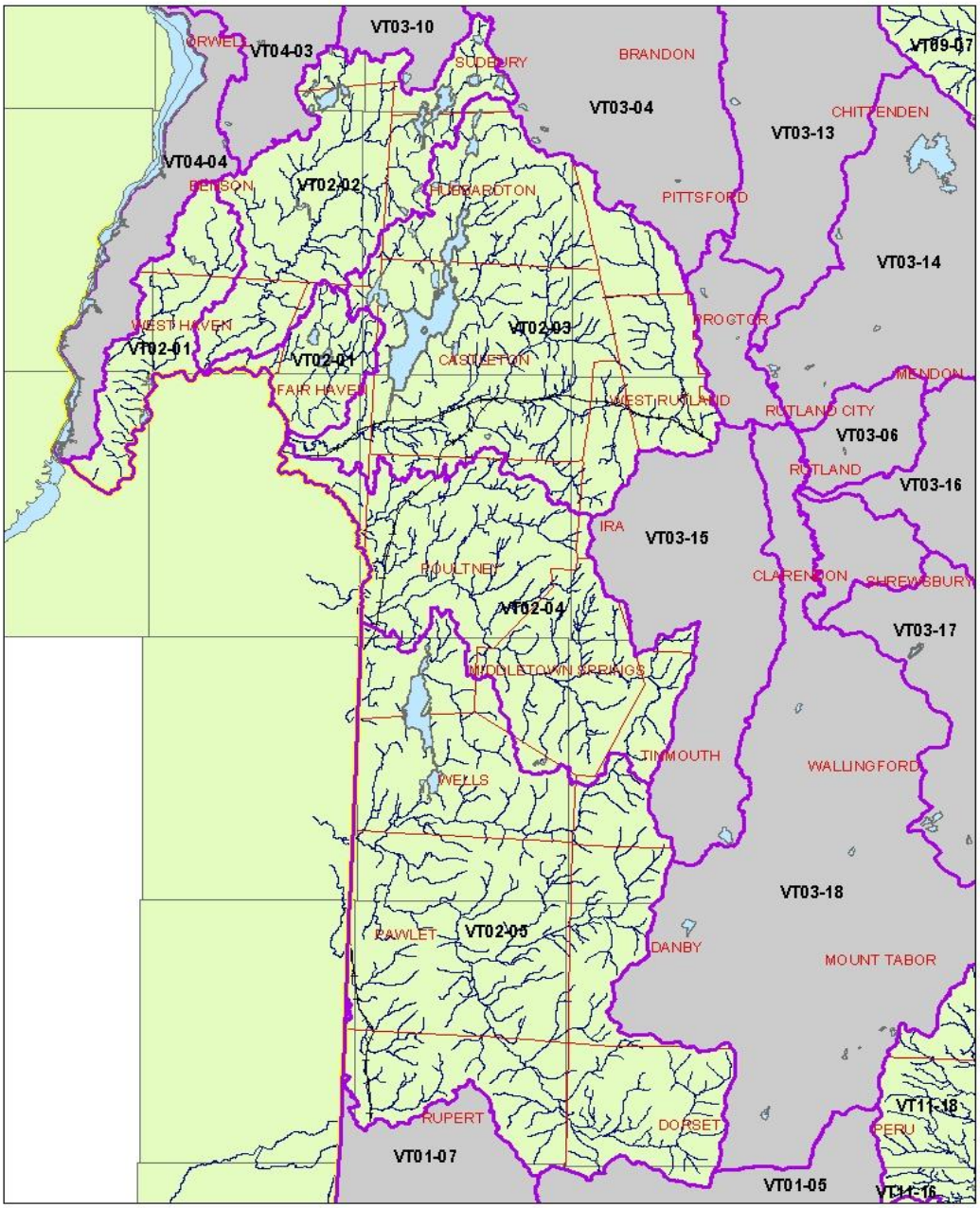
Basin 2
Poultney – Mettawee Rivers Watersheds
Updated Water Quality and Aquatic Habitat Assessment Report

January 2013



Contents

Introduction

The Poultney and Mettawee Rivers Basin (Basin 2) is located in the southwestern portion of the state and covers 373 square miles in Vermont within the counties of Addison, Rutland and Bennington. The majority of the basin area lies in Rutland County.

The Poultney River originates in Vermont and flows westerly to the New York border and then as the border between Vermont and New York state, it makes an arc (north,west, then south) and enters South Bay of Lake Champlain near Whitehall, New York. The Castleton River is a major tributary of the Poultney River.

The Mettawee River begins in the hills of Dorset, flows northwesterly within Vermont into New York state, and joins the Poultney River via the Champlain Barge Canal near Whitehall, New York. The Indian River, which originates in Vermont, joins the Mettawee River at Granville, New York.

The first Poultney-Mettawee Watersheds Water Quality and Aquatic Habitat Assessment Report was completed in December 1999. That reports contains:

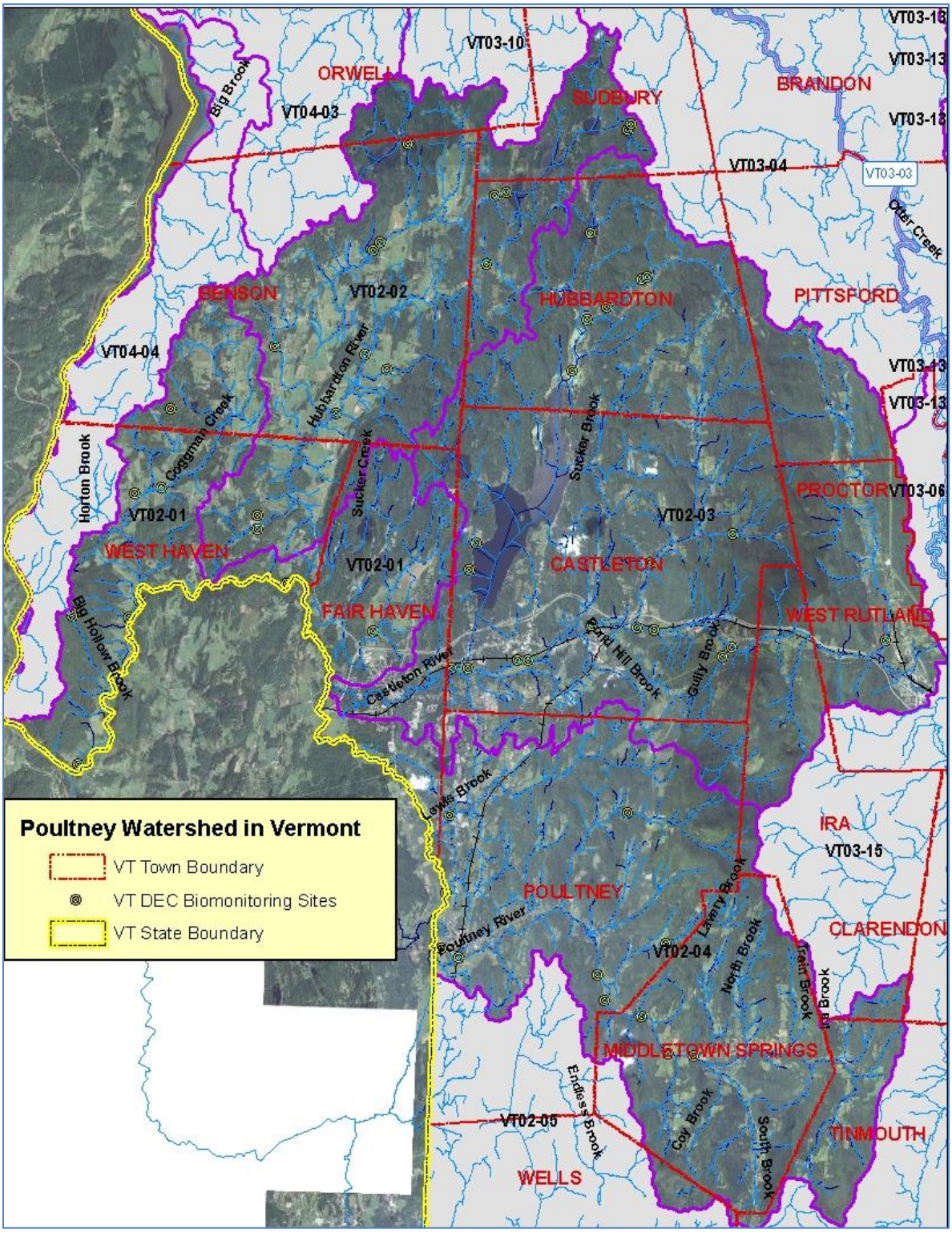
- a general description of the rivers and their tributaries courses
- the major wetland communities in the basin
- special values of the rivers including waterfalls and cascades, swimming holes etc
- special values of the ponds including rare and endangered plant species
- the river and lake causes and sources of impairments or threats
- the support status of river, stream, lake, pond designated uses at that time
- the waters on the TMDL list
- a description of special projects in the basin ongoing at that time
- the individual waterbody reports for the rivers and streams.

The Poultney-Mettowee Basin Plan was completed in March 2005. The plan contains information from the 1999 assessment report as well as updated information gained during the planning process.

This early 2013 updated water quality and aquatic habitat assessment report is focused on data and information that is more recent than 2005 and is being done in preparation for an updated South Lake Champlain tactical basin plan, which includes Basin 2 (Poultney and Mettawee) and Basin 4 (direct tributaries to southern Lake Champlain).

Poultney River and Tributaries

This section summarizes information available on the Poultney River and its tributaries (the Hubbardton River among others) not including the Castleton River and its tributaries, which is given following this section.



Assessment Information for Rivers and Streams

Macroinvertebrate Community

Macroinvertebrate assessments from the Poultney River are shown in the table below.

Table 1. Poultney River macroinvertebrate assessment results 1998 - 2010

	Rm 13.1	Rm 21.8	Rm 23.0	Rm 23.1	Rm 24.0	Rm 31.9	Rm 32.9
1998	fair	good	----	----	good	----	----
2002	----	----	----	----	----	very good	excellent
2003	vg-good						
2007	----	good-fair	good-fair	good-fair	good	----	----
2010	----	----	good	good-fair	----	----	----

The Poultney River mainstem site locations are as follows:

- Rm 13.1 is located below the West Street bridge in Fair Haven about 200 meters
- Rm 21.8 is located off of York street north of Poultney about one mile
- Rm 23.0 is located about 200 meters above York Street below the WWTF pipe
- Rm 23.1 is located about 300 meters above York Street above the WWTF pipe
- Rm 24.0 is located above the Granville Street bridge about 50 meters
- Rm 31.9 is located below Burnham Hollow about 1 mile. River on south side of road.
- Rm 32.9 is located immediately below bridge at Burnham Hollow and apple orchards.

At the rm 13.1 site in 1998, caddisfly larvae and Diptera (flies) dominated the community, which indicate problems from nutrient enrichment. The Poultney River was re-sampled at this site in 2003 and the macroinvertebrate community was improved to "very good-good" health and integrity.

Three sites on the Hubbardton River have been sampled and the macroinvertebrate community assessment results are given in the table below.

Table 2. Hubbardton River macroinvertebrate assessment results 1991-2011

	Rm 1.8	Rm 10.7	Rm 10.9
1991	good	----	----
1992	good	----	----
1994	----	good	----
1995	----	good	----
1996	----	good	----
2003	very good	----	----
2007	----	----	excellent
2011	very good-good	excellent	----

Coggman Creek in West Haven was sampled in October 2007 at rm 2.9. The macro-invertebrate community was assessed as "good-fair". This creek should be sampled again.

Macroinvertebrate sampling on Bump School Brook in Benson at rivermile 0.8 in 2003 resulted in a community assessment of "good-fair". Sampling on Breese Pond Outlet at rm 4.7 found a macroinvertebrate community in "very good-good" health in 2003 and "excellent" health and integrity in 2004.

Fish Community

Fish community sampling at rm 30.9 found an assessment of "good" also in 2002. There was also fish community sampling on the Poultney River in 2007 and it was assessed as "good" at rm 23.1 (a lack of trout and species richness) and "good" at rm 24.0 (too few trout and too many brown nose dace and common shiners).

Sites: Poultney River rm 21.8 is located off York St north of Poultney about 1 mile; 23.0 is about 200 meters above York St. below WWTP pipe; rm 23.1 is about 300 m above York St and above WWTP pipe; rm 24.0 is located above Granville Street bridge about 50m and above the Poultney WWTF.

Lampricide Impacts

Following the lampricide treatment of the Poultney River in 2007, at least thirteen species of non-target fish were killed by lampricide. Among those killed were 97 white suckers and 12 silvery minnows. There were also 46 dead leopard frogs and 8 dead mudpuppies found in the survey following the treatment.

There was a specific before-and-after treatment channel darter study on the Poultney River. The following information is from: *Poultney River Channel Darter (Percina copelandi) Sampling Results, 2007 & 2008*. Prepared by Chet Mackenzie, Vermont Department of Fish and Wildlife, April 29, 2010.

The darters were sampled on three days before the treatment and on two days after the treatment (81 seine hauls pre-treatment and 65 seine hauls post-treatment).

Species captured	2007	2008
Channel darters	25	4
Sand darters	81	53
Tessellated darters	167	73

Following the lampricide treatment on the Poultney River in fall 2011, there were the following non-target species found dead in the post-treatment survey: 1 tessellated darter, 1 logperch, 4 gar, 1 eastern silvery minnow, 1 northern pike, 24 mudpuppies, and 1 unidentified salamander.

The following non-target species from the Hubbardton River were found dead in the post-treatment survey: one largemouth bass, one pumpkinseed, one mudpuppy, and one unidentified salamander were found dead in the Hubbardton.

The level of post-treatment survey effort was not described in the report and thus it is not clear what the numbers above reflect in terms of non-target impacts.

E. coli

Eight sites were sampled on the Poultney River by the Poultney-Mettowee Watershed Partnership volunteers in 2004, 2005, 2006 2007, and 2008 (4 other sites were sampled in 2003 but are not discussed here). Seven of the eight sites are in waterbody VT02-04. Of the 7 sites in this waterbody, the geometric mean of the summers' samples (6 samples in 2004 and 7 in 2005) were as follows:

Table 3. E coli geometric means from Poultney River sample sites.

	2004	2005	2006	2007	2008	2011
PR01	47	26	----	64	54	---
PR02	177	163	77	447	115	---
PR03	147	205	125	257	78	234
PR04	128	96	---	---	---	---
PR05	122	63	---	148	71	---
PR06	117	79	69	214	89	----
PR07	137	127	126	257	115	---
PR08	245	297	197	631	234	---

Site PR01 is downstream of the historic Daisy Hollow bridge abutments, PR02 is at Coy Hill Road below South Brook, PR03 is Barker Bridge on Orchard Road , PR04 is Parker Water Well, PR05 is Morse Hollow downstream of Lavery Brook confluence, PR06 is downstream of Finel Brook and upstream of Hampshire Brook in East Poultney, PR07 is at the D&H Rail Trestle in Poultney, PR08 is off Green Road.

Wastewater Treatment Facilities

The discharge from the Benson WWTF used to cause violations of total residual chlorine (TRC), ammonia and temperature criteria. Violations of the permit limit for E. coli occurred from 11/97 - 1/98 (as seen in a file review in June 1998). Because of the small size and low 7Q10 flow of the tributary to which Benson discharges, it is expected that violations of dissolved oxygen standards would occur if the plant is up near design flow even if it is meeting the BOD conditions of the permit. A dechlorination system was constructed and addressed the chlorine problem. The plant also now has a refurbished aeration system and there was a sludge removal project that improved operations. Considered to be "running like a top" now (Feb 2010).

At milepoint 2.2 on the unnamed tributary below Benson village and the WWTF in 1997, the macroinvertebrate community was "poor". Strong Swamp is at the headwaters of this tributary. This tributary needs re-sampling to see if the improvements at the WWTF are reflected in the health of the macroinvertebrate community.

The Poultney WWTF expansion and upgrade, which included phosphorus removal, was completed 12/31/2001. The new WWTF is operating fine. Therefore *E. coli*, overflows, and phosphorus problems due to plant problems in this reach of the Poultney River have been addressed. As part of the upgrade, the town replaced sewer lines that were old and significantly reduced the inflow and infiltration. When the WWTF permit is renewed next, the phosphorus removal may have to be adjusted as part of the new Lake Champlain Phosphorus TMDL implementation plan.

Other
The Carvers Falls project owned by Central Vermont Public Service has gone to a run-of-river operation from a daily peaking operation under the New York State 401 and FERC license. This should eliminate DO and other impacts once due to low or fluctuating flows below the Carvers Falls dam. The Vermont 401 certificate was issued in December 2008 and the FERC license was issued in February 2009 and so this stretch is no longer considered altered.

As of January 29, 2013, there were eight operational stormwater permits; five construction permits; and 5 MSGP permits in the Poultney River watershed (not including the Castleton River subwatershed).

Lovery Brook is in a primarily forested watershed with scattered rural homes. A road crosses the brook at least four times as it winds down from Spaulding Hill.

North Brook was also surveyed and generally appeared in good condition. Minor threats to the stream are a potential where it passes through Middletown Springs.

South Brook is a small alder and willow-lined stream that has vegetation along much of its length. At the upper end, however, it appears to be surrounded by development of a small private golf course.

Assessment Status of Rivers and Streams

Impaired Miles
Poultney River: 10.4 - mouth to Carver's Falls - fish consumption impaired due to mercury contamination of walleye from atmospheric deposition.

Tributary to Hubbardton River: 3.0 - from Benson to confluence with Hubbardton River - secondary contact recreation, contact recreation, and aquatic biota/habitat impaired due to enrichment, thermal modifcation, pathogens, turbidity from a municipal point source, agricultural land uses (esp. crop production, animal grazing, and animal waste mgmt.) and streambank erosion.

Stressed Miles
Poultney River: 7.8 miles - from Buxton Hollow downstream to the D&H Rail Trail over river at Poultney Village - contact recreation stressed due to elevated *E coli* levels from agricultural land uses most likely although villages and natural sources could play a role - very uncertain the sources.

Hubbardton River: 15.0 - from Pleasant Valley road downstream to mouth - aquatic biota and habitat, aesthetics, non-contact recreation and contact recreation (swimming) stressed from nutrients, sediments, turbidity, thermal modifications, and pathogens from agricultural land use (especially grazing on streambanks, cows instream, crop production), loss of riparian vegetation, streambank destabilization and a short section of roadbank erosion.

Listing Status of Rivers and Streams & Lakes and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 303(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT02-02.01	Trib to Hubbardton River	ALS, CR, 2CR	Nutrients, temperature	Benson WWTF, possibly ag.

There are no Basin 2 waters on the **Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination list.

Part C – Stressed Waters in need of Further Assessment

Id #	Waterbody	Uses stressed	Pollutant	Issues
VT02-04	Poultney River from Buxton Hollow to D&H Rail Trail	CR	E. coli	

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT02-01.01	Poultney River from its mouth upstream to Carvers Falls (10.4 mi)	mercury	Elevated levels of mercury in fish tissue	December 20, 2007

Part E list – Waters altered by exotic plants

Id#	Waterbody	Uses affected	Problem	Action
VT02-01	Discrete areas of lower Poultney River	AES, ALS, CR, 2CR	water chestnut infestation	handpulling by TNC since 1998
VT02-01L01	Coggman Pond (West Haven)	AES, ALS, CR, 2CR	locally abundant Eurasian watermilfoil	handpulling by VTDEC & TNC since 1999
VT02-01L01	Coggman Pond (West Haven)	AES, ALS, CR, 2CR	water chestnut infestation	handpulling by VTDEC & TNC since 1999
VT02-02L06	Black Pond (Hubbardton)	AES, ALS, CR, 2CR	locally abundant Eurasian watermilfoil	weevil present; weevil addition 1997-2000
VT02-02L07	Mill Pond (Benson)	AES, ALS, CR, 2CR	Locally abundant water chestnut growth	VTDEC & TNC handpulling ongoing

There are no waters on the **Part F** - Waters Altered by Flow Regulation list for Basin 2.

Special Values and Features

The ***Lower Poultney River*** has been designated as an Outstanding Resource Water (ORW) due to its exceptional natural, cultural and scenic values. The Lower Poultney River ORW begins at the Poultney/Fair Haven town line and extends 22 miles downstream to a headwater region of Lake Champlain, referred to as the "elbow" (an area of the river that turns north toward Lake Champlain).

Hinkum Pond in Sudbury ranks in the top 5% (top 42 of 343 total lakes) of the "Best Lakes" in Vermont. Lakes ranked in three categories of best in water quality, best biological diversity, and best for unusual or scenic natural features and then given an overall rank that determined if they made the Best Lakes list.

Spruce Pond in Orwell, a eutrophic, low alkalinity pond ranks in the top 20% of the "Best Lakes" list and is in the top 100 lakes identified as important for biological diversity in the ANR Natural Resources Mapping project.

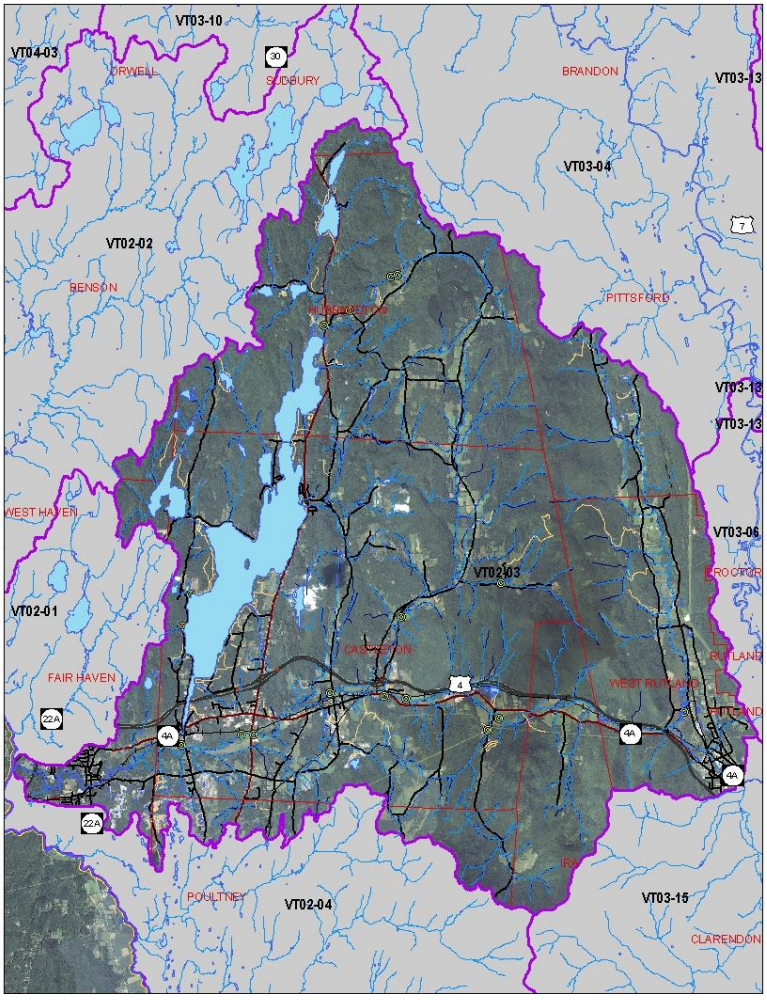
Old Marsh Pond in Fair Haven is in the top 100 lakes identified as important for biological diversity in the ANR Natural Resources Mapping project.

Inman Lake in Fair Haven and ***Hough Lake*** in Sudbury are both eutrophic lakes with high alkalinity that are also in the top 100 lakes identified as important for biological diversity in the ANR Natural Resources Mapping project.

Castleton River and Tributaries

The Castleton River is the largest tributary of the Poultney River, with a length of 20 miles and a drainage area of 99 square miles. The Castleton River is, throughout most of its length, a slow and meandering stream. It originates on the southeastern slopes of Biddie Knob in the town of Pittsford. From its source, it flows southerly through Whipple Hollow, entering the town of West Rutland. Proceeding through a large swamp northwest of West Rutland Village, the Castleton River turns west and flows into the town of Castleton, where at a point 11 miles from its source, it is joined by North Breton Brook from the north.

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



Assessment Information

Biological community health

Macroinvertebrate sampling was done at several locations on the Castleton River over the years. Site rm 6.2 is located in the first riffle below the Castleton WWTF and Route 30. Site rm 6.5 is located immediately above Route 30, above the Castleton WWTF. Site rm 8.7 is located upstream of North Road in Castleton; upstream of the two WWTFs that discharge to the Castleton River; and upstream of the Fair Haven landfill that is discussed below. Site rm 9.6 is below the old Route 4 bridge that is east of Castleton.

Table 4. Macroinvertebrate community assessment on the Castleton River

	Rm 6.2	Rm 6.5	Rm 8.7	Rm 9.6
1990	---	---	vg-good	---
1991	---	---	exc	---
1993	---	---	exc-vgood	---
1995	---	---	exc-vgood	---
1996	---	---	exc	---
1998	---	---	exc	---
2002	---	---	---	fair
2003	vgood	vgood	---	---
2007	fair	---	---	---

Macroinvertebrate sampling was also done on Giddings Brook in Hubbardton and Belgo Brook in Castleton in 2003. The community at both locations (rm 1.1 on Giddings Brook and rm 1.0 on Belgo Brook) was assessed as "excellent."

Macroinvertebrate sampling was done on Gully Brook in 2007 at rm 0.5 and the assessment was "exc-very good".

E. coli sampling

The Poultney-Mettowee Watershed Partnership has sampled four or five sites on the Castleton River over the past three years at least. The results of this *E. coli* sampling are:

Table 5. Castleton River Sample Sites *E. coli* geometric means

	2006	2007	2008	2011
Ca01	279	347	417	347
Ca02	92	275	339	---
Ca03	101	257	178	---
Ca05	177	437	170	437
Ca06	---	398	209	---

Ca01 is at the Birdseye Road with the sample taken upstream above the culvert; Ca02 is at the first Route 4A crossing downstream of Gully Brook and the Castleton avulsion; Ca 03 is at the Dumas property downstream of the 4A bridge; Ca05 is at Blissville Road downstream of the WWTF; and Ca06 is at the Adams Road bridge in Fair Haven.

Wastewater Issues

The Castleton wastewater treatment facility was expanded and upgraded with the addition of phosphorus removal in 1998. The Fair Haven wastewater treatment plant was upgraded with the addition of phosphorus removal in March 2001 and the Fair Haven wastewater collection system was rehabilitated including abatement of the Adams Stream pump station overflow (see below).

There has been a history of overflows from the Adams Street pump station of the Fair Haven WWTF and from upstream of the River Street ejector station to the Castleton River. There were sixteen documented overflows between March 1993 and January 1998. Fair Haven was under an enforcement order to stop overflows. In December 2000, a pneumatic plug was put into the overflow pipe at River Street where the pipe was taking water into the system from the river. The plug has stopped the inflow.

In March 2001, a new pump station was started up at Adams Street which had both increased storage capacity and increased pumping capacity. In the study period from May 2000 to March 2001, there were nine overflow incidents and then after the pump station start-up, there was only one overflow incident from March 2001 to June 2002. In addition to the pump station work, repairs and replacement on the collection system were done to address infiltration and inflow problems.

The Adams Street pump station, however, still discharges during large storm events to the Castleton River and does not comply with the CSO Control Policy. As a result of a recent inspection, the Agency has requested that the Town take additional steps to eliminate sources within the service area of the pump station. When the NPDES permit is reissued, conditions to meet the nine minimum controls and monitor the overflow point for compliance will be included. (The last three sentences from the September 2011Bacteria TMDL Appendix 19).

Landfills

Three unlined landfills (Castleton, West Rutland, and Fair Haven) are in the watershed of the Castleton River.

The order requiring closure of the Castleton landfill cited the potential for adverse impact on adjacent surface waters. Sampling in the Castleton River upstream and downstream of the landfill in summer 2001 did not show elevated chloride, iron, manganese, or other elements below the landfill. Concerns still exist however due to the trash ending up instream and the ongoing erosion of the bank.

The closure plan approved by DEC in 1990 for the West Rutland landfill called for biannual surface and ground water monitoring. An inspection report in 1993 noted leachate seeps and standing water at the toe of the slope from the landfill. No monitoring data were seen in the files.

The Fair Haven landfill ceased operations around 1985 prior to Act 78 and the current Solid Waste Rules. The landfill sits in a meander of the Castleton River so that the river flows over 180 degrees around it. The banks down to the river are over 50 feet high, very steep, and historically bulky wastes – refrigerators, tires, car bodies, among other items, ended up over the bank. This material dates from the 1960s - 1970s and earlier. After operations ceased, the town did arrange for the National Guard to spread some capping material over the upper surfaces of the landfill, but it was not a true closure. After Act 78 passed, Vermont DEC had grant money to pay for closure plans for all the unlined landfills that were facing a closure deadline and a plan for the Fair Haven landfill was supported. The consultant who did the plan estimated that the closure would cost $400,000 for a clay cap and $700,000 for a synthetic cap. And this figure did not include cleaning the side slopes as this was considered impractical. The Town rejected the plan based on costs, and no further work was done. The landfill was closed in the mid-1980s but never was capped or closed according to the plan. Tires, glass, and numerous other pieces of trash are in the river itself from the slopes of the dump being eroded into the river.

As of April 2012, there was no new information on these unlined, unmonitored landfills. There should at least be some upstream and downstream monitoring to determine if there are potential impacts of these landfills on the Castleton River or its tributaries.

Hazardous Waste

Hutchins & White Fuels hazardous waste site (94-1626) had a series of spills and releases prior to 1995. This site is adjacent to the Castleton River. The latest information in the DEC Hazardous Waste Section's files is a letter in response to a report done in 2007 by Malter Consulting. Following is a summary of the status taken directly from the letter.

> The Sites Management Section (SMS) has reviewed the Groundwater Monitoring Status Report (November 1998 – May 2007) for the above referenced property, which was prepared by Malter Consulting, Inc. and dated July 9, 2007. Groundwater monitoring and other site activities were conducted as part of an ongoing assessment of petroleum contamination at the Hutchins & White property.
>
> The report indicated that the groundwater treatment system originally installed on the property in 1994 failed in December 2005 as the result of frozen plumbing at the Hutchins & White facility. During the eleven years the system was operational, it treated over 11,043,071 gallons of groundwater. In total, 4,792 gallons of petroleum product has been recovered from the site since 1994.
>
> Other site activities included the collection of ground and surface water quality samples of a semi-annual basis between November 1998 and May 2007, for analysis via EPA Method 8021B. Samples were also collected from the influent and effluent points of the site groundwater treatment system on a monthly basis, prior to the 2005 failure of the system. Samples collected from 10 points (MWs 11, 12, and 16, PZs 1A, 2, 3, 4A, and 5, and both RW-1 and 2) demonstrated a decline in BTEX and MTBE concentrations over the course of the 1998 – 2007 sampling period. During this time, samples collected from another ten wells (MWs 1, 6, 7, 13, 16A, and 17, PZs 3A, 4, and 7, and RW-3) contained levels of BTEX and MTBE that remained relatively constant. Another 16 wells were checked monthly for the presence of free product.

During the most recent sampling round, five of the eleven wells sampled contained Benzene in excess of the Vermont Groundwater Enforcement Standards (VGES); two of the five wells also contained Naphthalene in excess of the VGES. It should be noted that MW-12, an off-site well, contained Benzene in excess of the VGES during both 2005 sampling rounds. Another off-site well, MW-13, contained Benzene in excess of the VGES during both 2006 sampling rounds.

Based on the results presented in this report, Malter Consulting, Inc. recommended additional rounds of groundwater sampling to be conducted on an annual basis for select wells that have historically contained petroleum related contaminants. Continued free-product checks were also recommended, to be conducted on an annual basis. The SMS concurs with these recommendations, with the following modifications: please have your consultant conduct free-product checks on a quarterly basis.

Please note that as the owner of the Hutchins & White facility, you are required to conduct this work as stated in Title 10 of the Vermont State Statutes Annotated (V.S.A.), Chapter 59 § 6615b. The length of time that passed between the completion of site monitoring activities and the subsequent reporting for this site is unacceptable. It is the responsibility of Owner Services, Inc. to ensure that site investigation/monitoring activities and reporting are conducted in a timely manner. Please direct your consultant to submit to the SMS the results of the May 2008 sampling round no later than **July 1, 2008**. The possibility for enforcement action exists if the next round of work is not conducted, and reported on, within this time frame.

There has been no response from the owner since this letter in 2007. DEC WMD Sites Management Section staff are still following up.

Other

North Breton Brook in Castleton has a small dam about a mile upstream of its mouth. A deer farm is present further upstream.

Gully Brook, a small stream in Castleton and Poultney, was described as threatened by road runoff in earlier assessment. Steep banks along the road drop down to the brook. Sediment was observed on the rocks in the channel. In summer 2002, a Phase I geomorphic assessment was done on Gully Brook. In 2004, following Phase I, Phase II, and some Phase III assessment, there was a restoration project undertaken on Gully Brook. A gravel pile at the confluence of the Gully Brook with the Castleton River was removed; and then a berm along the right bank of Gully Brook and 8200 cubic yards of material were removed to create a floodplain at an elevation accessible to the Gully Brook during annual flood events. “Since the completion of the excavation work in 2004, the Gully Brook has overflowed into its new floodplain 3 times. A quantity of 312 cubic yards of sediment was retained in the new floodplain as alluvial deposits thereby not entering the Castleton River. At the the head of the project, the Gully Brook has started eroding and depositing within the active channel to begin re-establishing meandering riffle-pool habitat.."

The Castleton River has a "moderate" amount of Eurasian watermilfoil in the lower part. It was found in 1990. There is no control program at this time.

As of January 29, 2013, there were seven operation stormwater permits, one individual stormwater permit, seven construction permits, and three MSGPs in the watershed.

Assessment Status of Rivers and Streams

Impaired Miles

Castleton River: 0.5 - below Fairhaven WWTF Adams Street pump station - contact recreation stressed due to elevated E. coli levels from occasional pump station overflows.

Stressed Miles

Castleton River: 0.2 - below old Fair Haven landfill - stresses on aesthetics, contact recreation and secondary contact recreation and threats to aquatic biota/habitat due to a lot of trash in the river and high pH value. (0.2 miles arbitrarily chosen until more investigation can be done).

Gully Brook: 3.0 - mouth to headwaters - stresses on aquatic habitat, secondary contact recreation due to sedimentation and physical alterations due to road runoff, bank erosion to stream.

Listing Status of Rivers and Streams, Lakes and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 3030(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT02-03.01	Castleton River	swimming	E. coli	WWTF pump station overflows

There are no Castleton River watershed waters on the '**Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination' list; the '**Part C** – Stressed Waters in Need of Further Assessment list'; or the '**Part D** – waters that have completed and approved TMDLs.

Part E – Surface Waters Altered by Exotic Invasive Species

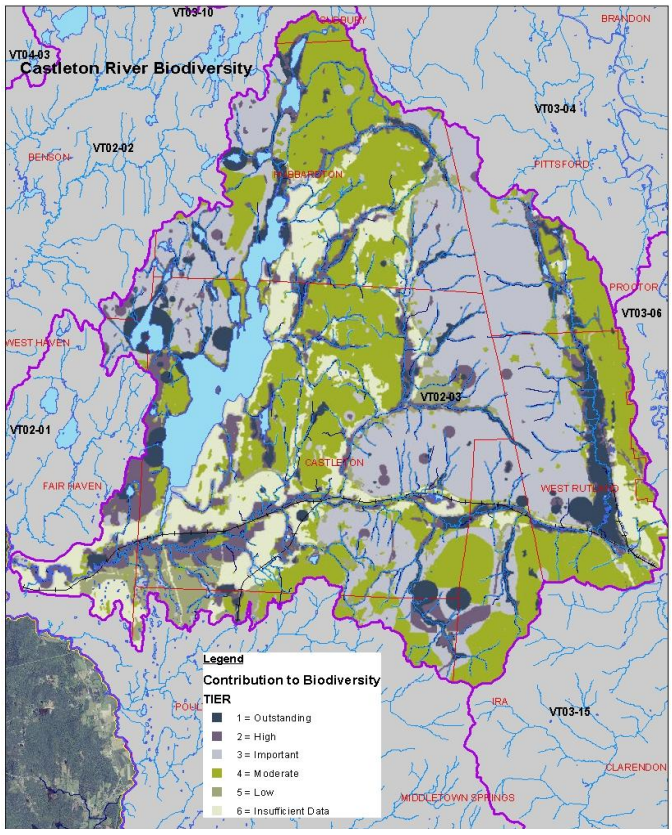
Id #	Waterbody	Uses altered	Problem	Status
VT02-03	Castleton River	AES, ALS, CR, 2CR	Moderate levels of Eurasian watermilfoil	No control taking place
VT02-03L05	Lake Bomoseen (Castleton)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil	Weevils present & added, milfoil declines 1997 & 2001 but cause not known
VT02-03L05	Lake Bomoseen (Castleton)	ALS,CR	Zebra mussel infestation	Has spread.
VT02-03L06	Glen Lake (Castleton)	AES, ALS, CR, 2CR	Locally abundant Eurasian watermilfoil	

There are no Castleton River waters on **Part F** - Waters Altered by Flow Regulation list.

Special Uses and Values

The excellent wetland natural communities of the Castleton River subwatershed are described in the 1999 *Poultney-Mettawee Watersheds Water Quality and Aquatic Habitat Assessment Report* as well as in the Natural Heritage natural community inventory or county-specific reports that have been done.

The ***West Rutland Marsh*** wetland complex is a highly significant wetland, providing many functions and values. The 832 acre wetland complex extends from the Castleton River headwaters in Pittsford south to Route 4 in West Rutland. It is ecologically diverse, including at least the following wetland community types: Shallow Emergent Marsh, Cattail Marsh, Sedge Meadow, Alder Swamp, Red Maple-Black Ash Swamp, and Hemlock-Northern White Cedar Swamp. The West Rutland Marsh provides habitat for seven very rare to uncommon breeding birds and three very rare to uncommon plant species. The area makes an outstanding contribution to Vermont's biological diversity (see map below). Unfortunately industrial activities have had an impact on this area especially along the eastern and southeastern ends and many areas are now overgrown with *Phragmites*.



Halfmoon Pond in the Castleton River subwatershed is in the top 25% of the "best lakes" in the state list. The mesotrophic, high alkalinity pond in Hubbardton is also one of the top 100 lakes identified for its contribution to biological diversity in the ANR Natural Resources Mapping Project.

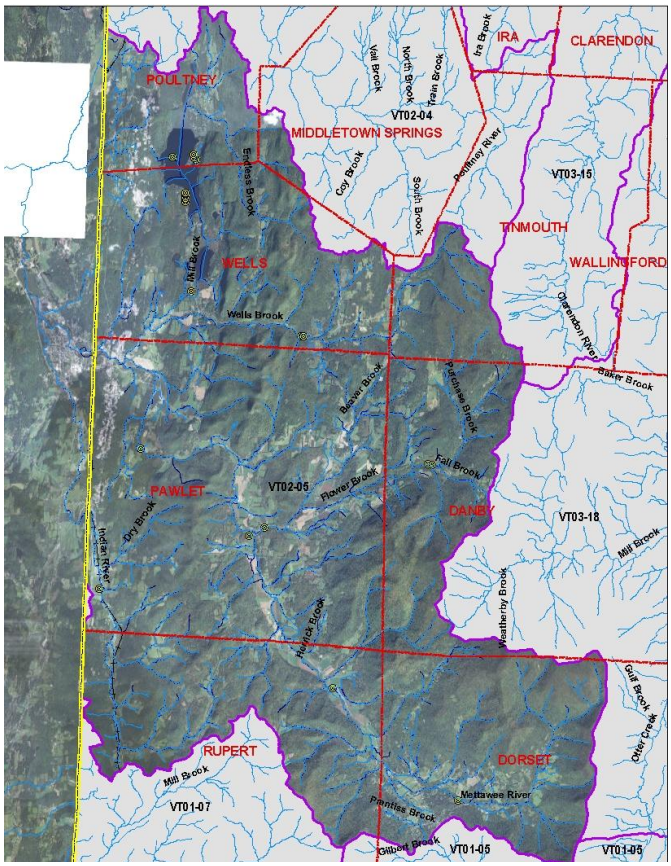
Mettawee River

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

Proceeding west then north from Pawlet Village, the Mettawee River forms a wide “S” loop at Butternut Bend and continues under Vermont Route 153. It passes through a rocky gorge and continues to the point where Wells Brook enters from the northeast, 6.9 miles downstream of Flower Brook.

Continuing westerly, the Mettawee River enters the State of New York at a point 0.6 mile below Wells Brook.

In addition to Flower Brook and Wells Brook, the Indian River is a major tributary to the Mettawee River.



Assessment Information

Temperature Monitoring History

The Poultney-Mettowee Watershed Partnership did temperature monitoring on the Mettawee River and Flower Brook in the summer season from 2003 through 2006. Only one of the Mettawee River sites was in Vermont - Mettowee 3. This site located south of Pawlet at Stonebroke Farm never registered temperatures above 70F (a threshold for coldwater fishery health used by the PMWP) and generally hovered above and below the low 60s (gross generalization about much data). The monitoring involved hourly measurements from either June or July into late September.

Flower Brook Site 1, which is the downstream-most site, is located behind the clerk's office in Pawlet and downstream of the mill pond. In 2006, the temperature went above 70F on five days (sampling period Aug 2 - Sept 20); in 2005, it went above 70F on 38 days (June 23-Sept 24 sampling); in 2004, it appears to have risen above 70F only one day (end June until mid-Sept sampling); and in 2003, nine days (early Aug into Sept sampling). The temperatures never remained elevated always dipping back to the mid to low 60s and, in 2004 especially, to the upper 50s.

Flower Brook Site 2 is located behind the Pawlet Fire Department upstream of the mill pond. It was not sampled in 2006 but in 2005 had 31 days where the temperatures went above 70F. In 2004, it just went above 70F on six days and , in 2003, the temperatures went over 70F on 10 days. Again the temperatures do not linger above the 60s at all.
Flower Brook Site 3 was also not monitored in 2006 but had 27 days in 2005 when it reached above 70F; no days above 70F in 2004 and 6 days above 70F in 2004.
Flower Brook Site 4 is at the Route 133 crossing after this road turns north. In 2006, the site saw temperatures above 70F on 13 days (sampling from July 18- Step 20) and in 2005, the site had temps above 70F on 38 days. In 2003 and 2004, the temperature never went above 70 F during the time sampled.

Biological Sampling

Macroinvertebrate data were gathered from four sites on the Mettawee River and three sites on Flower Brook over the last 20 years. Community assessments are given below.

Table 6. Mettawee River biological sampling sites

	Rm 23.6	Rm 28.6	Rm32.5	Rm 36.9
1997	----	good	----	----
2002	vgood-good	----	excellent	----
2004	----	----	----	exc-vgood
2011	fair	----	----	----

Rivermile 23.6 is located above the Route 153 bridge and bend in the first riffle in Pawlet; rm 28.6 is located below the bridge 100 meters near Pawlet Village; rm 32.5 is located off of Route 30 one mile southeast of Ruper at the Fish and Wildlife access area, and rm 36.9 is just below Dorset Hollow Road in Dorset.

Flower Brook was sampled in 1991 at the two upper Flower Brook sites (rm 4.8 and rm 4.9) and these sites were "excellent" those many years ago and then the brook was sampled in 2007 at rm 0.5 in Pawlet and the macroinvertebrate community was also found to be "excellent".

Flower Brook fish community was "fair" at rm 4.8 in 1991 but "very good" at rm 4.9 in 1991. The lower site, rm 4.8, had no brook trout hence the "fair". In 1992, however, the fish community assessment at rm 4.8 was "very good" and in 1993, it was "excellent".

E. coli Sampling

The geometric means of *E. coli* samples for three summers on the Mettawee River sites as well as Flower Brook and Beaver Brook are given below:

Table 7. Mettawee River E. coli geometric means

	2006	2007	2008	2011
Mett1.5	52	195	74	---
Mett2	210	199	123	---
Mett2.25	---	---	132	---
Mett2.5	178	347	138	437
Mett3.0	183	676	98	380
Flower01	219	631	112	537
Beaver01	258	282	240	339
Beaver02	---	---	---	148
Wells01	---	---	---	56
Wells02	---	---	---	200

Mett 1.5 is at the fishing access; Mett 2 is at Stone's Farm at the temp monitoring site; Mett 2.25 is immediately upstream of Flower Brook confluence; Mett 2.5 is downstream of Pawlet and the Flower Brook confluence; and Mett 3 is at Pillemer's vegetable farm.

Flower01 is is located in downtown Pawlet behind the town offices; Beaver01 is where Route 133 crosses it; Beaver 02 is on Kelly Hill Road downstream of the culvert crossing underneath Kelly Hill Road. (This is the upstream sample of the two done on Beaver Brook); Wells01 is on Wells Brook directly behind the Wells Village Store. (Sample is taken upstream of the culvert that crosses under North-South road connecting Wells and Pawlet); Wells02 is at the intersection of McCoy Road and Route 133 south. (Sample taken from upstream of culvert crossing under Route 133.)

Old Landfills

Information gathered from the Solid Waste files showed that at the ***Pawlet Landfill*** instream sampling site, the instream iron concentrations exceeded the 1000 ppm chronic criterion in at least six samples collected between 1995 and 1997. The highest result was a value of 6390 ppm in October 1996. Zinc criteria at a hardness of 50 mg/liter are: acute = 65 ppb and chronic = 58.6 ppb. Instream zinc concentrations exceeded both of these criteria on 7 occasions from 1995 to 1997. The maximum concentration sampled was 156 ppb. In spring 2000, the landfill was closed and capped.

Surface water sampling in May 2011 on the unnamed tributary below the landfill found arsenic at 2.02 ug/liter; iron at 16,400 ug/liter; manganese at 3400 ug/liter; nickel at 10.5 ug/liter; and zinc at 287 ug/liter.

Threats to an unnamed tributary (also called Quarry Brook) below the ***Wells Landfill*** have been noted for many years. Staff from the Vermont DEC Waste Management Division collected a surface water sample in May 2012. Conductivity, chemical oxygen demand, and VOC results are available so far. Results for metals are to come.

Wastewater Treatment Facilities

The Pawlet WWTF is a small plant on Indian Brook a few hundred yards upstream of the New York border. It has had very low effluent DO concentrations although we don't have instream DO values to know the effect of the effluent levels. An example of the low effluent values: from July 1997 to May 1998, the effluent DO concentrations were below 4 mg/ liter on 30% of the days recorded and below 5 mg/liter on 75% of the days. The permit for this facility does not call for DO measurements, however, - there are limits on BOD, P, TSS. There was a major mechanical failure at the facility several years ago and the plant needed to get an emergency discharge order. It has been fixed and there have been no violations of the permit conditions recently.

Stormwater Permits

As of January 29, 2013, there were four operational stormwater general permits; eight construction permits, and eight industrial (MSGP) permits (gravel pits and quarries) in the Mettawee River watershed.

Assessment Status

Impaired miles

Unnamed tributary to Mettawee River: 0.2 - downstream of Pawlet landfill - aquatic habitat and aesthetics impaired due to instream iron and zinc levels that exceed standards from landfill discharges (0.2 miles arbitrarily chosen to represent length of this impact).

Flower Brook: 0.1 - Pawlet Village - aesthetics impaired due to collapsing structure, old pipes, other debris and iron staining at Flower Brook Cascade.

Flower Brook: 0.5 - mouth upstream to Pawlet Village - contact recreation impaired due to *E coli* likely from failing septic systems in village

Stressed Miles

Mettawee River: 8.2 - upstream from NY/VT border to confluence with Flower Brook - aquatic biota/habitat and secondary contact recreation stressed due to temperature, sediments, and nutrient enrichment from agricultural land uses (esp. corn, hay and pasture), loss and removal of riparian vegetation and streambank erosion.

Listing Status of Rivers and Streams, Lakes and Ponds

The following is from the 2012 303(d) List of Waters and the List of Priority Surface Waters Outside the Scope of Clean Water Act Section 3030(d).

Part A – Impaired Surface Waters in need of a TMDL

Id #	Waterbody	Uses impaired	Pollutant	Problems
VT02-05.02	Unnamed trib to Mettawee River	aquatic life	metals (iron, zinc)	Pawlet landfill

There are no Mettawee River watershed waters on the '**Part B** – Impaired Surface Waters not needing a Total Maximum Daily Load Determination' list.

Part C – Stressed Waters in need of Further Assessment

Id #	Waterbody	Uses stressed	Pollutant	Issues
VT02-05	Indian River below West Pawlet WWTF	ALS	low DO	DO levels of the discharge & downstream

Part D – Waters with EPA-approved TMDLs

Id#	Waterbody	Pollutant	Problem	Date TMDL approved
VT02-05.03	Flower Brook, mouth to rm 0.5	E.coli	Elevated E. coli monitoring results	September 30, 2011

Part E – Surface Waters Altered by Exotic Invasive Species

Id #	Waterbody	Uses altered	Problem	Status
VT02-05L03	Lake St. Catherine (Wells)	AES, ALS,	Alewives	Alewives confirmed in 1997; throughout lake

Information Sources

Vermont ANR DEC Lakes and Ponds Program “Best Lakes” list

Vermont ANR Natural Resources Mapping Project highlighting biological diversity

Lake Champlain Sea Lamprey Control Program Chemical Treatment Summary: Poultney-Hubbardton River, Vermont 2011 by Stephen Smith, U.S. Fish and Wildlife Service, Lake Champlain Fish and Wildlife Resources Office. No date on report but treatments were in Sept 2011.

Vermont DEC Waste Management Division letter sent by certified mail on September 28, 2007 re: November 1998 – May 2007 Status Report, Hutchins & White Fuels, Castleton (SMS Site # 1004-1626).

Poultney River Summer Water Quality Monitoring Program, Poultney-Mettowee Watershed Partnership submitted to Vermont DEC Waterbury, Vermont. Reports from 2004 through 2007.

Chemical Treatment Summary done by Vermont Department of Fish and Wildlife. The summary report has no date but treatment was done on November 8, 2007.

Poultney Mettowee Basin Plan March 2005. Vermont ANR DEC Water Quality Division, Waterbury, Vermont.

Vermont Success Story written by Ethan Swift and Mike Kline, Vermont DEC Water Quality Division about the Gully Brook restoration project (May 2005)

Vermont DEC Wastewater Management Division files - information on discharges from Poultney WWTFand information about Benson WWTF discharges.

Overflow Effectiveness Report for the Sewer System, Town of Fair Haven, Vermont June 2002. Peter M. Laramie, Chief Operator Fair Haven WWTF.

Vermont Department of Fish & Wildlife - temperature data from the Poultney River above Granville Street bridge.

Vermont DEC Biomonitoring and Aquatic Studies Section - provided data from, and information about, the biomonitoring sites on watershed rivers and streams.

Hydro Assessment Vt DEC May 1987 - noted low/fluctuating flows caused by Carvers Falls Hydro; potential for DO violations to occur (esp. during summmer overnight ponding) - supersaturated DO levels and indications of algae and presence of 3 rare fish species below facility.

Vermont DEC Waste Management Division Solid Waste files and staff – landfill updates.