburg**	**Huntington**	**Jericho**	**Richmond**	**St. George**
National Flood Insurance Program (NFIP)	Y	Y	Y	Y	N
Road and Bridge Standards	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	Y	Y	Y	Y	Y
River Corridor Protection	Early Adopter	N	Early Adopter	Early Adopter	N
Comments on River Corridor Protection	has some FEH (Not RC) overlay already	RC provisions in proposed 2018 revisions to bylaws	FEH areas included in town's River District		Working with VDEC and FEMA towards NFIP and RCP in 2018
ERAF	17.5	12.5	17.5	17.5	7.5
Flood Hazard By-law	Y	Y	Y	Y	N
	Y	Yes, updating zoning bylaws in 2018	Y	Y	Working with VDEC and FEMA towards NFIP and RCP in 2018
Flood Resilience in Town Plan	Yes	Yes	Yes	In process	In process
				re was a flood resilience element in 2012 plan, which is now expired. town is in process of updating its plan and CCRPC staff have assisted with flood resilience sections.	Plan expired in 2012; CCRPC staff are working with town on flood resilience updates to meet statutory requirements and reflect its pursuit of NFIP participation
Municipal By-law or Zoning District for Water Resource Setback	Y	Y	Y	Y	Y
	Outside Village District, streams have 75 ft setback for new structures, but vegetation mgt. is not addressed. Village District: has stream buffer provisions combined with stream setbacks in village growth area. In se areas stream buffers have greater protection re how vegetation is managed.- LaPlatte River and Patrick Brook – 100' on each side. Village District - Streams in developed areas – 25' on each side (see map), unless waived by DRB, see below.	Huntington River has a 100 ft setback. Named Streams has a 50 ft setback.	35-ft 1st order, 50-ft 2nd order, 100-ft 3rd order	Winooski, Huntington Rivers 50 ft. setback. or rivers, brooks & ponds has a 50 ft setback.	Streams has a 50 ft setback.
	Y	Y	Y	Y	Y

Chittenden County					
	Wetlands & assoc. buffer areas (per State of VT) protected in 2 large rural districts (AG and RR2 – 80% of town) from certain types of development – i.e., subdivisions and projects requiring site plan review. See §5.26 of Zoning & §6.12 of Subdiv. Regs.	Class II wetlands has a 50 ft setback.	25-ft Class III, 50-ft Class II, 100-ft Class I	Class II wetlands has a 50 ft setback.	class II wetlands have a 50 ft setback.
	Y		N	Y	
	Lake/Pond has a 75 ft setback. Outside of Village District			Gillette Pond & Lake Iroquois = 50 ft setback. or rivers, brooks & ponds = 50 ft setback.	

Chittenden County						
Green = muni proofread data	**Shelburne**	**So. Burlington**	**Underhill**	**Westford**	**Williston**	**Winooski**
National Flood Insurance Program (NFIP)	Y	Y	Y	Y	Y	Y
Road and Bridge Standards	Y	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	Y	Y	Y	Y	Y	Y
River Corridor Protection	Early Adopter	Early Adopter	N	Early Adopter	Early Adopter	Early Adopter
Comments on River Corridor Protection		considering RC or RCPA in 2018	considering RC or RCP in 2018	working on combined RC and RCPA overlay district	considering RC or RCPA	considering RC or RCPA over next few years
ERAF	17.5	17.5	12.5	17.5	17.5	17.5
Flood Hazard By-law	Y	Y	Y	Y	Y	Y
	Y	Y	Y	Y	Y	Y
Flood Resilience in Town Plan	Y	Yes	Yes	Yes	Yes	Yes
	Town staff are aware of need to strengthen Fluvial Erosion discussion in next draft of plan, which will be adopted 2019					Plan drafting beginning. 2014 Plan-City staff and PC aware of need to increase discussion of fluvial erosion. In flood resilience section
Municipal By-law or Zoning District for Water Resource Setback	Y	Y	Y	Y	Y	
	LaPlatte, McCabe's and south branch Munroe has a 100 ft setback. North branch Monroe & tribs has a 50 ft setback.	Muddy and Potash Brook has a 100 ft setback. Minor streams have a 50 ft setback.	25-ft for all rivers and 50-ft from TOB or 100-ft from TOS for Selected Rivers: Beaver Brook, Settlement Brook, Crane Brook, Roaring Brook, Seymour River, Harvey Brook, Stevensville Brook, Mill Brook, Clay Brook, and Brown's river	Water Resource Overlay District =50 ft for 1st order stream & 100 ft.for all or streams, rivers, class 2 wetlands, etc. Ponds= same buffer as associated waterway	Named Rivers and Brooks has a 150 ft setback. unnamed streams have a 50 ft setback.	
	Y	Y	Y	Y	Y	
	Wetlands has a 500 ft setback.	wetlands have a 50 ft setback.	25-ft Class III, 50-ft Class II, 100-ft Class I	Yes, 100 ft. per WRO	Class II wetlands has a 50 ft setback.	

Chittenden County						
	Y	Y	N	Yes, 100 ft. per WRO	Y	
	Shelburne Pond =s a 500 ft setback. Lake Champlain = a 100 ft setback.	Lake Champlain has a 150 ft setback.			Lake Iroquois has a 250 ft setback.	

Lamoille County				
	Status	**Elmore**	**Morristown**	**Stowe**
Town Plan rewrite timeframe		2017-2018, have started update process	Last Plan update August 2016. Next Plan update 2023-2024	Last updated June,2015, next update 2019-2020
New Zoning adoption scheduled		Adopted revised subdivision regulations and River Corridor Bylaws in January 2017. Town is applying for an FY 18 Municipal Planning Grant to re-format/ further update zoning bylaws and subdivision regulations with an emphasis on forest fragmentation.	Zoning and Subdivision Bylaws last updated June, 2017	Zoning Regulations last updated June 2017. Subdivision Regulations last updated June 2012.
National Flood Insurance Program (NFIP)	Enrolled?	Y	Y	Y
Adopted new Road and Bridge Standards (2013)	Adopted?	Y	N. LCPC has conducted outreach through TAC and directly to Town staff, Road Foreman, Town officials, but adopting these standards are too cost prohibitive for the Town. LCPC continues to outreach and work with Road Foreman/public works on providing guidance to implementing MRGP standards.	N. LCPC has conducted outreach through TAC and directly to Town staff, Road Foreman, Town officials, but adopting these standards are too cost prohibitive for the Town. LCPC continues to outreach and work with Road Foreman/public works on providing guidance to implementing MRGP standards.
Hazard Mitigation Plan (LHMP)	Adopted?	Y	Y (Valid through October 2017) Town was approached regarding assistance for 2017 update but did not show interest. LCPC brought this issue up to the Town again fall of 2017 and noted PDM funding opportunities. LCPC put Town contacts in touch with the State Hazard Mitigation Planner. Town expressed interest in being part of the 2017 State PDM grant to update the Morristown Hazard Mitigation Plan.	Y (re-adopted and approved in 2017)
River Corridor Protection	Adopted?	Y	N	Y
Comments		50-ft or more setback for streams	Stream setback varies by district, generally 50-ft	Adopted Fluvial Erosion Hazard Overlay District. Bylaws last updated in 2017.
ERAF	Percent	17.5	7.5	7.5
Flood Hazard By-law	Adopted?	Y	Y	Y
	Comment	Updated Flood Hazard Regulations to include River Corridor Overlay language. River Corridor Bylaws adopted in January 2017.	Zoning Bylaws last updated June, 2017	Flood Hazard Bylaws updated during 2017 Zoning Regulations update.
Flood Resilience in Town Plan	Completed?	N	Y	Y
	Comment	Part of 2017-2018 Town Plan update. LCPC will be assisting the Elmore Planning Commission with meeting Flood Resilience Element requirements.	Included in 2016 Town Plan update	Flood Resilience Plan included in 2015 Town Plan update.

Lamoille County				
	Status	**Elmore**	**Morristown**	**Stowe**
Municipal By-law or Zoning District for Water Resource Setback (provide needs assessment for outreach and technical assistance along with appropriate partner)	River/ Stream buffer	Y	Y	Y
	Comment	50 feet. Larger setback for steep slopes (additional 2ft buffer for every 1% increase in slope above 15% when within 500ft of river/stream/wetland)	varies by district, generally 50 ft	50 feet setback from watercourses.
	Wetland	Y	Y	Y
	Comment	50 feet. Larger setback for steep slopes (additional 2ft buffer for every 1% increase in slope above 15% when within 500ft of river/stream/wetland	50 feet	50 feet setback from watercourses
	Lake/ Pond	Y	Y	Y
	Comment	Local delegation for VT shoreline protection act. Regulates activities within 250 feet of the mean water level of lakes greater than 10 acres in size (Lake Elmore).Vegetative cover within 100 feet of the mean water level must be managed according to the Vegetation Protective Standards. The Remote Area Overlay District is located east of Route 12, in the southeast section of town. Within the District development is restricted in areas a substantial distance from existing public roads and public services. Permitted uses in the RAO District are forestry, agriculture and passive recreation.	varies by district, generally 50 ft	Shoreland District:no development within two hundred (200') feet of the mean water mark of Lake Mansfield and any form of development within five hundred (500') feet of the mean water mark must be reviewed by the DRB for approval of a conditional use permit in addition to the existing zoning.

Central VT counties	Status	**Barre City**	**Barre Town**	**Berlin**	**Cabot**	**Calais**	**Duxbury**	**E. Montpelier**	**Fayston**
Town Plan rewrite timeframe (expiration date)		**Jun-19**	**May-19**	**expired**	**Aug-25**	**Feb-24**	**Oct-19**	**expired**	**Oct-19**
New Zoning adoption scheduled				draft zoning dated May 20, 2016 includes increased protections for all riparian areas	draft zoning regulations dated August 2014 include flood hazard and increased protections				
National Flood Insurance	Enrolled?	Y	Y	Y	Y	Y	Y	Y	Y

Central VT counties Program (NFIP)	Status	Barre City	Barre Town	Berlin	Cabot	Calais	Duxbury	E. Montpelier	Fayston
Road and Bridge Standards	Adopted?	N	Y	Y	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	Adopted?	Y	Y	Y	Y	Y	Y	Y	Y
River Corridor Protection	Adopted?	N	N	N	N	N	N	N	N
Comments									
ERAF	Percent	7.5	12.5	12.5	17.5	12.5	12.5	12.5	17.5
Flood Hazard By-law	Adopted?	Y	Y	Y	Y	Y	Y	Y	Y
	Comment	Standalone Flood Hazard Area Regulations	Section 5.8 Flood Hazard Area Development. Regulations buried within the development review section of the zoning regulations.		Flood Hazard regulations not included in current zoning and not posted on town website - status?	Table 2.7 Flood Hazard Overlay	Section 7 Flood Hazard Overlay District	Article 9 Flood Hazard Regulations	Table 2.7 Flood Hazard Overlay District
Flood Resilience in Town Plan	Completed?	N	N	Y	Y	Y	Y	N	Y
	Comment	in progress						in progress	
Municipal By-law or Zoning District for Water Resource Setback (provide needs assessment for outreach and technical assistance along with	River/Stream buffer	N	Y	Y	N	Y	N	Y	Y
	Comment		Section 3.11 - 50 ft buffer on streams, ponds and wetlands (class I and II)	75 FT		Section 3.14 - Surface Water Protection - on all lakes, ponds, streams, rivers and wetlands. Buffers of 50 ft - 20 ft (on un named streams)		Section 3.12 Protection of Water resources applies to surface waters and wetlands as identified on towns water resource map. 25 ft - 50 ft dependent on development type.	Section 3.13 Streams and Wetlands section. 50 ft. Plus Table 2.2 Soil and Water Conservation District purpose to protect water resources.
	Wetland	N	Y	Y	N	Y	N	Y	Y

Central VT counties **appropriate partner)**	Status	**Barre City**	**Barre Town**	**Berlin**	**Cabot**	**Calais**	**Duxbury**	**E. Montpelier**	**Fayston**
	Comment		Section 3.11 - 50 ft buffer on streams, ponds and wetlands (class I and II)	50 FT		Section 3.14 - Surface Water Protection - on all lakes, ponds, streams, rivers and wetlands. Buffers of 50 ft - 20 ft (on un named streams)		Table 2.6 Conservation Overlay Districts include Wetland Overlay District. 50 ft.	Section 3.13 Streams and Wetlands section. 50 ft
	Lake/Pond	N	Y	Y	Y	Y	N	Y	N
	Comment		Section 3.11 - 50 ft buffer on streams, ponds and wetlands (class I and II)	Highland Conservation District plus the Rural Res District's purpose statements include references to protecting wetlands and surface waters. Also see Section 3.14 Stream Protection	Section 4.4 Shoreland District includes 75 ft, 50 ft or 25 ft setback from pond dependent on use or development type.	Section 3.14 - Surface Water Protection - on all lakes, ponds, streams, rivers and wetlands. Buffers of 50 ft - 20 ft (on un named streams). ALSO, Table 2.4 Shoreland District - purpose to protect surface waters.		Section 3.12 Protection of Water resources applies to surface waters and wetlands as identified on towns water resource map. 25 ft - 50 ft dependent on development type.	

Central VT Counties	Status	**Marshfield**	**Middlesex**	**Montpelier**	**Moretown**	**Northfield**	**Orange**	**Plainfield**	**Roxbury**
Town Plan rewrite timeframe (expiration date)		**expired**	**Mar-18**	**Dec-25**	**Jan-24**	**Sep-19**	**May-18**	**Feb-19**	**Jun-19**

Central VT Counties	Status	Marshfield	Middlesex	Montpelier	Moretown	Northfield	Orange	Plainfield	Roxbury
New Zoning adoption scheduled				proposed regulations in hearing process - may include increased protections?				draft revised zoning regulations incorporate river corridor into flood hazard overlay district.	
National Flood Insurance Program (NFIP)	Enrolled?	Y	Y	Y	Y	Y	Y	Y	Y
Road and Bridge Standards	Adopted?	Y	Y	Y	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	Adopted?	Y	Y	Y	Y	Y	Y	Y	Y
River Corridor Protection	Adopted?	N	N	N	N	Y	Y	Y	Y
Comments						Included within Article V Floodplain Zoning Regulations			
ERAF	Percent	7.5	17.5	12.5	12.5	17.5	17.5	17.5	17.5
Flood Hazard By-law	Adopted?	Y	Y	Y	Y	Y	Y	Y	Y
	Comment	Section 440 Flood Hazard District	Table 2.7 Flood Hazard Overlay District	Section 309 Floodplain Development	Table 2.5 Flood Hazard Overlay District	Article V Floodplain Zoning Regulations	No Zoning. Standalone Inundation Hazard Areas Regulations. Goes above NFIP minimum, no new structures in floodplain, does allow from small accessory structures.	Standalone Inundation hazard Area Regulation. Goes above NFIP minimum, no new structures in floodplain, does allow from small accessory structures.	No Zoning. Standalone Flood Hazard Area Ordinance.
Flood Resilience in Town Plan	Completed?	N	N	Y	Y	Y	N	N	N
	Comment	in progress							
Municipal By-law or	River/Stream buffer	Y	Y	N	Y	Y	N	Y	N

Central VT Counties	Status	Marshfield	Middlesex	Montpelier	Moretown	Northfield	Orange	Plainfield	Roxbury
Zoning District for Water Resource Setback (provide needs assessment for outreach and technical assistance along with appropriate partner)		75 ft to 125 ft dependent on bank slope. Water Conservation Overlay District which purpose is to protect surface waters on all streams and on ponds over 5 acres.		Section 715 Rivers, Streams and Rivers/Stream Bank section includes "sufficient setbacks" but doesn't specify		Section 603 Conservation and Forestry District includes 100ft setback on any brook or stream. Section 607 Mill Hill Industrial/Commercial District includes 50 ft from edge of stream.		Section 3.14 Construction along Watercourses, Waterbodies, and Scenic Roads include 50 ft setback from stream, brook or pond.	
	Comment		Section 3.9 Protection of Water Resources. 25-75 ft.		Section 4.11 Protection of Streams, Stream banks and Wetlands includes 25 ft +				
	Wetland	Y	N	N	Y	N	N	N	N
	Comment	references State wetland regulations	references state regulations		Section 4.11 Protection of Streams, Stream banks and Wetlands includes 50 ft from class II, 100 ft from class I				
	Lake/Pond	Y	Y	N	N	N	N	Y	N
	Comment	75 ft to 125 ft dependent on bank slope. Water Conservation Overlay District which purpose is to protect surface waters on all streams and on ponds over 5 acres.	Section 3.9 Protection of Water Resources. 25-75 ft.					Section 3.14 Construction along Watercourses, Waterbodies, and Scenic Roads include 50 ft setback from stream, brook or pond.	

	Status	Warren	Washington	Waterbury	Williamstown	Woodbury	Worcester
Town Plan rewrite timeframe (expiration date)		**expired**	**Nov-18**	**Dec-18**	**Apr-24**	**expired**	**expired**
New Zoning adoption scheduled							
National Flood Insurance Program (NFIP)	Enrolled?	Y	Y	Y	Y	Y	Y
Road and Bridge Standards	Adopted?	Y	Y	Y	Y	Y	Y
Hazard Mitigation Plan (LHMP)	Adopted?	Y	Y	Y	Y	Y	Y
River Corridor Protection	Adopted?	Y	N	N	N	N	Y
Comments		Table 2.14 Fluvial Erosion Hazard Overlay District					Included within standalone Flood Hazard Area Regulations.
ERAF	Percent	17.5	12.5	12.5	12.5	7.5	17.5
Flood Hazard By-law	Adopted?	Y	Y	Y	Y	Y	Y
	Comment	Table 2.14 Flood Hazard Overlay District. Goes above NFIP minimum, no new structures in floodplain, does allow from small accessory structures.	Standalone Flood Hazard Area regulations (should be updated)	Article VI Flood Hazard Area Regulations and Overlay District	No zoning. Standalone Flood Hazard Area Bylaws (should be updated)	Should be a standalone document, not included in zoning. Cannot find document.	No zoning. Standalone Flood Hazard Area Regulations.
Flood Resilience	Completed?	N	N	N	Y	N	N
	Comment	in progress				in progress	in progress

in Town Plan	Status	Warren	Washington	Waterbury	Williamstown	Woodbury	Worcester
Municipal By-law or Zoning District for Water Resource Setback (provide needs assessment for outreach and technical assistance along with appropriate partner)	River/Stream buffer	Y	Y	N	N	N	N
	Comment	Section 3.13 Surface Water Protection includes 50 ft setback.	Section C applies to streams, rivers and shores of naturally occurring lakes and ponds. 50 ft setback.				
	Wetland	Y	Y	N	N	N	N
	Comment	Section 3.13 Surface Water Protection includes 50 ft setback.	Section B wetlands includes 50 ft setback.				
	Lake/Pond	Y	Y	N	N	Y	N

Status	Warren	Washington	Waterbury	Williamstown	Woodbury	Worcester
Comment	Section 3.13 Surface Water Protection includes 50 ft setback on ponds over 1 acre.	Section C applies to streams, rivers and shores of naturally occurring lakes and ponds. 50 ft setback.		Williamstown does not have zoning regulations, except those for the special hazard flood zones	Section 4.3 Shoreland District applies to all lakes and ponds which are 20 acres or larger, includes setbacks from brooks, streams and wetlands 50-100 ft and other setbacks for other activities.	

Appendix E - Regulatory and Non-Regulatory Programs Applicable to Protecting and Restoring Waters in Vermont

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

Regulatory programs may be accessed at:

http://dec.vermont.gov/sites/dec/files/documents/wsmd_swms_Appendix_A_Vermont_Regulations_Pertaining_to_Water_Quality.pdf

Non-regulatory programs may be accessed at:

http://dec.vermont.gov/sites/dec/files/documents/wsmd_swms_Appendix_D_Toolbox.pdf

Appendix F – Existing Use Tables

During the Basin 8 planning process, the Agency collected sufficient information to document and determine the presence of existing uses for swimming (contact recreation, fishing and boating on flowing waters. All surface waters used as public drinking water sources were also identified. The Agency presumes that all lakes and ponds in the basin have existing uses of fishing, contact recreation and boating. This simplified assumption is being used because of the well-known and extensive use of these types of waters for these activities based upon their intrinsic qualities and, to avoid the production and presentation of exhaustive lists of all of these waterbodies across Basin 8. Likewise, the Agency recognizes that fishing activities in streams and rivers are widespread throughout the state and can be too numerous to document. Also recognized is that streams too small to support significant angling activity provide spawning and nursery areas, which contribute to fish stocks downstream where larger streams and rivers support a higher level of fishing activity. As such, these small tributaries are considered supporting the use of fishing and are protected at a level commensurate with downstream areas. This presumption may be rebutted on a case-by-case basis during the Agency's consideration of a permit application, which might be deemed to affect these types of uses.

The following lists are not intended to represent an exhaustive list of all existing uses, but merely an identification of well-known existing uses. Additional existing uses of contact recreation, boating and fishing on/in flowing waters may be identified during the Agency's consideration of a permit application or in the future during subsequent basin planning efforts.

Table 1238. Determination of existing uses of flowing waters for boating in Basin 8.

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [20]	Public access: Put in [21]	Public access: Take out
Winooski River: Down town Marshfield	Marshfield	Regularly paddled by Vermont Paddlers Club members(VPC) [22]	II/III	Below Mollys Falls Power House, Cabot Road, Marshfield	Old School House Commons, Marshfield
Winooski River: Marshfield to Winooski #8 Dam	Marshfield, Plainfield, East Montpelier,	WWRV[23] and FWR[24]	I-III	Old School House Commons, Marshfield	Dam Road – adjacent to Winooski #8 Dam
Nasmith Brook	Marshfield	VPC use	III – V	Holt Road	Twinfield High school
Great Brook	Plainfield	VPC use	I-II	Maxifield Road	Recreation Field Road off Mill St.
Winooski River – Kingsbury branch	E. Montpelier	VRC[25] conservation easement for boating access	I	Off Coburn Road, approx. ¾ mile, past the bridge on right.	Winooski main stem take outs
Stevens Branch	Williamstown, Barre Town, Barre & Berlin	FWR & VPC use	I-IV	Brockway Hill Road, Williamstown	Confluence with Winooski, Montpelier

[20] Class rating pertains to the difficulty of whitewater passage.
[21] The list of put in and take out points for boats allow for the use of the entire Winooski river between dams for flat water boating.
[22] Pers. Communication, Vermont Paddler's Club Secretary, Ryan McCall, 5/18/11
[23] Jenkins J. and Zika P 1992. *The Whitewater Rivers of Vermont: The Biology, Geography and Recreational Use.* Agency of Natural Resources, Waterbury, VT.,
[24] Friends of the Winooski River, *A Paddling and Natural History Guide to One of Vermont's Great Rivers* www.winooskiriver.org

[25] Vermont River Conservancy

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [20]	Public access: Put in [21]	Public access: Take out
Jail Branch	Barre Town	VPC	III-V	Washington Road at base of Reservoir, Barre Town	Ayers Street, Barre City
North Branch Winooski River	Elmore, Worcester, Middlesex, Montpelier	Let it rain, VPC, FWR	I-V	Route 12 in Elmore	Confluence with Winooski, Montpelier
Hancock Brook	Worcester	VPC and VRC	IV-V	Hampshire Hill Road Worcester	Route 12 Worcester
Minister Brook	Worcester	VPC	III-IV	Minister Brook Road, Worcester	Route 12 in Worcester
Martins Brook	Middlesex	VPC	III-IV	Macey Road, Middlesex	Shady Rill Park, Middlesex
Winooski River: Montpelier to Middlesex Dam	Montpelier, Middlesex	FWR	I/II	Montpelier High School: Put in is `100 yards below the Bailey Ave. bridge. Path is off the bike path.	Just above Middlesex Dam: The take out is on the left just beyond the Rte. 100B bridge.
Dog River	Roxbury, Northfield, Berlin, Montpelier	VPC, WWRV, FWR	I-II	Rabbit Hollow Road, Northfield	Confluence with Winooski River, Montpelier under I-89 bridge
Stony Brook	Northfield	VPC	III-IV	Chamberlin Road, Northfield	Confluence with Dog River, Northfield
Cox Brook/Devils Washbowl	Moretown, Berlin & Northfield	VPC	III-V	Devils Washbowl Road, Moretown	Confluence with Dog River, Northfield
Winooski River: below Middlesex Dam to Waterbury	Middlesex, Waterbury	FWR	I/II	south side of river at Middlesex Dam Powerhouse off Rte. 100B	Waterbury Recreation Fields: Take out is on the right, near the mouth of Thatcher Brook.

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [20]	Public access: Put in [21]	Public access: Take out
Mad River-Austin Brook confluence park to confluence with Winooski River	Warren, Waitsfield, Fayston, Duxbury, Moretown	WWRV, VPC, FWR	I-V	Picnic area at confluence of Austin Brook and Winooski – Route 100, Warren	Route 2, west of bridge over Winooski River (west of the state highway garage) with parking
Mill Brook	Fayston	VPC	III-IV	German Flats Road, Fayston	Route 17, Fayston
Little River	Stowe, Waterbury	WWRV, VPC	I-III	Tansy Hill Road, Stowe	Confluence with Winooski River
Sterling Brook	Stowe	VPC	III-IV	Sterling Valley Road, Stowe (Stowe Land Trust)	Cole Hill Road, Stowe
Ranch Brook	Stowe	VPC	III-IV	Ranch Valley, Stowe	Route 108, Stowe
Notch Brook/West Branch Little River	Stowe	VPC	III-IV	Bingham Falls, Stowe	Route 108, Stowe
Gold Brook	Stowe	VPC	III-IV	Covered Bridge Road, Stowe	Route 100, Stowe
Winooski River: Bolton to Richmond	Bolton, Richmond	FWR	I/II	Bolton Dam Take Out is located on the left side of the river.	Volunteer Green Richmond: under the Bridge St. bridge
Ridley Brook	Duxbury	VPC, Let it Rain	IV-V	Upper Monroe Trail parking area, Duxbury	River Road, Duxbury
Joiner Brook	Bolton	VPC, Let it Rain	IV-V	Bolton Valley Access Rd	Route 2, Bolton
Winooski River: Richmond to Essex	Richmond, Jericho, Essex	FWR	I	Volunteer Green Richmond	GMP Access off IBM access rd.

Waterbody	Town(s)	Basis for determining the presence of an existing use	Rating of water (class) [20]	Public access: Put in [21]	Public access: Take out
Huntington River – 10 miles from Hanksville to just before Huntington Gorge and below lower Huntington gorge to Winooski	Huntington, Starksboro, Richmond	WWRV	II-IV	North of Carse Road bridge, Huntington	Dugway Road, Richmond
Brush Brook	Huntington	VPC, Let it Rain	IV-V	Camel's Hump State Forest	Camel's Hump Road, Huntington
Winooski River: Essex to Winooski	Essex, Williston, Winooski,	FWR	I	Below Essex Dam: off 2A below power generating station. Park at Overlook Park,	Winooski Gorge Dam: After passing through Lime Kiln Gorge, the river turns right. Take out is on the left before river narrows into the gorge.
Mill Brook	Jericho	VPC, Let it Rain	II-IV	Fitzsimonds Road, Jericho	Route 117, Jericho
Winooski River: Winooski to Colchester	Colchester, Burlington, Winooski	FWR	I/II	Millyard Canoe Access in Winooski off Canal St.	VFWD Colchester Point access area off Windermere Road. .

Table 1339. Determination of existing uses of flowing waters for fishing in Basin 8.

Surface Water	Location of Use	Town	Documentation
Winooski River	Mainstem Winooski in Marshfield downstream to the Bolton Dam in Duxbury.	Marshfield to Duxbury	Stocked by VFWD
Winooski River	Duxbury and Waterbury, from the top of the Bolton Dam in Duxbury and Waterbury upstream to the Route 2 Bridge (east side of Waterbury Village	Duxbury/Waterbury	Special fishing regulations
Winooski River	Ridley Brook mouth upstream to the top of the Bolton Dam in Duxbury and Waterbury.	Bolton/Duxbury/Waterbury	Special fishing regulations
Winooski River	From Preston Brook mouth upstream (approximately 4.4 miles) to the Ridley Brook mouth	Bolton/Duxbury/Waterbury	Special fishing regulations
Winooski River	From the Winooski One Hydro Dam west of Main Street (US 7) in Winooski and Burlington upstream to Preston Brook, Bolton	Duxbury	Special fishing regulations
Winooski River	From the Winooski One Hydro Dam west of Main Street (US 7) in Winooski and Burlington and extending downstream to the downstream side of the first railroad bridge.	Winooski, Burlington	Special fishing regulations
Winooski River	Lake Champlain upstream to the first railroad bridge (approximately 9 mile) in Winooski and Burlington.	Winooski, Colchester, Burlington	Special fishing regulations
Jail Branch	Upstream and downstream of East Barre Dam.	Washington, East Barre	VFWD document good wild trout populations present. Access at VDEC dam in E. Barre, off Washington St.
North Branch	Worcester Rt 12 brdg north of Russ Pond Bk to Rt 12 brdg north of Hancock Bk	Worcester	Stocked by VFWD
North Branch	Below Rt. 12 bridge south of Washington/Lamoille county line to access across from Moose Hollow road	Middlesex	Stocked by VFWD

Dog River	Downstream edge of the Junction Road Bridge in Berlin/Montpelier upstream to the top of Northfield Falls Dam in Northfield.	All applicable towns	Special fishing regulations
Chase Brook	From its confluence with the Dog River upstream approximately 1/2 mile to the top of the natural falls in Berlin - – closed to fishing second Saturday in April – May 31st	Berlin	Special fishing regulations
Mad River	Below Warren Village	Applicable towns	Stocking by VFWD
Little River	From the confluence with Winooski River upstream to the top of the Waterbury Dam	Waterbury	Special fishing regulations
Ridley Brook	Winooski River upstream approx. 1700 ft to first falls	Duxbury	Special fishing regulations
Ridley Brook	First falls to headwaters	Duxbury	Special fishing regulations
Ridley Brook	End of Camels Hump Road to River Road	Duxbury	Stocking by VFWD
Pinneo Brook	Winooski River upstream approx. 100 ft to railroad crossing	Bolton	Special fishing regulations
Pinneo Brook	Railroad crossing to headwaters	Bolton	Special fishing regulations
Joiner Brook	Winooski River upstream approx. 1900 feet to first falls	Bolton	Special fishing regulations
Joiner Brook	First falls to headwater	Bolton	Special fishing regulations
Preston Brook	Winooski River upstream approx. 2600 feet to first falls	Bolton	Special fishing regulations
Huntington River	Entire river	Huntington, Richmond	Stocking by VFWD

Table 1440. Determination of existing uses of flowing waters for swimming in Basin 8.

Waterbody	Town	Aesthetic values and use by public confirmed	Public Access
Winooski River Main Stem – Hidden Dam	East Montpelier	Deep pools above barely submerged remains of dam	VTrans owned land, Rt. 2 provides parking area. Also trail from high school and CrossVermont trail goes by
Nasmith Brook – Paradise swimming hole	Plainfield	VSH[26]	Pull off on Nasmith Brook Road. Access from road and bridge ROW
North Branch at Nature Center	Montpelier	Sandy beach at walking bridge with deep pool	City land. Parking at city park and nature center.
Martins Brook - Shady Rill Park	Middlesex	Swimming hole, bedrock controlled grade to create deep swimming holes	Town land with parking. Opposite of Wrightsville parking lots,
Hancock Brook – Upper Pots	Worcester	VSH	VRC conservation easement. Parking .4 miles from the beginning of Hancock Brook Road
Dog River – Jacuzzi swimming hole	West Berlin	VRC	Owned by Town of Berlin. Parking at Fire Department before bridge over Route 12. Trail to swimming hole with wooden steps. Mowed lawn and picnic table above river.
Mad River-River side park	Warren	Friends of Mad River[27]	Public land. Parking lot opposite the Sugarbush Access Road,
Mad River-Picnic Area Cascades		VSH, Friends of Mad River	Public land and parking
Stetson Brook Cascades (Stetson Brook)		VSH, Friends of Mad River	Public land and parking
Mad River-Warren Falls	Warren	VSH, Friends of Mad River	Federal Land. Parking along the right side of Route 100 in front of Forest Service access gate.
Mad River-Lareau's Swimming Hole	Waitsfield	VSH, Friends of Mad River	Public land. Parking lot and sand beach off Route 100

[26] Jerry Jenkins, *Vermont Swimming Hole Study* Agency of Natural Resources, Waterbury, VT
[27] Pers. correspondence with Caitrin Noel, Director, Friends of the Mad River 6/30/11

Waterbody	Town	Aesthetic values and use by public confirmed	Public Access
Mad River-Moretown Gorge	Moretown	VSH	Parking lot north of 100B bridge over the Mad River. Take trail to sandy beach below gorge
West Branch - Bingham Falls	Stowe	VSH	State land. Access from a dirt pull off the Mountain Road or through the Stowe Land Trust owned Mill Trail
Moss Glen Brook - Moss Glen Falls	Stowe	VSH	State Land with parking lot
Gold Brook under bridge before Gold Brook Circle	Stowe	VSH	Road and Bridge ROW. Parking pull offs on road
Ridley Brook	Duxbury	VLT easement includes swimming	Duxbury Land Trust property. Parking on Camels Hump Road opposite Marshall Road
Huntington River - Horsebend swimming hole	Huntington	VSH	Audubon Center land. Parking at trail.
Huntington River - Audubon River Trail Swimming (Audubon Hemlock)	Huntington	VSH	Audubon Center land. Parking at center, accessible by trail.
Huntington River - Lower Audubon Swimming hole (River loop trail swimming hole)	Huntington	VSH	Audubon Center Land. Parking at center, accessible by trail.
Lower Huntington River Gorge (Huntington Gorge Cascade Chain)	Richmond	Richmond Land Trust (RLT) website and VSH study	16 acres of shoreland owned by Richmond Land Trust. Pull offs on Dugway Road

Table 15~~41~~. Determinations of existing uses of waters for public surface water supplies in Basin 8

Surface Water	Town	Water Supply	Use Status
Thatcher Brook and tributaries	Waterbury	Village of Waterbury	Active
Unnamed tributary to the West Branch	Stowe	Village of Stowe	Emergency use only
Thurman Dix, Lower Reservoir and tributaries	Barre & Orange	City of Barre	Active

Standard & consolidated quarries	Barre	Websterville	Active
Berlin Pond	Berlin, Northfield, Williamstown	City of Montpelier	Active