



2017 Upper Winooski Fisheries Assessment

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The Upper Winooski River watershed is defined in this fisheries assessment as the Winooski River from the headwaters in Cabot downstream to the top of the Bolton Dam in Duxbury.

Introduction

The Winooski River basin contains a diversity of fish species, many of which support popular recreational fisheries. Most streams within this watershed provide suitable habitat to support naturally reproducing, “wild” trout populations. Wild populations of native brook trout flourish in the colder, higher elevation streams. Lower reaches of some tributaries and much of the mainstem also support naturalized populations of wild rainbow and brown trout. Both species were introduced to Vermont in the late 1800s, rainbow trout from the West coast and brown trout from Europe.

Most of the tributary streams of the Winooski River basin are managed as wild trout waters (i.e. are not stocked with hatchery-reared trout). The Vermont Fish and Wildlife Department (VFWD) stocks hatchery-reared brook trout, brown trout or rainbow trout to supplement recreational fisheries in the Winooski River mainstem from Marshfield Village to Bolton Dam, as well as in the North Branch (Worcester to Montpelier) and Mad River (Warren to Moretown) where habitat conditions (e.g. temperature, flows) limit wild trout production. As mainstem conditions vary seasonally, wild trout may reside in these areas during certain times of the year.

Naturally reproducing populations of trout have been observed in the upper mainstem of the Winooski as far downstream as Duxbury. Trout from mainstem reaches and larger tributaries may migrate into smaller tributary streams to spawn. These streams then serve as nursery areas for young trout until they are ready to migrate downstream to mainstem areas. Trout and other species may also move upstream and downstream to meet habitat needs. These movements could be localized or may involve many miles of travel. For example, during warm periods in the summer, trout often migrate to coldwater refuges such as the mouths of tributary streams or to areas of groundwater inflow. Likewise, trout may migrate in the fall to areas providing overwintering habitat.

Warm water temperatures are the most important factor limiting brook trout distribution. Brook trout thrive in water temperatures below 68°F and can tolerate brief periods of up to 72°F. Rainbow trout and brown trout are more tolerant of elevated water temperature and may be able to withstand temperatures in the low 80s for short periods.

Upper Winooski Mainstem Fisheries

Winooski headwaters to the confluence with Molly's Brook

The Winooski River originates near the Cabot/Walden town line where headwater streams join approximately a mile upstream of Cabot village. Wild brook trout are abundant in the Winooski



mainstem upstream of Cabot Village. Temperature and habitat conditions deteriorate downstream of the village primarily due to a lack of riparian habitat (Photo 1).



Photo 1 – Winooski River mainstem and the lack of riparian area downstream of Cabot Village

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

Table 1. Water temperature data (°F) between June and October from the mainstem of the Winooski River upstream of Molly’s Falls Brook. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Winooski River	1160	44.42369200	-72.30794900	2015	13	1	0	0	0	68.0	66.3
Winooski River	895	44.38270000	-72.33289000	2015	76	55	21	5	0	76.6	74.6
Winooski River	840	44.35985556	-72.33658611	2015	89	71	32	10	0	77.8	76.0



The Confluence with Molly’s Brook to confluence with Kingsbury Branch

Below the mouth of Molly’s Brook, the Winooski River flows southwesterly to Plainfield. Along this reach there are a mix of wild brown trout, rainbow trout, and brook trout with supplemental stockings of primarily rainbow trout to provide additional angling opportunity in areas with low wild trout levels. Local habitat conditions vary widely resulting in an uneven distribution of wild trout. Wild trout populations have also been slow to recover below Cabot Village following a 2005 fish kill along roughly 5.5 miles of the mainstem including some of this reach. Wild brown trout populations, observed prior to the fish kill, are no longer present in this area.

In 2012, the Marshfield 8 dam was removed to prevent failure, improve stream processes and aquatic habitat, and allow aquatic organism passage upstream of Marshfield. Further downstream (9.5 miles) a dam in Plainfield, near the confluence with Great Brook, still blocks the upstream passage of aquatic populations. The Winooski flows West before entering East Montpelier, and then turns south downstream of the confluence with the Kingsbury Branch. VFWD owns three parcels of riparian land along mainstem in Plainfield and Marshfield which provides angler access and naturally vegetated riparian habitat.

The Kingsbury Branch to the confluence of the Stevens Branch

The Winooski flows West from the Kingsbury Branch toward Montpelier where the Stevens Branch enters from the South. In this section of the Winooski, there is a mix of wild brown trout and rainbow trout with supplemental stockings of rainbow trout. Water temperatures during summer occasionally reach 80°F and may be unsuitable for trout during certain times of the year (Table 1). Again, trout populations vary in abundance with local habitat conditions which vary widely in this reach. The Vermont Fish and Wildlife Department (VFWD) owns extensive riparian land along the Winooski River directly above Warsaw’s dam in East Montpelier.

Table 2. Water temperature data (°F) between June and October from the mainstem of the Winooski River below the confluence to the Kingsbury Branch. Elevation (Above mean sea level (MSL)) number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Winooski River	650	44.26122778	-72.49819167	2015	83	74	44	21	1	80.2	77.8
Winooski River	650	44.26122778	-72.49819167	2004	101	81	33	9	0	78.7	75.0

The Stevens Branch to the confluence of the Dog River

From the mouth of the Stevens Branch, the Winooski River flows through the City of Montpelier. The North Branch then joins the Winooski River in downtown Montpelier and the Dog river enters just below the interstate crossing. This reach of stream is extremely confined by existing infrastructure and lacks riparian habitat. Proximity to larger wild trout tributaries (Stevens Branch and Dog River) provides a mix of wild brown trout and rainbow trout in this reach which receives supplemental stockings of brown trout. Again, elevated water



temperatures (Table 2) in addition to widely varying habitat conditions likely limit local wild trout abundance in some areas. Several dams also fragment and degrade habitat within this reach.

Table 3. Water temperature data (°F) between June and October from the mainstem of the Winooski River below the confluence to the Stevens Branch. Elevation (Above mean sea level (MSL)) number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Winooski River	505	44.25605833	-72.59720556	2015	97	77	44	27	2	81.0	79.3
Winooski River	505	44.25605833	-72.59720556	2004	103	82	42	17	2	80.4	76.5

Dog River to the confluence with the Mad River

The Winooski River continues northwesterly. Below Middlesex village, the river goes through Middlesex Gorge, a deep gorge with a hydroelectric dam that fragments and degrades habitat. Below the gorge, the Mad River joins the Winooski from the southwest. A mix of wild brown trout and rainbow trout with supplemental stockings of brown trout occur within this reach. Again, wild trout abundance varies with local habitat conditions and warm summer temperatures likely limit trout distribution. Due to river size trout sampling was limited to angler creel surveys in 1999 and 2015.

Table 4. Water temperature data (°F) between June and October from the Mainstem of the Winooski River above the confluence to the Mad River. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Winooski River	498	44.27397778	-72.64825000	2004	97	75	38	15	1	80.2	76.2

Mad River Confluence to Bolton Dam

The Winooski River continues northwesterly toward Waterbury where several tributaries including Crossett Brook, Thatcher Brook and the Littler River enter which help to somewhat moderate temperature (Table 4). A Mix of wild brown trout and rainbow trout with supplemental stockings of brown trout and rainbow trout occur along this reach. Wild trout populations vary with local habitat conditions in this reach. The large stream size limits direct population sampling, although angler creel surveys were conducted in 1999 and 2015. Improved hydroelectric operations resulting from a recently issued Section 401 water quality certificate and FERC license is expected to improve flow and temperatures beginning in 2018. Although the Bolton falls was likely a natural barrier before the dam was constructed, the dam degrades habitat within this reach and prevents aquatic organism passage.



Table 5. Water temperature data (°F) between June and October from the Mainstem of the Winooski River below the confluence to the Mad River. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Winooski River	420	44.31390278	-72.70303056	2015	81	58	31	18	0	79.3	78.0
Winooski River	420	44.31390278	-72.70303056	2004	88	66	31	9	0	78.4	75.3

B1 Waters in the Upper Winooski Watershed

VFWD assesses wild trout populations and important nursery areas to document high quality recreational fisheries, which are typically found in surface waters that exhibit clean and cool conditions. Waters with abundant wild self-sustaining salmonid populations supporting multiple age classes are identified below as “very good” or class B1 waters for recreational fishing. These waters support multiple age classes of trout totaling a minimum of 1,000 per mile (all species/ages/sizes), and/or 200 per mile > 6 inches (total length).

It should be recognized that wild trout populations vary widely from year to year and therefore an individual population may sometimes go below or greatly exceed these values (1,000 per mile, and/or 200 per mile > 6 inches (total length)) in any given year. The upstream and downstream extent of the stream classification should be based upon consistent or improving water quality, physical habitat quality and land use conditions, as per VDEC language for class A1 waters: *“The length of river or stream reach to be recommended for reclassification shall be delineated by analyzing the extent of biological, chemical, physical habitat, and land use information available for the watershed. The decision to include tributaries to the river or stream under consideration will follow the same process.”* The reach should include all upstream habitats which are deemed essential to sustain water quality and physical habitat requirements necessary to support wild salmonid populations at a very good level.

Other waters that have not been surveyed may also support similar wild trout densities and may be identified in the future. Certain noteworthy streams are also important to support spawning and nursery habitat and are noted below. Location data is provided for either the survey location or the downstream extent of the proposed reach.

Based upon fish population surveys conducted by VFWD very good fisheries (Class B1) exist in the following waters within the upper Winooski Watershed:



Table 6. B1 Waters for recreational fishing in Upper Winooski and small direct tributaries including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Winooski River (Above Lower Cabot)	BKT	44.401532	-72.313661
Molly's Brook (Above Marshfield Dam)	BKT, BNT	44.370495	-72.270039
Kidders (aka. Hooker) Brook	BKT, BNT	44.37392	-72.261009
Nasmith Brook	BKT, BNT, RBT Important spawning tributary	44.299742	-72.387648
Great Brook	BKT, BNT, RBT Important spawning tributary	44.231992	-72.406267
Jones Brook	BKT, RBT. Important spawning tributary.	44.248972	-72.654826
Crossett Brook	BKT, BNT, RBT Important spawning tributary	44.32805	-72.747014
Thatcher Brook	BKT, BNT, RBT	44.3409	-72.75139

Table 7. B1 Waters for recreational fishing in the Kingsbury Branch including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Dugar Brook	BKT	44.393344	-72.467825

Table 8. B1 Waters for recreational fishing in the Stevens Branch watershed including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Jail Branch	BKT	44.105767	-72.430317
Gunners Brook	BKT, BNT, RBT Important spawning tributary	44.205447	-72.506175
Stevens Branch	BKT	44.132939	-72.533325

Table 9. B1 Waters for recreational fishing in the North Branch watershed including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Martins Brook	BKT, BNT	44.353128	-72.606703
Herrick Brook	BKT, BNT	44.346283	-72.609164



Table 10. B1 Waters for recreational fishing in the Dog River watershed including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Dog River Mainstem	BKT, BNT, RBT	44.246156	-72.599111
Felchner Brook	BKT	44.125128	-72.715756
Stony Brook	BKT, BNT, RBT	44.119219	-72.681664
Bull Run	BKT, BNT, RBT	44.117139	-72.672956
Sunny Brook	BKT, BNT, RBT	44.120875	-72.658308
Robinson Brook	BKT, BNT, RBT	44.116064	-72.642978
Union Brook	BKT	44.157722	-72.677042
Chase Brook	BKT, BNT, RBT Important spawning tributary	44.206727	-72.636622

Table 11. B1 Waters for recreational fishing in the Mad River watershed including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Mad River (Above Warren Village)	BKT	44.175722	-72.661631
Bradley Brook	BKT	44.11949	-72.85795
Clay Brook*	BKT	44.13515	-72.895369
Rice Brook	BKT	44.138231	-72.891653
Mill Brook	BKT, RBT	44.194164	-72.889842
Chase Brook	BKT	44.178856	-72.884308
Slide Brook	BKT	44.167197	-72.887525
Shepard Brook	BKT, BNT, RBT	44.236758	-72.821114
Dowsville Brook	BKT, BNT, RBT	44.273039	-72.824189

*Previously listed as impaired, however; populations have exceeded 1,000 trout/mile every year 2001- 2016

Table 12. B1 Waters for recreational fishing in the Little River watershed including stream name, trout species present; Brook trout (BKT), Brown trout (BNT), and rainbow trout (RBT), and downstream location.

Stream	Trout Species Present	Latitude	Longitude
Little River - West Branch	BKT	44.523892	-72.774686
Ranch Brook	BKT	44.502097	-72.758717

Upper Winooski Lakes and Ponds Fisheries Resources and Public Access

- **Coits Pond** – Chain pickerel, largemouth bass, yellow perch, brown bullhead, VFWD access
- **West Hill Pond** – Largemouth bass, chain pickerel, yellow perch, brown bullhead, VFWD access.
- **Molly's Falls Pond (Marshfield Reservoir)** – Northern pike, smallmouth bass, largemouth bass, yellow perch, rainbow trout (stocked), brown trout (stocked),



- brown bullhead. VFWD access. The late fall and winter drawdown impacts littoral zone productivity and may affect spawning tributary access.
- ***Peacham Pond*** – Brown trout (stocked), smallmouth bass (observed in 2014), yellow perch, rainbow smelt, VFWD access. The late fall and winter drawdown impacts littoral zone productivity and may affect spawning tributary access.
 - ***Molly's Pond*** – Chain pickerel, yellow perch
 - ***Buck Lake*** – Smallmouth bass, yellow perch, brown bullhead, pumpkinseed, VFWD access and location of VFWD Green Mountain Conservation Camp.
 - ***Pidgeon Pond*** - Brook trout (stocked) public access provided by private landowner.
 - ***Greenwood Lake*** – Brown trout (stocked), smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VFWD access.
 - ***Valley Lake*** – Smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VFWD access.
 - ***Cranberry Meadow Pond*** – Smallmouth bass, yellow perch, pumpkinseed.
 - ***Nelson Pond*** – Lake trout (wild & stocked), rainbow trout (stocked), brown trout (stocked) rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VFWD access
 - ***Mirror Lake*** (No. 10 Pond) – Rainbow trout (stocked), rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VFWD access.
 - ***Woodbury Lake*** (Sabin Pond) - Rainbow trout (stocked), brown trout (stocked), smallmouth bass, largemouth bass, rainbow smelt, smallmouth bass, yellow perch, chain pickerel, brown bullhead, pumpkinseed, VFWD access
 - ***Curtis Pond*** – Largemouth bass, chain pickerel, yellow perch, brown bullhead, pumpkinseed, black crappie, channel catfish, VFWD access.
 - ***Baker Pond*** - Largemouth, yellow perch, pumpkinseed, brown bullhead. VFWD owns surrounding land, dam and access area.
 - ***Berlin Pond*** - Public water supply. Largemouth bass, smallmouth bass, chain pickerel, yellow perch, pumpkinseed, brown bullhead. The Vermont Department of Transportation owns a small carry on watercraft access area which is leased by VFWD. New in 2018!
 - ***Bliss Pond*** – Largemouth bass, yellow perch, chain pickerel, brown bullhead.
 - ***North Montpelier Pond*** – Chain pickerel, yellow perch, brown bullhead, pumpkinseed.
 - ***Blueberry Lake*** - Largemouth bass, bluegill, stocked brook trout, brown bullhead and rudd. Access provided by the U.S Forest Service
 - ***Thurman Dix Reservoir*** – Largemouth bass, yellow perch, pumpkinseed, brown bullhead Public water supply with limited shoreline fishing access
 - ***Wrightsville Reservoir*** – Largemouth and smallmouth bass, yellow perch, chain pickerel, pumpkinseed, brown bullhead. VDEC Access area.
 - ***Waterbury Reservoir*** – Brown trout, rainbow trout (wild and stocked), smallmouth bass, rainbow smelt, yellow perch, pumpkinseed, brown bullhead. The Vermont Department of Forest and Parks (VFPR) and GMP provide access at three locations



around the reservoir. Little River State Park is also located on Waterbury Reservoir. Annual winter drawdown impacts littoral habitat and may interfere with rainbow smelt spawning. As part of a 401 water quality certificate adopted in 2014, once the tainter gates of the dam are repaired, the winter drawdown will be reduced and therefore the fishery and health of the surrounding ecosystem should improve.

Other Small Ponds with no or limited public access

- ***Horn of the Moon Pond*** - Chain pickerel, yellow perch (1996 sampling only)
- ***Bolster Reservoir*** - Brown bullhead, yellow perch (1968 sampling only)
- ***Pecks Pond*** – No VFWD fisheries data
- ***Lime Hurst Pond*** – No VFWD fisheries data
- ***Cutter Pond*** – No VFWD fisheries data
- ***Knob Hill Pond*** – No VFWD fisheries data
- ***Little Mud Pond*** – No VFWD fisheries data
- ***Baily Pond*** – No VFWD fisheries data
- ***Hawkins Pond*** – No VFWD fisheries data
- ***Turtle Head Pond*** – No VFWD fisheries data
- ***Sodom Pond*** – No VFWD fisheries data
- ***Worcester Pond*** – yellow Perch

Upper Winooski Tributary Fisheries

Kingsbury Branch Watershed

The Kingsbury Branch is about 12 miles long and has a watershed of 53 square miles. This river contains wild brook trout in East Calais and upstream. A wild population of burbot also exists in East Calais. Burbot found within the Kingsbury Branch is the only know population upstream of Lake Champlain in the Winooski watershed. Public access along the Kingsbury Branch is limited, and the sampling conditions are difficult from East Calais downstream to the mouth. Elevated water temperatures leaving Sabin Pond cool slightly due to inflow from Pekin Brook before entering North Montpelier Pond where this impoundment increases downstream water temperatures (Table 13). A dam in East Calais also fragments and degrades habitat.

Pekin Brook – Enters the Kingsbury Branch from the northwest In Calais and contains wild brook trout and burbot.

Dugar Brook – Enters Pekin Brook in North Calais and contains brook trout and burbot.



Table 13. Water temperature data (°F) between June and October from Kingsbury Branch. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Kingsbury Branch	895	44.38494000	-72.41774000	2006	103	79	53	33	6	81.6	80.1
Kingsbury Branch	740	44.36214000	-72.43486000	2006	81	65	41	16	2	80.0	78.3
Kingsbury Branch	710	44.33179444	-72.44563611	2006	65	51	20	6	0	78.4	75.9
Kingsbury Branch	705	44.31816111	-72.43791944	2006	73	55	23	7	0	77.9	76.0
Kingsbury Branch	660	44.28437500	-72.45315556	2006	86	66	39	23	0	79.5	78.1

Stevens Branch Watershed

The Stevens Branch is 14.7 miles long; drains a watershed of 129 mi²; and joins the Winooski River East of Montpelier. The Stevens Branch originates downstream of Cutter Pond in Williamstown and flows northeasterly into the town of Barre. The Steven’s largest tributary, the Jail Branch (14-miles long and 49mi²) joins the Stevens in Barre City.

Stevens Branch - Exclusively wild brook trout exist above Route 63 in South Barre and downstream, the brook supports a mix of wild brook, brown and rainbow trout. Despite urbanization and associated impacts, the Stevens Branch still supports good levels of wild trout populations in areas. This stream meets the criteria for B1 waters from Williamstown upstream.

Martin Brook - No VFWD data

Cold Spring Brook - No VFWD data

Orange Brook - No VFWD data

Nelson Brook - No VFWD data

Baker Brook - No VFWD data

Honey Brook - No VFWD data

Gunners Brook - Gunner Brook has wild brook, brown trout, and rainbow trout. It is an important spawning tributary for Stevens Branch populations. This brook meets criteria for B1 waters.

Pond Brook - No VFWD data

Jail Branch -The upper reaches in Washington support exclusively wild brook trout. From East Barre to the mouth, the stream supports a mix of wild brook, brown and rainbow trout. This river meets the criteria for B1 waters above Washington and contains populations of relatively large wild brown trout. Habitat begins to degrade downstream due to increased urbanization, lack of riparian habitat and increasing water temperatures (Table 14). Storm water runoff from roads and parking areas enter the stream directly along Boynton Street (Photo 3).



Photo 2 – Storm water flow directly entering the Jail Branch on Boynton Street in Barre City.

Table 14. Water temperature data (°F) between June and October from the Stevens Branch and Jail Branch. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Stevens Branch	760	44.1333361	-72.5325306	2016	77	35	1	0	0	72.9	69.4
Stevens Branch	760	44.13333611	-72.53253056	2006	33	8	0	0	0	69.8	68.3
Stevens Branch	710	44.1711833	-72.5110556	2016	98	72	32	7	0	78.1	74.5
Stevens Branch	710	44.17118333	-72.51105556	2006	44	15	0	0	0	71.0	69.2
Stevens Branch	610	44.18932222	-72.50092778	2016	89	60	8	1	0	75.9	71.3
Stevens Branch	610	44.18932222	-72.50092778	2006	50	19	0	0	0	71.8	70.1
Stevens Branch	600	44.19013333	-72.50099722	2006	26	10	1	0	0	72.1	67.9
Stevens Branch	570	44.2104417	-72.5163806	2016	97	75	32	7	0	77.6	73.4
Stevens Branch	570	44.21044167	-72.51638056	2006	56	29	3	0	0	72.8	71.4
Stevens Branch	540	44.22205833	-72.54863889	2016	99	84	44	13	0	78.4	75.3
Stevens Branch	540	44.22205833	-72.54863889	2006	62	34	4	0	0	73.1	71.6
Jail Branch	1210	44.11595000	-72.43007500	2016	81	58	15	4	0	75.8	72.6
Jail Branch	1010	44.16333889	-72.45156667	2007	86	52	20	6	0	77.4	75.1
Jail Branch	780	44.17619000	-72.46844000	2016	100	84	51	15	0	79.2	75.1
Jail Branch	780	44.17618611	-72.46844167	2006	67	44	9	1	0	75.7	72.8
Jail Branch	620	44.18867000	-72.49295000	2016	96	81	45	14	0	78.2	74.3
Jail Branch	620	44.18867000	-72.49295000	2007	74	38	5	1	0	75.8	71.2



North Branch Watershed

The North Branch is approximately 18 miles long and flows from a large wetland complex east of the Worcester Mountains in Elmore through Worcester, Middlesex, and Montpelier where it joins the Winooski River. In Middlesex, the North Branch is impounded to create Wrightsville Reservoir. Elevated downstream temperatures due to a surface water release is magnified by a loss of diurnal cooling within the reservoir (Table 15). These factors likely limit the ability of the North Branch to sustain wild trout and other coldwater fish species below the reservoir (Kirn 2017). Poor recruitment of largemouth bass within the reservoir may reflect the impact of water level fluctuations during and following spawning and a lack of aquatic vegetation growth within the reservoir. From the Reservoir, the North Branch flows through Montpelier and into the Winooski River. Riparian habitat is largely absent from the mouth roughly 3/4 mile upstream.

The North Branch - Wild brook trout exist in the upper elevations (>1000') only. Brook trout are stocked along the mainstem in Worcester above Wrightsville Reservoir. Elevated water temperatures also occur above the reservoir in North Middlesex (elevation 800) and likely limit wild brook trout abundance within the upper mainstem (Table 15)

Barnes Brook - No VFWD data

Russ Pond Brook – Wild brook trout

Hardwood Brook – Wild Brook Trout (VDEC data only)

Catamount Brook – Wild brook trout

Hancock Brook – Wild brook trout

Worcester Brook – Wild brook trout and brown trout

Minister Brook – Wild brook trout

Martins Brook - Wild brook trout and brown trout – This brook meets the criteria for B1 waters

Patterson Brook – Wild brook trout and brown trout

Herrick Brook – Wild brook trout and brown trout – This brook meets the criteria for B1 waters

Long Meadow Brook – Wild Brook trout (1958 data only)



Table 15. Water temperature data (°F) between June and October from the North Branch of the Winooski River. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
North Branch	800	44.40251111	-72.55103056	2003	77	53	28	11	1	80.5	76.8
North Branch	730	44.37736389	-72.54598611	2003	95	73	41	14	0	79.0	77.3
North Branch	660	44.34263056	-72.56599167	2012	87	79	68	45	7	84.0	79.5
North Branch	660	44.34263056	-72.56599167	2003	101	75	42	22	2	82.5	78.8
North Branch	570	44.30744722	-72.57683056	2012	91	85	70	35	2	81.1	77.5
North Branch	570	44.30744722	-72.57683056	2002	104	88	57	27	0	79.3	78.7
North Branch	530	44.27938333	-72.57057778	2012	93	89	79	67	33	86.2	82.9
North Branch	530	44.27938333	-72.57057778	2003	111	95	73	51	18	86.6	82.8

Dog River Watershed

The Dog River is approximately 20 miles long with a watershed of about 94mi². The River originates from along the west side of the Northfield Mountains and flows southeasterly to Roxbury village. The river then flows north through Northfield and Berlin before emptying in the Winooski River just downstream of Montpelier. In 2001, following a year of a full season angler creel survey and several trout population surveys to gather good baseline data, special regulations (reduced harvest) were set for a 4.3 mile stretch on the Dog River from the West Berlin railroad bridge to the first Route 12 bridge above the mouth in Berlin to improve the size structure of the wild trout in the river.

Dog River - The Dog River mainstem and all tributaries are managed as “wild trout waters”. There are exclusively wild brook trout above Route 12A in Roxbury and a mix of wild brook trout, brown trout and rainbow trout downstream. Wild rainbow trout and brown trout dominate the fishery below Northfield Falls. The Dog River meets the criteria for B1 waters throughout the entire mainstem.

Felchner Brook – Wild brook trout and brown trout below the falls wild brook trout only above the falls.

Stony Brook - Wild brook trout and rainbow trout. This brook meets the criteria for B1 waters.

Bull Run – Wild brook trout, brown trout and rainbow trout. This brook meets the criteria for B1 waters.

Sunny Brook - Wild brook trout, brown trout and rainbow trout. This brook meets the criteria for B1 waters.

Robinson Brook- Wild brook trout, brown trout, and rainbow trout. This brook meets the criteria for B1 waters.

Union Brook – Wild brook trout. This brook meets the criteria for B1 waters.

Cox Brook – Wild brook trout and rainbow trout. A dam above the mouth was removed in 2008 to allow for upstream fish movement

Chase Brook – Wild brook trout, brown trout and rainbow trout. Managed as a rainbow



trout spawning water with special regulations that close fishing until June 1. This brook meets the criteria for B1 waters.

Whestone Brook - No VFWD data

Table 16. Water temperature data (°F) between June and October from the Dog River. Elevation (Above mean sea level (MSL)), number of days each temperature (65,68,72,75 and 80) was reached or exceeded, the overall maximum temperature (Max Temp F) and the overall maximum of a 7-day rolling average of daily maximum temperatures (7DaymaxAVG F).

River	Elevation (feet MSL)	Latitude	Longitude	Year	Days >65F	Days >68F	Days >72F	Days >75F	Days >80F	Max Temp F	7Day max AVG F
Dog River	1340	44.10578710	-72.75237770	2016	9	1	0	0	0	68.1	65.7
Dog River	1340	44.10578710	-72.75237770	2015	4	0	0	0	0	65.9	64.3
Dog River	1340	44.10578710	-72.75237770	2014	2	0	0	0	0	65.9	62.6
Dog River	1340	44.10578710	-72.75237770	2012	8	0	0	0	0	66.6	65.2
Dog River	805	44.11033611	-72.69125278	2016	43	5	0	0	0	69.6	67.2
Dog River	805	44.11033611	-72.69125278	2015	20	2	0	0	0	68.3	66.6
Dog River	805	44.11033611	-72.69125278	2014	11	1	0	0	0	68.4	65.3
Dog River	805	44.11033611	-72.69125278	2012	46	8	0	0	0	69.8	68.1
Dog River	572	44.19906944	-72.63443056	2016	93	58	12	0	0	74.3	71.7
Dog River	572	44.19906944	-72.63443056	2015	65	29	2	0	0	73.2	71.4
Dog River	572	44.19906944	-72.63443056	2014	66	31	1	0	0	72.8	69.5
Dog River	572	44.19906944	-72.63443056	2012	84	60	10	0	0	74.0	72.1
Dog River	530	44.22999000	-72.59956000	2015	76	50	10	0	0	74.9	73.5
Dog River	530	44.22999000	-72.59956000	2014	70	38	1	0	0	72.6	70.1
Dog River	530	44.22999000	-72.59956000	2012	91	76	31	4	0	76.3	74.0
Dog River	515	44.24725556	-72.59983611	2016	105	90	52	22	0	78.4	75.7
Dog River	515	44.24725556	-72.59983611	2015	76	61	25	5	0	76.6	74.8
Dog River	515	44.24725556	-72.59983611	2014	80	61	14	1	0	75.9	72.6
Dog River	515	44.24725556	-72.59983611	2012	95	83	49	18	0	78.1	76.0

Mad River Watershed

The Mad River is 26 miles long and drains 143 mi². The river originates in Granville and flows north between the Green Mountains and Northfield Mountains. The Mad River continues to flow north through Warren, Waitsfield, and Moretown before entering the Winooski River in Middlesex.

The Mad River above Warren Village can generally be described as having excellent trout habitat typical of high gradient, forested upland streams. This upper reach (Warren Village and upstream) have some of the highest trout populations in the watershed. Between Warren Village and Waitsfield, the Mad River loses gradient and is characterized by wide, shallow riffles or flats with occasional deep pools. Overall, the riparian area is generally well vegetated although some long stretches lack streamside vegetation. Below Waitsfield Village, the Mad River is characterized by wide shallow riffles or flats, a high proportion of fine substrate (sand, silt), and a poorly vegetated riparian area. Wild trout populations are low although pockets of good habitat may hold greater trout densities.

Mad River - The upper reach of the Mad River supports mostly wild brook, with



occasional rainbow trout observed. Above Warren Village, the Mad river is managed for wild trout and meets the criteria for B1 waters in this area. Below Warren village, increasing water temperature and habitat deficiencies limit trout production to populations associated with large pools or nearby tributaries. Rainbow trout are stocked below Warren to the Moretown 8 dam to supplement the recreational fishery. Dams in Warren and Moretown fragment and degrade habitat.

Austin Brook – Wild brook trout and rainbow trout

Stetson Brook – Wild brook trout and rainbow trout

Mills Brook – No VFWD data

Freeman Brook – Wild brook trout and rainbow trout

Lincoln Brook – Wild brook trout

Bradley Brook – Wild brook trout. This brook meets the criteria for B1 waters.

Clay Brook – Wild brook trout. Following a 1998 flood event, brook trout populations dropped to their lowest levels in 11 years. A further decline in 1999 was recorded before recovery was apparent in 2000 while in subsequent years population levels were sustained at pre-flood levels. This brook meets the criteria for B1 waters.

Rice Brook – Wild brook trout. This brook meets the criteria for B1 waters.

Folsom Brook - Wild brook trout, brown trout and rainbow trout

Mill Brook – Wild brook trout and rainbow trout. This brook meets the criteria for B1 waters.

Chase Brook – Wild brook trout. This brook meets the criteria for B1 waters.

Slide Brook – Wild brook trout. This brook meets the criteria for B1 waters.

High Bridge Brook - Wild brook trout, brown trout and rainbow trout (last survey occurred in 1959)

Shepard Brook – Wild brook trout, brown trout and rainbow trout

Pine Brook – Wild brook trout and rainbow trout in lower reaches (last survey occurred in 1959)

Dowsville Brook – Wild brook trout, brown trout and rainbow trout. This brook meets the criteria for B1 waters.

Doctors Brook -

Welder Brook – Wild brook trout

Little River Watershed

The Little River begins at the confluence of Sterling and Moss Glen Brooks in Stowe and flows south to Waterbury draining 112mi² between the Green Mountain and Worcester Mountain ranges. Moscow Mills dam (2.6 miles upstream of the reservoir) and Waterbury dam fragment and degrade habitat.

The Little River mainstem contains wild brook trout at higher elevations and wild brown and rainbow trout below confluence with the West Branch. The river above the reservoir provides spawning habitat for migrating brown trout, rainbow trout, rainbow smelt and other species.



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

Sterling Brook - Wild brook trout (last surveyed in 1959)

Moss Glen Brook - Wild brook trout

West Branch - Wild brook trout above the confluence with Ranch Brook and wild brook trout and brown trout below. This brook meets the criteria for B1 waters although Stowe Mountain Resort also withdraws water from the West Branch for snowmaking and golf course irrigation.

Ranch Brook – Wild brook trout. This brook meets the criteria for B1 waters.

Gold Brook - Wild brook trout, brown trout and rainbow trout

Peterson Brook – No VFWD data

Stevenson Brook – Wild brook trout, brown trout and rainbow trout. Rainbow smelt spawn within the confluence to Waterbury Reservoir.

Miller Brook – Wild brook trout, brown trout and rainbow trout.

Barrows Brook – No VFWD data

Alder Brook – Wild brook trout

Cotton Brook – Wild brook trout, brown trout, and rainbow trout.

Barrows Brook – No VFWD data

Bahannan Brook – No VFWD data

Other Winooski Mainstem Tributaries

Kidders (aka Hooker) Brook – Enters Molly’s Brook in South Cabot and contains wild brook trout and brown trout. This brook meets the criteria for B1 waters

Molly’s Brook (Above Molly’s Falls Reservoir) – Flows into Molly’s Falls Reservoir and contains wild brook trout, brown trout and occasionally rainbow trout. This brook meets the criteria for B1 waters above the reservoir.

Jug Brook – Enters the mainstem in Cabot and contains wild brook trout

Knob Hill Brook - Enters the mainstem in Marshfield and contains wild brook trout and rainbow trout.

Beaver Meadow Brook – Enters the mainstem in Marshfield and contains wild brook trout and occasionally wild brown trout.

Marshfield Brook – Enters the mainstem in Marshfield and contains wild brook trout and occasionally wild brown trout.

Nasmith Brook – Enters the mainstem in Marshfield and contains wild brook trout, rainbow trout, and occasionally brown trout. This is an important spawning tributary for



mainstem populations and meets the criteria for B1 waters

Great Brook – Enters the mainstem in Plainfield and contains wild brook trout, rainbow trout, and brown trout. This is an important spawning tributary for mainstem populations and meets the criteria for B1 waters

Cold Brook – No VFWD data

King Brook – Wild Brook trout

Sodom Pond Brook – Enters the mainstem in North Montpelier and contains wild brook (last surveyed in 1998) trout, brown trout and rainbow trout. This brook is an Important spawning tributary for mainstem trout populations

Mallory Brook – No VFWD data

Bennett Brook – Enters the mainstem in East Montpelier and contains wild brook trout, brown trout and rainbow trout.

Wells Brook - No VFWD data

Blanchard Brook – No VFWD data

Sunny Brook (Montpelier) – No VFWD data

Jones Brook – Enters the mainstem in Montpelier and contains wild brook trout, and rainbow trout with occasional brown trout. This brook is an Important spawning tributary for mainstem trout populations and meets the criteria for B1 waters.

Great Brook – Enters the mainstem in Middlesex and contains wild brook trout, brown trout, and rainbow trout

Crossett Brook – Enters the mainstem in Waterbury and contains wild brook trout, brown trout, and rainbow trout. This brook is an Important spawning tributary for mainstem trout populations and meets the criteria for B1 waters.

Thatcher Brook - Enters the mainstem in Waterbury and contains wild brook trout, brown trout, and rainbow trout. This brook is an Important spawning tributary for mainstem trout populations and meets the criteria for B1 waters.

Recommendations:

To maintain quality fisheries, the continued protection and enhancement of aquatic habitat is required. The removal of barriers, enhancement of riparian areas, control of nutrient and sediment runoff, improvement of hydroelectric operations, and prevention of the spread of undesirable aquatic species are essential to provide healthy and resilient aquatic ecosystems within the Winooski watershed.

Improve Habitat Connectivity

The movement of fish and other aquatic populations to critical feeding, spawning, and refuge habitats is hindered by dams and poorly designed culverts. Removing dams and replacing impassible culverts is vital to improve connectivity. Currently, only 6% of the 1,032 culverts assessed within the Winooski watershed are fully passable to trout (Figure 1)

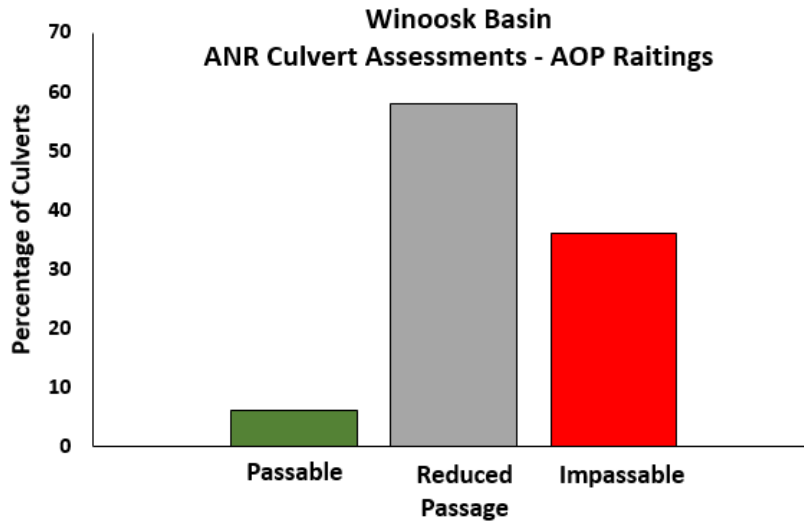


Figure 1. Aquatic organism passage ratings for 1,032 culverts assessed by the Agency of Natural Resources.

At least 100 dams exist within the upper Winooski watershed alone (Figure 2). These structures alter natural flow regimes, collect sediment, elevate water temperatures, block aquatic organism passage and could become dangerous in the event of a catastrophic failure. These structures should be removed wherever possible.

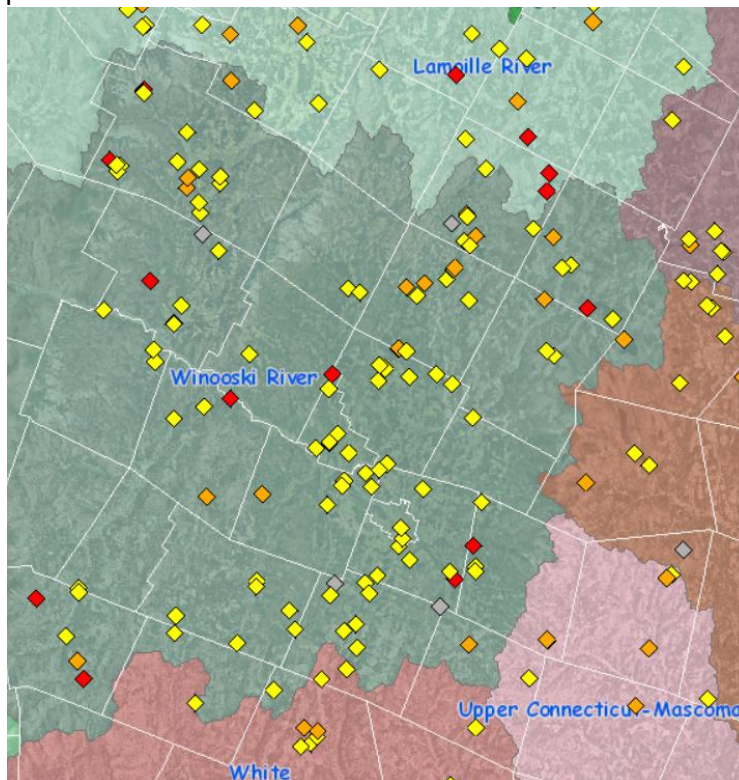


Figure 2 – Dams located within the upper Winooski watershed. Colors represent High Significant Low and Undetermined Hazard Potential.



Enhance Naturally vegetated riparian areas

Undisturbed riparian areas provide a host of vital functions and values including filtering pollutants, maintaining cool water temperatures, recruiting natural wood and other organic materials, preventing erosion, and providing food and shelter for fish and other aquatic organisms. These benefits are realized not only within the protected stream reach, but also in the downstream receiving waters.

Land acquisition – Work with agency stewardship teams to advocate for and acquire headwater and riparian lands. Currently the Barre Stewardship team is working to acquire land adjacent to the Worcester Range Management Unit containing the headwaters to Patterson brook in Middlesex.

Private landowner outreach – In Vermont, most riparian lands are privately owned providing limited opportunity to improve habitat conditions. Educate private land owners and provide technical assistance to help restore riparian areas on private lands. Work with VDEC to provide incentive to improve agricultural practice adjacent to water including cover cropping, expanded naturally vegetated riparian areas, and manure injection.

Riparian plantings and undisturbed riparian areas – Work with partners to fund and restore impacted riparian areas. Prioritize headwater reaches of streams (i.e. Winooski headwaters in Cabot), locations impacted by ongoing erosion, and agricultural fields.

Decrease Sedimentation and nutrient input

Preventing sediment runoff and erosion help to benefit stream and riparian ecosystems. Work with the Vermont Department of Transportation (VTrans), town municipalities, VDEC, local partners and farmers to improve storm water infiltration and reduce sediment runoff from roads (i.e. Lower Jail Branch in Barre) and nutrient runoff from agricultural fields. The [Better Roads Program](#) through VTrans is a good example of these efforts.

Restore Natural Hydrologic Regimes

Regulated stream flows from hydroelectric facilities and water withdrawals can reduce habitat availability and quality in reservoirs and downstream reaches. Lake elevation fluctuations often negatively affect littoral habitats and can impact fish and other aquatic populations. Work with VDEC to improve these operations through the regulatory process and continue to monitor fish populations near these projects.

Restore Habitat Complexity and Reduce Future Anthropogenic Impact

Complex and diverse habitat is essential to a healthy ecosystem. The removal of woody habitat and alteration of stream channels following tropical storm Irene lead to over 75 miles of stream habitat degradation Statewide. Within the Winooski watershed it was estimated that major impact to instream habitat occurred along roughly 15,425 feet of stream following Tropical Storm Irene (Kirn 2012). While the restoration of these impacts can be cost prohibitive, several projects have occurred through partnerships with VTrans and other organizations. Highly degraded areas and/or areas where extensive channel management occurred should be prioritized. Within the Winooski basin, the Mad River and Dog River drainages were impacted most by TS Irene.



The River and Roads training conducted by ANR and VTrans is a good example of efforts to reduce future impact following flood events and a practice of installing embedded, bank-full-width culverts to replace undersized structures will reduce future maintenance costs and overall impact.

Prevent the Spread of Undesirable Aquatic Species and pathogens

The introduction and establishment of fish pathogens or undesirable aquatic species can have a significant impact on fish populations. The movement of fish, including baitfish, not only increases the potential for introducing new populations, but may introduce and spread serious fish pathogens such as whirling disease and viral hemorrhagic septicemia, parasites and other harmful organisms. A variety of non-native invasive aquatic species and harmful pathogens are present in Vermont or surrounding states. Limiting the spread of these detrimental species will help maintain healthy fisheries.

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Cc: Rich Kirn, Brian Chipman; Bernie Pientka; VFWD