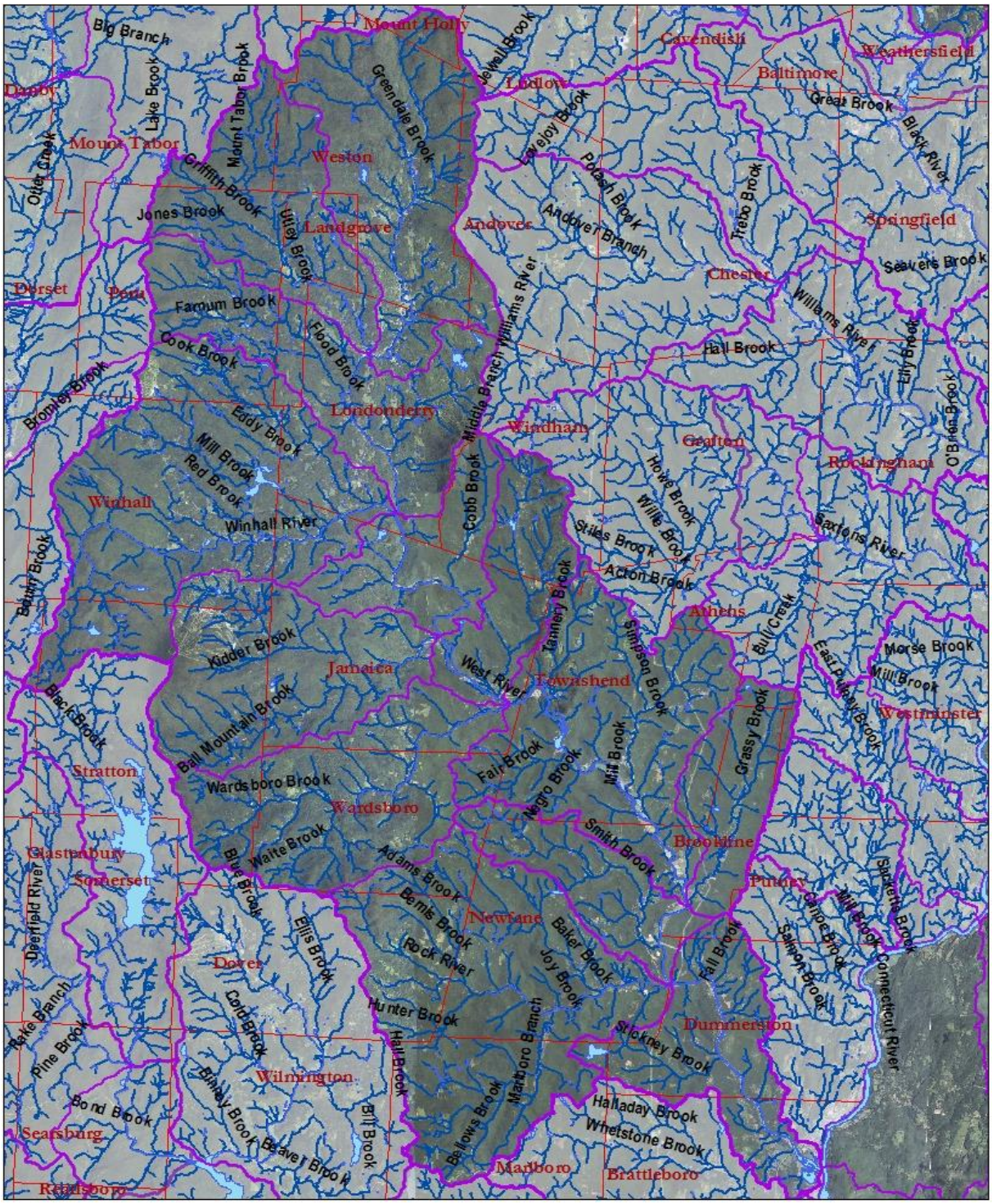
West River Watershed

Updated Water Quality/Aquatic Habitat Assessment Report

October 2014



The West River watershed with towns and some tributaries

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Earlier Information on the West River Watershed

The last time that a formal assessment report was done on the West River was in 2001 as the Basin 11 – West, Williams & Saxtons Rivers Water Quality and Aquatic Habitat Assessment Report. In 2008, there was the Basin 11 West River, Williams River, Saxtons River Management Plan. In addition, there have several river corridor or geomorphic assessment reports done for stretches of these waters since 2008.

This 2014 assessment is a further update in preparation for the 2015 Basin 11 plan. This report is divided into two sections with one section the West River and its tributaries but for Ball Mountain Brook subwatershed, which is described separately starting on page 9.

General Description of the Watershed

The mainstem of the West River originates in the south part of Mount Holly, 2,400 feet above sea level. It flows generally south through the towns of Weston and Londonderry then southeasterly through Jamaica, Townshend, Newfane, Dummerston, and Brattleboro where it meets the Connecticut River. The length of the mainstem is 46 miles and the river drains a watershed that is 423 square miles.

The major tributaries to the West River from north to south or upstream to downstream include: Greendale Brook, Utley Brook, Flood Brook, the Winhall River, Mill Brook, Grassy Brook, Smith Brook, Ball Mountain Brook , Wardsboro Brook, and the Rock River.

Along the length of the West River are two major reservoirs formed by huge dams that were built as Army Corps of Engineers flood control dams. In addition, just above the mouth is a wetland area called Retreat Meadows, a backwater created by the Vernon Dam on the Connecticut River that has become a large marsh.

A more detailed description of the West River watershed is given in the November 2001 Basin 11 West Williams Saxtons Rivers Assessment Report.

Special Features and Values of the West River Watershed

The West River is well known for its swimming holes, boating runs, fishing, and waterfalls, cascades, and gorges. A summary of the features is given in the Basin 11 Management Plan West, Williams, and Saxtons River June 2008 on pages 52 and 53 with some of the exceptional locations specifically described there.

North Branch Ball Mountain Brook from the confluence of Kidder Brook to a point below Pikes Falls where an unnamed tributary enters from the Winhall Municipal Forest, about 4000 feet, was made an Outstanding Resource Water (ORW) due to fish habitat, geologic feature, scenic area and recreational value.

Kidder Brook watershed is a Class A watershed (1989 Board decision).

West River Watershed Summary of Segments with Impacts

Stream or Lake Segment	Mileage & Status	Pollutant	Source	Use affected & other information
West River, below Ball Mtn dam to Townshend dam	9.0 miles ***Impaired*** Part A list	temperature	impoundment	2cr –fishery; affected by high temps
Ball Mountain Brook, above confluence of the North Branch	8.4 miles ***Impaired*** Part A list	acid	atmospheric deposition	aquatic life/habitat; chronic acidification
Bear Creek Brook, rm 0.7 to headwaters	1.5 miles ***Impaired*** Part A list	acid	atmospheric deposition	aquatic life/habitat; chronic acidification
Kidder Brook, confluence of Sun Bowl Brook up	2.2 miles ***Impaired*** Part A list	acid	atmospheric deposition	aquatic life/habitat chronic acidification
North Branch Ball Mountain Brook	0.4 miles ***Impaired*** Part B list	manganese	former onstream pond	aesthetics of “black rocks”
Styles Brook,	2.0 miles ***Impaired*** Part D list	sediment	land develop-ment, hydrologic modification	aquatic life/habitat; EPA approved a TMDL 6/21/2002
West River, 1 mile below to ½ mile up of So Londonderry	1.5 miles ***Impaired*** Part D list	E. coli	failing septic systems sus-pected.	contact recreation EPA approved a TMDL Sept 30, 2011
Forester Pond (Jamaica)	9 acres ***Impaired*** Part D	acid	atmospheric deposition	aquatic life/habitat chronic acidification EPA approved a TMDL Sept. 30, 2003
Little Pond (Winhall)	18 acres ***Impaired*** Part D	acid	atmospheric deposition	aquatic life/habitat; episodic acidification; EPA approved a TMDL Sept 20, 2004
Stratton Pond (Stratton)	46 acres ***Impaired*** Part D	acid	atmospheric deposition	aquatic life/habitat; episodic acidification; EPA approved a TMDL Sept. 30, 2003
Moses Pond (Weston)	12 acres ***Impaired*** Part D	acid	atmospheric deposition	aquatic life/habitat; chronic acidification EPA approved a TMDL Sept. 30, 2003
West River, Mouth upstream and Retreat Meadows	0.6 miles ***Altered*** Part E list	Eurasian watermilfoil		was checked in 2004 and 2007 – needs re-checking
Stickney Brook	2.5 miles ***Altered*** Part F list	flow fluctuations	Brattleboro water supply withdrawal	

Ball Mountain Reservoir	85 acres ***Altered*** Part F List	water level fluctuation, fish passage	operation of ACOE dam	
West River, Ball Mtn Dam down to Townsend Dam	9.0 miles ***Altered*** Part F list	artificial flow regime – no minimum flow for biota	operation of ACOE dam	Overlaps with the 9.0 miles impaired above
Mill Brook	1.6 miles ***Altered*** Part F list	insufficient flow	Bromley snowmaking water withdrawal	
Trib to Mill Brook	2.2 miles ***Altered*** Part F list	insufficient flow	Bromley snowmaking water withdrawal	
Hapgood Pond	7 acres ***Altered*** Part F list	flow alteration		
West River, mouth up to Grassy Brook	12.0 miles ***Stressed***	temperature, flow modification	wide shallow channel, dam operations	Fishing (2cr), aquatic habitat
West River, Grassy Brook up to Townshend Dam	7.1 miles ***Stressed***	temperature, flow modification	impoundment warms waters, flow mod from dam operations	Fishing (2cr), aquatic habitat
Rock River, mouth to Adams Brook	7.5 miles ***Stressed***	sediment, temp, physical alterations	impacts from TS Irene & post-Irene	Fishing (2cr), aquatic habitat
Wardsboro Brook, mouth to West Wardsboro	7.0 miles ***Stressed***	sediment, temperature	streambank erosion, road runoff, channel widening…	
Winhall River, mouth to IPCo. bridge	8.0 miles ***Stressed***	sediment, temperature	channelization, road runoff, loss of riparian veg, erosion	
Flood Brook, mouth to 0.1 mile below dam	2.5 miles ***Stressed***	temperature	impoundment warms water	
Adams Brook	200 feet	physical alterations	channel rip-rapped and 'paved'	Post-Irene channel work eliminated habitat, caused fish passage issues. Status to be determined in 2016.
Dover Brook	600 feet	physical alterations	channel rip-rapped and 'paved'	Post-Irene channel work eliminated habitat & caused fish passage issues. Status to be determined in 2016.

Assessment Information

Following is a map showing biological monitoring sites; constructs that could influence the rivers and streams such as dams, landfills, hazardous sites; and the condition of the stream following assessments using all available information. After the map are tables with data from biomonitoring and water chemistry monitoring.

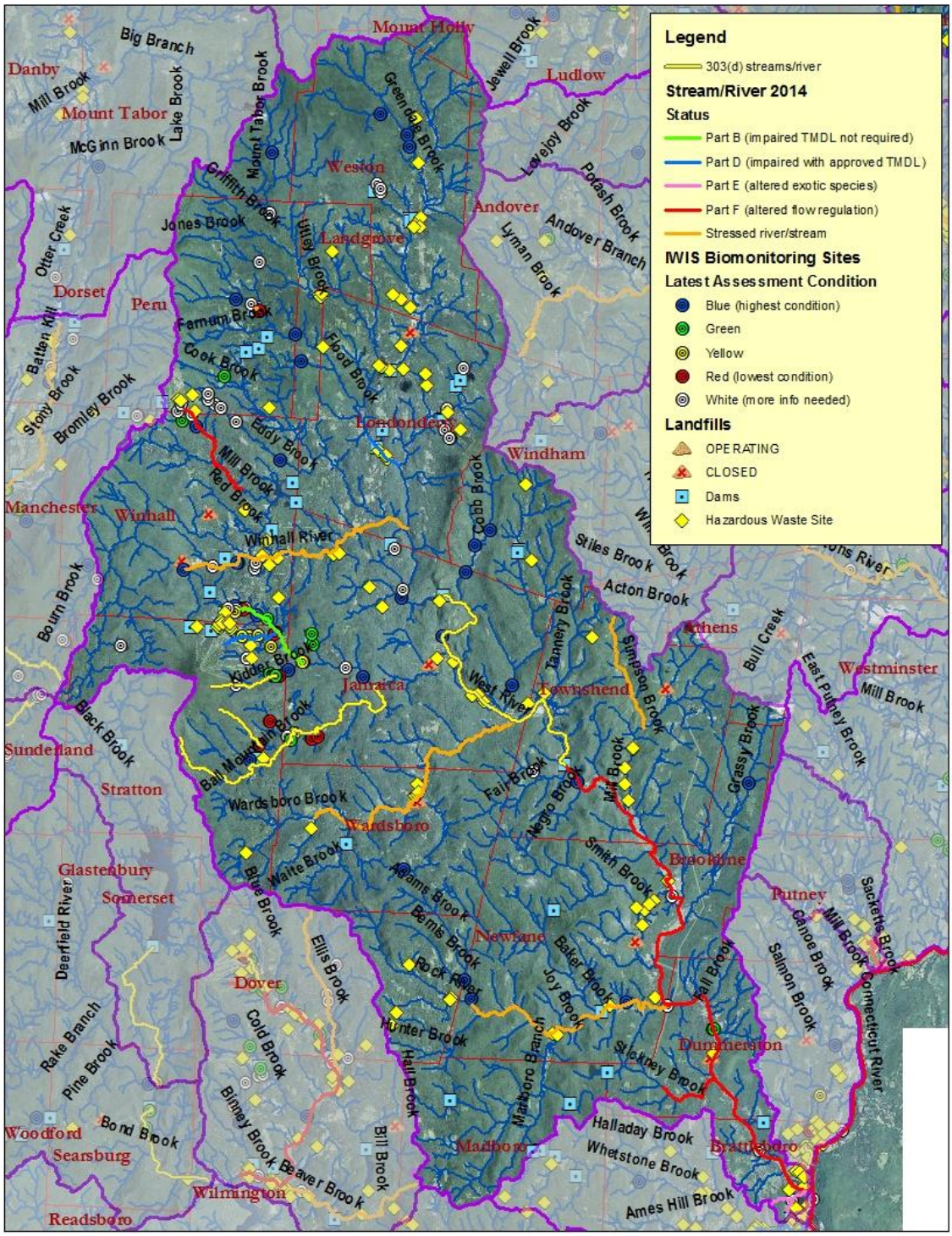

Figure 2. West River Watershed with Assessment Information

Biological Monitoring

Table 1. Biological community sampling results for West River & Tributaries - 2008 to 2013

Wbid	River/Stream	Town	Station	Date	Assessment	Com-munity
VT11-07	West River	Dummerston	6.1	9/23/2008	Exc-vgood	M
VT11-07	West River	Dummerston	6.1	10/6/2011	Fair-poor	M
VT11-07	West River	Dummerston	6.1	9/25/2012	Good	M
VT11-09	Adams Brook	Marlboro	0.2	10/17/2012	Exc-vgood	M
VT11-09	Adams Brook	Marlboro	0.8	10/17/2012	Very good	M
VT11-11	Grassy Brook	Brookline	5.5	9/23/2008	Exc-vgood	M
VT11-11	Grassy Brook	Brookline	5.5	9/23/2008	Very good	F
VT11-12	West River Trib 31	Jamaica	0.1	9/23/2008	Exc-vgood	M
VT11-12	West River Trib 31	Jamaica	0.1	9/23/2008	Very good	F
VT11-13	Cobb Brook	Jamaica	0.9	9/23/2010	Excellent	M
VT11-13	Cobb Brook	Jamaica	0.9	9/23/2010	Excellent	F
VT11-13	Cobb Brook	Jamaica	0.9	9/27/2012	Exc-vgood	M
VT11-16	Mill Brook Trib #6	Winhall	1.6	9/18/2009	Excellent	M
VT11-16	Mill Brook Trib #6	Winhall	1.9	9/4/2008	Fair	M
VT11-16	Mill Brook Trib #6	Winhall	1.9	9/30/2009	Fair	M
VT11-16	Mill Brook Trib #6	Winhall	1.9	9/10/2012	Good	M
VT11-16	Mill Brook Trib #6	Winhall	1.9	9/12/2013	Good	M
VT11-16	Mill Brook Trib #6	Winhall	2.2	9/12/2013	Good	M
VT11-16	Winhall River	Winhall	6.4	9/18/2008	Exc	M
VT11-16	Winhall River	Winhall	6.4	9/15/2010	Exc	M
VT11-16	Winhall River	Winhall	6.4	9/6/2012	Exc	M
VT11-16	Winhall River	Winhall	6.4	9/18/2013	Exc-vgood	M
VT11-16	Winhall River	Winhall	7.1	9/18/2008	Exc	M
VT11-16	Winhall River	Winhall	7.1	9/15/2010	Exc-vgood	M
VT11-16	Winhall River	Winhall	7.1	9/6/2012	Exc	M
VT11-16	Winhall River	Winhall	7.1	9/18/2013	Exc	M
VT11-16	Winhall River	Winhall	8.1	9/18/2008	Exc	M
VT11-16	Winhall River	Winhall	8.1	9/10/2008	Exc	F
VT11-16	Winhall River	Winhall	8.1	9/30/2009	Exc	M
VT11-16	Winhall River	Winhall	8.1	9/23/2010	Exc	M
VT11-16	Winhall River	Winhall	8.1	10/7/2011	Fair	M
VT11-16	Winhall River	Winhall	8.1	10/7/2011	Very good	F
VT11-16	Winhall River	Winhall	8.1	9/27/2012	Exc	M
VT11-16	Winhall River	Winhall	8.1	9/27/2012	Very good	F
VT11-16	Winhall River	Winhall	8.1	10/15/2013	Exc-vgood	M
VT11-16	Winhall River	Winhall	8.1	10/15/2013	Very good	F
VT11-18	Burnt Meadow Brook	Landgrove	1.0	9/30/2009	Exc	M
VT11-18	Burnt Meadow Brook	Landgrove	1.0	10/7/2011	Exc-vgood	M
VT11-18	Flood Brook	Landgrove	4.0	9/16/2008	Exc	M
VT11-18	Flood Brook	Landgrove	4.0	9/16/2008	Good	F
VT11-18	Flood Brook	Landgrove	6.1	9/16/2008	Fair	M
VT11-18	Flood Brook	Landgrove	7.2	9/16/2008	Exc	M

VT11-18	Greendale Brook	Weston	1.2	9/16/2008	Exc-vgood	M
VT11-18	Greendale Brook	Weston	1.2	9/23/2010	Exc	M
VT11-18	Jenny Coolidge Brook	Weston	0.4	9/16/2008	Exc-vgood	M

Table 2. Biological sampling sites locations

WBID	Stream or River	Station	Description
VT11-07	West River	6.1	Below covered bridge in Dummerston
VT11-09	Adams Brook	0.2	Next to Adams Hill Road
VT11-09	Adams Brook	0.8	Below Copperhead Road
VT11-11	Grassy Brook	5.5	At 76 Grassy Brok Rd below private bridge
VT11-12	West River Trib 31	0.1	Above a falls up trib from West River
VT11-16	Mill Brook Trib 6	1.6	Below the confluence of 2 watersheds that drain Bromley Mtn ski area
VT11-16	Mill Brook Trib 6	1.9	Below Bromley spray disposal area
VT11-16	Winhall River	6.4	Off Kendall Farm Road, below proposed spray disposal area for Stratton Corp
VT11-16	Winhall River	7.1	Off Kendall Farm Road, above spray disposal area for Stratton Corp
VT11-16	Winhall River	8.1	Above IP Co bridge about 100 meters
VT11-16	Cook Brook	8.1	
VT11-18	Burnt Meadow Brook	1.0	At end of Red Pine Rd (in from jct of this & Landgrove Hollow Road)
VT11-18	Flood Brook	4.0	Below Forest Mtn Rd about 100 m, first riffle
VT11-18	Flood Brook	6.1	Below Hapgood Pond outlet about ¼ mile, at USFS fish mon site trail crossing
VT11-18	Flood Brook	7.2	Above Hapgood Pond about ½ miles, just below North Rd
VT11-18	Greendale Brook	1.2	Just above small tributary that blew out in 2006 from beaver pond failure. Site is just above a small pullout on right side of road. Stream moves away from road at the site
VT11-18	Jenny Coolidge Brook	0.4	Located above bridge 1000ft.

Table 3. Biological monitoring needed in the West River watershed

Waterbody id	Stream or river name	Location/number of sites	Comments
VT11-08	Wardsboro Brook	1 or 2 sites	No sites on this stream.
VT11-09	Rock River	rm 1.5	Last sampled in 1993.
VT11-18	Flood Brook	rm 6.1	Last sampled in 2008 and it was fair (3rd year of failing wqs). We need an update and then to discuss.
VT11-18	Thompsonburg Brook	rm 2.4	Last sampled in 1990.

E. coli Sampling

The Southeastern Vermont Watershed Alliance is the new name for the West River Watershed Alliance (WRWA) and it is this organization that has been conducting the E. coli and other monitoring in the West River. The Southeastern Vermont Watershed Alliance continues the work of the WRWA but expands sampling into the Saxtons River and Williams River and even Whetstone Brook. Site names were changed as well from the SH (swimming hole) and GW (general water quality) system to river name and rivermile. Table 3 below gives E. coli geometric means for the 2007 to 2013 season and Table 4 gives site identification information.

Table 4. E. coli geometric means for the season

	2007	2008	2010	2011	2012	2013
West 0.08	76	97	163	74	63	110
West 0.5	----	---	----	68	81	---
West 1.42	----	----	46	76	84	91
West 6.4	35	64	35	33	56	85
West 9.5	76	80	----	----	----	----
West 13	79	89	59	69	82	123
West 16	----	181	47	----	73	89
West 19	74	112	----	----	----	----
West 26.7	19	24	----	----	----	----
West 36	483	----	168	91	212	148
West 36.1	----	----	----	57	262	149
West 36.2	129	212	147	----	----	----
West 38.5	----	----	----	66	132	122
West 39						

Table 5. E. coli sampling sites locations

Site	Old site id	Stream or River Site Description
West 0.08	SH1	Milkhouse Meadows
West 0.5	----	Above West .08
West 1.42	----	Behind Brattleboro Professional Center
West 6.4	SH4	Dummerston Covered Bridge
West 9.5	SH7	Topitzers Beach
West 13	SH8	Brookline Bridge
West 16	----	Ellen Ware Road swimming hole
West 19	SH9	Scott Covered Bridge
West 26.7	SH10	Jamaica State Park
West 36	SH12	So. Londonderry, Rowes Road
West 36.1	----	So. Londonderry, above Route 100 bridge
West 36.2	GW19	Cobb's swimming hole
West 38.5	----	South entrance to Mountain Marketplace
West 39	----	Below Route 100 and dam Londonderry

Ball Mountain Brook Watershed

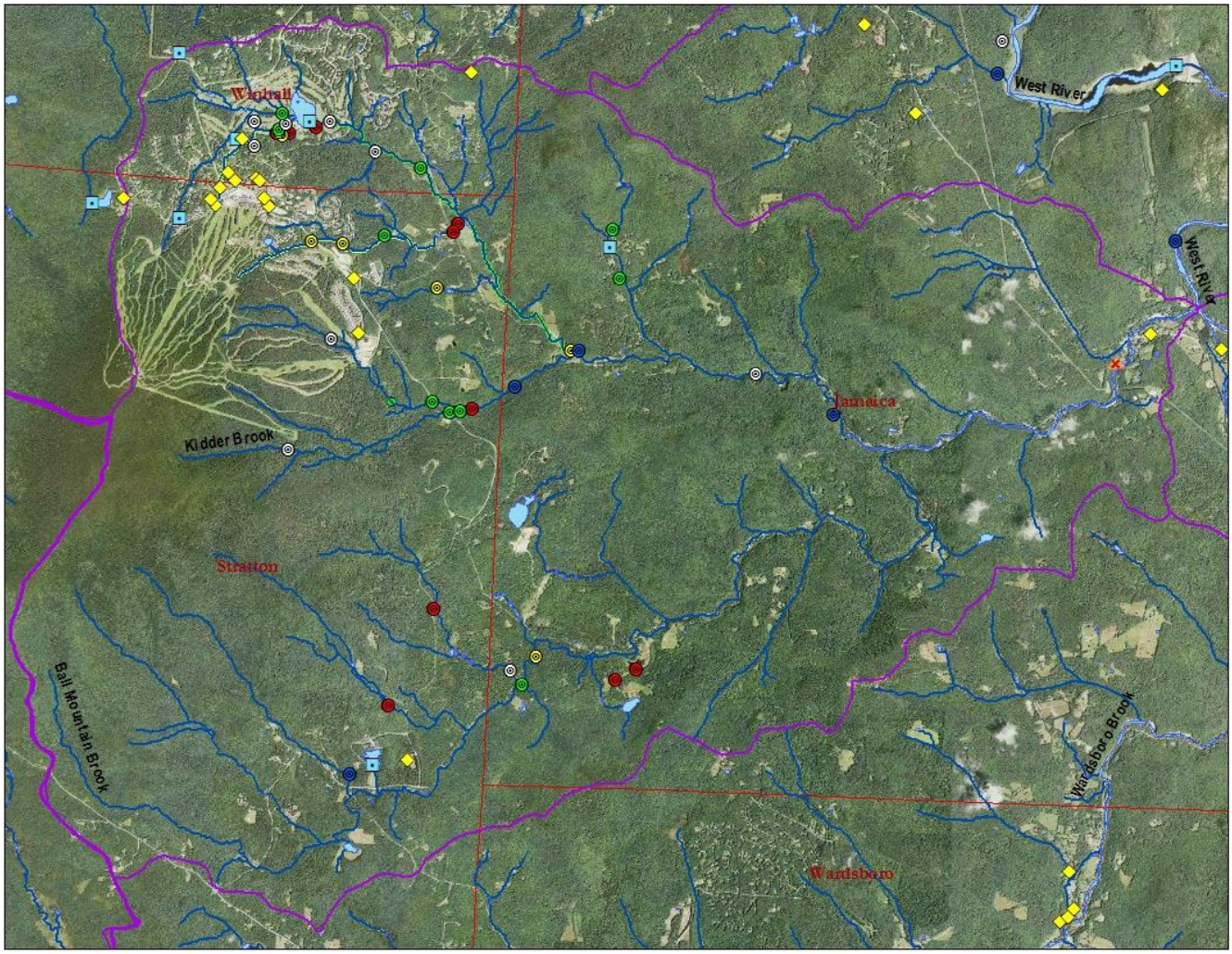

Figure 3. Ball Mountain Brook watershed with biosites, haz sites, dams

General Description

The Ball Mountain Brook watershed is a mountainous watershed and due to both ski area development and acid rain has had a number of impacts to its rivers and streams documented. Ball Mountain Brook originates off the southern slopes of Stratton Mountain and overall flows east-northeasterly to the West River with a number of small tributaries coming into it. The North Branch Ball Mountain Brook drains the Stratton Mountain ski area development - both the ski slopes themselves and all the associated roads, parking, and residential development. Pinnacle Brook, Kidder Brook (and its trib Sunbowl Brook), Brazer Brook, and Styles Brook flow into North Branch Ball Mountain Brook. Tributary 1 and Tributary 2 to Stratton Mountain Lake (or Stratton Lake or Stratton Pond), which is an impoundment on the North Branch Ball Mountain Brook, are additional tributaries.

Assessment Status

The segments of streams and brooks in the Ball Mountain Brook watershed that are impaired, altered, or stressed are given in Table 1 above with the rest of those in the West River watershed. However, due to the number of sampling sites and various impacts to waters in this subwatershed, the Ball Mountain Brook subwatershed information is also presented below.

Impaired Miles

Styles Brook: 2.0 - upstream from mouth - aesthetics and aquatic biota/habitat impaired due to sedimentation from land development activities, parking lots, streambank erosion and watershed hydrology changes.

Ball Mountain Brook: 8.4 - above North Branch Ball Mountain Brook confluence to headwaters - aquatic biota/habitat impaired due to low pH from atmospheric deposition.

Kidder Brook (Class A): 2.2 - from confluence of Sun Bowl Brook upstream to headwaters - aquatic biota/habitat impaired due to low pH (critically acidified; chronic acidification) from atmospheric deposition.

Bear Mountain Brook: 1.5 - from rm 0.7 to headwaters - aquatic biota/habitat impaired due to low pH (critically acidified; chronic acidification) from atmospheric deposition.

North Branch Ball Mountain Brook: 0.4 miles - below Stratton Pond – aesthetics impaired due to “black rocks” – staining of the stream substrate due to high levels of Mn from the onstream pond .

Stressed Miles

Ball Mountain Brook: 6.7 - mouth to West Jamaica (overlap of 3.7 miles with stretch above - North Branch confluence to West Jamaica is 3.7 miles) - aquatic habitat and aesthetics stressed due to habitat alteration, turbidity/sedimentation from flooding and flood repair work, channelization, berming, and developed land runoff.

Tributary #2 to Stratton golf course pond: 0.5 - aquatic biota/habitat stressed due to siltation/sedimentation from road/drive and other runoff. Lack of riparian vegetation in some places still a concern but temperatures are better with onstream pond removal.

Assessment Information

There have been many years of biological monitoring in the Ball Mountain Brook watershed, and especially in the North Branch Ball Mountain Brook subwatershed, due to impacts from the ski area development and acid precipitation. Stratton Mountain Resort has been sampling and reporting on six small streams over most of the years from 1999 to the present as part of its Water Quality Remediation Plan. The streams sampled include Tributary 1 and Tributary 2 to Stratton Pond on the North Branch, Styles Brook, Kidder Brook, Brazers Brook, and Sunbowl Brook. There is an excellent color-coded "Historic Summary of Biomonitoring Results & Remediation Projects" from 1999 to 2012 that was done by Stratton's consultant VHB.

North Branch Ball Mountain Brook

Table 6. Site locations of biological sampling on North Branch Ball Mtn Brook

Rivermile	Old site id	Site description
Rm 0.4	----	Below Pikes Falls, above confluence with Ball Mtn Brook about 3000 feet
Rm 2.2	MP28	Below confluence with Kidder Brook about 200 meters
Rm 3.9	----	Above the cement bridge off a side road to Upper Taylor Hill Road near the Stratton/Winhall Town line
Rm 4.3	MP25.9	Above Upper Taylor Hill road about 0.5 miles
Rm 4.7	MP24.8	About 400 meters below Stratton Lake

Table 7. Macroinvertebrate sampling North Branch Ball Mtn Brook 1989 to 2013

Year	Rm 0.4	Rm 2.2	Rm 3.9	Rm 4.3	Rm 4.7
1989	----	exc	exc	----	----
1991	----	exc-vgood	very good	----	----
1992	----	very good	----	----	----
1997	----	----	exc-vgood	----	very good
1998	----	good-fair	exc	exc	good
1999	----	exc-vgood	exc	---	exc-vgood
2000	----	vgood-good	good-fair	----	very good
2001	----	exc-vgood	exc-vgood	good	good-fair
2002	----	exc	----	----	fair
2003	----	exc	good	exc	good-fair
2004	----	exc	----	exc	very good
2005	----	very good	----	fair	fair
2006	----	exc-vgood	----	good	fair
2007	---	exc	----	poor	good-fair
2008	exc (exc)[1]	exc	----	vgood-good	----
2009	----	----	----	good	vgood-good
2010	----	----	----	good	good
2012	----	----	----	vgood-good	----
2013	----	----	----	very good	very good

1. a fish community sample was done at rm 0.4 in 2008 and was excellent also

Table 8. Macroinvertebrate sampling results from Tributary 1 (to Stratton Pond and North Branch Ball Mtn Brook) from 1990 to 2012

	rm 0.1	rm 0.3	rm 0.4	rm 0.5
1990	fair	----	----	----
1997	----	----	poor	----
1999	----	----	poor	----
2000	----	fair	poor	fair
2001	good-fair	----	poor	poor
2002	----	fair	----	----
2003	good	fair	----	----
2004*	very good	fair	vgood-good	vgood-good
2005	fair	fair-poor	----	good-fair
2006	fair	fair	poor	----
2007	fair	fair-poor	----	----
2008	fair	fair	good-fair	----
2009	good-fair	---	fair	---
2010	good	---	good	---
2012	very good	----	good	----

*** the sites 0.1, 0.4, and 0.5 were sampled in November past the usual sampling window**

The entry on the Part D Impaired Waters List (impaired waters that have a TMDL) until the 2014 listing cycle was: Tributary #1 to Stratton Mtn Lake: 0.5 - upstream from pond - aquatic biota/habitat and aesthetics impaired due to nutrient enrichment, iron leachate, siltation/sedimentation, watershed hydrology changes, sloughing banks and lack of riparian vegetation. In the 2014 305(b)/303(d) cycle, Tributary 1 was removed as the macroinvertebrate sampling shows the stream no longer impaired.

Water quality monitoring was done by the consultants VHB for Stratton in 2013 (as well as in earlier years) on Tributary 1 (site MP-TC). The 2013 round of sampling found the chloride concentrations of the two samples taken at baseflow (230 and 240 mg/Liter) above the EPA guidance value of < 230 mg/L; and conductivity was high at 891 umho/cm. Monitoring during a 1.2 inch rain storm event (9/12/2014) found conductivity at 874 and turbidity was 88 NTU.

The four temperature readings taken on Tributary 1 are important to note as it appears that storm events may affect stream temperature. See Table 9 below:

Table 9. Temperature data for Tributary 1

Date	Time	Flow type	temperature (°C)
8/16/2013	9:25 a.m.	Baseflow	13.4
9/06/2013	9:25 a.m.	Baseflow	11.4
9/10/2013	1:35 p.m.	Storm event flow (0.26”)	13.7
9/12/2013	3:40 p.m.	Storm event flow (1.20”)	15.8

Based on these sampling results, the sources of runoff should continue to be evaluated and reduced with chloride, conductivity, turbidity, and warmer water could result in an impact to an aquatic community currently recovering.

Table 10. Macroinvertebrate sampling results on Tributary 2 (to Stratton Pond and North Branch Ball Mtn Brook) from 1999 to 2013

Year	Rivermile 0.1
1999	fair
2000	fair
2001	good-fair
2002	good-fair
2003	good
2004	good
2005	good-fair
2006	good
2007	exc-vgood
2008	good
2009	good
2010	very good
2012	very good - good
2013	very good

Water quality monitoring was also done on Tributary 2 to Stratton Pond/North Branch during baseflow and storm events twice each in 2013. Substrate and aquatic habitat conditions were also assessed in addition to the chemistry and biomonitoring on this stream. During the baseflow conditions, there weren't the same levels of chloride and conductivity as seen in Tributary 1. During the storm event sampling (same 9/12/14 and 1.2" event), conductivity jumped to 1887 (average was 468 during baseflow), turbidity was 100 NTUs, and the temperature jumped to 16.1°C (average was 12.5 during baseflow).

Figure 4. Trib 1 & Trib 2 to Stratton Pond & Adjacent Land Use

Tributary 2 had substrate embeddedness of 25-50% and fines at 22%. The embeddedness was higher than the 2012 results and percent fines have "increased steadily since 2009." Bank stability was rated at 50 to 75%, which was an improvement over the 2012 results.

Again some of the storm event sampling results and the habitat conditions indicate that stormwater runoff should be examined so that increased turbidity, temperature, deposition of fines, and other water quality effects do not lead to decreased health of the aquatic community.

Styles Brook

Vermont DEC assessed Styles Brook in 1994 and then again in Sept 1998 - the biological integrity of the macroinvertebrate community was "fair" in both years. The community was low in density, richness and EPT richness and Oligocheates formed a significant component (28%). Brook trout were the only fish species present with low numbers but not abnormal. There was a high percentage of sand in the substrate, which was also coated with a fine clay/silt material. Macroinvertebrate assessments from 1999 to the present are given in Table 10 below.

Table 11. Macroinvertebrate sampling on Styles Brook 1999-2013

	Rm 0.1 then rm 0.3*	Rm 0.8
1999	fair	fair
2000	good-fair	fair
2001	fair	fair
2002	good-fair	fair
2003	fair	vgood-good
2004	fair	fair
2005	fair	----
2007	----	fair
2008	----	fair
2009	----	fair-poor
2010	----	fair
2012	----	good
2013	----	good-fair

* **Rm 0.1 through 2003 and then rm 0.3 starting in 2004**

Two sites were sampled for water quality parameters, substrate conditions, aquatic biota, and aquatic habitat on Styles Brook in 2013. Site MP-13E is near the Tree Top development area but upstream of Parking Lot #2 and the Maintenance Area. Site 14 is co-located with the ANR biomonitoring site at rm 0.8, which is downstream of all of these developments.

During baseflow conditions, MP-13E had an average pH of 7.85, average chloride of 76.0 mg/L, average conductivity of 352, and average temperature of 12.3°C. During the September 12 storm event (1.2" rain), the pH was 7.9, conductivity was 218, and temperature was 17.2°C. (It is important to note that on September 6, the water temperature at baseflow was 11.6°C). The substrate and habitat assessments at MP-13E had embeddedness of 25-50%, 15% fines, and bank stability of only 25-50%.

For the MP-14 site on Styles Brook below tributaries draining the parking lot, Basin 18, and the Maintenance Area, the 2013 sampling results were average pH 7.85, average chloride of 125 mg/L, average conductivity of 477 umho/com, and average temperature of 12.3°C (two sampling dates) at baseflow; pH 8.00, conductivity of 324, temperature of 16.9°C, and turbidity of 194 NTUs (again averages of two sample dates) following storm events; 225-50% embeddedness, 18% fines, and 25-50% bank stability.

As seen in Table 9 above, Styles Brook macroinvertebrate community is only in “good-fair” health. Information from storm events sampling at the outlets of five culverts indicate possible reasons for the good-fair condition at rm 0.8 and also highlight where changes could occur to improve water quality and aquatic health.

Table 12. Some water quality results following 9/12/14 storm event with 1.2” rain

	Location	water temp	turbidity	TSS
E-C1	Outlet of roadside culvert, below sand pile and Stratton Mtn Road	19.6 (15.2)*	525.8	106
E-C2	Outlet of roadside culvert, below sand pile and Stratton Mtn Rd. Inlet to Basin 18.	19.9 (no flow)	198.2	527
E-C2a	Outlet of Basin 18 at culvert outlet above confluence with Lot 2 channel	21.1 (no flow)	601.2	262
E-C6	Outlet of roadside culvert, below Stratton Mtn Rd and Maintenance Area	18.7 (15.6)	377.6	560
E-CM	Outlet of roadside culvert, near intersection of Stratton Mtn Rd and Brazer’s Way, downslope of Maintenance Basin	20.1 (15.4)	27.7	45

*** Smaller storm (0.26”) two days earlier results in parens**

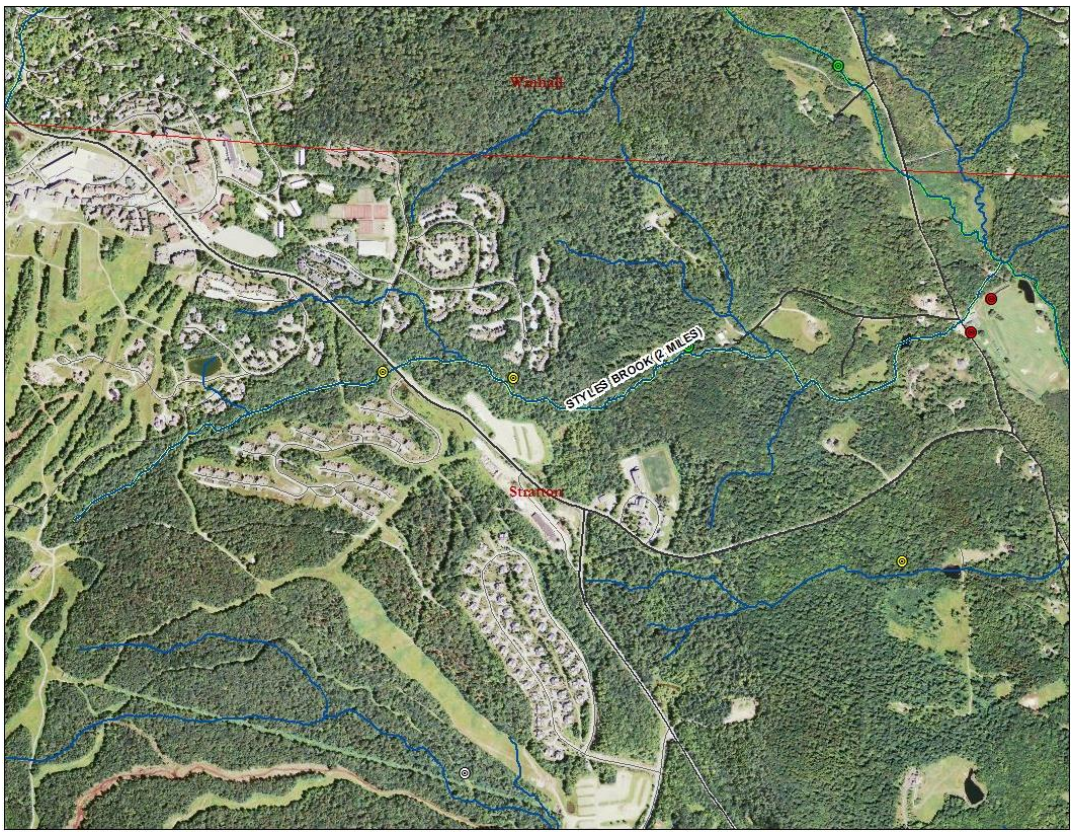

Figure 5. Styles Brook watershed land use

Brazer Brook

Macroinvertebrate sampling results at rm 0.7 on Brazer Brook have been in flux since 1992. The community was "very good" in 1992; "good in 1993; "good" in 1999; "fair" in 2000; "poor" in 2001; "fair" in 2003; "very good" in 2004; "good" in 2005; "fair" in 2006; and "good-fair" in 2008.

Pioneer's (now VHB) macroinvertebrate sampling found a "fair" community in 2003 and a community that meets Class B2/B3 standards in 2004. They sampled at point mapped as MP-16, which is about the sample location as DEC rm 0.7.

Sunbowl Brook (trib to Kidder)

"A total of 12 years data on Sunbowl Brook show this stream reach to be consistently in very good to excellent condition. In 2002 and 2003, the reach was moderately low in richness and EPT taxa and was rated as good-very good as a result. In 2004, the community was again in excellent to very good condition." Since 2004, the tributary has stayed healthy with macroinvertebrate community assessments of "very good-good" in 2005 and 2006 and "excellent" in 2007 and 2008.

Post-Irene in September 2011, Sunbowl Brook was in “fair-poor” condition with very low abundance of macroinvertebrate organisms, however by fall 2012, the community was assessed as “very good-good”.

Kidder Brook

Table 13. Macroinvertebrate sampling on Kidder Brook from 1991 to present

	Rm 0.5	Rm 0.7	Rm 0.8	Rm 0.9
1991	----	----	----	good
1992	----	good	----	? (2 samples)
1993	----	fair	----	? (2 samples)
1994	----	----	----	
1999	----	----	----	good-fair
2000	----	----	----	good-fair
2001	----	----	----	fair
2002	----	----	----	good-fair
2003	----	----	----	good-fair
2006	----	----	----	exc-vgood
2008	----	----	----	very good
2009	----	----	----	good
2010	----	----	----	good
2011	poor	----	poor	fair-poor
2012	exc-vgood	----	vgood-good	vgood-good

Table 14. Biological Sampling Site Locations on Kidder Brook

Site	Stream or River Site Description
Rm 0.5	Located about 1/2 way between Cross-Stratton Rd and Pikes Falls Road below small drainage entering from the north (this would receive SW from "Powers" development)
Rm 0.7	Located right below the confluence with Sunbowl Brook
Rm 0.8	Located immediately below the Cross-Stratton Road.
Rm 0.9	Located above Cross-Stratton Rd about 50m, above Sunbowl Bk.
Sunbowl Brook Trib to Kidder	

Pinnacle Brook

Biological sampling on Pinnacle Brook in 2003 found a "good" macroinvertebrate community at rm 0.8 and a "good-fair" community at rm 1.2.

Bear Mountain Brook

The macroinvertebrate community has been sampled on this brook at rm 0.7 from 2002 through 2008. The assessment has always been "fair" except for 2003 when it was "good-fair".

Information Sources

Ball Mountain Brook Watershed Stream Geomorphic Assessment Phase I and Phase 2 Report, summer 2004, 2005. December 9, 2005. Windham County Natural Resource Conservation District, Brattleboro, Vermont.

Memo from Steve Fiske, aquatic biologist to Doug Burnham, Chief Vermont DEC Water Quality Division, Biomonitoring and Aquatic Studies Section, July 25, 2005. Comments, Recommendations on Stratton Mtn. Resort 2004 Annual Performance Report.

Southeastern Vermont Watershed Alliance Water Quality Monitoring Program 2010 & 2011 Report, January 2012. Prepared by: Laurie Callahan, Water Quality Monitoring Program Coordinator.

Stratton Mountain Resort Master Plan Water Quality Remediation Plan Annual Performance Reports 2000 through 2013, May 17, 2001 – July 11, 2014.

Steve Fiske, Vt. DEC Water Quality Division Biomonitoring Section - data on unnamed tributaries 1 & 2 to golf course pond, North Branch Brook and Styles Brook. Also November 7, 1997 memo on unnamed tributaries to Stratton golf course pond.

How Clean is the West River?, Bonnyvale Environmental Education Center, 1998. Results of the West River Watch Project June - November 1997 - had E. coli, temperature and pH data for the West River and tributaries.