White River Watershed Water Quality and Aquatic Habitat Assessment Report

November, 2012

Watershed Management Division
Department of Environmental Conservation
Agency of Natural Resources
Montpelier, Vermont
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Introduction to the 2012 White River Assessment Report

This copy of the White River Water Quality and Aquatic Habitat Assessment Report is an update of the report originally done in November 1997, which was then updated in 2002. The following changes, additions, deletions were made since the 2002 report:

- The watershed was broken up into seven subwatersheds for the purposes of presenting the information on: the lower, mid, and upper White River subwatersheds; the Tweed River subwatershed; and the First, Second, and Third Branches subwatersheds.

- Five appendices were removed that included: a table of the major floodplain forests; a list of all the dams and their status; a buffer analysis of the mainstem done in the mid 1990s that was out-of-date; population and housing data tables; and individual waterbody reports. The dams and floodplain forest lists can be seen in the earlier report or gotten from the Water Quality Division Streamflow Protection Section and the Fish and Wildlife Department's Natural Heritage Program respectively. New waterbody reports can be generated at any time and their current contents are summarized in this report.

- New biological site information has been added to the seven subwatersheds sections.

- General maps have been made for each of the subwatersheds.

- The White River Partnership *E. coli* data and a table of their site locations are included.

- Specific uses and values of the rivers and streams as well as specific stretches with problems are highlighted.

- More information about lakes and ponds is provided than in the past including the summary status from the new "Lake Scorecards".

- Four stream geomorphic assessment reports were reviewed and information from their conclusions have been added.

General Description of the Basin *

The White River Basin encompasses 710 square miles or approximately 454,400 acres in Vermont draining portions of Addison, Orange, Rutland, Washington, and Windsor Counties. The White River itself is approximately 56 miles long. It originates in the town of Ripton on the slope of Battell Mountain then flows southerly and easterly before emptying into the Connecticut River at White River Junction in the town of Hartford. The Vermont Department of Environmental Conservation (DEC) has a count of 457 waterbody miles for the watershed, which includes two mainstem segments (VT09-01, VT09-02) and five subbasins (VT09-03-VT09-07).

The White River has five major tributaries: the First Branch with a length of 24 miles and drainage area of 103 square miles; the Second Branch with a length of 20 miles and a drainage area of 74 square miles; the Third Branch with a length of 19 miles and a drainage area of 136 square miles; the Tweed River with a length of 10 miles and a drainage area of 51 square miles and the West Branch with a length of 10 miles and a drainage area of 43.4 square miles. More detail is given on the subwatersheds of the First Branch, Second Branch, Third Branch, and Tweed River starting on page 17.

The White River is significant for being one of the last free-flowing rivers in Vermont. As the longest undammed tributary to the Connecticut River, the White River is very important to the Connecticut River Atlantic Salmon Restoration Program – a federal program aimed at revitalizing Atlantic salmon populations. The White River watershed is also a designated *Special Focus Area* of the US Fish & Wildlife Service Silvio O. Conte National Fish & Wildlife Refuge because the watershed provides nursery and rearing habitat for juvenile Atlantic salmon and potential spawning habitat for adults.

Table 1. Landcover of the White River Watershed in 2006

Code	Landcover (2006 NLCD)	Acres	Percent of Basin
11	Open Water	1,329	0.3
21	Developed, Open Space	13,492	3.0
22	Developed, Low Intensity	5,379	1.2
23	Developed, Medium Intensity	1,667	0.4
24	Developed, High Intensity	203	0.0
31	Barren Land	302	0.1
41	Deciduous Forest	202,519	44.5
42	Evergreen Forest	72,651	15.9
43	Mixed Forest	104,225	22.9
52	Shrub/Scrub	8,882	1.9
71	Herbaceous	2,191	0.5
81	Hay/Pasture	27,755	6.1
82	Cultivated Crops	10,681	2.3
90	Woody Wetlands	3,938	0.9
95	Emergent Herbaceuous Wetlands	319	0.1
	Total:	455,534	100.0

Exceptional Uses and Values of Basin Waters

The entire length of the main stem of the White River, at approximately 50 miles, is the longest free-flowing large river in the state because of the lack of flow-regulating dams. It is unique and significant for this characteristic.

Waterfalls, Cascades and Gorges

Waterfalls, cascades and gorges are abundant in the White River Watershed. Four sets of falls or cascades were identified in the early *Waterfalls, Cascades, and Gorges of Vermont* by Jerry Jenkins and Peter Zika in 1988. One of these and a very well known waterfalls, Moss Glen Falls I, is located on Deer Hollow Brook in Granville Gulf Natural Area. Another and equally well-known waterfall is Texas Falls on the Hancock Branch in Hancock. It is a small gorge and cascade with a small falls and some nice pools.

Another important waterfall and cascades in the White River watershed is the Web Falls and Granville Cascade Chain on Sandusky Brook in Granville. Sandusky Brook is a tributary to the Third Branch.

Cascades, waterfalls, gorges and pools occur in the headwaters of many streams in the basin, including the White River in the Green Mountain National Forest in Granville, on Thatcher Brook in Granville, and on Fletcher Brook in Stockbridge. Several additional falls and/or cascades discovered during field work are briefly described in the appropriate subwatershed sections below.

Swimming

An abundance of swimming holes are located in the White River basin. Fourteen sites were identified in *The Swimming Hole Study* and the authors acknowledge that their study focused on the White River mainstem between Stockbridge and Bethel and so many sites may not have been captured in the report.

The White River mainstem contains many large holes with jumping ledges, including Big Parker Swimming Hole in Bethel, Twin Bridge Swimming Hole in Gaysville, Little Parker in Stockbridge, plus many other unnamed holes along its entire length. Tubing is also popular along the river, with at least one tube rental establishment in Gaysville. An important swimming hole is located on the Tweed River, near its mouth in Stockbridge. There are also swimming holes on the Third Branch in Braintree, and on Locust Creek in Bethel. The sites are described in the sections on specific branches or sections of the White River mainstem below. The degree to which Tropical Storm Irene changed these sites is not yet described.

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

There are a total of 143 occurrences of species or natural communities in the White River watershed that are considered state significant. Of these 143 occurrences, 87 are plant species, 15 are animal species, 40 are natural communities, and one is a bat hiberniculum. A number of the significant natural communities identified in the basin are communities integrally connected to the White River itself. Three of the community occurrences are Calcareous Riverside Seeps found along the stretch of river that flows through Sharon, Pomfret and West Hartford. Five of the significant community occurrences are Sugar Maple-Ostrich Fern Riverine Floodplain Forest community. One of the community occurrences is the Riverside Sand or Gravel Shore community - a community that is the product of dynamic river systems. Spring flooding or other high water and ice scour shape these often sparsely vegetated depositional communities.

An inventory and study of the state's floodplain forest communities was conducted by the state Natural Heritage Program in 1997 and it was during that inventory that the White River floodplain communities were described. Along the Third Branch, from Gilead Brook upstream to above Randolph Village, there is a stretch containing a number of significant floodplain forest communities. This 6.5 mile length of floodplain vegetation may be an important wildlife corridor as well as buffer for the aquatic habitat.

Some of the other significant natural communities are various unique and interesting wetland communities including Rich Fens, Red Maple-Black Ash Seepage Swamps, and Hemlock-Balsam Fir-Black Ash Seepage Swamps among others.

Boating

The White River has one of the longest uninterrupted kayak runs on a major river in New England and is known nationally for this fact. From Stockbridge to Bethel, the river is considered a classic Vermont whitewater run. The first three miles from Stockbridge contains intermittent Class II rapids. The last three miles to Bethel are quickwater. From Bethel to the Connecticut River, the river is mostly quickwater, but there are a variety of short drops and narrows and Class II rapids.

The first portion of the First Branch below Chelsea is Class II with a low Class III segment, and is a nice whitewater run. The next segment downstream contains a mile of interesting ledges, followed by a nice touring section.

The Third Branch of the White River is boatable from Roxbury to Randolph. Whitewater boating also takes place on the Hancock Branch, from its confluence with the Robbins Branch to the White River. The Hancock Branch is hydrologically distinguished by being the smallest stream in the state known to be used as a whitewater run. It is a Class II run with some Class III spots, lots of rocks and current.

Fisheries of the White River and Its Tributaries

An update on the fisheries of this watershed is given in each subsection below. The information was updated by Tim Appleton of the Department of Fish and Wildlife in February 2012 and reviewed by Rich Kirn of DFW in April 2012.

Lakes with Special Significance or Features

Vermont DEC's Lake Protection Classification System is a framework within which lakes can be evaluated for their special significance when compared to other lakes statewide. The Lake Protection Classification System identifies unique lakes based on: wilderness status; occurrence of scenic and natural features; existence of very high water quality; and/or, the presence of rare, threatened and endangered species. Additionally, lakes considered threatened by nutrient enrichment, Eurasian watermilfoil, toxic contamination and acid precipitation are also identified. One Basin lake, North Pond in Brookfield, is notable for its Lake Protection Classification System ranking as "wilderness-like" (i.e. undeveloped) and another, Rood Pond, is notable in that it provides public lake access in an area of the state with relatively few lakes. The ponds are described more in the subwatershed sections below.

Activities Potentially affecting Basin Waters

Permitted Discharges in the Watershed

Four wastewater treatment facilities (Bethel, Royalton, Chelsea, Randolph) and one fish hatchery discharge to waters of the White River watershed. There are 53 issued operational permits and 38 issued construction permits in the White River watershed as of July 30, 2012.

Dams in the Watershed

In the summer of 2001, the Vermont Agency of Natural Resources and Vermont Division for Historic Preservation sponsored a dam assessment in the White River and Lamoille River watersheds. A total of 104 dams were assessed in the White River watershed. Among these, 52 were intact and in good condition, 4 intact and in fair condition , and 6 intact but in poor condition. A total of 39 dams were breached: 28 fully breached (no remnants or abutments only), and 11 partially breached (approximately 75% of dam structure remains, though does not necessarily impound any water). Three dams were beaver dams, and were not fully assessed.

A large number of the dams (58) were earthfill dams creating a ponded impoundment used for recreation. Out of 62 intact dams, 38 consisted of this type of privately owned pond.

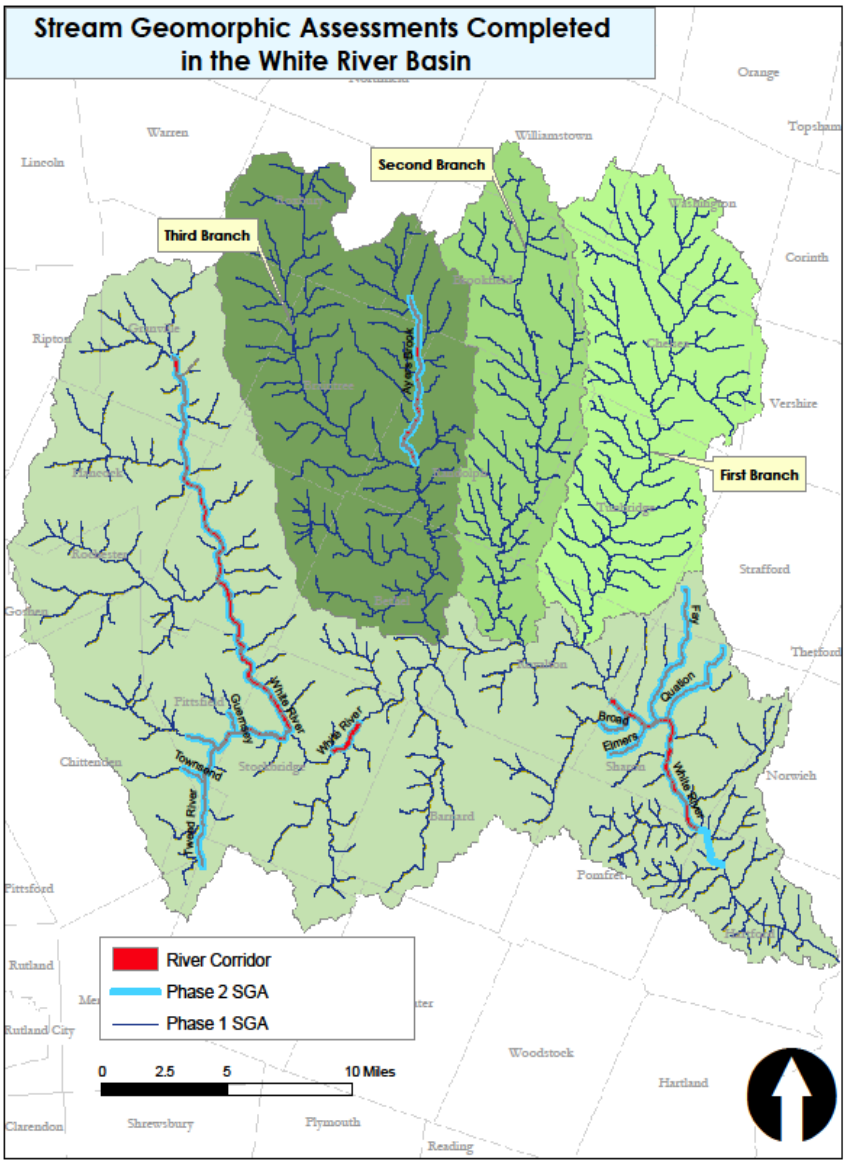
The majority of these dams were constructed within the last 30 years, many within the last 5-10 years. These possess little or no cultural significance at this time. In the White River watershed, 14 dams are over 50 years old, of which 11 are intact and 3 are partially breached. Out of a total of 38 dams breached (full and partial), at least 13 were known to be hydropower sites. More research would most likely uncover that a much higher number of dams were actually used for hydropower. Out of 104 dams, only 16 currently demonstrate some kind of cultural or historical significance.

Physical Alterations

A number of physical alterations including straightening of the channel and dredging, encroachments on the floodplains, and inadequately sized or placed culverts and bridges have caused impacts to the White River basin rivers and streams. Stream Geomorphic Assessments at the Phase 2 level have been done on the Upper White River (from the Tweed River mouth up to Alder Meadow Brook mouth), the Tweed River, the first reach of Guernsey Brook and Townsend Brook, the White River where it flows through Sharon, Ayers Brook, first reach of Broad Brook, Quation Brook, Fay Brook, and Elmers Brook. See the map below for the stream stretches where Phase 1, Phase 2, and River Corridor level physical assessment work was done.

The Stream Geomorphic Assessments provide insight into how river reaches have evolved in response to historical and existing physical alterations. Generally, encroachment and channelization can lead to increased power in the channel and downcutting of the stream bottom, so that the stream no longer spills over its banks onto a floodplain during annual or biennial flooding. As the higher banks are weakened by increased stream power, erosion of the banks and widening may ensue. Often, practices such as bank armoring, straightening, and dredging have occurred at this point, causing the river to return to downcutting the stream bed. However, if the stream is permitted to adjust, it may eventually rebuild its bed with sediments, and it may move from side to side to create a new floodplain it can access at the new lower elevation.

Using channel cross sections and other field data, assessors can assign reaches to a particular stage of a channel evolution process. For the portions or all of the ten Phase 2 assessed streams and rivers named above, 64% of these assessed reaches are in Stage III of channel evolution. This means these streams have scoured away their beds, and are now widening and beginning to build up sediments in the channel. Only during greater flood events, if at all, are they able to access their floodplains - only about 15% of the assessed reaches appear to have access to floodplains on a 1-2 year basis.



Eighty-four bridges and 454 culverts have been assessed using DEC Stream Geomorphic Assessment protocols to identify structures that may have some degree of geomorphic incompatibility with the stream. Geomorphic incompatibility means the structures have a high likelihood of failure due to:

- systemic channel adjustments unrelated to the structure but that are caused by other watershed stressors, and/or
- the disruption of fluvial geomorphic processes caused by the structure being inadequately designed and/or poorly located.

A description of some of the geomorphic assessment results from the basin rivers and streams where there was a Phase 2 level of assessment done are in the basin subwatershed discussions starting on page 17.

Causes and Sources of Impairment or Stresses to Streams

The word “causes” in terms of impacts to surface waters in this document refer to either pollutants or conditions that cause a stress or an impairment to the designated uses of the waters (uses being swimming or aquatic life – more on this in the following section).

In the White River Watershed overall, sediment, temperature, pathogens, changes to the physical stream habitat, nutrients, and metals have the greatest documented impact.

Table 2. Pollutants or Conditions that Stress or Impact Water Quality or Habitat

Pollutant or Condition	High Impact (miles)	Stressed (miles)	Total Impact (miles)
Sediment/Siltation	0	109.0	109.0
Pathogens	0	103.0	103.0
Temperature	0	85.3	85.3
Physical habitat alterations	0	52.3	52.3
Nutrients	0	27.5	27.5
Metals	0.2	0.5	0.7

Table 3. Sources of River Water Quality Impacts or Stresses

Source	High impact (miles)	Stressed (miles)	Total Impact (miles)
Agriculture	0	113.3	113.3
Removal of riparian vegetation	0	86.0	86.0
Streambank modification/de-stabilization	0	84.5	84.5
Road/bridge impacts/runoff	0	60.5	60.5
Channel Instability	0	27.5	27.5
Resource Extraction	0	15.3	15.3
Channelization	0	10.8	10.8
Landfills	0.2	0.5	0.7

Temperature monitoring

The White River Partnership monitored temperatures from 2001 through 2004. Following are some highlights of their results in 2001 on the mainstem. At rivermile (rm) 6.4, there were 4 days in a row when the water temperatures were at or above 77F in August. Several days on either side of those four had temperatures above 77F for 20-22 of the hourly readings. At rm 8.4, there were 2 full days in July and 7 full days in August when the temperatures (recorded each hour) were above 77F. At rm 13.0, there was 1 day in July and 4 days in August when the temperatures were above 77F for all 24 hours. At rm 22.8, 3 days in August each had temperatures above 77F for 20-21 hours.

In 2002, sampling sites in Pomfret, Sharon Royalton, Bethel and Stockbridge (from rm 8.4 up to above rm 33.4) on the mainstem White River had seven day maximum averages in mid-August of 82 - 84 degrees F. Most of the tributaries sampled had 7-day maximu averages in the 70s F with the following exceptions: the First Branch had 2 locations with a 7-day maximum average of 82 F and Gilead Brook had a 7-day maximum average of 67 F.

In 2003, it was the temperature thermographs were deployed in the tributaries where the 7-day maximum average ranged from 64 F on Broad Brook, Batchelder Brook, and Thurston Brook to 78 F on the Second Branch. Of the 16 sampling sites that season, nine had 60 something 7-day max averages, four had 70 or 71 7-day max averages, and three were above 72 F.

In 2004, the temperature sampling was again concentrated on the tributaries and the 7-day max average ranged from 67 F to 80 F. Most of the 7-day max averages were in the 70s (12 of the 16 samples). Ayers Brook and Riford Brook had 7-day max averages of 67 and 68 F respectively. The First Branch at Russel Road had a 7-day max average of 80 F in July.

Causes and Sources of Impairment or Stresses to Lakes and Ponds

Table 4. Acres affected by causes of impact or stress to Basin 9 lakes or ponds

Cause of Alteration	Aesthetics	Aquatic Biota/Habitat	Boating and Fishing	Fish Consumption	Swimming
Flow alteration	0	84	0	0	0
Cause of Impairment					
pH	0	2	0	0	0
Cause of Stress					
Eurasian Water Milfoil	70	70	70	0	70
Flow alteration	0	3	0	0	0
Mercury in Fish Tissue	0	0	0	418	0
Nutrients	109	25	109	0	109
pH	0	27	0	0	0
Phosphorus	109	25	109	0	109
Sedimentation/Siltation	124	40	124	0	124

Table 5. Acres affected by sources of impact or stress to Basin 9 lakes or ponds.

Source of Alteration	Aesthetics	Aquatic Biota/Habitat	Boating and Fishing	Fish Consumption	Swimming
Flow Alterations from Water Diversions	0	84	0	0	0
Source of Impairment					
Atmospheric Depositon - Acidity	0	2	0	0	0

Basin Water Quality and Aquatic Habitat Conditions

Rivers and Streams

Designated Use Support Status

Aquatic biota/habitat is the most affected designated use in the White River basin with approximately 110 miles stressed but under a mile impaired. Pathogens are affecting swimming as a use for 28 miles and are a threat to this use for 41 miles. The source of the bacteria used to indicate presence of pathogens is not known in most locations. Aesthetics are only partially supported for 33 miles and are threatened on 82 miles.

Table 6. Designated Use Support Status for Rivers and Streams

Use	Miles fully supported	Miles stressed	Miles altered	Miles impaired
Overall	346.6	110.5	0	0.2
Aquatic biota/habitat	347.6	109.5	0	0.2
Swimming	359.8	97.5	0	0
Secondary contact recreation	365.0	92.3	0	0
Aesthetics	400.6	56.5	0	0.2
Fish consumption	0	457.3	0	0

Lakes and Ponds

The White River Basin has relatively few lake acres: only four of Vermont's 17 major river basins contain fewer lake and pond acres. Following is the information available on use support of lake acres; and characteristics and available monitoring for individual lakes. More detail on individual lakes is given in the report subsections below.

Designated Use Support Status

Table 7. Use Support for Lake or Pond Uses in Acres for Basin 9

Use	Fully Supporting	Stressed	Altered	Impaired	Unassessed
Aesthetics	187	205	0	0	26
Aquatic Biota/Habitat	155	151	84	2	26
Boating and Fishing	187	205	0	0	26
Fish consumption	0	418	0	0	0
Swimming	163	205	0	0	37

Table 8. Lakes and Ponds in Basin 9

Lake or Pond	Town	Waterbody ID	Lake Acres	Watershed Acres	Outlet Type	Trophic Status[1]	Monitoring Data[2]	Water Quality[3]	Habitat[3]	Invasive Species[3]	Atmospheric Pollution[3]
AINSWORTH;	Williamstown										
ANSEL	Bethel	VT09-03L05	2	544			AcidMisc				
BABCOCK;	Sharon										
BEAVER MEADOWS	Chittenden	VT09-07L06	3	380							
BLAIR;	Hancock										
BM746;	Brookfield		9	4370							
CHAMPAGNE	Randolph	VT09-06L02	3	243			AcidMisc				
COLTON	Killington	VT09-07L03	27	501	artificial	M	AcidMisc, SpringTP	Good		Good	Fair
CRESCENT	Sharon	VT09-03L03	20	955			LakeAsmt, SpringTP	Good		Good	Fair
DOWNER;	Sharon										
FAY;	Strafford		10	223							
HANCOCK MT;	Rochester	VT09-07L07	14	319			LakeAsmt	Good		Good	Fair
HOLDENS	Brookfield	VT09-05L07	10	324							
HUTCHINSON;	Braintree										
JONES	Chelsea		2	54							
KEYSER;	Chelsea	VT09-04L01	7	532							
KINGS	Rochester	VT09-07L05	4	17							
LAMSON	Brookfield	VT09-05L02	24	230	natural		LakeAsmt, SpringTP	Good		Good	Fair
MCINTOSH	Royalton	VT09-03L01	23	606	artificial		SpringTP	Good		Good	Fair
MITCHELL	Sharon	VT09-03L02	28	4652	artificial	O	AcidMisc, RemapHg,	Good		Good	Fair

Lake or Pond	Town	Waterbody ID	Lake Acres	Watershed Acres	Outlet Type	Trophic Status[1]	Monitoring Data[2]	Water Quality[3]	Habitat[3]	Invasive Species[3]	Atmospheric Pollution[3]
							SpringTP				
MUD (BRAINT)	Braintree	VT09-06L05	10	681							
NORTH (BRKFLD)	Brookfield	VT09-05L04	24	829	natural with artificial control		LakeAsmt, RemapHg, SpringTP	Good		Good	Fair
NORTH (CHITDN)	Chittenden	VT09-07L02	3	35			AcidMisc, LakeAsmt	Good		Good	Fair
PICKLES	Brookfield	VT09-06L03	17	268			AcidMisc				
POMFRET;	Pomfret										
RANDOLPH-N;	Randolph	VT09-06L04	10	117							
ROOD	Williamstown	VT09-05L01	23	343	natural with art. control	M	LakeAsmt, SpringTP	Good		Good	Fair
ROXBURY FLAT;	Roxbury	VT09-06L01	13	1806							
ROYALTON HILL;	Royalton	VT09-03L04	11	199							
SHARON-E;	Sharon		8	304							
SILVER (BARNRD)	Barnard	VT09-07L04	84	1091	natural with artificial control	M	AcidMisc, LakeAsmt, LayMon, SpringTP	Good	Fair	Good	Fair
SKYLIGHT	Ripton	VT09-07L01	2	17	natural		AcidMisc, LakeAsmt	Good		Good	Poor
SOUTH (BRKFLD)	Brookfield	VT09-05L06	16	365	natural		LakeAsmt, SpringTP	Good		Good	Fair
STANDING	Sharon		15	76							
STAPLES	Williamstown	VT09-05L05	15	326							
STRAFFORD;	Strafford		18	209							

Lake or Pond	Town	Waterbody ID	Lake Acres	Watershed Acres	Outlet Type	Trophic Status[1]	Monitoring Data[2]	Water Quality[3]	Habitat[3]	Invasive Species[3]	Atmospheric Pollution[3]
SUNSET (BRKFLD)	Brookfield	VT09-05L03	25	2664	natural with artificial control	M	LayMon, RemapHg, SpringTP	Good		Good	Fair
TUNBRIDGE TROUT	Tunbridge		5	229							
TWIN	Brookfield		16	438							

1 - O=oligotrophic; M=mesotrophic; E = eutrophic; D = dystrophic
2 - Acid = Acid Lakes Program; LakeAsmt = Lake Assessment Program; LayMon = Lay Monitoring Program; RemapHg = Assessment of Mercury; SpringTP = Spring Phosphorus Program
3 – These four categories are components of the Lake Score Card that has been developed for each lake for which there is adequate information. The range of conditions is good, fair, poor.

Note that the use of a semi-colon (;) after the pond name denotes a water for which Vermont DEC has established a name based on USGS topographic map features. These names were established for tracking purposes, and may not reflect local pond names.

Specific Subwatersheds in the White River Watershed

Lower White River

Description

For this assessment report and for planning purposes, the Lower White River subwatershed consists of the White River mainstem from its mouth upstream to the Sharon/Royalton town line and the tributaries to this reach. The tributaries include: Jericho, Dimick, Podunk, Tigertown, Mill, Mitchell, High Pole, Quation, Fay, Whitewater Broad, and Sewall Brooks.

Figure 1. Lower White River (streams in yellow have been assessed geomorphically)

Biological Community Data

The following seven samples are the only biological community samples that have been taken in this stretch of the White River or its tributaries in the last 20 years. They are all macroinvertebrate community samples. Jericho Brook especially should be sampled again as the assessment result was on the border of good and fair in 2006.

Table 9. Biological Sampling Sites and Results in the Lower White River Watershed

Wbid	Name	Town	River Mile	Date	Bio Com	Assessment
VT09-01	White River	Hartford	1.9	09/1992	M	Excellent
VT09-01	White River	Sharon	14.0	10/1997	M	Good
VT09-01	White River	Sharon	14.0	10/1998	M	Fair
VT09-01	White River	Sharon	14.0	09/1999	M	Good
VT09-01	White River	Sharon	14.0	09/2001	M	Good
VT09-01	White River	Sharon	15.4	09/2006	M	Very Good
VT09-03	Jericho Brook	Hartford	0.1	09/2006	M	Good-Fair
VT09-03	Jericho Brook	Hartford	0.1	09/2006	F	Excellent

Fishery – mainstem from the First Branch confluence to the Connecticut River

Mainstem: Primarily wild rainbow trout, occasional brown trout, smallmouth bass and walleye in the lowest reaches of the main stem. VDFW owns a parcel of land along the White River at the I-89 overpass south of West Hartford Village.

Tributaries:

- Broad Brook- mix of wild brook, brown and rainbow trout. A major spawning tributary for lower reach of the White River. Atlantic salmon are not stocked here but run up from the main stem White River.
- Whitewater Brook- a small but heavily used spawning stream for rainbow trout, with wild brook trout also present.
- Fay Brook- wild brook trout and historically contained dense rainbow trout reproduction but has subsequently declined. A natural falls and dam exists under I-89 overpass, and a culvert under Route 14, compromises upstream migration from the main stem White River.

- Quation Brook- a small stream containing low number of wild brook trout and historically contained good rainbow trout reproduction but is now absent. RT 14 and I-89 culvert preclude upstream migration.
- High Pole Brook – wild brook trout
- Mitchell Brook- wild brook and rainbow trout but upstream migration problematic due to barriers associated with I-89 and Route 14 culverts.
- Mill Brook- primarily wild brook and rainbow trout, as well as Atlantic salmon from main stem White River. Brown trout occasionally show-up in lowest reach. Use to exhibit very high rainbow reproduction but has been compromised by a long culvert near the mouth. Culvert was baffled in ~ 1995 to facilitate upstream migration.
- Tigertown Brook- wild brook trout; upstream migration problematic due to barriers associated with I-89 and Route 14 culverts.
- Podunk Brook- wild brook trout; upstream migration problematic due to barriers associated with I-89 and Route 14 culverts.
- Dimick Brook- wild brook trout; falls at mouth precludes upstream migration
- Jericho Brook – wild brook trout

Lakes and Ponds:

- McIntosh Pond- brook and rainbow trout (stocked), brown bullhead. VDFW owns surrounding land, dam and access area.

Physical Habitat Assessment

Extensive logging of the watershed's forest from early European settlement, as well as use of the White River for log drives, has contributed to the physical condition of the river and its tributaries today. Sharon was particularly affected by major floods, such as the 1927 flood, and dredging and gravel mining have contributed to instability of the river. The lower White River's channel-spanning bedrock features have had a role in reducing the degree of downcutting in this area; still, in many places, there is a loss of floodplain access.

A total of 23.5 river miles were assessed in the town of Sharon in 2010, including reaches on the main stem and four major tributaries (Quation Brook, Fay Brook, Broad Brook, and Elmers Brook). On the lower White River, three out of four segments are in "fair" geomorphic condition (one segment is "good"). On Quation Brook, five out of eight segments are in "good" condition (two are "fair" and one "poor"). On Fay Brook, 9 out of 13 segments are in "fair" condition, while four are "good." Elmers and Broad Brooks had just five segments assessed; they were either "fair" or "good".

Because of the naturally more confined valleys of the Lower White, areas for flood attenuation are limited. However, floodplain protection along the tributaries may be important.

Special Values and Features

Significant Natural Communities and Rare, Threatened, and Endangered Species
There are 14 significant natural communities found along the lower White River or on its tributaries. All but one are riverine or wetland natural communities such as Calcareous Riverside Seeps or Rich Fens. Twenty-five rare or threatened or endangered plants have been identified as well as three rare animals or threatened or endangered animals. Two occurrences of the state-listed threatened tiger beetle have been found in the Lower White River subwatershed.

Impacts or Threats

E. coli Sampling Results
There are slightly elevated *E. coli* numbers from the White River Partnership (WRP) sampling that has been done on the Lower White River.

Table 10. WRP *E. coli* sampling on the White River- mouth up to the Sharon/Royalton line.

	Geometric mean (# in parens is number of single samples > 235) by site and year									
Site (mouth upstream)	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Watson Park	30(0)	46(1)	58(3)	71(0)	78(2)	100(1)	30(0)	89(2)	105(2)	84(1)
Dimick Brook	53(0)	92(4)	96(4)	99(2)	107(2)	47(0)	53(2)	--	---	---
W Hartford Bridge	---	---	---	92(1)	12(0)	---	---	62(1)	101(3)	99(2)
Mill Brook[1]	9(0)	43(1)	66(3)	---	---	19 (0)	31(2)	38(1)	45(1)	27(1)
Sharon	40(0)	115(3)	114(4)	113(1)	85(2)	110(3)	105(2)	---	---	---
White Brook[2]	---	---	---	---	---	---	---	112(3)	150(3)	201(3)

1. From 2001 to 2006, the Mill Brook site was on the mainstem then from 2007 to present, it was on Mill Brook itself
2.The Sharon site at rm 13.0 was moved to this White Brook site at mainstem rm 15.1 due to access.

Waters on the Vermont Priority Surface Waters Lists
Two stretches of the White River are on the Vermont Priority Waters List, Part C – Waters in Need of Further Assessment. The *E. coli* listing needs review because there are many years of data and it does not really need "further assessment". The levels of *E. coli* found over the years in the Lower White River, especially below Sharon, have not been very high.

Table 11. Lower White River Watershed Part C waters

Wbid	Stretch	Possible pollutant	Possible problem
VT09-01	White River – mouth to Bethel	E. coli	Elevated levels of E. coli in early 1990s and 2001 to 2003
VT09-01	White River in West Hartford	Metals – Ni, Cr	Elevated levels of Nickel and Chromium in sediments

Specific Lakes and Ponds in Lower White watershed

Crescent Pond
2002 Lake Assessment Visit: This small impounded pond's shoreline is largely forested to the shore and/or wetland margin, although a town road runs along the lake's east shore for approximately 1/3 of the shoreline. The watershed is primarily forested. Roadside culverts appear to deliver small quantities of sediment to the pond. One camp is present near the shore and two homes are across the road.

There is alkalinity of 79 mg/l as CaCO3 sufficient to preclude acidification threats. The mean water column dissolved oxygen of 8.3 is well above Vermont's Warmwater Water Quality Standard of 5 mg/l. The pH measured for this lake is also well within compliance with Vermont Water Quality Standards (mean for water column = 7.86 s.u.). There is good clarity (Secchi transparency to bottom at 4.0 meters). No spring total phosphorus data is available. The profundal benthic sample is characterized by *Chironomus* spp., *Chaoborus* spp., and other organisms. There is a very small population of *Phragmites* sp. noted at the north end wetland, which was handpulled by the resident landowner. Many fish and waterfowl have been seen. No changes to assessment needed at this time, although *Phragmites* sp. population should be watched. This pond is recommended for Spring Phosphorus Program sampling.

Lake Mitchell
2000 Assessment Notes: This lake was sampled under REMAP program. It is a shallow, protected trout club pond with good water quality by all measures. There is low mercury in the sediments (0.185 ug/g dry weight.); high alkalinity (102.5 mg/l as CaCO3); and no problems voiced by the Club director during discussions with DEC samplers.

Middle White River

Description

For this assessment report and for planning purposes, the Middle White River subwatershed consists of the White River mainstem from the Sharon/Royalton town line upstream to the mouth of the Tweed River and all the tributaries to this reach (not including the three branches which are treated separately). The named tributaries in the middle portion of the White River watershed include Broad, Sewall, Cleveland, Locust, Little Stony, Stony, Davis Hill, Perkins, Johnson, Mink Basin, Windfall, Fletcher, Taggard, Boutwell, and Broughton Brooks.

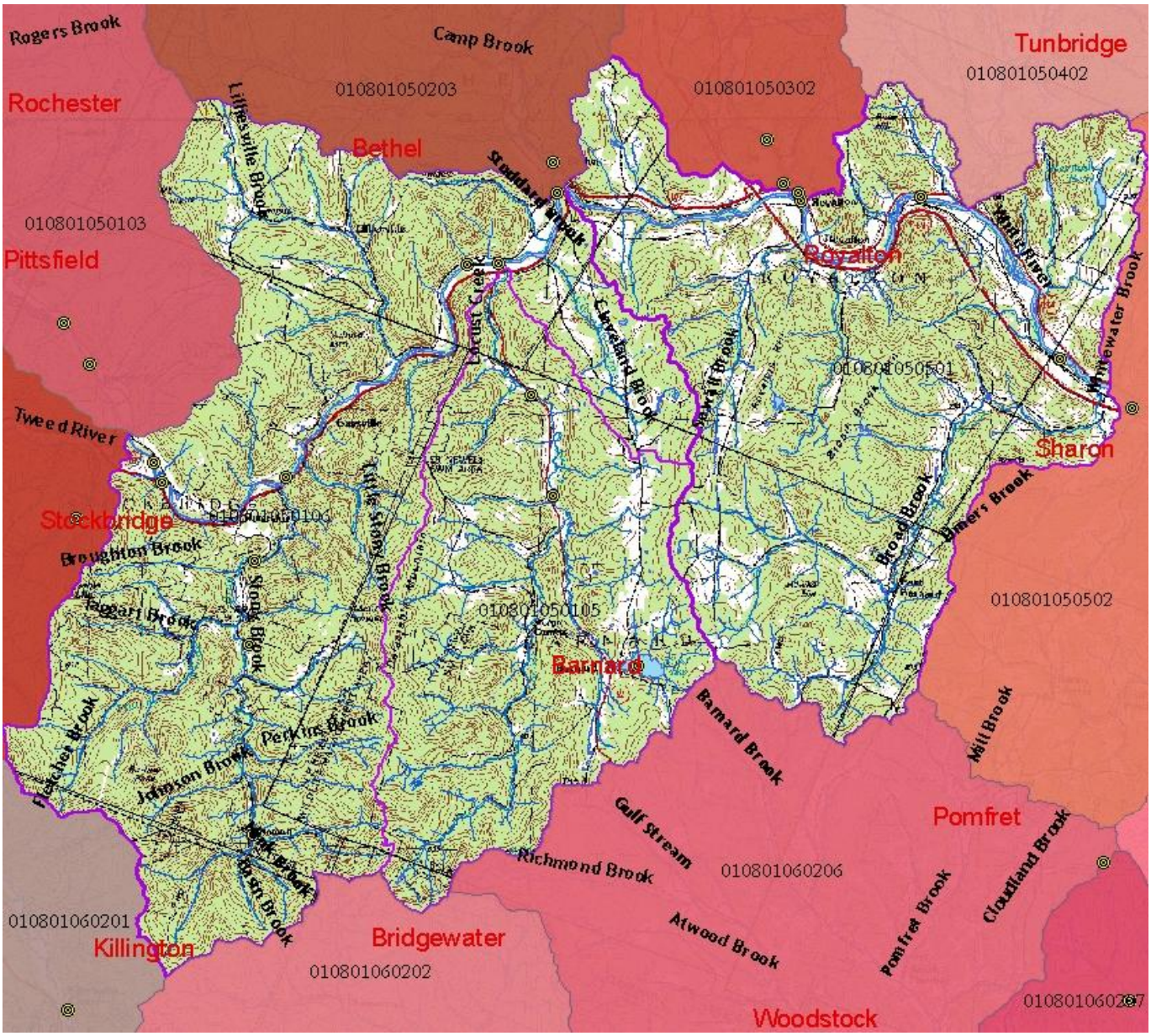


Figure 2. Middle White River watershed (circles show biomonitoring sites)

Biological Community Data

The table below contains the sites at which either macroinvertebrates or fish were sampled to assess the health of the community. Generally the aquatic communities are in good to excellent health, although in 2007, a stretch of the White River had macro-invertebrate communities affected by *Didymo,* which is an invasive exotic plant that grows on stream beds. The macroinvertebrate community was only "fair" at the two sites on the White River affected by the *Didymo*.

Table 12. Biological Sampling Results in the Middle White River

Wbid	Name	Town	River Mile	Date	Com type	Bio Community Assessment
VT09-02	White River	Bethel	26.9	09/2001	M	Good-Fair
VT09-02	White River	Bethel	26.9	10/2007	M	Fair
VT09-02	White River	Stockbridge	29.4	10/2007	M	Fair
VT09-02	White River	Stockbridge	29.4	10/2008	M	Good
VT09-02	White River	Stockbridge	32.4	10/1993	M	Excellent
VT09-02	White River	Stockbridge	32.4	10/1994	M	Excellent
VT09-02	White River	Stockbridge	32.4	09/1995	M	Excellent
VT09-02	White River	Stockbridge	32.4	09/1996	M	Excellent
VT09-02	White River	Stockbridge	32.4	10/2007	M	Vgood-Good
VT09-02	White River	Stockbridge	32.4	10/2008	M	Exc-Vgood
VT09-02	White River	Stockbridge	32.4	09/2009	M	Very Good
VT09-07	Stony Brook	Stockbridge	1.9	09/2001	M	Very Good
VT09-07	Perkins Brook	Stockbridge	0.1	09/2001	M	Exc-Vgood

Fishery – mainstem from the Tweed River to confluence with the First Branch

Mainstem: A mix of wild rainbow and brown trout are present. Atlantic salmon are stocked as part of the Connecticut R. restoration program. Rainbow trout are stocked annually from the mouth of the Tweed River to Gaysville, and again from Bethel bridge to Hartford

Village. Special regulation zone exist from confluence with Lilliesville Brook downstream to below Cleveland Brook (~3.3 miles). This zone is managed as a wild trout fishery where no stocking takes place and anglers are restricted to 1 trout per day with a 18" minimum length and artificial gear (lures and flies) only. Angler access is poor between the confluences of the Third and Second Branches. Smallmouth bass also present from Stockbridge downstream to mouth.

VDFW owns several parcels of riparian land: one parcel between Bartlett Brook and Route 107 bridge along south bank of Tweed River, and one parcel downstream of Tweed River in Stockbridge; one parcel downstream of Locust Creek, and another parcel downstream of Bethel bridge along south bank of White River at Graham St in Bethel; an access area known as Fox Stand in North Royalton and another parcel on other side of river at this point.

Tributaries:

- Stony Brook- wild brook, rainbow and brown trout, with browns found predominately in lower reach. Important rainbow spawning tributary of White R.
- Lilliesville Brook- wild brook, brown and rainbow trout, with Atlantic salmon present from main stem stocking. Important rainbow spawning tributary of White R. and subsequently closed to fishing from second Saturday in April to June 1 to protect spawning rainbows from mouth upstream to 2nd bridge on Lilliesville Brook Road. VDFW owns parcel of land on both sides of White River at it's confluence with Lilliesville Brook.
- Locust Brook- wild brook, brown and rainbow trout, with Atlantic salmon stocked by VDFW annually. Important rainbow spawning tributary of White R. and subsequently closed to fishing from second Saturday in April to June 1 to protect spawning rainbows from mouth upstream to 2nd bridge on Route 12.
    - Pond Brook- wild brook, brown and rainbow trout. VDFW owns riparian land at Blackmer Road in Barnard.

Lakes and Ponds:

- Ansel Pond- brook trout (stocked), red breast sunfish reported by game warden in 1995 but unconfirmed. VDFW owns surrounding land, dam and access area.
- Silver Lake- brown bullhead, largemouth bass, northern pike, pumpkinseed, rock bass, white sucker, yellow perch. VT state park campground located on the lake and is a heavily used recreational lake.

Special Values and Features

Very High Quality Waters

The site that is rivermile 32.4 has been sampled periodically for almost 20 years and has always been "excellent" to "very good" macroinvertebrate community health. A reach associated with this milepoint should be considered very high quality aquatic biota.

Swimming Holes

There were six swimming holes identified on this stretch of the White River in the Vermont Swimming Hole Study. Three of the six have moderate to heavy swimming use and are in well-known areas.

- Cobb Bridge Swimming Hole is upstream of Gaysville under a bridge just off Route 107. It has a large deep pool with a sand beach and ledges for jumping. People fish as well as swim and picnic at the site and it is a popular spot. The aesthetics of the site were degraded when the old bridge was replaced with a wider concrete bridge with new abutments, but the swimming is still excellent.
- Dean Hill Swimming Hole has a large deep pool for swimming and jumping at a forested bend in the river just upstream of Gaysville. The ledges for jumping are ten to forty feet high and the pool is ten feet deep. It too is also used for fishing.
- Twin Bridge Swimming Hole is right at the Gaysville bridge (which was two bridges before the 1927 flood hence its name). This is a well-used spot for swimming, jumping, gathering, picnicking, tubing. A private campground is located on the river just downstream of the pool and bridge and campers use this area as well.

Rare, Threatened or Endangered Species or Significant Natural Communities

There are nine significant natural communities, 12 rare, threatened, or endangered plants, and four rare, threatened, or endangered animals identified in the Middle White River watershed. A cobblestone tiger beetle and a Jefferson salamander have been found in this area.

Impacts or Threats

E. coli Sampling Results

Table 13 *E. coli* sampling - White River from the Sharon/Royalton line to the Tweed River

	Geometric mean (# in parens is number of singles samples > 235)									
Site name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Vermont Law School	35(0)	120(3)	71(2)	107(1)	86(1)	---	---	92(1)	108 (2)	120 (2)
Paynes Beach	---	----	----	----	----	86 (0)	99(1)	101(2)	---	---
Fox Stand	---	---	---	148(2)	152(1)	125(3)	131(1)	153(3)	---	---
Royalton	54(0)	55(2)	114(3)	---	---	---	---	---	---	---
Bethel below WWTF	100 (1)	109(3)	110(2)	103(2)	160(3)	72 (0)	89(2)	87(1)	110 (2)	144 (2)
Bethel above WWTF	42(0)	59(1)	50(1)	52(0)	70(0)	37(1)	47(1)	45(0)	59 (2)	84(2)
Locust Creek mouth	26(0)	38(0)	34(0)	36(0)	53(0)	46(0)	67(0)	79(2)	13 (1)	36(1)
Gaysville Bridge	---	---	---	49(0)	5(0)	33(0)	51(1)	46(1)	46(2)	87(2)
Stockbridge School	32(0)	48(1)	48(1)	---	---	---	---	---	---	---
Stony Brook	---	---	---	---	---	12(0)	11(0)	30(0)	---	---

Waters on the Vermont Priority Surface Waters Lists
There are no river or stream segments on either the Vermont impaired waters list or on any of the other priority waters lists that identify known or potential water quality or aquatic habitat problems. Silver Lake, which is described below, is on Part F – Waters Altered by Flow Regulation although there is currently a petition before the Vermont Water Resources Panel to eliminate the winter drawdown of the lake. The ANR petition was submitted on March 24, 2011.

Specific Lakes and Ponds

Silver Lake, Barnard:
This 84 acre lake is a mesotrophic lake with stable water quality conditions. It is noteworthy that the Silver Lake Association, a group of citizens with a strong interest in improving the lake's water quality, has been instrumental in reducing sediment and nutrient runoff from roads in the watershed, and is active in monitoring long-term water quality indicators. Water levels on this lake are manipulated by the dam which is owned by Vermont DEC. Consistent with a 1968 Water Resources Board rule, the lake is drawn down by 1.5 feet during winter. Due to this annual drawdown, aquatic life use is altered in Silver Lake.

Silver Lake (Barnard)
ALTERED ACRES:
84 acres of aquatic life use altered due to winter drawdown.

STRESSED ACRES:
84 acres of aesthetic, aquatic life, secondary contact recreation, and swimming uses stressed due to nutrients, sedimentation.

There is a Vermont Water Resources Board rule (June 7, 1968) that sets the water levels of the lake, and requires a 1.5 foot annual drawdown between the summer recreation season water level (1,307.5 feet msl) and the winter non-recreation season water level (1306.0 feet msl). The Vermont DEC owns the dam.

2007 Assessment Notes: This lake was visited as part of the National Lakes Survey in July 2007. At the time of the visit, the water clarity was fair (secchi= 3.1m), and the bottom two meters had low DO concentrations (0.46-1.72 mg/l). Water quality samples indicated an alkalinity sufficient to preclude acidification (62.8 mg/l CaCO3); chl-a= 3.32 ug/l, TN= 0.18 ug/l, and TP= 11.3 ug/l. The physical habitat assessment sites had a mixture of bottom substrates (50% mud-dominated, 50% sand/gravel-dominated) and fish covers. Nine out of ten riparian sites had moderate to dense canopy coverage, and the shoreline at every site was at least 40-75% vegetation. Buildings were present/adjacent to 4/10 sites, docks/boats were present/adjacent to 6/10, two sites had walls (one present, one adjacent), and lawn was present in 4 sites. In June 2007, a crew from the EPA and VTDEC collected fish for tissue samples for mercury analysis.

Upper White River

Description

The Upper White River for the purposes of this assessment report is the mainstem of the White from the mouth of the Tweed River upstream and all the tributaries to it minus the Tweed River watershed, which is treated separately below.

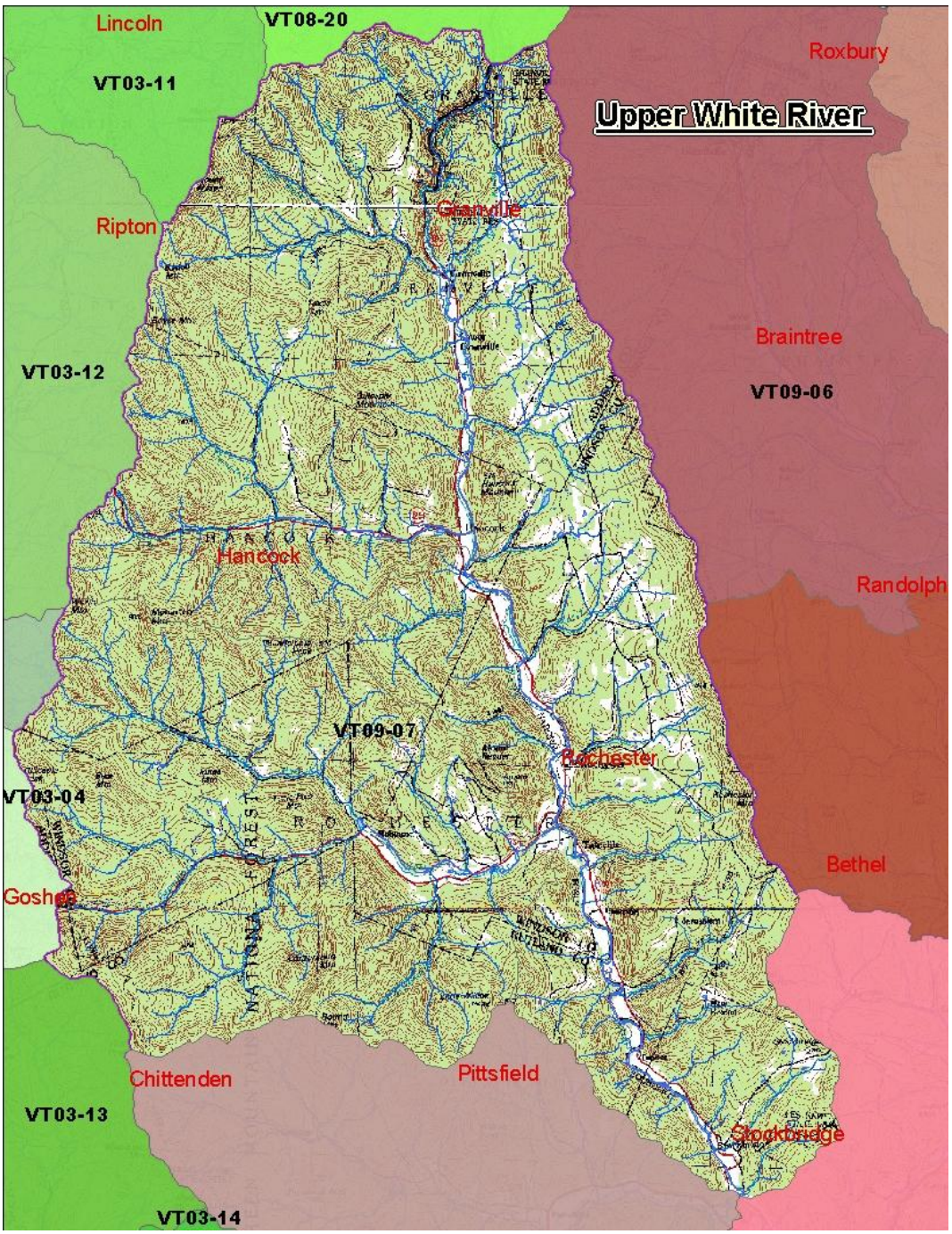


Figure 3. Upper White River watershed (Tweed River subwatershed separate)

Biological Community Data

Two sites on the upper White River mainstem and 28 sites on tributaries to the upper White have been sampled in the last 14 years as shown in the table below.

Table 14. Biological Sampling Sites and Results in the Upper White River

Wbid	Stream	Town	River-mile	Date sampled	Com-munity	Community Assessment
VT09-02	White River	Rochester	43.7	09/2001	M	VGood-Good
VT09-02	White River	Rochester	43.7	09/2006	M	Excellent
VT09-07	White River	Rochester	47.7	08/2008	F	Very Good
VT09-07	West Branch	Rochester	0.5	11/2000	M	Excellent
VT09-07	Bingo Brook	Rochester	1.3	10/1999	M	Very Good
VT09-07	Bingo Brook	Rochester	1.3	09/2000	M	Excellent
VT09-07	Bingo Brook	Rochester	1.3	09/2001	M	Exc-Vgood
VT09-07	Bingo Brook	Rochester	1.8	10/2003	M	Excellent
VT09-07	Bingo Brook	Rochester	1.8	09/2004	M	Excellent
VT09-07	Bingo Brook	Rochester	1.8	09/2005	M	Very Good
VT09-07	Bingo Brook	Rochester	1.8	09/2009	M	Vgood-Good
VT09-07	Bingo Brook	Rochester	1.8	09/2010	M	Excellent
VT09-07	Chittenden Brook	Rochester	0.1	10/2003	M	Exc-Vgood
VT09-07	Chittenden Brook	Rochester	0.1	09/2004	M	Exc-Vgood
VT09-07	Chittenden Brook	Rochester	0.1	09/2005	M	Excellent
VT09-07	Horrid Brook	Goshen	0.1	09/1997	M	Excellent
VT09-07	Howe Brook	Hancock	0.3	09/1999	M	Fair
VT09-07	Howe Brook	Hancock	0.3	09/2000	M	Good
VT09-07	Howe Brook	Hancock	0.3	09/2001	M	Exc-Vgood
VT09-07	Howe Brook	Hancock	0.3	09/2002	M	Exc-Vgood
VT09-07	Marsh Brook	Rochester	0.1	09/2001	M	Very Good
VT09-07	Perkins Brook	Stockbridge	0.1	09/2001	M	Exc-Vgood
VT09-07	Smith Brook	Goshen	1.3	09/1997	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	09/1998	M	Excellent

VT09-07	Smith Brook	Goshen	1.3	09/1999	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	10/1999	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	09/2000	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	09/2001	M	Very Good
VT09-07	Smith Brook	Goshen	1.3	09/2002	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	09/2009	M	Excellent
VT09-07	Smith Brook	Goshen	1.3	10/2010	M	Vgood

Fishery - mainstem from White River headwaters to confluence with Tweed River

Mainstem: Wild brook, brown and rainbow trout populations, as well as Atlantic salmon from CT River restoration effort. Brook trout stocked annually from Lower Granville Village to Hancock Village. Rainbow trout are stocked annually from the USFS access area near Ranger Road to Route 100 bridge at Ted Green Ford dealership.

Tributaries:

- Alder Meadow Brook - wild brook, brown and rainbow trout
    - Deer Hollow Brook- wild brook trout
- Hancock Branch- wild brook, brown and rainbow trout. Atlantic salmon stocked by USFS.
    - Robbins Branch – wild brook and rainbow trout. Atlantic salmon stocked by USFS
- Marshs Brook- wild brook, brown and rainbow trout
- Nason Brook- wild brook, brown and rainbow trout
- West Branch- wild brook, brown and rainbow trout. Atlantic salmon stocked by USFS
    - Bingo Brook- wild brook, brown and rainbow trout. Atlantic salmon stocked by USFS
    - Brandon Brook- wild brook and rainbow trout. Atlantic salmon stocked by USFS
        - Chittenden Brook- primarily wild brook trout with wild rainbows present some years
            - Joe Smith Brook- wild brook and rainbow trout
        - Smith Brook- wild brook trout
    - Corporation Brook- wild brook and rainbow trout. Atlantic salmon stocked by USFS

Physical Habitat Assessment

Two major floods occurred in the Upper White River – one in 1830 and then the big flood in 1927. Big floods also happened in 1973, 1998, and 2000 with dredging and channelization following the 1973 flood. Extensive channelization also occurred to accommodate roads and the railroad: evidence remains that 78-100% of the Upper White River was historically straightened. The land clearing of the 1800s as well as the woody debris removal from some tributaries and the mainstem for log drives are other historical events that have led to the physical condition of the Upper White River today. Ongoing channel management has included further channelization, dredging, and bank armoring. As a result of these activities and development encroachment, the Upper White has downcut and no longer has access to its floodplain.

Due to the inability of the river to overflow onto its historical floodplain, the river's flow and energy are concentrated in the channel. The reaches of the river are now "transport reaches" and sediment and debris loads are largely transported downstream rather than deposited on floodplains. To some extent, sediment is dropped when the load becomes too great for the river to carry, or at constrictions along the way, such as bridge abutments. The increased power in the stream channel has resulted in overwidening as banks are eroded, and lateral movement may increase until the stream is able to re-establish a balance between its power and its sediment load. Traditional approaches (such as bank armoring or dredging) have prevented the river from naturally regaining that balance.

Geomorphic assessment data show that 7 out of 14 stream segments were in "fair" geomorphic condition, while 7 out of 14 segments were in "poor" geomorphic condition, with loss of floodplain access throughout all segments. Protection and restoration of floodplain access will be particularly important for improving the physical condition of the Upper White.

Special Values and Features

Very High Quality Waters

Bingo Brook in Rochester, Chittenden Brook in Rochester, and Smith Brook in Goshen all have macroinvertebrate communities in excellent to very good health and integrity. Three years of assessment on Bingo Brook, three years on Chittenden Brook, and six years of assessment on Smith Brook have shown these streams to be very high quality for the aquatic life they support.

Waterfalls, Cascades and Gorges

One of the very well known waterfalls, Moss Glen Falls I, that was described in the Waterfalls, Cascades and Gorges Report and is marked on most Vermont maps and in the Gazetteers, is located on Deer Hollow Brook in Granville Gulf Natural Area. It is actually a high-angle cascade that drops approximately 30 feet over a rock face 15 to 25 feet wide. It is a popular scenic attraction on Route 100 that now has a boardwalk and observation platform for access and viewing.

Another equally well-known waterfall is Texas Falls on the Hancock Branch in Hancock. It is a small gorge and cascade with a small falls and some nice pools. It is especially beautiful in the spring following snowmelt. The area has been developed by the U.S. Forest Service with trails, and observation and picnic areas. It is listed on the Vermont Fragile Areas Registry.

Rare, Threatened or Endangered Species or Significant Natural Communities
This upper portion of the watershed has three identified significant natural communities, 25 rare, threatened, or endangered plants, and four rare, threatened or endangered animals.

Impacts or Threats

E. coli Sampling Results
The *E. coli* geometric mean numbers for the sites in the Upper White River subwater-shed have been low indicating generally clean, safe waters for swimming and bathing.

Table 15. WRP *E. coli* sampling - White River from the Tweed River up to the headwaters

	Geometric mean (# in parens is number of singles samples > 235)									
Site name	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
West Branch	78(1)	77(1)	74(1)	---	16 (0)	13(0)	14	---	---	---
Lions' Club Park	103(3)	59(1)	57(0)	95(3)	88 (0)	52 (0)	51(1)	47(1)	33(0)	56(1)
Hancock Branch	42(0)	47(0)	57(0)	78(2)	---	---	14(0)	21(0)	29(0)	59(0)
Clark Brook	5(0)	7(0)	---	---	---	---	---	---	---	---

Waters on the Vermont Priority Surface Waters Lists
There are no stretches of river or stream on the 2010 303(d) List of Waters (impaired surface waters) in this part of the watershed. There are two streams that are on the Vermont Priority Waters List, Part C – Waters in Need of Further Assessment because potential impacts have been identified. Clark Brook will likely be removed from this list in 2012 because the brook's fish communities are healthy and appear to meet the Water Quality standards.

Table 16. Stream stretches on the Part C waters list

Wbid	Stream	Possible pollutant	Possible problem
VT09-07	Clark Brook	acidity	
VT09-07	Hancock Branch	acidity, sediment	

Specific Lakes and Ponds

Colton
Stressed Acres
27 acres of aquatic life use stressed due to acid precipitation.

Hancock Mt;
2002 Lake Assessment Visit: Prior pond acreage appeared to be about 14 acres (based on orthophoto from 1995), but has been reduced to about 1 acre in size (beavers either abandoned the spot or were trapped out). Total phosphorus, total nitrogen, and alkalinity samples were collected, as well as the standard acid rain monitoring suite. Hydrolab data results at the outlet: pH of 7.46 s.u., ORP of 555, conductivity of 80.2, dissolved oxygen of 10.92 mg/l, temperature of 10.58 degrees Centigrade, and chlorophyll-a of 2.5 ug/l . Alkalinity was 13.1 mg/l (as CaCO3), TP was 15 ppb, and TN was 0.49 ppm. These data indicate a mesotrophic pond with no acid sensitivity. No changes to acreages warranted. Very scenic setting.

North (Chittenden)
2001 Lake Assessment Visit: Lake visited to verify acidification status. Alkalinity = 21 mg/l as CaCO3 during visit. pH measured at 7.04 s.u. The reason for the discrepancy between the 1981 and 2001 data is unclear. Given an average alkalinity for the two measurements of 12.4 mg/l CaCO3, the pond is no longer considered threatened with respect to acidification. This is a small, scenic wilderness pond with difficult access and very limited sign of human visitation. It is quite shallow - the bottom was visible throughout. Numerous herps observed, as well as one large bullhead (8"), which seemed out of place in this high mountain pond.

*Skylight Pond, Ripton***:**
Aquatic life uses on this tiny two acre pond located near the spine of the Green Mountains are impaired due to acidification. The lake's alkalinity has been measured from 1.53 to 2.19 mg/l. The pH was 5.92 and the alkalinity was 1.88 during the latest sampling in May 2010. Atmospheric deposition of acid-inducing pollutants such as nitrous oxides and sulfur dioxide exacerbates acidification in this lake.

Tweed River

Description

The Tweed River basin encompasses roughly 51 square miles from about 3500 feet in elevation down to 715 feet, and the mainstem length of the Tweed is about 10 miles. The stream originates in Killington and it flows downstream to its confluence with the White River mainstem in Stockbridge. Named tributaries include Bartlett Brook, Guernsey Brook, the West Branch, and Townsend Brook.

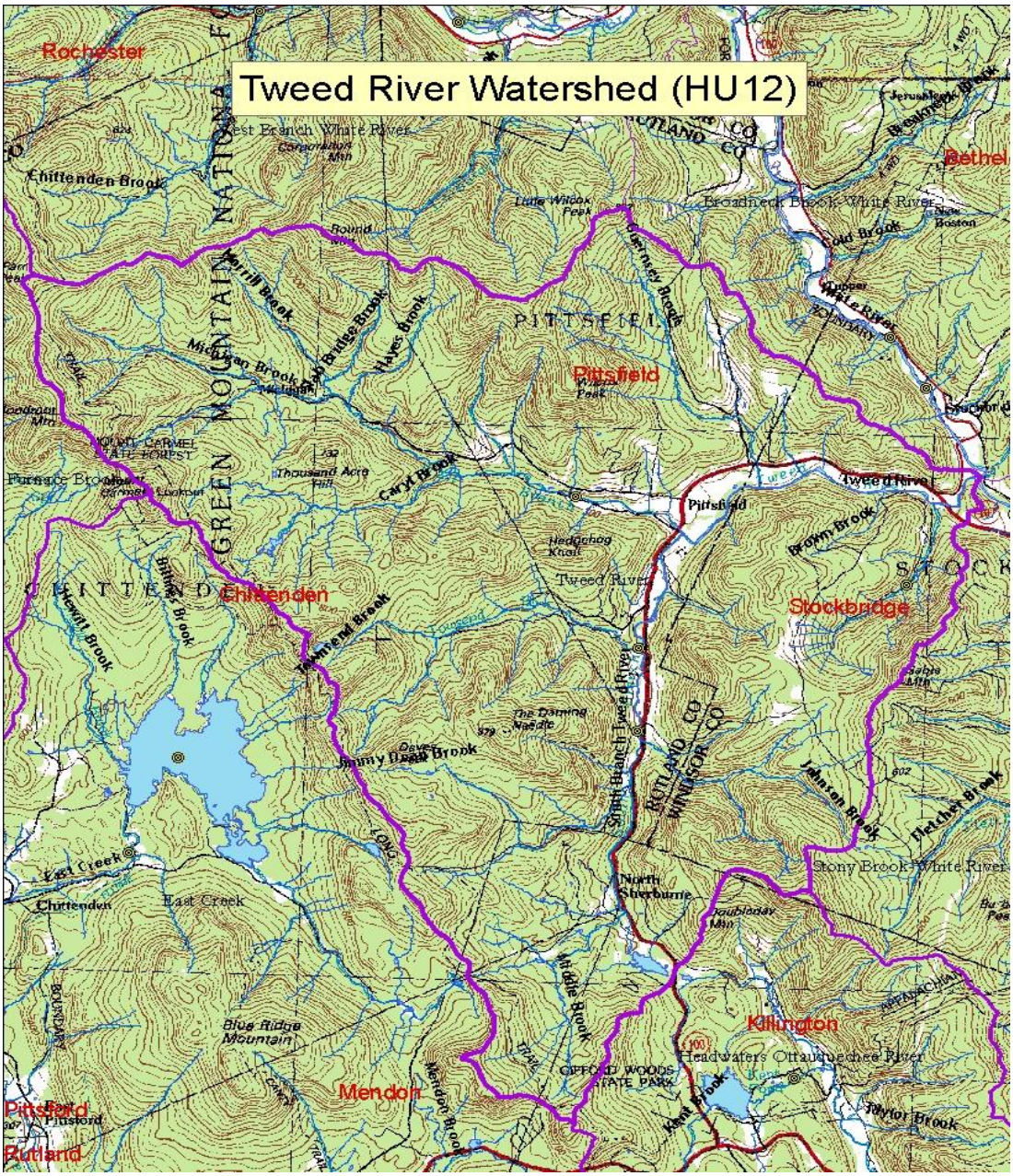


Figure 4. Tweed River subwatershed

Biological Community Data

There are not many samples of the biological communities in the Tweed River sub-watershed but the few that have been taken indicate healthy aquatic biota.

Table 17. Biological Sampling Sites and Results in the Tweed River watershed

Wbid	Name	Town	River Mile	Date	Com Type	Assessment
VT09-07	West Branch Tweed River	Pittsfield	1.4	10/2000	M	Very Good
VT09-07	West Branch Tweed River	Pittsfield	1.4	09/2001	M	Excellent
VT09-07	Tweed River	Pittsfield	6.0	10/2007	F	Very Good
VT09-07	Tweed River	Pittsfield	7.0	10/2007	F	Very Good

Fishery – Tweed River watershed

Mainstem: Mix of wild brook, brown and rainbow trout. Atlantic salmon is stocked by VDFW. VDFW owns a parcel of land on the south side of the confluence of the Tweed River with the main stem White River.

Tributaries:

- Townsend Brook- wild brook and rainbow trout
- West (Michigan) Branch- wild brook, brown and rainbow trout. Atlantic salmon stocked by USFS.
- Guernsey Brook- wild brook and rainbow trout

Lakes and Ponds:

- Colton Pond- brook trout (stocked), brown bullhead, largemouth bass, white sucker, yellow perch. VDFW owns surrounding land, dam and access area.

Physical Habitat Assessment

The Tweed River watershed has had a history of land use and river alterations that are manifested in the condition of the river today. A lot of logging and clearing occurred pre-1920 and construction of the railroad resulted in the river being straightened and pushed against the valley wall. With the river straightened and channelized, and the area's hydrology altered by extensive logging, stream power has increased in the channel leading to downcutting and the stream losing access to its floodplains. The Tweed River is now eroding its banks and widening as well as moving laterally. The cobble, gravel, and sand that is eroded and transported is dropped at constrictions such as culverts that are too small, rather than being deposited on the floodplain. The load is also dropped when it becomes too heavy for the stream to carry further, but generally, much of the sediment is

being transported downstream. The river is now in an unstable condition, causing it to change course or jump its banks and shortcut across fields in an attempt to expend its energy. Encroachments in the floodplain or in the path of the moving river are subject to damage during heavy storms, and these investments can limit the ability of the river to move laterally to regain its stable meanders, slope, and channel size.

The Rapid Geomorphic Assessment (RGA) results for the Tweed River reaches show the consequences of these activities:

- 17 out of 19 segments have major loss of floodplain access, and
- 12 out of 19 segments are in fair geomorphic condition
- and 7 out of 19 segments are in poor geomorphic condition.

Because of development in river corridor areas within the Tweed River watershed, opportunities for floodplain access are limited; protecting remaining flood attenuation areas will be particularly important for flood hazard planning as well as improvement of the stream's physical stability.

Special Values and Features

Swimming Holes

Dailey's Bend is a swimming hole on the Tweed River not far from where it enters the White River. It consists of two nice pools connected by a small cascade. There is excellent swimming and bathing with nice rocks to sit on. Although not far from Route 100 north of the Route 107 junction, the spot feels secluded.

Rare, Threatened or Endangered Species or Significant Natural Communities

There is one significant natural community identified in the Tweed River subwatershed and four plant species that are rare. Two of the plant occurrences are Nuttall's waterweed.

Impacts and Threats

Vermont Priority Surface Waters Lists

There are no river or stream segments currently on either the Vermont impaired waters list or on any of the other priority waters lists that identify known or potential water quality or aquatic habitat problems. *E. coli* sampling by the White River Partnership from 2008 to 2010 on one site on the Tweed River show low *E. coli* numbers (geometric means in the 40s). There are also no lakes and ponds from this portion of the watershed that are on any of the lists. However, the physical assessment results described above indicate that there is potential for substantial habitat change should a rain event exacerbate the fair and poor geomorphic condition.

First Branch White River

Description

The headwaters of the First Branch originate in the hills of Washington and both perennial and intermittent streams converge north of the Chelsea/Washington line to form the First Branch. This stream flows south through Chelsea with Jail Brook entering from the east and further downstream, Cram Brook, entering from the west. The First Branch continues south through Tunbridge with first Dickerman Brook then Farnham Branch and Russell Brook as well as unnamed tributaries joining before the First Branch joins the White River in South Royalton. The First Branch is 24 miles long and drains a 103 square mile watershed.

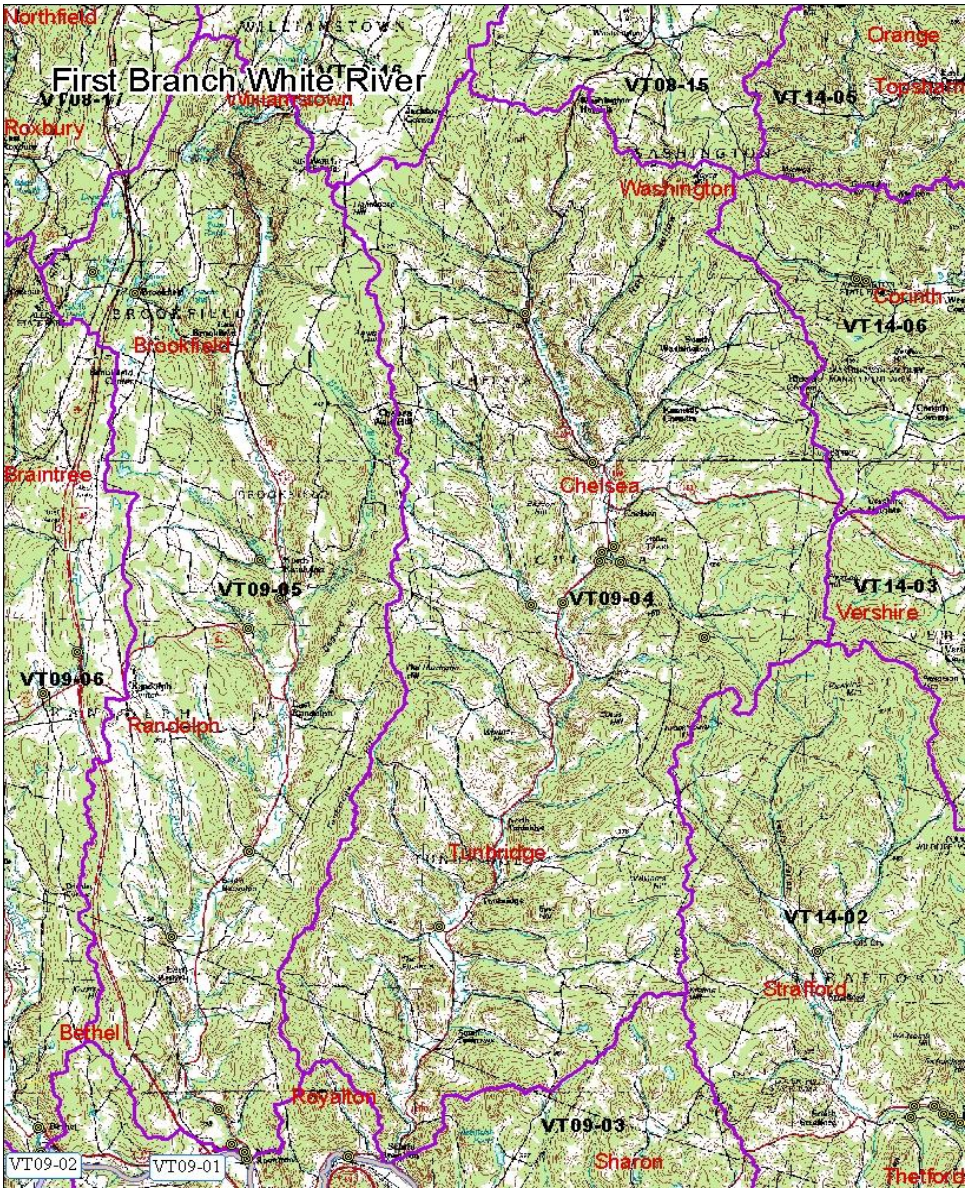


Figure 5. First Branch White River subwatershed (circles are biomonitoring sites)

Biological Community Data

The following table contains the biological sampling sites and results for the First Branch and its tributaries from 1992 to the present.

Table 18. Biological Sampling Sites and Results in the First Branch watershed

Wbid	Name	Town	River Mile	Date	Com-munity	Assessment
VT09-04	First Branch	Tunbridge	6.6	09/2001	M	Vg-Good
VT09-04	First Branch	Chelsea	15.1	09/1992	M	Very Good
VT09-04	First Branch	Chelsea	15.1	09/2001	M	Vg-Good
VT09-04	First Branch	Chelsea	15.7	09/2006	M	Good
VT09-04	First Branch	Chelsea	15.7	09/2006	F	Failed due to habitat
VT09-04	First Branch	Chelsea	16.8	09/2001	M	Vg-Good
VT09-04	First Branch	Chelsea	17.1	09/2006	M	Good
VT09-04	First Branch	Chelsea	17.1	08/2010	M	Good
VT09-04	First Branch	Chelsea	17.1	08/2010	F	Excellent
VT09-04	First Branch	Chelsea	21.0	09/2001	M	Excellent
VT09-04	First Branch Trib 28	Washington	0.8	08/2010	F	Pass
VT09-04	Cram Brook	Chelsea	0.7	09/2001	M	Vg-Good
VT09-04	Cram Brook	Chelsea	0.7	09/2006	M	Good-Fair
VT09-04	Jenkins Brook	Chelsea	0.3	09/2001	M	Excellent
VT09-04	Jenkins Brook	Chelsea	2.6	09/2006	F	Pass

Fishery – First Branch watershed

Mainstem: Primarily wild brook trout present above Chelsea Village, with wild brook and rainbow trout present below Chelsea Village. Rainbow trout reproduction was noted by MacMartin above Chelsea Village. Wild brown trout were present during the 1980s below Chelsea. Atlantic salmon, brook and rainbow trout are stocked annually by VDFW from

Chelsea Village to Tunbridge fairgrounds. Almost all of the tributaries contain wild brook trout that sustains brook trout within the mainstem.

VDFW owns a parcel of riparian land below Moxley covered bridge in Chelsea and two parcels of riparian land in Tunbridge at Foundry Rd and Justin Morrill Highway.

Tributaries:

- Jones Pond Brook – wild brook trout
- Hart Hollow Brook– wild brook trout
- Kennedy Road Brook – wild brook trout
- Meadow Brook– wild brook trout
- Jenkins Brook– wild brook trout
- Cram Brook -– wild brook trout
- Bicknell Brook – wild brook trout
- Dickerman Brook– wild brook trout
- Potash Road Brook – wild brook trout
- Farnham– wild brook trout

Special Values and Features

Covered Bridges

The First and Second Branches of the White River have one of the greatest concentrations of covered bridges in the state. The First Branch has six covered bridges and, from upstream down, they are Moxley Bridge in Chelsea then Flint Bridge, Larkin Bridge, Mill Bridge, Cilley Bridge, and Howe Bridge in Tunbridge. All but Larkin Bridge, which was built in 1902, were built in the 1800s.

Rare, Threatened or Endangered Species or Significant Natural Communities

Four Rich Fen natural communities have been identified in the First Branch watershed and two rare plants species have been found as well.

Waterfalls and Cascades

There are very pretty falls on Dickerman Brook in hemlock forest away from the road. There is about a 20-foot high waterfall with cascades above it.

Impacts or Threats

E. coli Sampling Results

There are no stretches of river or stream on the 2010 303(d) List of Waters (impaired surface waters) in this part of the watershed. However, ongoing *E. coli* sampling by the White River Partnership has shown elevated levels of *E. coli* and there needs to be some pollution source assessments done. Table 19 below contains the WRP *E. coli* sampling data.

Table 19. White River Partnership *E. coli* sampling on the First Branch of the White River

Geometric mean (# in parens is number of singles samples > 235)										
Site and rivermile	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Cilley Bridge fb5.9	126(3)	232(5)	131(4)	144(3)	---	116	143	247(3)	82(1)	194(3)
Chelsea Rec Park fb15.2	184(6)	274(4)	250(5)	---	---	98	138	153(3)	79(1)	173(4)

Vermont Surface Waters Priority Lists

There are two reaches of the First Branch that are on the 2010 Part C of the List of Priority Surface Waters outside the Scope of CWA Section 303(d) - Part C are waters that are in need of further assessment because a potential impact has been identified. One of these listings is the *E. coli* issue just mentioned above and the next step for this issue is to determine whether there are any natural contributions to the E. coli levels seen (beaver, other) or whether they are all anthropogenic sources.

Table 20. Two stream segments on the Part C List of Priority Waters.

Wbid	Stream segment	Possible pollutant	Potential Problem
VT09-04	First Branch	E. coli	Sources of elevated E. coli numbers unknown
VT09-04	First Branch – Chelsea to mouth	sediment, temperature	soil & streambank erosion

Second Branch White River

Description

The Second Branch of the White River begins in Williamstown with streams coming out of Staples Pond and Rood Pond and flows through Williamstown Gulf down into a narrow valley in Brookfield. The Second Branch then flows south through Brookfield with Sunset Brook joining from the west. It continues south into Randolph with Snows, Halfway, Blaisdell, Osgood, Penny, Peak, and Conant Brooks all joing the Second Branch in the town of Randolph. The Second Branch then flows through the eastern corner of Bethel into Royalton then through the western portion of Royalton before it joins the White river in North Royalton. The Second Branch is about 20 miles long and drains a 74 square mile watershed.

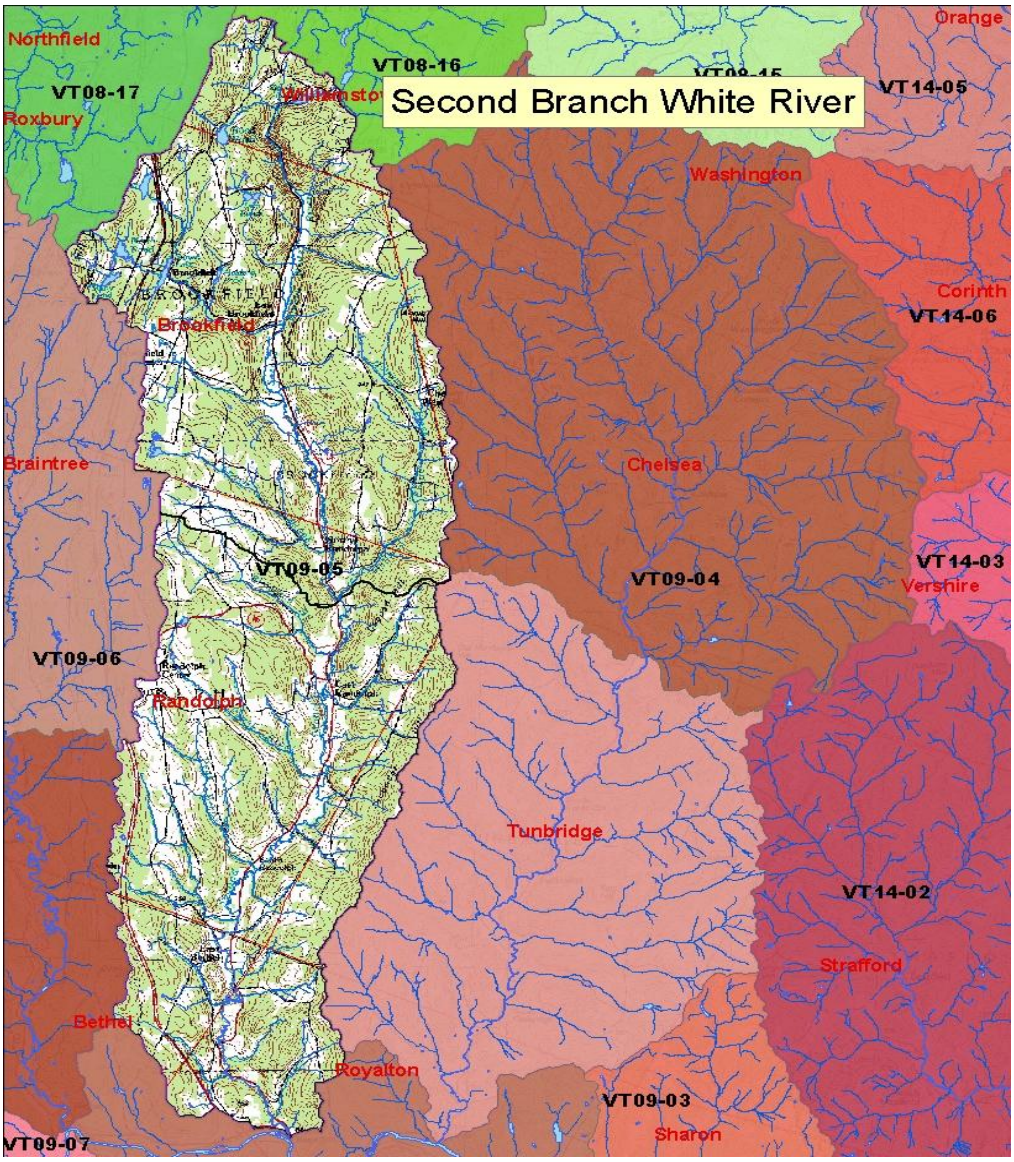


Figure 6. Second Branch White River

Biological Community Data

The following table contains the biological sampling sites and the results of sites sampled from 1997 to the present on the Second Branch and its tributaries. Except for the Kingsbury Brook, the Second Branch itself and the two tributaries, Blaisdell Brook and Snows Brook, all have aquatic communities that pass the Water Quality Class B standards. Snows Brook should be sampled again to ensure that the health of its macroinvertebrate community has not been diminished any farther.

Table 21. Biological Monitoring Sites and Results in the Second Branch watershed

Wbid	Stream	Town	Rivermile	Date sampled	Com-munity[1]	Community assessment
VT09-05	Second Branch	Royalton	0.1	09/2001	M	Very Good
VT09-05	Second Branch	Randolph	18.0	09/2001	M	Very Good
VT09-05	Kingsbury Brook	Randolph	0.5	09/2001	M	Fair
VT09-05	Blaisdell Brook	Randolph	1.6	09/2001	M	Very Good
VT09-05	Blaisdell Brook	Randolph	1.6	10/2002	F	Good
VT09-05	Blaisdell Brook	Randolph	1.6	09/2006	F	Very Good
VT09-05	Snows Brook	Randolph	0.7	09/1997	M	Good
VT09-05	Snows Brook	Randolph	0.7	09/2001	M	Good

1 M=macroinvertebrate community, F=fish community

Fishery - Second Branch Watershed

Mainstem: Much of the Second Branch is posted and inaccessible with heavy agricultural activities and severe erosion that limits trout production, but wild brook trout are present. There are many tributaries to the Second Branch with almost all of them containing wild brook trout. Brook trout are stocked annually from Route 14 bridge near Ferris Road to the confluence with the White River main stem. VDFW owns two parcels of riparian land: one upstream of Braley Road and a second at intersection of Route 14 and Kingsbury Road in Randolph. There is a dam present in East Bethel.

Tributaries:

- Sunset Brook
- Snows Brook
- Halfway Brook
- Blaisdell Brook
- Osgood Brook
- Penny Brook
- Peak Brook

Lakes and Ponds:

- Rood Pond- brook trout (stocked), brown bullhead, largemouth bass, yellow perch. VDFW owns 3 parcels including dam and access area.
- Sunset Lake (Floating Bridge)- brook and rainbow trout (stocked), chain pickerel, smallmouth bass, white sucker, yellow perch.

Special Values and Features

Covered Bridges
The Second Branch of the White River has three covered bridges that span it. From upstream near East Randolph heading downstream, there is Braley Bridge, Gifford Bridge, and Kingsbury Bridge all built in 1904.

Rare, Threatened or Endangered Species or Significant Natural Communities
There are five significant natural communities identified in the Second Branch watershed including three different swamp types and a rich fen. There are 14 rare, threatened, or endangered plant species including bog willow and straight-leaf pondweed. There are two rare, threatened, or endangered animal species including the Jefferson salamander.

Impacts or Stresses

E. coli Sampling Results
There are no stretches of river or stream on the 2010 303(d) List of Waters (impaired surface waters) in this part of the watershed. However, ongoing *E. coli* sampling by the White River Partnership has shown elevated levels of *E. coli* and there needs to be some pollution source assessments done. Table 22 below contains the WRP E. coli sampling data. The consistently high geometric means of *E. coli* colonies over the years may warrant impaired status if none of the *E. coli* numbers are coming from natural sources such as beaver or waterfowl.

Table 22. White River Partnership *E. coli* sampling on the Second Branch

	Geometric mean (# in parens is number of singles samples > 235)									
Site and rivermile	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Dugout Road sb9.8	442 (6)	314 (7)	333 (7)	513 (9)	243 (6)	227 (4)	188 (4)	300 (8)	144 (2)	228 (3)
Braley Bridge	---	---	---	575 (4)	---	---	---	---	---	---
East Hill Road sb21.9	247 (5)	201 (2)	324 (8)	316 (6)	188 (1)	---	225 (6)	217 (4)	72 (1)	171 (2)

Vermont Surface Waters Priority Lists
There are two reaches in the Second Branch watershed that are on the 2010 Part C of the List of Priority Surface Waters outside the Scope of CWA Section 303(d) - Part C are waters that are in need of further assessment because a potential impact has been identified. Field investigations are needed to see land uses and stream conditions above the macroinvertebrate sampling sistes on the Kingsbury and *E. coli* sampling sites on the Second Branch.

Table 23. Two stream segments on the Part C List of Priority Waters

Wbid	Stream	Possible Pollutant	Potential Problem
VT09-05	Kingsbury Brook	temperature, nutrients	agricultural runoff, loss of riparian veg.
VT09-05	Second Branch – from East Brookfield to one mile above the White	sediment, nutrients, E. coli	agricultural runoff, streambank erosion

Specific Lakes and Ponds

Holdens
10/1997 Lake Assessment Visit: Small, artificial lake, surrounded by farm fields and little buffering. 100 percent native plant cover. This is a farm pond.

Lamson
Stressed acres:
24 acres of aesthetics, aquatic life, secondary contact recreation and swimming uses stressed by Eurasian milfoil.

2002 Assessment Visit: This large wetland-lake complex supports beaver use as noted in the 1989 assessment. Approximately 3/4 of the lake shoreline is forested to the shore. The remaining 1/4 is an old abandoned field that transitions to wetland, then the lake. The lake margin is hummocky throughout and significant portions of the north section have emergent ericaceous island. There is evidence of fishing and waterfowl hunting. Sediments are loose and organic throughout and are between 3" (south end) and one foot (north end) deep over a firm bottom. This is consistent with a pond of this type. Three homes are visible from the lake, all set far back (>0.1 miles). Public access appears to be available across private land, by means of a four wheel drive track to near the lakeshore. Public launch of any type of boat required carry-in and bushwhacking. At the outlet (series of stepped beaver dams), there is a camping area that is accessed via a posted and gated four wheel drive track. The lake alkalinity remains high (89.9 mg/l as CaCO3), and phosphorus (21 ug/l), nitrogen (0.46 mg/l), and N:P ratios (22:1) are in the meso-eutrophic range. There are several aquatic macrophyte species noted including *Chara* sp., but dense Chara covering the entire pond bottom was not observed, and the water was not "murky" at the time of our visit (Secchi disk visible to bottom at 2.5m). No changes are warranted to the assessment at this time. This is a valuable pond for wildlife.

North (Brookfield)

Stressed Acres:
24 acres of aesthetics, aquatic life, secondary contact recreation, and swimming uses stressed due to Eurasian milfoil.

1998 and 2000 REMAP Program Sampling: Pasture to shore is limited to a very small length of shoreline. The remainder of the shore is well buffered. This is a naturally shallow, wetland-like pond (maximum depth = 17 feet). Water chemistry sampling does not show impairment. Swim dock in the pond suggests swimming use. There is dissolved oxygen depletion (0.77 mg/l DO) in the bottommost depths, but this deep hole is very small and constitutes a negligible portion of the lake's volume. There are low mercury concentrations in the sediments (0.14 ug/g dry weight), although two of five fish analyzed showed moderately elevated tissue mercury (0.303 and 0.547 ug/g d.w.). The algae and macrophyte-rich nature of this pond is very much what would be expected for this type of pond. Threats due to algae, sedimentation, and plant growth were removed.

2001 Bioassessment Program Evaluation: Lake assessed in conjunction with the lake bioassessment program. Results to be available mid-2002.

Rood Pond, Williamstown:
While it is not specifically identified by the Lake Protection Classification system, Rood Pond is noteworthy from a recreational standpoint. There are few ponds with boat launches in the White River Basin. Rood Pond, with its boat ramp and handicapped-accessible fishing platform, is an important angling resource in the White River Basin.

Stressed Acres:
Aesthetics, aquatic life, secondary contact recreation, and swimming uses are stressed on 10 acres due to threat of Eurasian milfoil invasion.

VT DEC Eurasian Milfoil Program has determined that the pond is threatened due to its close proximity to an infested lake.

1997 Lake Assessment Visit: The lake was reassessed as part of the rotating basin assessment. The presence of the sediment deltas was verified, but they do not appear to be growing significantly. Logged area on the adjacent hillside northwest of the lake is old and regrowing. Outhouse sited close to inlet tributary at F+W access area. Only two dwellings were noted, neither conspicuous. Very beautiful and clear water.

Staples
Stressed Acres:
Aesthetics, aquatic life, secondary contact recreation and swimming uses stressed on 15 acres due to excessive plant and algae growth and sedimentation.

2002 Lake Assessment Visit: Shallow-appearing beaver-like pond. Silty brown water with some tannic color visible. Sediments are loose muds. Aquatic plant growth largely *Chara* sp. and some shoreline *Typha* sp. Five other species noted as well as road erosion noted entering the pond. One tributary was observed to have been ditched nearby the lake as

well. Proximity of roads may detract from lake user's enjoyment of the setting. No evidence of excessive plant growth during this survey, nor of algae growth. Data from this visit corroborates the threatened status for this pond for sediment only, remaining causes are being removed.

Sunset Pond, Brookfield:
This 25 acre lake exhibits a water quality condition known as meromixis, whereby the lake does not fully turn over as most Vermont lakes do every spring and fall. This condition is most often found in lakes that are quite deep relative to their surface area, meaning that they have a steep-sided, almost conical configuration. Meromixis, or the lack of mixing, means that the deeper layers of the water column remain perpetually oxygen starved. A result of this condition is that the underlying sediments often release accumulated nutrients. Over time, concentrations of nutrients build to such a degree, and rise sufficiently high in the water column, that they become available to algae, which can in turn bloom. On at least two occasions, blooms of the nuisance cyanobacteria (blue-green algae) *Oscillatoria rubescens* have been observed on Sunset Pond. The swimming use is considered threatened on this pond. Norwich University research studies have found a relatively high rate of sediment movement through Sunset Pond over time. The degree to which this sediment affects the lake's meromixis is unknown.

Sunset (Brookfield)
Stressed Acres:
Aesthetics, aquatic life, secondary contact recreation, and swimming uses stressed on 12 acres due to threat of Eurasian milfoil infestation.

Aesthetics, aquatic life, secondary contact recreation, and swimming uses stressed on 25 acres due to nutrients, sedimentation, and algae .

2000 Assessment Notes: Lake sampled under the REMAP mercury program in 1999 and 2000. Strongly stratified lake with conductivities in excess of 600 uS/ml (very high). Akalinity (mean water column = 128 mg/l), chlorides (mean water column = 43.5 mg/l) and sulfates (mean water column = 11.4 mg/l) are elevated in relation to other lakes of similar size and morphometry within the geographic region. Sulfide present in hypo-limnion. This lake is likely monomictic or meromictic (doesn't turn over twice/year). *Oscillatoria rubescens* was observed during the July 2000 field visit.

Given the proximity to the east lakeshore of several old (100+ year) buildings, historical direct disposal of waste is likely, which would have resulted in the storage of phosphorus in the sediments. The lake is a favored local fishing spot which nearly always has anglers fishing from the floating bridge. One lay monitor complaint of algae was received in August 2000. The water level of the pond has been slightly lowered in the past 1-2 years after the dam failed. The dam was rebuilt by the VT DEC in the summer of 2000 and the full water level of the pond has been restored. There is no indication that uses of the pond are not fully supported, or that Vermont Water Quality Standards are being violated.

Third Branch White River

Description

The Third Branch begins in Roxbury and flows south in a valley that it shares with Route 12A. Woodard Brook and Flint Brook join the Third Branch in Roxbury. The Third Branch then flows south through the eastern corner of Granville with Sandusky Brook and East Granville Brook coming in from the west. It then flows southeasterly into and through the town of Braintree. Cahee Brook, another Flint Brook, and Riford Brook join the Third Branch in Braintree. The Third Branch flow becomes more easterly as it goes from Braintree to Randolph village center. Thayer Brook joins the Third Branch and the the relatively large subwatershed of Ayers Brook adds it drainage to the Branch.

Ayers Brook is a 10 mile long stream that drains 38 square miles. Named tributaries to Ayers Brook include Open Meadow, Cold, Farnsworth, Spear, and Adams Brooks. From the confluence of Ayers, the Third Branch begins a more southerly flow again. It winds through part of Randolph and then into Bethel. It continues down to meet the White River in Bethel village. Named tributaries in this stretch include Smith, Maple, Trout, Gilead, and Camp Brooks.

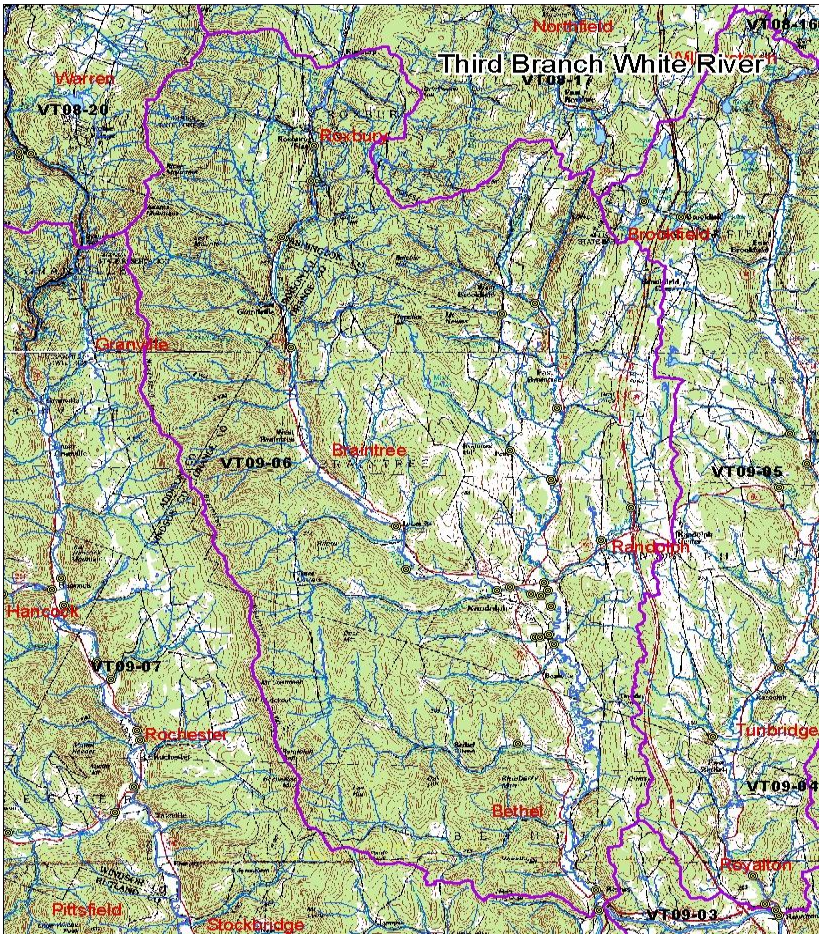


Figure 7. Third Branch White River

Biological Community Data

Table 24. Biological Monitoring Sites and Results in the Third Branch watershed

Wbid	Name	Town	River Mile	Date	Com type	Bio Community Assessment
VT09-05	Third Branch	Randolph	8.5	09/2001	M	Good
VT09-06	Third Branch	Randolph	9.5	08/1993	M	Good
VT09-06	Third Branch	Randolph	9.5	09/2001	M	Good
VT09-06	Third Branch	Randolph	9.5	09/2006	M	Good-Fair
VT09-06	Third Branch	Randolph	9.9	08/1993	M	VG-Excellent
VT09-06	Third Branch	Randolph	10.2	08/1993	M	VG-Excellent
VT09-06	Third Branch	Randolph	12.7	09/1997	M	VG-Excellent
VT09-06	Third Branch	Braintree	18.1	09/1993	M	Excellent
VT09-06	Third Branch	Granville	20.6	10/2001	F	Excellent
VT09-06	Third Branch	Roxbury	21.5	09/2009	F	Excellent
VT09-06	Gilead Brook	Bethel	2.0	09/2001	M	Excellent
VT09-06	Smith Brook	Randolph	0.1	09/2001	M	Poor
VT09-06	Ayers Brook	Randolph	0.3	09/1997	M	Vg-Good
VT09-06	Ayers Brook	Randolph	0.3	09/2001	M	Good
VT09-06	Ayers Brook	Randolph	4.5	09/2001	M	Fair-Good
VT09-06	Adams Brook	Randolph	1.5	09/1997	M	Fair
VT09-06	Adams Brook	Randolph	1.5	09/2001	M	Good
VT09-06	Spear Brook	Randolph	0.1	09/1997	M	Fair
VT09-06	Spear Brook	Randolph	0.1	09/2001	M	Good
VT09-06	Spear Brook	Randolph	0.1	09/2001	F	Good
VT09-06	Spear Brook	Randolph	1.1	09/1997	M	Good
VT09-06	Cold Brook	Brookfield	1.1	10/2001	M	Fair-Poor
VT09-06	Open Meadow Brook	Brookfield	0.2	09/2001	M	Excellent-VG

Fishery Summary

Mainstem: There is a mix of wild brook, brown and rainbow trout, with Atlantic salmon stocked annually by VDFW from lab downstream to Camp Brook. Brook trout is stocked annually from the Roxbury RR trestle pool, north of Granville townline, to Randolph sewage treatment plant. Brown trout are stocked annually from Randolph sewage treatment plant to the confluence with the White River main stem.

VDFW owns riparian land along Third Branch, above and below confluence with Riford Brook, and above and below confluence with Ayers Brook at Montague Golf Club.

Tributaries:

- Woodward Brook- wild brook trout
- Sandusky Brook- wild brook trout
- Riford Brook- wild brook and rainbow trout with lowest section used by spawning rainbows. VDFW owns riparian land along Riford Brook upstream from it's confluence with the Third Branch.
- Ayers Brook- primarily wild brook and rainbow trout with brown trout present some years. VDFW owns riparian land upstream of Scenic Drive, and a second parcel upstream of Peth Road.
    - Open Meadow Brook- a very small stream that historically contained large numbers of wild YOY rainbow trout; also contains wild brook trout.
- Gilead Brook- wild brook and rainbow trout with brown trout present some years. Atlantic salmon stocked annually by VDFW.
- Camp Brook- primarily wild brook and rainbow trout.

Physical Habitat Assessment

Ayers Brook

A Phase 2 geomorphic assessment was done on Ayers Brook and a river corridor management plan was written for the brook in 2007. Ayers Brook has been straightened, dredged, and rip-rapped, and development, especially roads, have encroached onto its floodplains over the years. Much of the vegetation has also been removed from its streambanks.

As a result of these many alterations, the stream energy has been concentrated in the channel causing Ayers Brook to cut down and then also erode its banks leading to a widening of the channel. Where the channel has become sufficiently wide, the stream has slowed and deposited sediments that it has carried from the eroded banks and bed and other sources. Sand and gravel bars have formed and, where the river has a lateral space, a new floodplain has started to form at a lower elevation. All of the Phase 2 reaches on Ayers Brook are considered to be in "fair" geomorphic condition meaning that there are still major active adjustments occurring in the stream system. Six out of eight assessed segments have a major loss of floodplain access.

Special Values and Features

Waterfalls, Cascades and Gorges
Webb Falls is on Sandusky Brook in Granville and is a 25-foot high waterfall with a pool at the base. There are sculpted rocks on which to sunbathe and ledges for diving. Above the falls are a set of low cascades and narrow pools.

Brackott Brook is a spectacular little brook with small falls and pools, turquoise-colored water, sculpted rocks. Very high quality for its scenic beauty and clarity.

Rare, Threatened or Endangered Species or Significant Natural Communities
There are six identified significant natural communities in the Third Branch subwatershed: two rich fens, two swamps, a floodplain forest, and an emergent marsh. There are five rare, threatened, or endangered plants species including bog willow and slender naiad; three animal species including a tiger beetle and wood turtle; and one bat hibernaculum.

Impacts or Threats

Waters on the Vermont Priority Surface Waters Lists
There is one stream on the 2010 Vermont 303(d) or Impaired Waters list. That stream is listed below with the reason for its impairment.

Waterbody id	Stretch of stream	Pollutant	Problem
VT09-06	Smith Brook	Iron	Leaching from an old dump site

There are five stream stretches that are on the Vermont Priority Waters List, Part C – Waters in Need of Further Assessment because potential impacts have been identified.

Table 25. Five stream segments on the Part C List of Priority Waters

Wbid	Stream	Possible Pollutant	Potential Problem
VT09-06	Cold Brook	Sediment, nutrients, E. coli, organic enrichment	Ag runoff, streambank erosion
VT09-06	Ayers Brook	Metals (Ni,Cr)	Elevated levels of Cr & Ni in stream sediment
VT09-06	Ayers Brook from its mouth up to Brookfield Gulf	Sediment	Morphological instability
VT09-06	Third Branch from Randolph/Ayers Brook down to Bethel	Sediment, nutrients, E. coli	Stormwater, ag runoff, livestock access, streambank erosion, riparian vegetation loss, morphological instability
VT09-06	Third Branch	E. coli	Elevated E coli, source unknown

E. coli Sampling Results

Table 26. E. coli sampling results from 2001 – 2010.

	Geometric mean (# in parens is number of single samples > 235)									
Site and rivermile	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Stock Farm Road tb4.3	56 (1)	98 (1)	183(3)	166(2)	---	103(1)	161(3)	179(4)	115(2)	172(2)
Golf Course Bridge tb9.3	202(8)	211(3)	242(6)	190(6)	---	86 (0)	123(2)	146(4)	112(2)	116(1)
Thresher Road tb18.2	51 (1)	53 (0)	43(0)	78(1)	56(0)	---	41(1)	82(2)	---	---
Ayers Brook	---	175(2)	270(5)	340(7)	211(3)	113(0)	175(3)	279(6)	134(3)	302(3)
Adams Brook ab2.7	83 (3)	186(4)	129(5)	33(1)	39(0)	105(1)	15(1)	26(0)	1 (1)	32(0)

Specific Lakes and Ponds

Champagne

Stressed Acres:

Aquatic life use stressed on three acres due to dredging and flow alterations.

2000 Assessment Notes: This is a private pond, stocked with gamefish, which has a campground adjacent. Campers have had problems with swimmer's itch for years, and the campground owner has an Aquatic Nuisance Control permit to use CuSO4 to control the problem. The CuSO4 is noted to be effective at abating the swimmer's itch, but has had non-target impacts on benthic biota - coleopterans and gastropods in particular. The campground owners manipulate pond water levels and have dredged. Water chemistry data are available for the pond. The pond is used for swimming and fishing.

North Pond, Brookfield:

North Pond is a 24 acre warmwater wetland-pond system, which has a remote feeling despite being close to two main roads in Brookfield. Indeed, this pond ranks eight on a scale of 10 for its wilderness-like setting. The pond has three distinct sections, each separated by constrictions in the shoreline. The water is occupied largely by a diverse mix of native macrophytes, and the shoreline itself is undisturbed. A Vermont Association of Snow Travelers snowmobile trail crosses one arm of the pond.

Mud Pond (Braintree)

7/26/2002 Lake Assessment Visit: 4-wheel drive access maintained by Randolph Fish and Game Club. It is open to public use during daylight hours. The water is tannic with very limited macrophyte cover. Only two stems of *Sparganium* sp. were noted in the pond, but it is surrounded by a wetland margin including *Typha* sp. (cattail) beds. Scenic area with wilderness-like feel. Biologist noted this to be a good wildlife viewing pond. Informal footpaths circle the pond. The pond is popular with geocaching afficiondos. Outlet sample

data using Hydrolab: Temperature = 23.38 degrees C; DO = 7.14 mg/l, 84.8% saturation; conductivity = 42 us/cm3; pH = 6.83 s.u.; Redox = 346 mV

Pickles
2002 Assessment Notes: Lake visited for a brief assessment. Shoreline undisturbed and intact, and lake is wetland-like. The rare plant *Peltandra virginica* (arrow arum) was noted. No algal blooms noted during visit. Watershed areas in agriculture and logging are limited, and are along the edges of the watershed.

Roxbury Flat;
2002 Lake Assessment Visit: This is a small, narrow pond formed by the presence of a railroad fill along VT Route 12A, and the Route 12A corridor itself. It is largely run-of-river, and supports nearly 100% macrophyte cover. Small informal access trails lead to the pond from Rte. 12A, and use appears light at best. Moose droppings and tracks were noted adjacent to the pond.

Royalton Hill;
2002 Lake Assessment Visit: This is a shallow pond dominated by a cattail wetland margin and moderate macrophyte growth dominated by surfacing plant types. The outlet is via an old dam, which is built up by beaver activity. Limited public use. There is a sheep farm adjacent to the pond, and some logging in the watershed. The pond is too shallow for swimming use. Uses should be considered supported, although swimming remains unassessed.

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Appendix A

White River Partnership Sampling Sites

Master Site List – White River watershed (updated 7/19/2012)

Site Name	River-mile	Town	Years E. coli sampled[1]	Description
Mainstem				
Watson Park	ms1.0	Hartford	2001-2012	Site is at the public access area "boat launch." Sample in the current.
Dimick Brook	ms6.4	Hartford	2001-2007	Site is located on Rte 14 side of main stem, (river left), opposite side from Dimick Brook mouth, at the downstream end of riverside field. Sample in fast water upstream of slow streamside eddy.
West Hartford Bridge	ms7.3	Hartford	2004-2005, 2008-2012	Sample site is downstream of bridge on river right, at the small sandy beach.
Mill Brook	ms8.4 mb0.1	Pomfret	2001-2003, 2005-2006 2007-2010	Old site is in the mainstem downstream of the ledges above the mouth of Mill Brook on river right. Site was moved to actual Mill Brook. Sample below the Pomfret Road culvert downstream of large pool.
Sharon	ms13.0	Sharon	2001-2007	Site is on mainstem upstream of Quation Brook mouth on river left. Moved in 2008 because of access.
White Brook	ms15.1	Sharon	2008-2010	Site is on the main stem just upstream of White Brook Road. Access is from pulloff on Rte 14 across from White Brook Road. Sample site is on river left in current.
The Sharon Academy	ms15.3	Sharon	2011-2012	Site is located across from Sharon Academy access road. Large semi-circle pullout. Great river access and popular swimming site.
Vermont Law School	ms18.7	Royalton	2001-2005 2008-2010	Site is just downstream of where the First Branch comes into the mainstem at the VLS parking lot. Sample site access is from lower VLS parking area. Sample in current off of rock ledges on river right. In 2007 testing was done at the mouth of the First Branch.
Paynes Beach	ms19.0	Royalton	2006-2008	This site is located on the main stem, in South Royalton, at the Lion's Club Park public access area. From South Royalton village, you head north on N. Windsor St. about ½ mile. The public access area is on the right.

Pinch Rock	ms 19.4	Royalton	2011-2012	Located across from 3277 Rte 14 Royalton, Rock outcrop on river right. Popular swimming site
Fox Stand	ms22.3	Royalton	2004-2008	Located on the main stem in North Royalton at the VT Fish & Wildlife Fox Stand public access area. From the Route 107/14 intersection in North Royalton, head south on Route 14, take the first right onto Royalton Hill Rd. The access area is on the right, just across the RR tracks, before you cross the river. Follow stairs to river and sample from rocks.
Royalton	ms22.8	Royalton	2001-2003	This site is located on river right, upstream of the second branch mouth. Access is made via Perley Farm Rd (across from Waterman Rd). There is an old river access point where the road turns and follows the river.
Bethel below WWTF	ms25.2	Bethel	2001-2010	From Rte 14, take Vermont Castings Road across RR tracks. Park to the left just off track and proceed behind house. There is a rope down the bank.
Bethel above WWTF	ms26.0	Bethel	2001-2010	Access to site is off of Route 107/12 bridge in Bethel. There is an access road on the south side of the bridge. Sample is taken by wading out under the bridge.
Bethel Peavine Park	ms25.8	Bethel	2011-2012	Located on main stem at the Bethel Peavine Park-upstream of Third Branch mouth
Locust Creek mouth	lc0.1	Bethel	2001-2010	Site is located in Locust creek upstream of mouth. It has been collected over the years either below the Rte 107 bridge (below the falls) or just above the falls.
Gaysville Bridge	ms31.7	Stockbridge	2004-2012	Access is at the Gaysville Bridge. Turn into campground. Just downstream of bridge on river right is a gravel beach. Sample is collected here.
Stockbridge School	ms33.4	Stockbridge	2001-2003	Park at Stockbridge Elementary School. Walk towards back of school to the rec fields. Path leads to river.
Stony Brook	ms33.1	Stockbridge		Site listed as confluence with White.
Peavine Stockbridge	ms37.3	Stockbridge	2011-2012	Located at Forest Service pull out on Pit Road.

West Branch (Brandon Brook) (Bingo Brook)	ms44.8	Rochester	2001-2003, 2005-2006	This site is located on the main stem, south of Rochester village. There is a pullout on Route 100 on the northeast corner of the Route 73 bridge. You can access the river from the pullout, so we have located the site at this point.
Lions Club Park	ms46.6	Rochester	2001-2012	Lions Club park is located on Rte 100 north of Rochester Village. Access road is on the left. At the end of the parking area there is a trail that leads to some rip rap along the river.
Taylor Meadow Rd	ms49.7	Hancock	2011-2012	At the end of Taylor Meadow Rd
Hancock Branch(1) Hancock Branch(2)	ms54.2 hb0.2	Hancock	2001-2006, 2009-2010 2007-2008	From 2001 – 2006 and 2009 – 2010, testing was done on the main stem, upstream of the Hancock Branch mouth. In 2007 and 2008, testing was done in the Hancock Branch, upstream of the Rte 100 bridge.
Clark Brook	ms61.1	Granville	2001-2003	Tributary to Upper White in Green Mountain National Forest.
Tweed River				
Mouth of Tweed	tw.25	Stockbridge	2011-2012	Pull out on Rte 100 just up from the mouth of the Tweed
Tweed at Bartlett Brook	tw0.6	Stockbridge	2001-2003, 2005-2006	Access is the VT Fish and Wildlife public access site at the southeast corner of the Route 107 bridge. Follow the path to the river and test in the current. This is the same site as “Tweed Mouth” (2005) and “Tweed River” (2006). In 2007 and on, the site moved to Tweed at South Hill Road (below).
Tweed at South Hill Road	tw1.1	Stockbridge	2007-2010	South Hill Road is off of Rte 100 just south of Stockbridge town office. Sample on the river left on downstream side of bridge. Access is via field along river.
Third Branch				
Mouth of Third	tb0.03	Bethel	2011-2012	Site is located near the mouth of the 3rd Branch in Peavine Park Bethel
Stock Farm Road	tb4.3	Bethel	2001-2004, 2006-2010	From Rte 12 north of Bethel village, take Findley Bridge Rd. Follow river north 1.5 miles up stream. Pullout on river side, path down to river. Sample out on the ledges.

Golf Course Bridge	tb10 (oxbows cut in Irene)	Randolph	2001-2004, 2006-2010	Access is via Stock Farm Road. Pull out on road before you get to Three Stallion Inn. Cross golf course to the golf cart bridge that crosses Third Branch. Sample at the gravel bar upstream of bridge on River left.
Randolph Rec Park	tb11.5	Randolph	2011-2012	Randolph Rec Park foot bridge upstream on river left
Riford Brook	tb14.65	Braintree	2011-2012	Ledges below the Riford Brook Bridge-popular swimming hole
Thresher Road	tb20.38 (was 18.2)	Braintree	2001-2005, 2007-2010	Located in West Braintree. Thresher Road is north of village off of Rte 12A. Turn right onto Thresher. Park at pulloff on left, just before RR crossing. Sample upstream of bridge on river right.
Ayers Brook (Tributary to Third Branch)				
Ayers Brook(2) Ayers Brook (1)	ay0.1 ay1.03	Randolph	2007-2010 2002-2006	Access is the pump house parking lot on northeast side of the Route 66 bridge. Trail leads from pump house to gravel bar. Sample in current on river left. Sample site was behind volunteer's house – 214 Sugar Plum Court. Moved to Ayers (2) in 2007.
Adams Brook (Tributary to Ayers Brook)				
Adams Brook(1) Adams Brook(2)	ab2.7 ab2.85	Randolph	2001-2006 2007-2010	Original site located along Harvey Road, off of Route 66, parallels I-89. Left side of road before bridge over tributary. High conductivity readings led to tributary .15 miles up from Adams (1) site. Sample on small trib on right side of road that flows under I-89.
Second Branch				
Mouth of Second Branch	sb0.5	Royalton	2011-2012	On Rte 14 just North of 107 intersection vacant field along river.
Dugout Road	sb9.8	South Randolph	2001-2012	Located off of Rte 14 in South Randolph. Dugout Rd is on the right as you head north. Sample on upstream river right side of bridge.
Braley Bridge	sb13.0	East Randolph	2004	Located off of Rte 14 on Braley Covered Bridge Road.
East Hill Road	sb 23.6	East Brookfield	2001-2005 2007-2010	East Hill road is located in East Brookfield just south of Rte 65. Testing has been done on the river left side of the Second Branch both upstream and downstream of the Rte 14 bridge at East Hill Road
First Branch				

Mouth of First Branch	fb0.03	Royalton	2011-2012	Upstream of Rte 14 bridge on river right
Tunbridge Fair Grounds	fb6.8	Tunbridge	2012	Site is located near the upstream end of the Tunbridge Fairgrounds near the parking area on river right.
Cilley Bridge	fb5.9	Tunbridge	2001-2004, 2006-2010	Located on Howe Lane off of Rte 14 just south of Tunbridge Fair Grounds. Sample on River left side upstream of bridge.
Chelsea Rec Park	fb15.2	Chelsea	2001-2003, 2006-2010	Located behind the sewage treatment plant at the horseshoe pits. Follow steps down to the river. Gravel bar just downstream, sample in current. Sewage discharge is up stream from sample site.
Tunbridge town pool trib	Tb0.1	Tunbridge	2011-2012	Trib of First Branch at Tunbridge rec fields. Town uses trib to fill man made swimming pond at rec field. Turn off of Rte 110 onto Strafford Rd. Take left onto Recreation drive. Site is where the intake valve for pond is located.

1 Taken from a compilation done by Fritz Gerhardt for the White River Partnership and updated over time.