DEERFIELD RIVER
WATERSHED ASSOCIATION

2019

Water Quality Report

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Deerfield River Watershed Association
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Contents

Introduction

The Deerfield River Watershed Association (DRWA) continued the newest iteration of its monitoring program for the third year in 2019. This program monitors sites throughout Deerfield watershed, including its tributaries, in both Vermont and Massachusetts. It was conducted with the support of the Vermont Agency of Natural Resource's (VT ANR) LaRosa Partnership Program, Massachusetts Department of Environmental Protection (Mass DEP), the Connecticut River Conservancy(CRC), the Green River Watershed Alliance (GRWA), and DRWA volunteers.

Past and Other Monitoring Efforts

DRWA Past Volunteer Monitoring

DRWA monitored water quality in Deerfield River and several tributaries (primarily in Massachusetts) from 1990-2005. 1990-1998 focused on chemical data parameters including pH, alkalinity, and dissolved oxygen (DO). In 1998, DRWA reduced its chemical monitoring frequency and introduced testing for fecal coliform bacteria. After relying on outside labs for three years, DRWA established its own bacteria testing lab in Shelburne Falls in 2001. The program was discontinued after 2005. Generally, results from this period demonstrate that the watershed has low alkalinity and pH which can impact some aquatic species, and high dissolved oxygen which is good for supporting a coldwater fishery. Bacteria levels tended to be low during dry weather and become elevated at some sites after heavy rains.

DRWA Macroinvertebrate Monitoring

DRWA conducted macroinvertebrate sampling projects every year from 2005-2008 and in 2011. The projects focused on the Green River (2005), South River (2006), effects of regulated flows on macroinvertebrates (2006), North River (2007), Deerfield River Tributaries (2008), and Deerfield headwater streams (2011).

The Green River study conducted in 2005 sampled four mainstem Green River sites (one in Vermont and two in Massachusetts as well as eight sites (two in Vermont and six in Massachusetts) on lower reaches of Green River tributaries. Habitat conditions varied greatly with a general trend of becoming more degraded closer to Greenfield. Macroinvertebrates communities also reflected this trend of becoming more impacted the further down in the watershed and closer to Greenfield

The 2006 South River study sampled eight sites on the mainstem and five tributaries. Mainstem sites ranged from non-impacted to moderately impacted. Tributary sites ranged from non-impacted to slightly impacted.

Another 2006 study looked at the effects of regulated flows. Four sites in regulated reaches of Deerfield downstream of Fife Brook and three sites in unregulated reaches of tributaries were sampled twice, once in July and once in September. Water depth and velocity were recorded at each sampling and temperature loggers recorded 15-minute intervals from July-September. Results suggested that either hydrologic or thermal alterations affected macroinvertebrate community composition in comparison to non-regulated reaches. The effects of the dam appeared to be spatially limited as altered flow and temperature regimes were ameliorated downstream. This study has not been replicated and is inconclusive about the exact influences of regulated flows since dams have effects on flow, temperature, and nutrient availability. The report concluded that further study is necessary.

The 2007 North River study featured three sites on mainstem North, three sites on West Branch North, six sites on the East Branch North, and three sites in larger tributaries. North River watershed macroinvertebrate communities scored exclusively as not impaired.

The study conducted in 2008 looked at Deerfield Riv er tributaries. Fifteen mid-watershed tributary sites were sampled for this project: Dunbar Brook (slightly impacted), Pelham Brook (not impacted), Mill Brook (Deerfield River tributary, not impacted), Bear River (not impacted), Cold River (three sites, not impacted), Tannery Brook (not impacted), Chickley River (three sites, not impacted), Mill Brook (Clesson Brook Tributary, slightly impacted), Clesson Brook (three sites, not impacted).

The 2011 headwater streams study sampled twenty headwater sites across six state forests in Massachusetts. Nineteen were headwater stream sites and one site was a spring/seep in a headwater reach. Macroinvertebrate community composition varied widely with great species richness. Some taxa identified in this study potentially may have not been

previously observed in Massachusetts. Brook trout were also observed at nearly half of the sites. Riparian habitats were all in good condition and likely responsible for supporting such great macroinvertebrate communities.

Vermont DEC Monitoring

Prior to this program, there was no comprehensive water quality monitoring in most of the Vermont portion of the Deerfield watershed. The state of Vermont conducts biomonitoring assessments (including fish, macroinvertebrate, and habitat) on a five-year cycle. Biomonitoring results show generally very good to excellent conditions for supporting aquatic life within the watershed except directly below the Harriman and Sherman reservoirs and below the ski resort area of Mount Snow. There is also a bacteria total maximum daily load plan (TMDL) for a portion of the North Branch of the Deerfield River in Dover due to bacteria levels consistently exceeding safe recreation levels and state standards.

Massachusetts DEP Monitoring

Massachusetts's most recent assessment report of the Deerfield Watershed was released in 2004. Water quality assessment relied on the results from DRWA's volunteer monitoring of water chemistry and fecal coliform bacteria. By analyzing data from USGS streamflow gauges, the Green River near Colrain, the North River at Shattuckville, and the South River near Conway were identified as medium stressed while Deerfield River at Charlemont and Deerfield River near West Deerfield were identified as low stressed. A 2003 assessment survey quantified whether the designated uses of aquatic life, primary and secondary contact recreation, and aesthetics were supported or impaired. Most sites surveyed supported all uses with the exception of the Davis Mine Brook, impaired for recreation and not supportive of aquatic life or aesthetics, and the lower reach of the Green River, impaired for primary contact recreation. Davis Mine Brook is severely impacted by the Davis sulfur mine which collapsed in 1910 and leaches extremely acidic water directly into the brook.

Program Goals

The goals of the current Deerfield watershed monitoring program are to engage volunteers and educate our members by collecting quality assured data about the rivers in our watershed. This data will be used to provide recreational safety information, guide restoration efforts by DRWA, CRC, or other partners, and to assist VT ANR and Mass DEP with their assessments.

Methods

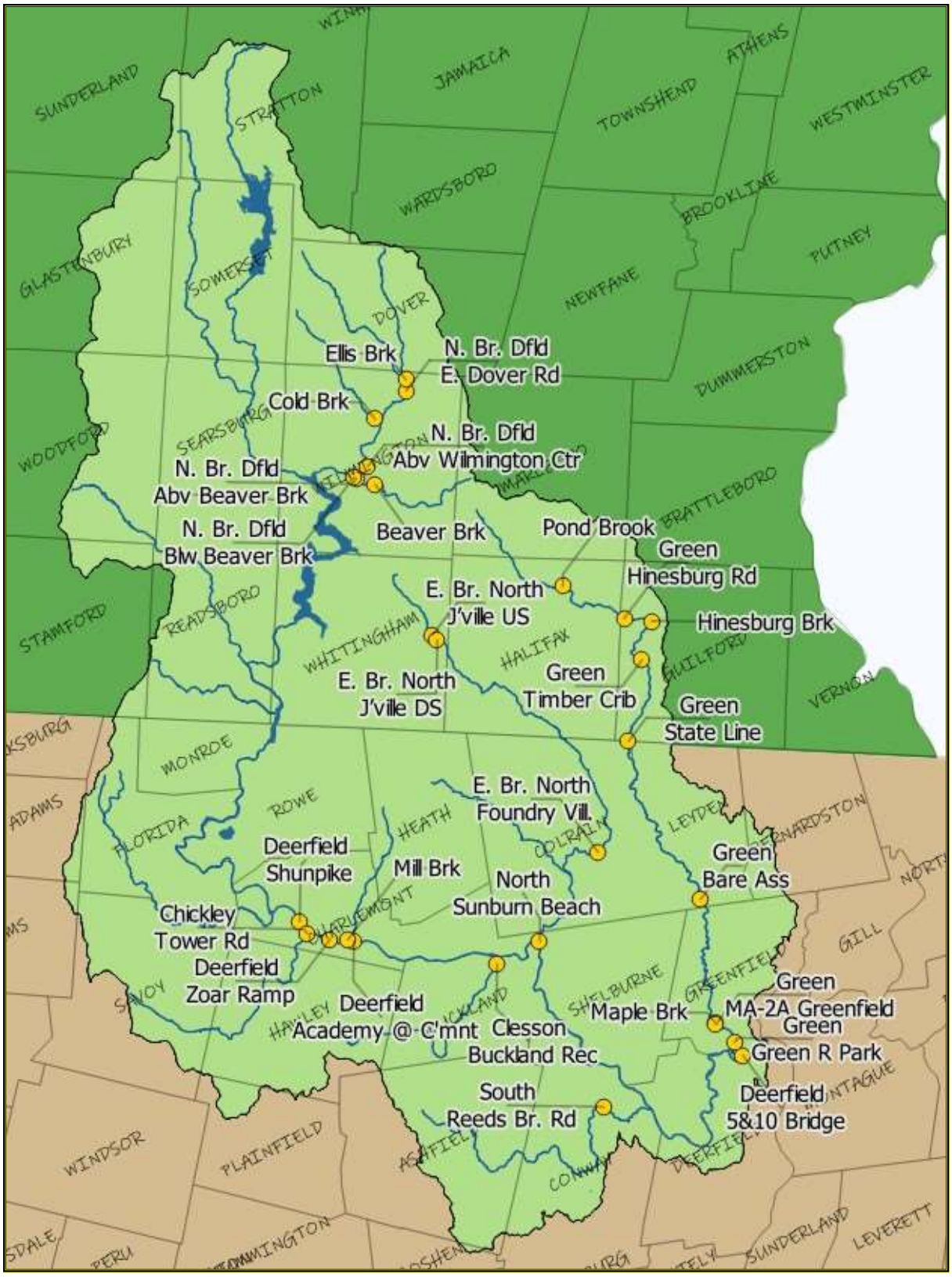
Sites Sampled

For the 2019 season, DRWA sampled 14 sites in Vermont and 14 sites in Massachusetts.

Table 1 - 2019 Sites Sampled

Site ID	*Site Name*	*River*	*Town*	*Sampled in*	
				2017	*2018*
VT-NBD_06.4	E Dover Rd	N. Br. Deerfield	Wilmington, VT	✓	✓
VT-NBD_02.7	Above Wilmington Center	N. Br. Deerfield	Wilmington, VT	✓	✓
VT-NBD_02.0	Wilmington Center, Above Beaver Brk	N. Br. Deerfield	Wilmington, VT		✓
VT-NBD_01.8	Wilmington Center, Below Beaver Brk	N. Br. Deerfield	Wilmington, VT	✓	✓
MA-DFR_28.9	Shunpike Rest Area	Deerfield	Charlemont, MA		✓
MA-DFR_27.6	Zoar Ramp	Deerfield	Charlemont, MA		
MA-DFR_24.0	Near Academy @ Charlemont	Deerfield	Charlemont, MA	✓	
MA-DFR_01.1	5&10 Bridge	Deerfield	Greenfield, MA	✓	✓
VT-EBN_15.0	Above Jacksonville WWTF	E. Br. North	Whitingham, VT		✓
VT-EBN_14.7	Below Jacksonville WWTF	E. Br. North	Whitingham, VT	✓	✓
MA-EBN_02.4	Foundry Village Rd Ballfields	E. Br. North	Colrain, MA	✓	✓
MA-NOR_00.1	Formerly Sunburn Beach (North River side)	North	Shelburne, MA		
VT-PND_00.1	Pond Brook Mouth	Pond Brook	Halifax, VT		✓
VT-GRN_23.4	Hinesburg Rd	Green	Guilford, VT	✓	✓
VT-HBG_00.1	Hinesburg Brk Mouth	Hinesburg Brook	Guilford, VT		✓
VT-GRN_20.2	Below Timber Crib Dam	Green	Guilford, VT	✓	✓
VT-GRN_16.8	VT-MA State Line	Green	Guilford, VT		✓
MA-GRN_09.8	Bare Ass Beach	Green	Colrain, MA		✓
MA-MPL_00.1	Maple Brook Mouth	Maple Brook	Greenfield, MA		✓
MA-GRN_02.0	Between MA-2A and RR Bridge	Green	Greenfield, MA		✓
MA-GRN_00.8	Green River Park (Greenfield)	Green	Greenfield, MA	✓	✓
VT-ELS_00.2	Mouth of Ellis Brook	Ellis Brook	Wilmington, VT		
VT-COB_00.3	Cold Brook Mouth	Cold Brook	Wilmington, VT	✓	✓
VT-BVR_01.1	Off Rte 9	Beaver Brook	Wilmington, VT		✓
MA-CHI_00.1	Tower Rd Bridge	Chickley	Charlemont, MA	✓	✓
MA-MBK_00.1	Mouth of Mill Brook	Mill Brook	Charlemont, MA		
MA-CLS_00.3	Buckland Recreation Area	Clesson Brook	Buckland, MA	✓	✓
MA-SOU_02.4	Reeds Bridge Rd	South	Conway, MA	✓	✓

Figure 1 - 2019 Site Map



Sampling Procedure

Before the start of the season, each volunteer was required to attend a training session with the program coordinator. Training sessions were held riverside so that each volunteer would have the opportunity to practice under the supervision of the coordinator before going out into the field.

Volunteers sampled sites on alternate Wednesday mornings from June 26th to September 4th before 10 am. In addition to collecting the suite of bottles to be tested for different parameters (see next section), volunteers recorded air and water temperature, flow conditions, visual and olfactory observations, and any other relevant notes about the site on the provided field sheet. They were also required to keep a chain of custody form for *E. coli* samples. On some days, volunteers collected additional quality control samples. Samples and field sheets were delivered to the CRC Lab in Greenfield by 10 am where most bottles were sorted to be dropped off at the Vermont Agricultural and Environmental Lab (VAEL). *E. coli* samples remained in Greenfield to be processed and tested immediately.

Parameters

Each site was tested for *E. coli*, total nitrogen, total phosphorus, turbidity, and conductivity. This is a change from 2017 where sites were tested for chloride instead of conductivity. This change was made at the request of the LaRosa partnership.

E. coli

Escheria coli (*E. coli*) is in the fecal coliform family of bacteria that is found in digestive tracts of all warm-blooded animals, including humans. Most *E. coli* will not make someone sick, but they do sometimes cause illnesses in people. The presence of *E. coli* in water indicates the presence of human or animal waste. It is relatively easy to test for in comparison to other more harmful waterborne pathogens, so it is used an indicator organism to determine the level of risk associated with primary recreation contact (swimming and wading), or secondary recreation contact (boating).

The US Environmental Protection Agency (EPA), Vermont, and Massachusetts standards for a single sample to be considered to be acceptable for swimming are 235 *E. coli* organisms per 100 mL of water. The state standards for results over a period of time are that the geometric mean (a way of averaging living populations) should not exceed 126 E. coli/100 mL; Vermont also requires that no more than 10% samples exceed 235 E. coli/100 mL.

Total Nitrogen

Total nitrogen (TN) tests for nitrogen in all its forms, including nitrate (NO_3-), nitrite (NO_2-), ammonium (NH_4+), and as part of organic matter. Nitrogen is an essential nutrient for plants and can be found in the atmosphere as well as all living beings. It is also an important component of fertilizers. An overabundance of nitrogen in our waterways can contribute to eutrophication (over growth of algae) and anoxia (lack of oxygen) in saltwater systems, such as Long Island Sound.

There is no numerical state standard for nitrogen in Massachusetts and the standard in Vermont is a very lax 5.0 mg-N/L of water. No sites that we test come close to exceeding that standard. The EPA currently recommends a limit of 0.34 mg-N/L for waters entering Long Island Sound that support eelgrass based on literature values. We choose to compare our results to the EPA suggested standard.

Total Phosphorus

Total phosphorus (TP) tests for phosphorus in all its forms, including organic and inorganic phosphates (PO_4-3). Organic phosphates are those that are bound to plant or animal tissue and formed primarily through biological processes, but they may occur from the breakdown of organic pesticides. Inorganic phosphates include orthophosphates, produced in natural processes and found in sewage, and polyphosphates, used in treating boiler waters and in detergents. An overabundance of phosphorus in our waterways can contribute to toxic algae blooms, eutrophication, and anoxia in freshwater systems, such as lakes and ponds.

There is no numerical state standard for phosphorus in Massachusetts and the standard in Vermont is based on gradient and temperature. The Green River sites are all high or medium gradient cold-water streams which have a standard of 9 µg-P/L for Class A(1) and B(1) waters and 15 µg-P/L for Class B(2) waters. Currently, the Green River and its tributaries in Vermont are classified as B(2), but results are compared to both standards.

Conductivity

Specific conductivity (also known as specific conductance) is a measure of how well water conducts electricity. Conductivity is easy to test for and gives a broad look at potential water quality issues. It can be affected by the underlying geology and soil (ions dissolved out of rocks and soil), acid mine drainage (variety of metals and other contaminants), agricultural runoff (including nitrates and phosphates), and road runoff (automobile fluids and road salt). Sudden changes in conductivity could indicate a change in water quality.

Conductivity is not in itself regulated but large fluctuations in values over time or between sites may be an indicator of a water quality issue not identified in other parameters.

Results & Discussion

Deerfield River Mainstem & Branches

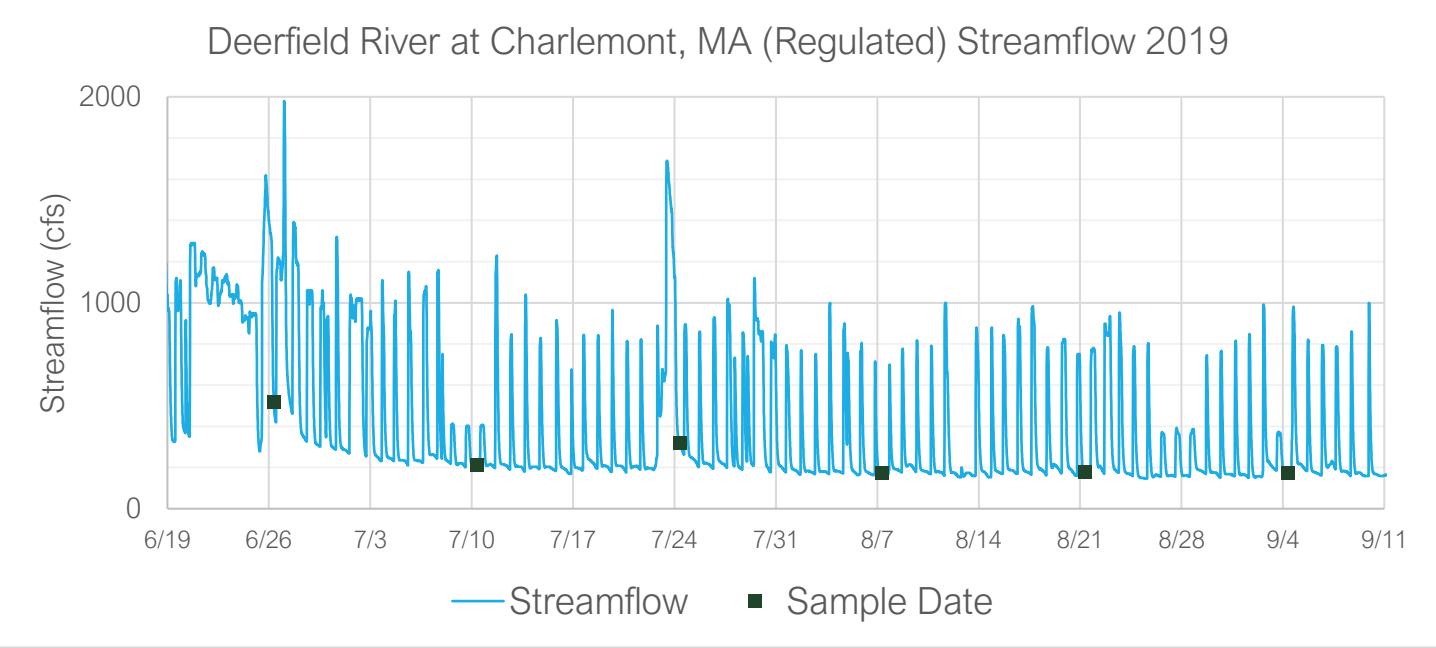
DRWA monitored four sites on the North Branch of the Deerfield River in Vermont and four sites on the mainstem of the Deerfield in Massachusetts. With the exception of the furthest downstream site in Massachusetts which is classified as warm water Class B, all of the sites are classified as cold water Class B. All sites were monitored for *E. coli*, total nitrogen, total phosphorus, and conductivity.

Table 2 - Flow observed at Deerfield sites sampled

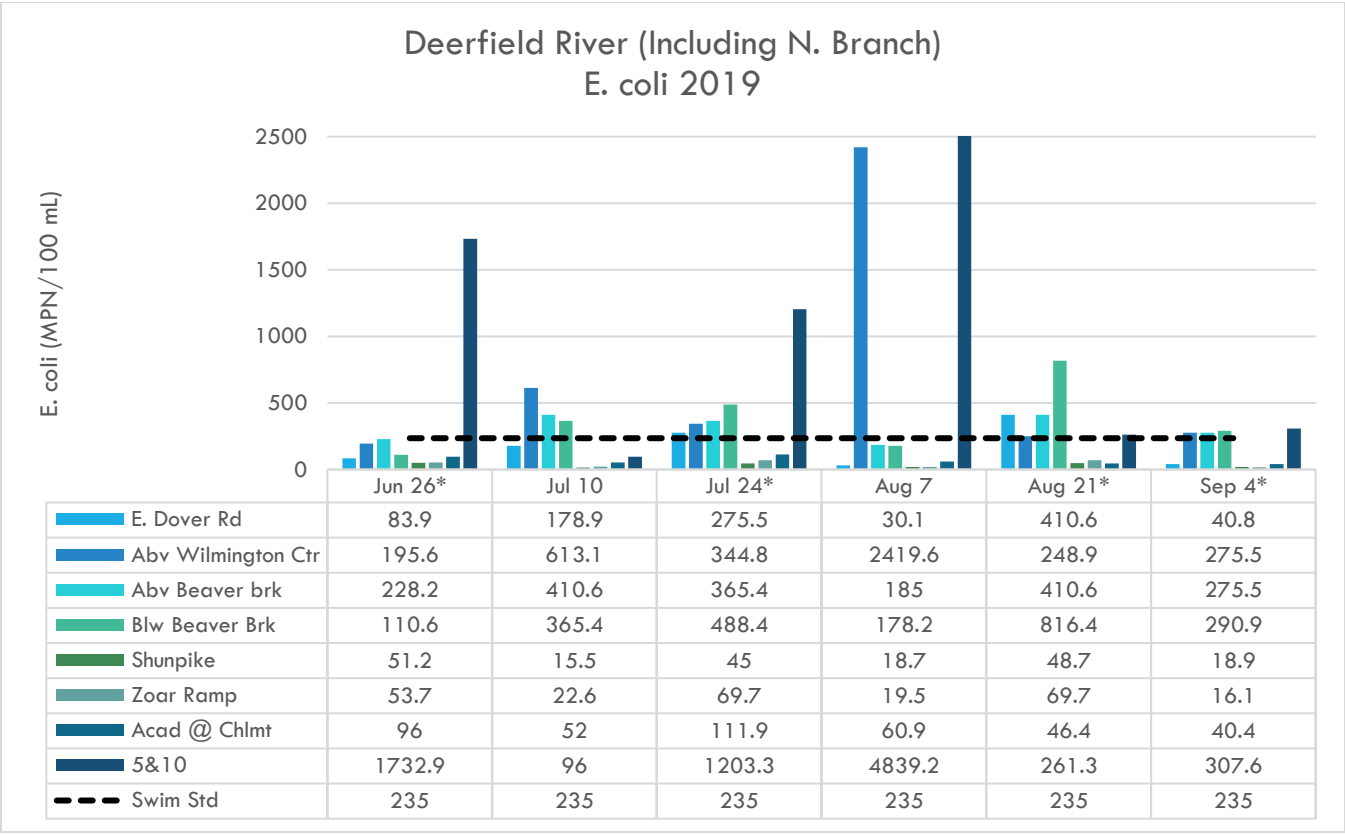
Site ID	6/26/2019		7/10/2019		7/24/2019		8/7/2019		8/21/2019		9/4/2019	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-NBD_06.4	Mod	Base	Mod	Base	High	Fresh	Mod	Base	Mod	Fresh	High	Base
VT-NBD_02.7	Mod	Base	Low	Base	High	Fresh	Low	Base	Mod	Fresh	Mod	Base
VT-NBD_02.0	Mod	Fresh	Mod	Base	High	Fresh	Low	Base	Low	Base	Low	Base
VT-NBD_01.8	Mod	Fresh	Mod	Base	High	Fresh	Low	Base	Low	Base	Low	Base
MA-DFR_28.9	Mod	Base	Low	Base	Low	Base	Low	Base	Low	Base	Low	Base
MA-DFR_27.6	Mod	Reg	Low	Reg	Low	Reg	Low	Reg	Low	Reg	Low	Reg
MA-DFR_24.0	Mod	Reg	Mod	Reg	Mod	Reg	Low	Reg	Low	Reg	Low	Reg
MA-DFR_01.1	Mod	Reg	Mod	Reg	Mod	Reg	Mod	Reg	Mod	Reg	Low	Base

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. They cannot be corroborated by any gages due to the highly regulated nature of the Deerfield River. There are no gauges on the North Branch Deerfield River. There are two USGS gages in the portion of the river that is subjected to daily hydropower and recreational releases. The streamflow recorded at the upstream gage (between MA-DFR_27.6 and MA-DFR_24.0) and time sampled are depicted below. Samples tended to be collected during lower flows in the mornings.

Figure 2 - Deerfield River Streamflow Summer 2019



The results for all parameters are presented in the graphs below.

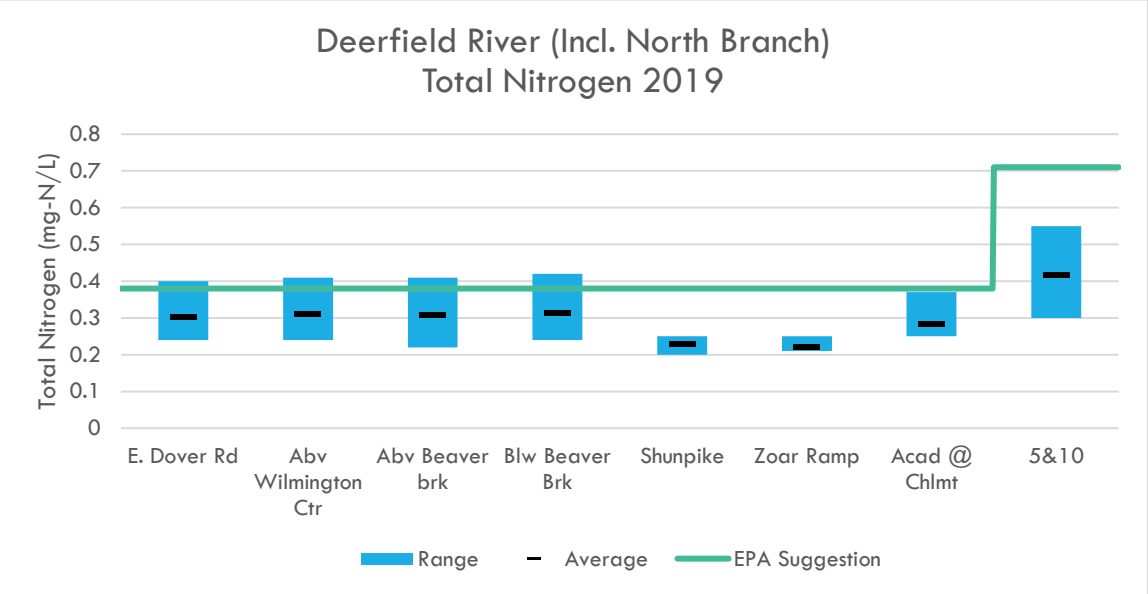


	Jun 26*	Jul 10	Jul 24*	Aug 7	Aug 21*	Sep 4*
E. Dover Rd	83.9	178.9	275.5	30.1	410.6	40.8
Abv Wilmington Ctr	195.6	613.1	344.8	2419.6	248.9	275.5
Abv Beaver brk	228.2	410.6	365.4	185	410.6	275.5
Blw Beaver Brk	110.6	365.4	488.4	178.2	816.4	290.9
Shunpike	51.2	15.5	45	18.7	48.7	18.9
Zoar Ramp	53.7	22.6	69.7	19.5	69.7	16.1
Acad @ Chlmt	96	52	111.9	60.9	46.4	40.4
5&10	1732.9	96	1203.3	4839.2	261.3	307.6
Swim Std	235	235	235	235	235	235

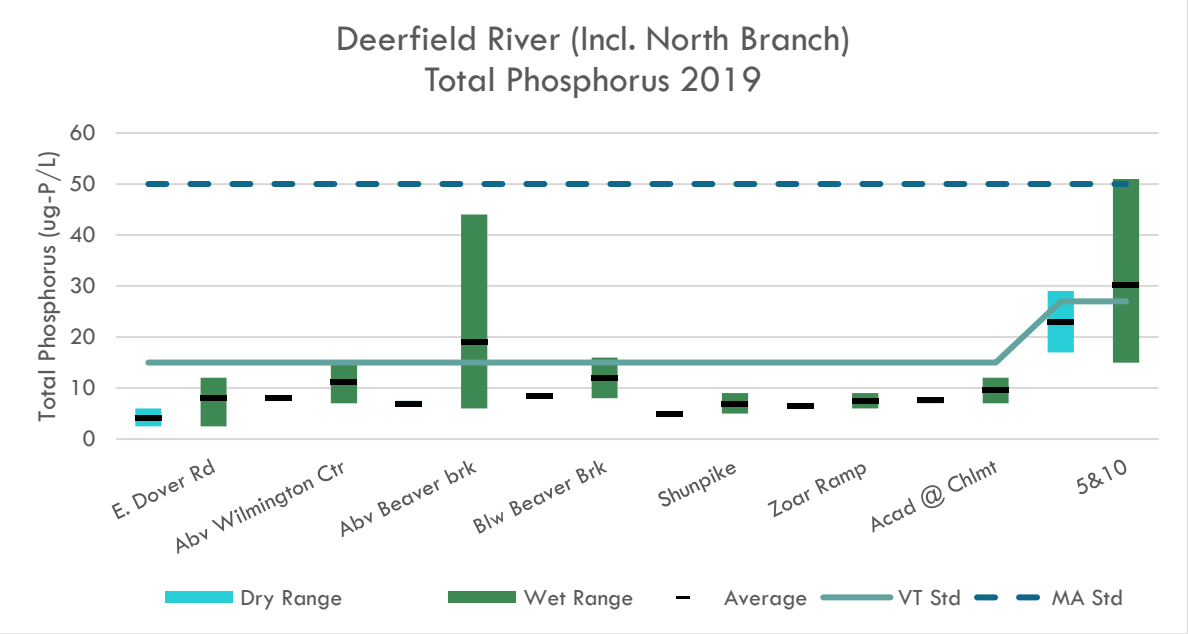
** Wet weather (>0.1" rain) in 24 hours prior to sampling*

The furthest upstream North Branch Deerfield site, Dover Rd, tended not to exceed the swimming standard except for in the wettest weather (September 4th). The rest of the North Branch sites, Above Wilmington Center, Above Beaver Brook, and Below Beaver Brook had high levels in wet weather and sometimes during dry weather. There was no indication this year that Beaver Brook was increasing or decreasing bacteria levels in the North Branch. Results from the Beaver Brook site can be found in the Other Tributaries section.

The mainstem sites, Shunpike Rest Area, Zoar Ramp, Academy at Charlemont, and 5&10 Bridge, overall had much lower bacteria levels than the North Branch sites. The first three tended to have very low bacteria levels even after heavy rain. The furthest downstream site at the 5&10 Bridge had the highest bacteria levels of the three mainstem sites and spikes were erratic; we believe this may be due to bridge construction that may have been stirring up sediment.

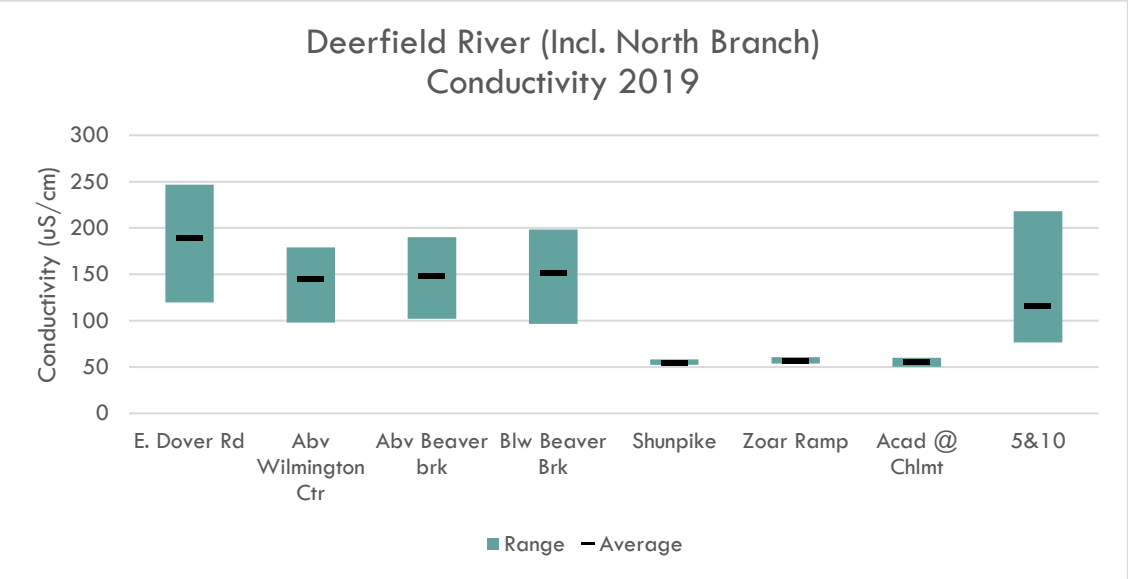


The averages for all sites were well below the VT standard of 5.0 mg-N/L and met the EPA's current suggested level for the ecoregion of 0.38 mg-N/L (0.71 mg-N/L for the lowest section of the Deerfield). The nitrogen levels are fairly consistent on the North Branch and the Beaver Brook does not appear to alter them. There appears to be a significant source of nitrogen between the Zoar Ramp site and the Academy at Charlemont site. Between these sites are two big tributaries, the Chickley River and Mill Brook (see Other Tributaries section for results) and the Charlemont wastewater treatment plant.



All site averages met the VT standard of 15 µg-P/L (27 µg-P/L for the one warm water site) when sampled during dry weather. The North Branch site Above Beaver Brook and the mainstem site at the 5&10 Bridge exceeded their standards when sampled during wet weather. There was not the same increase in phosphorus between the Zoar Ramp and Academy at Charlemont sites that was seen in the nitrogen. Phosphorus tends to fall out of the water column closer

to its source while nitrogen is more likely to stay suspended. In 2018, DRWA sampled closer to Mill Brook (results below) and the Charlemont wastewater treatment plant and saw higher TP numbers but re-evaluating the site location suggested it might not have been out of the mixing zone of the plant which may have skewed the results.



There is no standard conductivity in either state. The North Branch sites all have higher conductivity levels than the mainstem sites, except the 5&10 site. The higher conductivity at the 5&10 site was not observed in 2018. This may also be attributed to the bridge construction occurring this summer that was stirring up sediment.

In 2017, the Dover Rd site also had the highest chloride levels which may be due to its proximity to the Mount Snow ski area and the increased use of road salt to accommodate winter recreation.

North River

DRWA monitored four sites in the North River watershed, two in Vermont on the East Branch North River and two in Massachusetts, one each on the East Branch of the North River and the North River mainstem. The North River and its branches are considered class B cold water streams and are classified as high quality waters in Massachusetts. All sites were monitored for *E. coli* total nitrogen, total phosphorus, and conductivity.

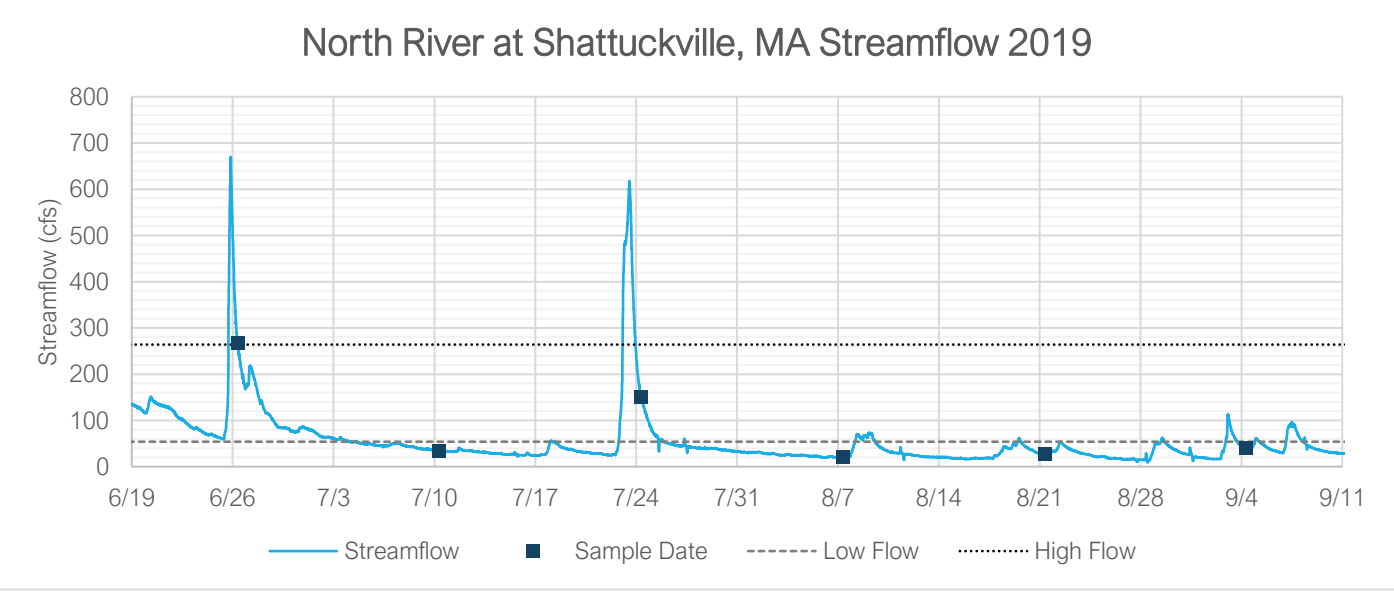
A sulfuric acid spill occurred between the two Massachusetts sites at the Barnhardt Manufacturing facility on September 1st. It is unlikely that this spill is observed in any monitoring results but it should be noted that it resulted in the deaths of nearly all the fish below the facility, the effects of which will be felt by the North River for many years.

Table 3 – Flow observed at North River sites sampled

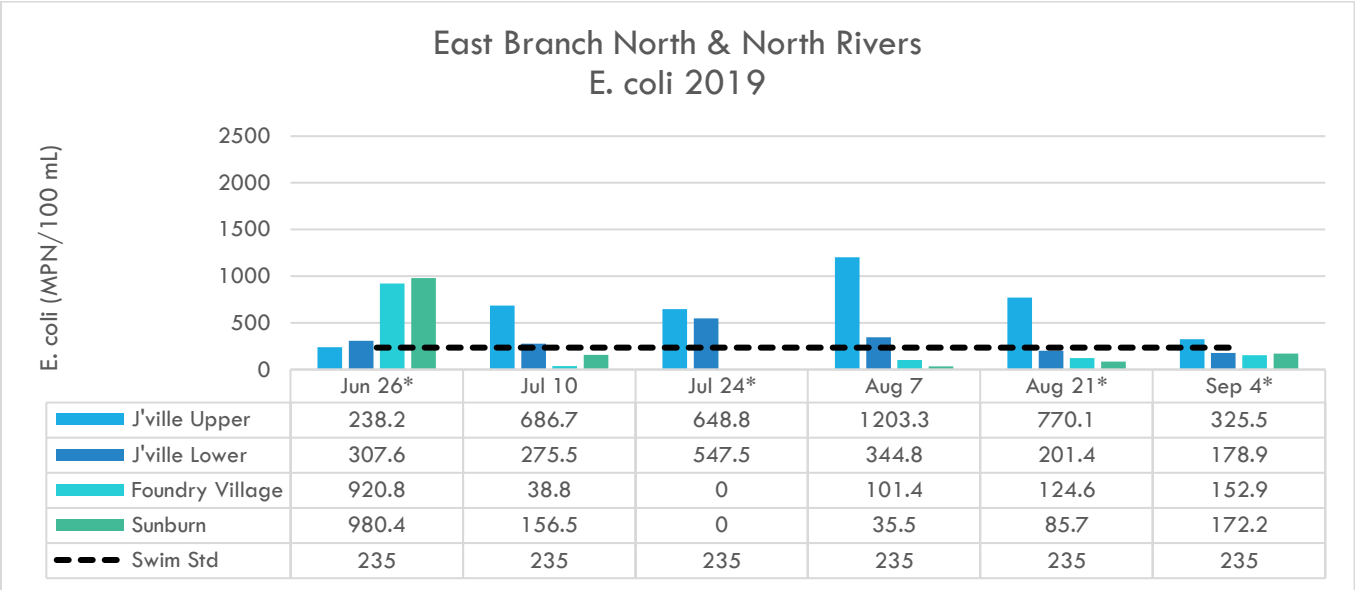
Site ID	6/26/2019		7/10/2019		7/24/2019		8/7/2019		8/21/2019		9/4/2019	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-EBN_15.0	mod	base	low	base	high	fresh	mod	base	mod	fresh	high	base
VT-EBN_14.7	mod	base	low	base	high	fresh	mod	base	mod	fresh	mod	base
MA-EBN_02.4	high	fresh	low	base	NT	NT	low	base	low	base	mod	base
MA-NOR_00.1	high	fresh	low	base	NT	NT	low	base	low	base	mod	base

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located downstream of all the sites on the mainstem North River. Based on flows measured at the gage, 6/26 had high flows, 7/24 had moderate flows, and 7/10, 8/7, 8/21, and 9/4 all had low flows.

Figure 3 - North River streamflow summer 2019



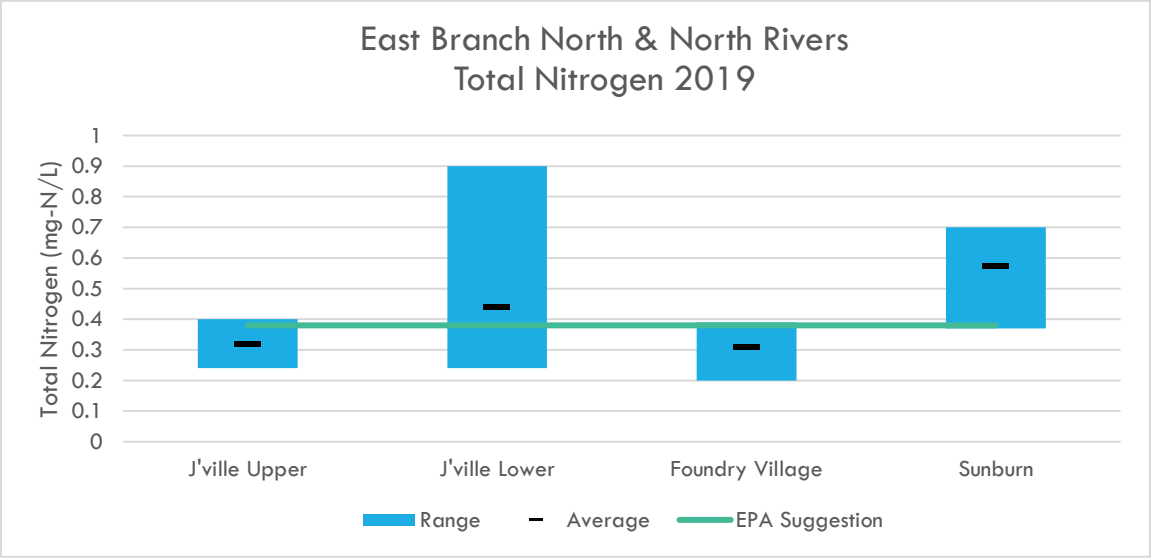
The results for all parameters are presented below.



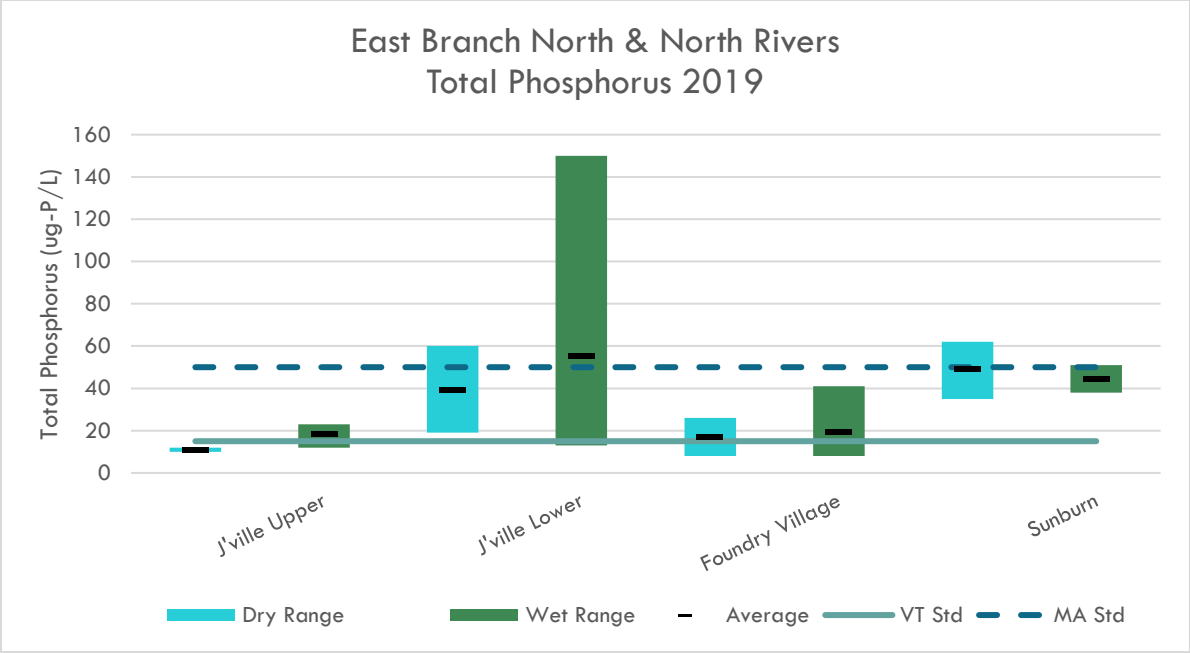
	Jun 26*	Jul 10	Jul 24*	Aug 7	Aug 21*	Sep 4*
J'ville Upper	238.2	686.7	648.8	1203.3	770.1	325.5
J'ville Lower	307.6	275.5	547.5	344.8	201.4	178.9
Foundry Village	920.8	38.8	0	101.4	124.6	152.9
Sunburn	980.4	156.5	0	35.5	85.7	172.2
Swim Std	235	235	235	235	235	235

** Wet weather (>0.1" rain) in 24 hours prior to sampling*

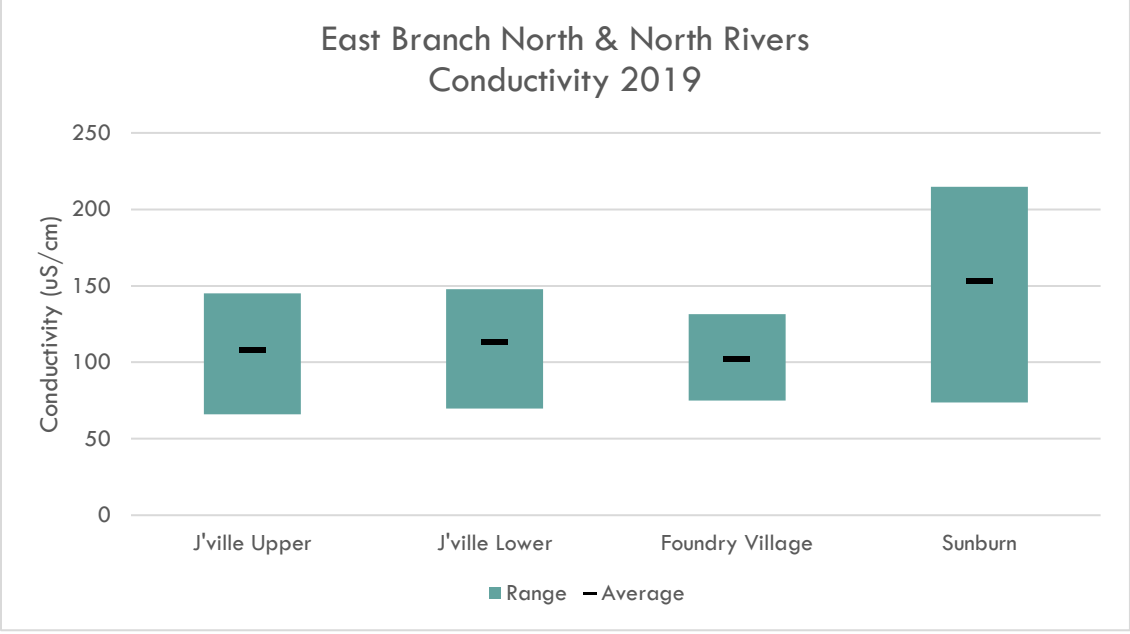
High *E. coli* levels were observed consistently in Jacksonville starting in July of 2019. The Upper Jacksonville site appeared to be higher than the Lower Jacksonville site. This site had to be moved upstream a few hundred feet due to the presence of the dangerous and invasive wild parsnip at the original site. The volunteer also observed the smell of bird poop during sampling. It is recommended that follow up investigations be conducted if high levels persist in 2020. The Massachusetts sites had good *E. coli* levels except during the highest of flows on June 26th.



The averages for all sites were below the VT standard of 5.0 mg-N/L. Both the Lower Jacksonville and Sunburn Beach sites exceeded the EPA suggestion of 0.38 mg-N/L for the EcoRegion. The lower Jacksonville site is located downstream of the Jacksonville wastewater treatment facility. Sunburn Beach is downstream of significant agricultural use and somewhat dense rural development (with septic tanks) but more investigation would be needed to determine the source.



The Upper Jacksonville site only exceeded the VT standard for cold water streams of 15 µg-P/L during wet weather. The Lower Jacksonville site always exceeded the VT standard, which is likely again from the wastewater treatment facility discharge. The Sunburn Beach occasionally exceeded the MA standard of 50 µg-P/L in both wet and dry weather. That site is downstream of significant agricultural use and somewhat dense rural development (with septic tanks) but more investigation would be needed to determine the source.



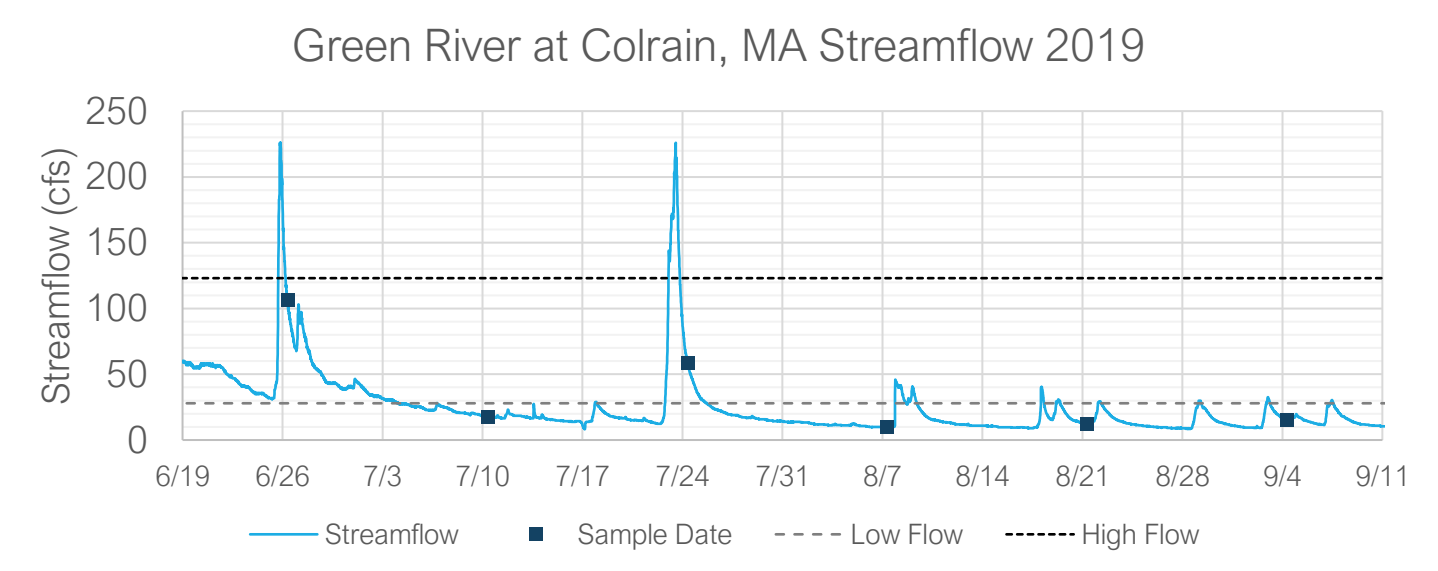
There is no standard conductivity in either state. The Foundry Village Road site had the lowest and the Sunburn Beach site had the highest conductivity readings. The acid spill did not appear to affect the Sunburn Beach results. No site stands out as concerning.

Green River

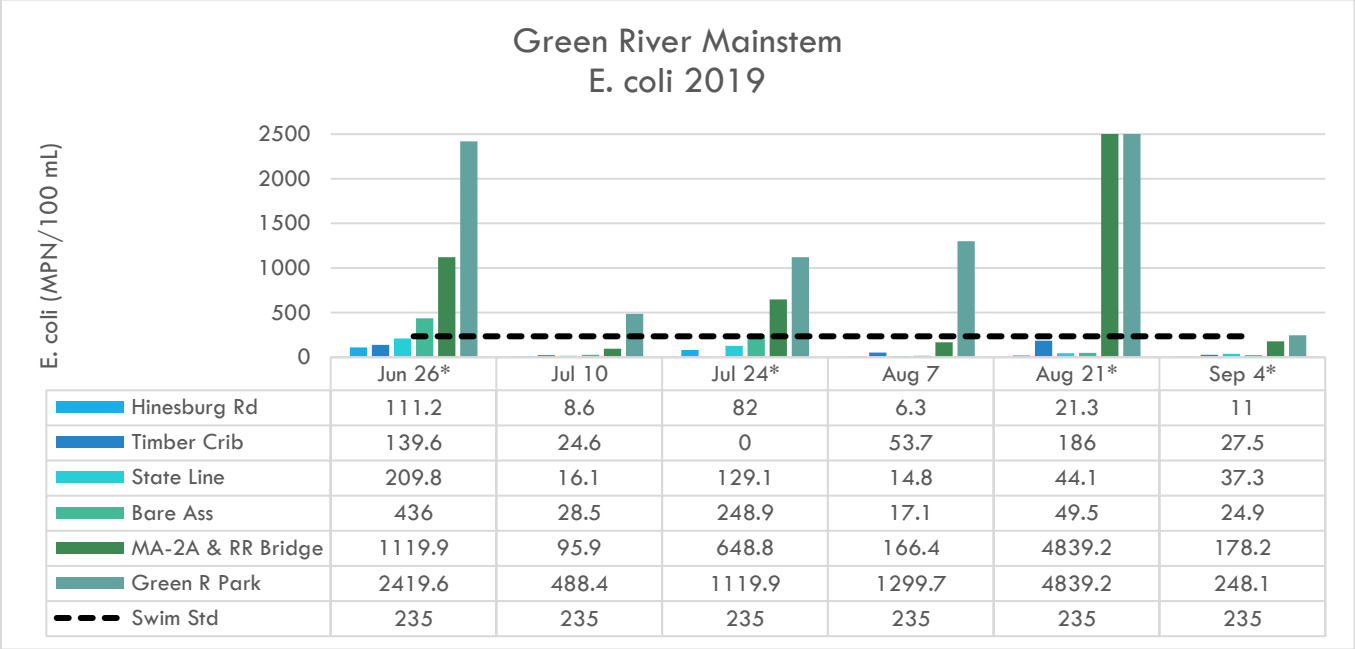
DRWA continued expanded monitoring in the Green River watershed in both Vermont and one in Massachusetts with support from the Green River Watershed Alliance for a second year. DRWA monitored three mainstem sites and two tributaries in Vermont and three mainstem sites and one tributary in Massachusetts. The Green River and its tributaries in Vermont are all Class B cold water; at the Massachusetts border, the Green River is classified as Class A until the drinking water reservoir just downstream of MA-GRN_09.8 (Bare Ass Beach) where it becomes classified as Class B cold water. All sites were monitored for *E. coli*, total nitrogen, total phosphorus, and conductivity. Note that most of the Green River tributary charts have a different scale in order to see the Maple Brook numbers.

Site ID	6/26/2019		7/10/2019		7/24/2019		8/7/2019		8/21/2019		9/4/2019	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-GRN_23.4	mod	fresh	low	base	mod	fresh	low	base	mod	fresh	low	base
VT-GRN_20.2	mod	fresh	mod	base	NT	NT	low	base	mod	fresh	mod	base
VT-GRN_16.8	mod	fresh	low	base	mod	fresh	low	base	mod	fresh	mod	base
MA-GRN_09.8	mod	fresh	mod	base	mod	fresh	mod	base	mod	base	mod	base
MA-GRN_02.0	high	fresh	low	base	mod	fresh	low	base	flood	fresh	mod	base
MA-GRN_00.8	mod	base	low	base	mod	base	mod	reg	mod	fresh	low	base
VT-PND_00.1	low	fresh	low	base	mod	fresh	low	base	mod	fresh	low	base
VT-HBG_00.1	mod	base	low	base	mod	base	low	base	low	base	low	base
MA-MPL_00.1	mod	base	low	base	mod	base	low	base	flood	fresh	mod	base

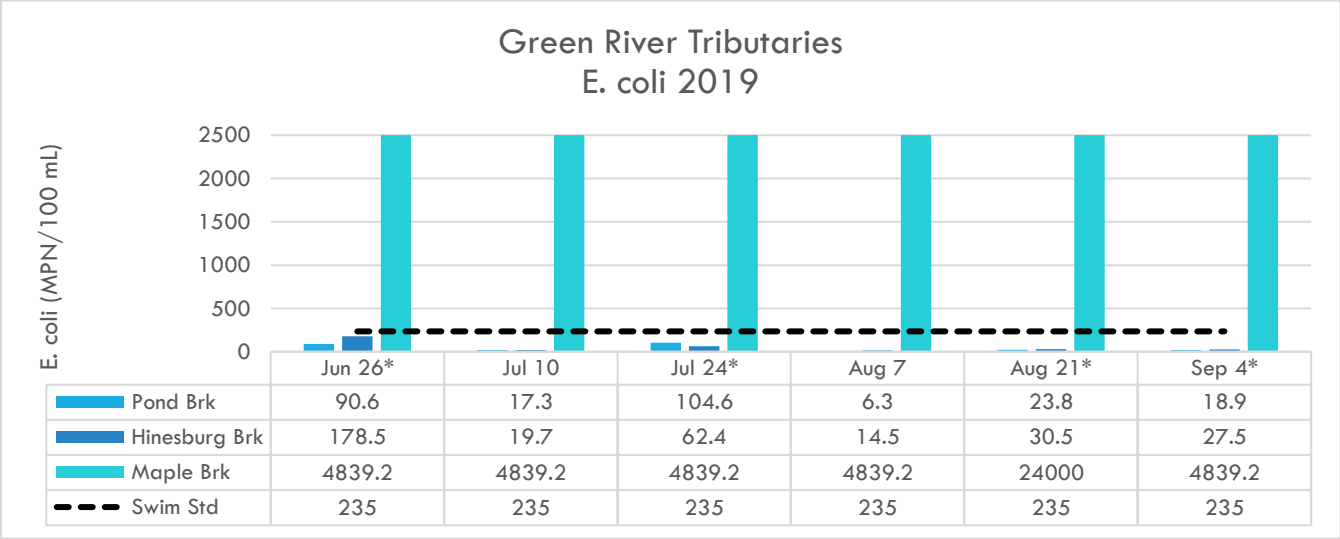
Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located between the Vermont and Massachusetts sites. Based on flows measured at the gage, 6/16 and 7/24 had moderate flows, and 7/10, 8/7, 8/21, and 9/4 had low flows.



Results from all parameters are presented below.



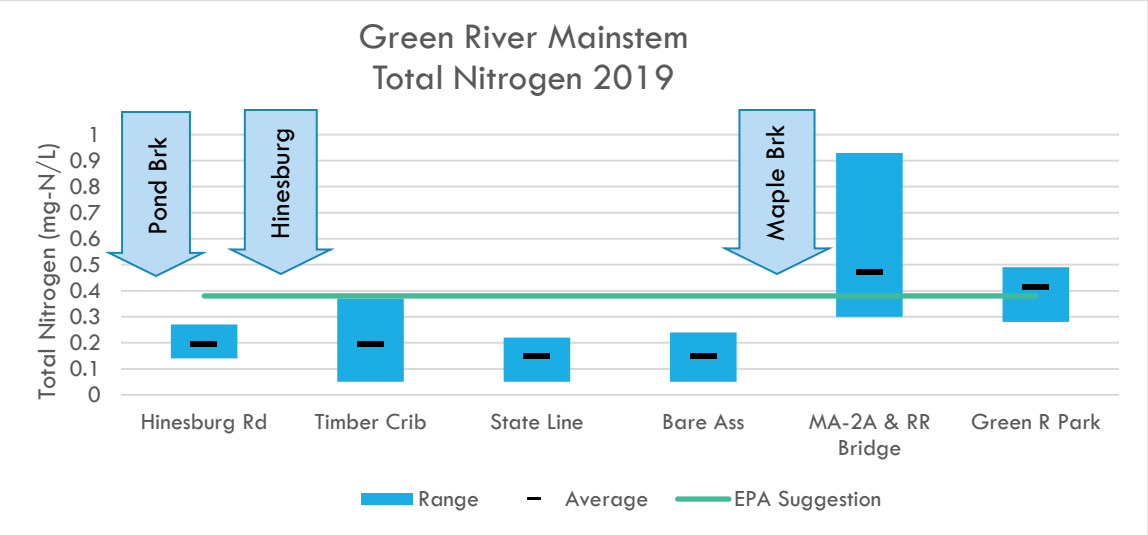
	Jun 26*	Jul 10	Jul 24*	Aug 7	Aug 21*	Sep 4*
Hinesburg Rd	111.2	8.6	82	6.3	21.3	11
Timber Crib	139.6	24.6	0	53.7	186	27.5
State Line	209.8	16.1	129.1	14.8	44.1	37.3
Bare Ass	436	28.5	248.9	17.1	49.5	24.9
MA-2A & RR Bridge	1119.9	95.9	648.8	166.4	4839.2	178.2
Green R Park	2419.6	488.4	1119.9	1299.7	4839.2	248.1
Swim Std	235	235	235	235	235	235

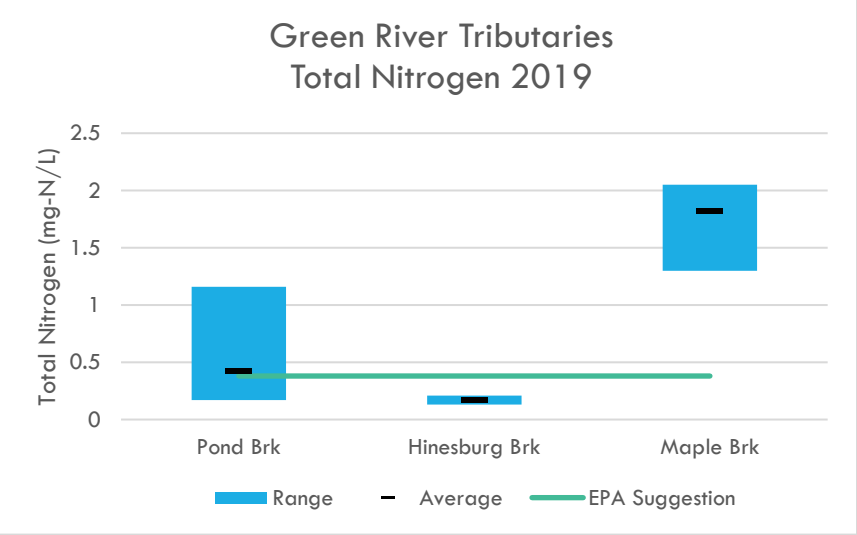


	Jun 26*	Jul 10	Jul 24*	Aug 7	Aug 21*	Sep 4*
Pond Brk	90.6	17.3	104.6	6.3	23.8	18.9
Hinesburg Brk	178.5	19.7	62.4	14.5	30.5	27.5
Maple Brk	4839.2	4839.2	4839.2	4839.2	24000	4839.2
Swim Std	235	235	235	235	235	235

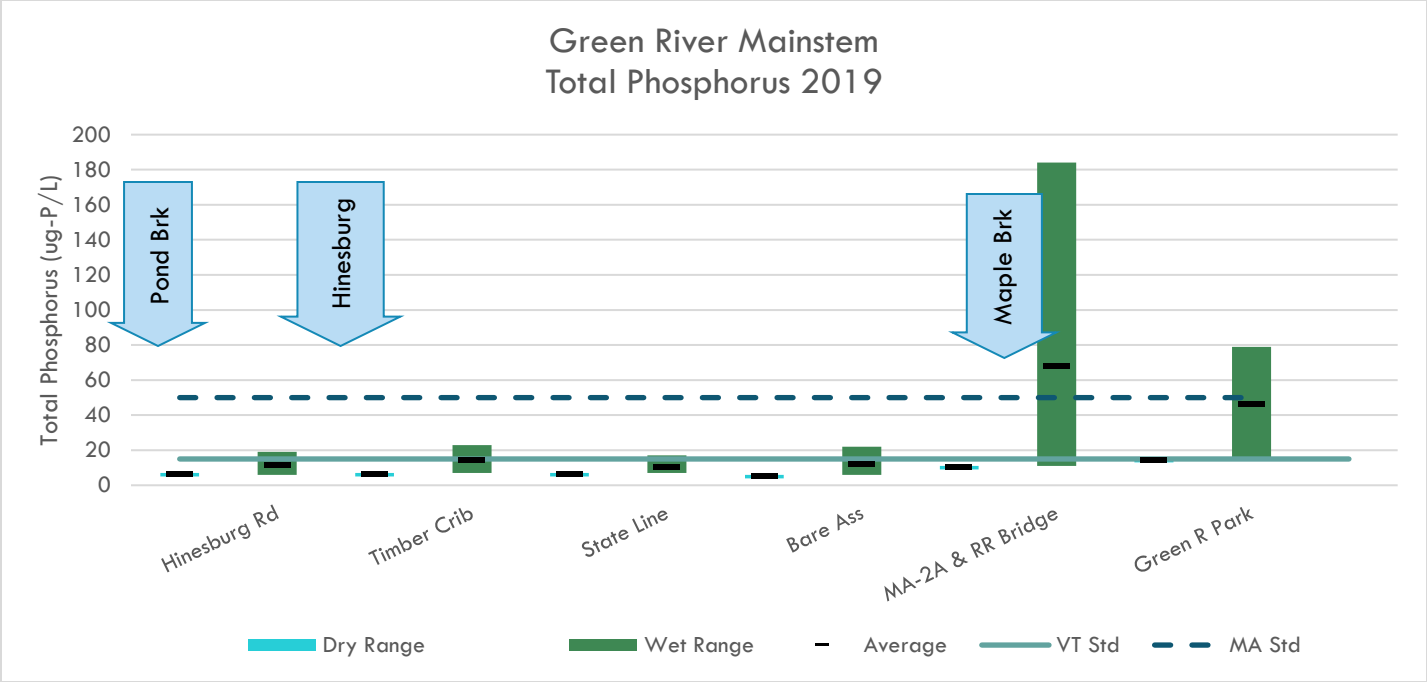
** Wet weather (>0.1" rain) in 24 hours prior to sampling*

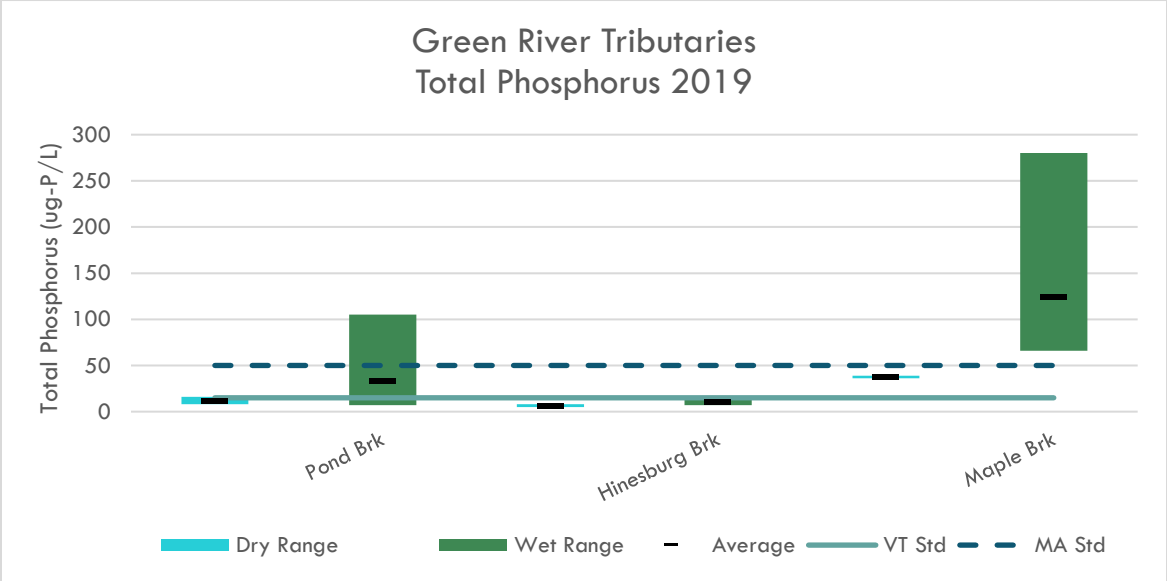
The mainstem Green River sites upstream of Greenfield proper (Bare Ass Beach and up) as well as the headwater tributaries (Pond Brook and Hinesburg Brook) tended to be below the swim standard in dry weather and mostly in wet weather as well. The upper Greenfield site, MA-2A, site met the swim standard in dry weather and lowest Greenfield site at the Green River Park never met the swim standard. Maple Brook, which always maxes out the test, is buried under Greenfield and is directly connected to much of the town's stormwater infrastructure before emptying into the Green River just upstream of the MA-2A site. It should be noted that the lab attempted a dilution to get an idea of the actual number of organisms and it maxed out that test at 24,000 organisms.



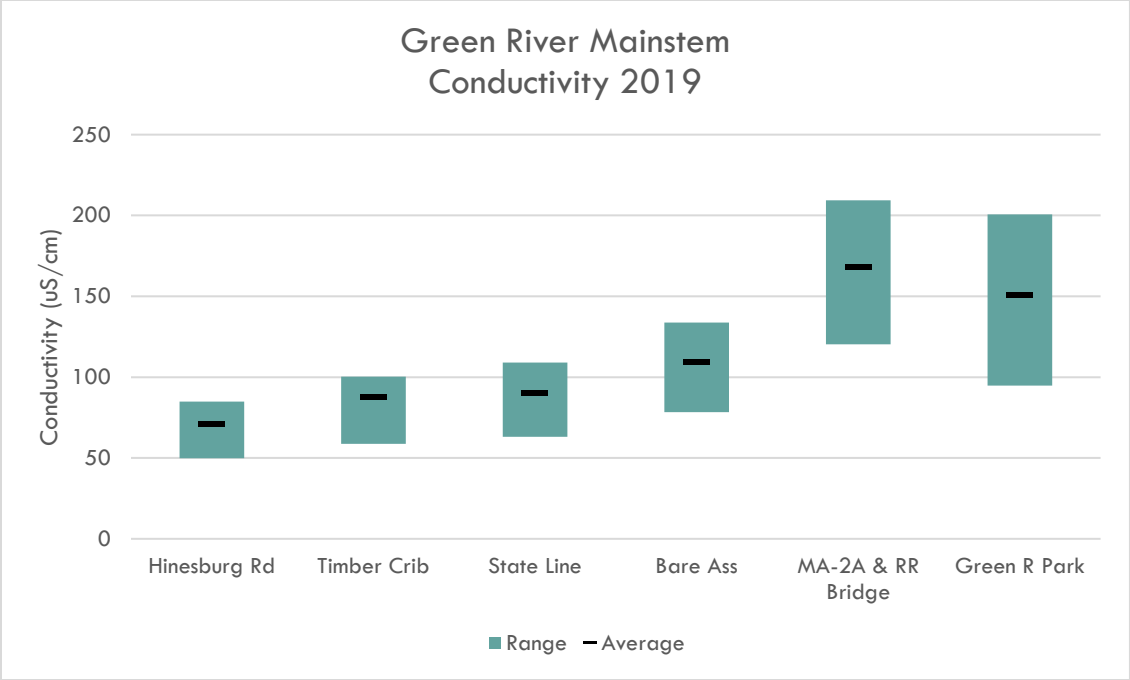


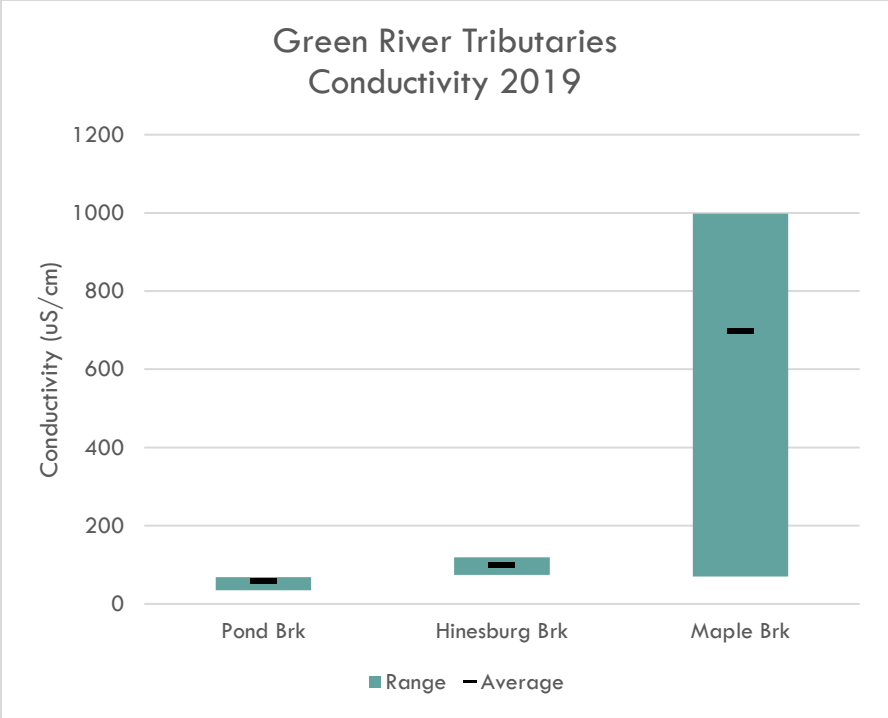
The averages for all sites were well below the VT standard of 5.0 mg-N/L. On the mainstem, the Greenfield sites (MA-2A and Green River Park) were above the EPA suggestion for the EcoRegion. As expected, Maple Brook was well above that EPA suggestion. Pond Brook results tended to be right at or below the EPA suggestion and one particularly wet day had a high result for both nitrogen and phosphorus; if this trend continues, it would be worth investigating potential sources of nutrients.





The upstream sites on the mainstem (up to Bare Ass Beach) met both the VT and MA standards in dry weather and on average in wet weather. Similar to the nitrogen results, Pond Brook has higher than expected phosphorus, especially during wet weather. Maple Brook actually meets the MA standard in dry weather but always exceeds it during wet weather.





There is no standard conductivity in either state. Ideal conductivity for freshwater streams to support aquatic life is below 1500 µS/cm, which Maple Brook is still below despite being 5-6 times higher than other sites throughout the Deerfield River watershed.

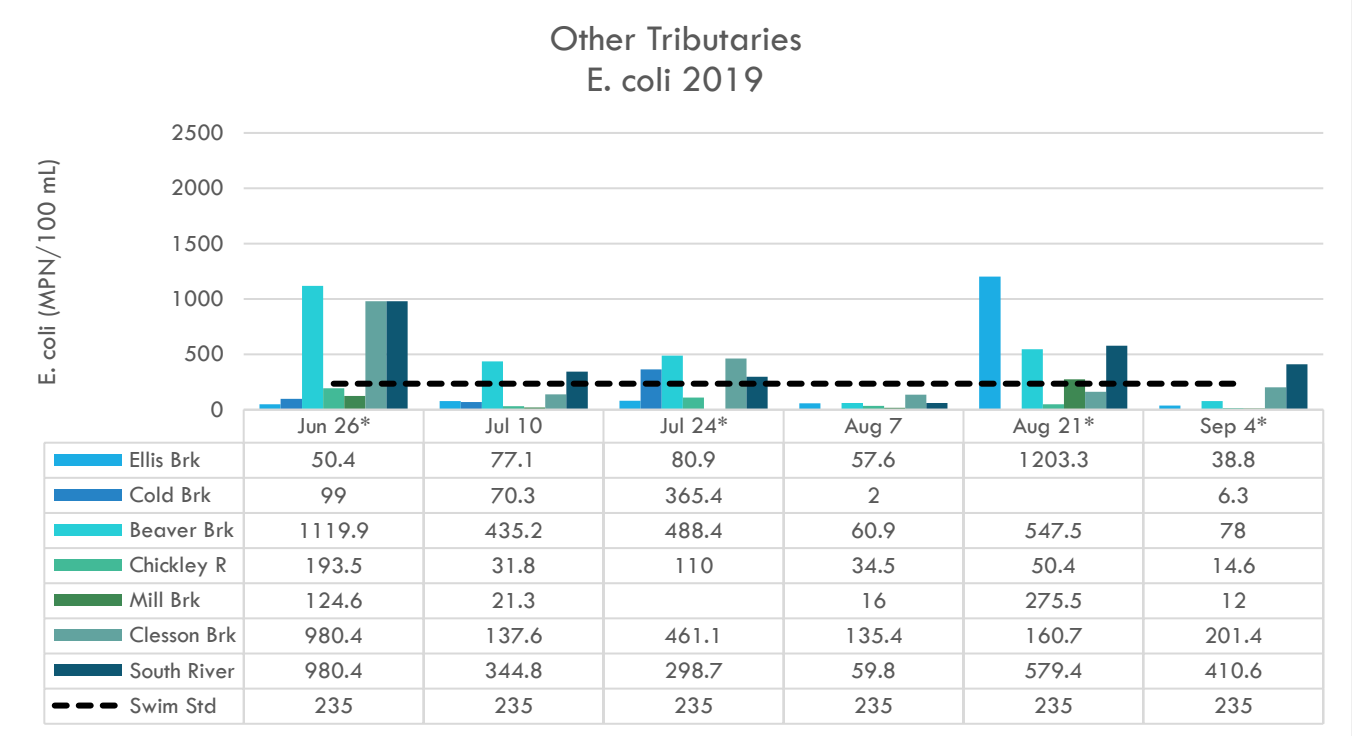
Other Tributaries

DRWA monitored single sites on several other tributaries within the Deerfield Watershed. Ellis Brook, Cold Brook, and Beaver Brook (tributaries to the North Branch Deerfield in Vermont) and the Chickley River, Mill Brook, Clesson Brook, and South River (tributaries to the Deerfield River in Massachusetts) were all monitored for *E. coli*, total nitrogen, total phosphorus, and conductivity. All these tributaries are considered Class B cold water streams. DRWA started to monitor a tributary to Beaver Brook but low flows made the site impossible to test. Preliminary results showed no water quality concerns.

Site ID	6/26/2019		7/10/2019		7/24/2019		8/7/2019		8/21/2019		9/4/2019	
	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type	Level	Type
VT-ELS_00.2	mod	base	mod	base	mod	fresh	mod	base	high	fresh	high	base
VT-COB_00.3	mod	fresh	low	base	high	fresh	low	base	NT	NT	mod	base
VT-BVR_01.1	mod	fresh	low	base	mod	fresh	low	base	low	base	low	base
MA-SOU_02.4	mod	fresh	NR	NR	mod	fresh	low	base	low	base	low	base
MA-MBK_00.1	mod	fresh	low	base	NT	NT	low	base	low	fresh	low	base
MA-CLS_00.3	high	fresh	mod	base	mod	fresh	low	base	mod	base	mod	base

Volunteers are required to note the level and type of flow at each site at the time of sampling, presented above. These observations are inherently subjective, based on individual observations at specific sites. There is a USGS gage located above the site on the South River, but all of the other tributaries are ungagged. Based on flow levels recorded at the South River gage, other gaged rivers in the watershed, and the flows recorded on the unregulated tributaries discussed above, 6/26 and 7/24 had moderate to high flows and the rest had low to moderate flows. It appears the South River had more moderate flows than the other tributaries discussed above.

Results from all parameters are presented below.

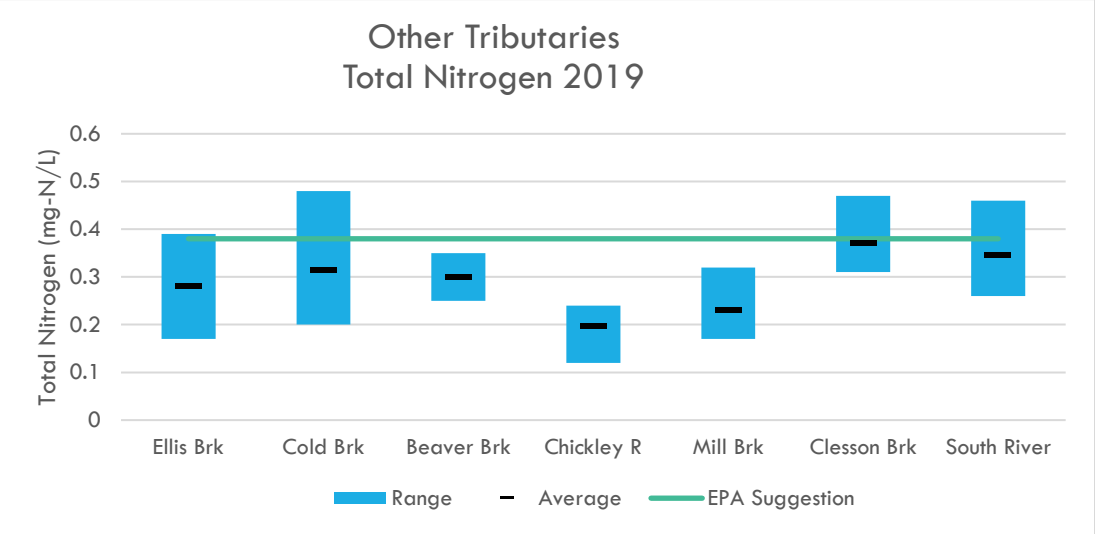


	Jun 26*	Jul 10	Jul 24*	Aug 7	Aug 21*	Sep 4*
Ellis Brk	50.4	77.1	80.9	57.6	1203.3	38.8
Cold Brk	99	70.3	365.4	2		6.3
Beaver Brk	1119.9	435.2	488.4	60.9	547.5	78
Chickley R	193.5	31.8	110	34.5	50.4	14.6
Mill Brk	124.6	21.3		16	275.5	12
Clesson Brk	980.4	137.6	461.1	135.4	160.7	201.4
South River	980.4	344.8	298.7	59.8	579.4	410.6
Swim Std	235	235	235	235	235	235

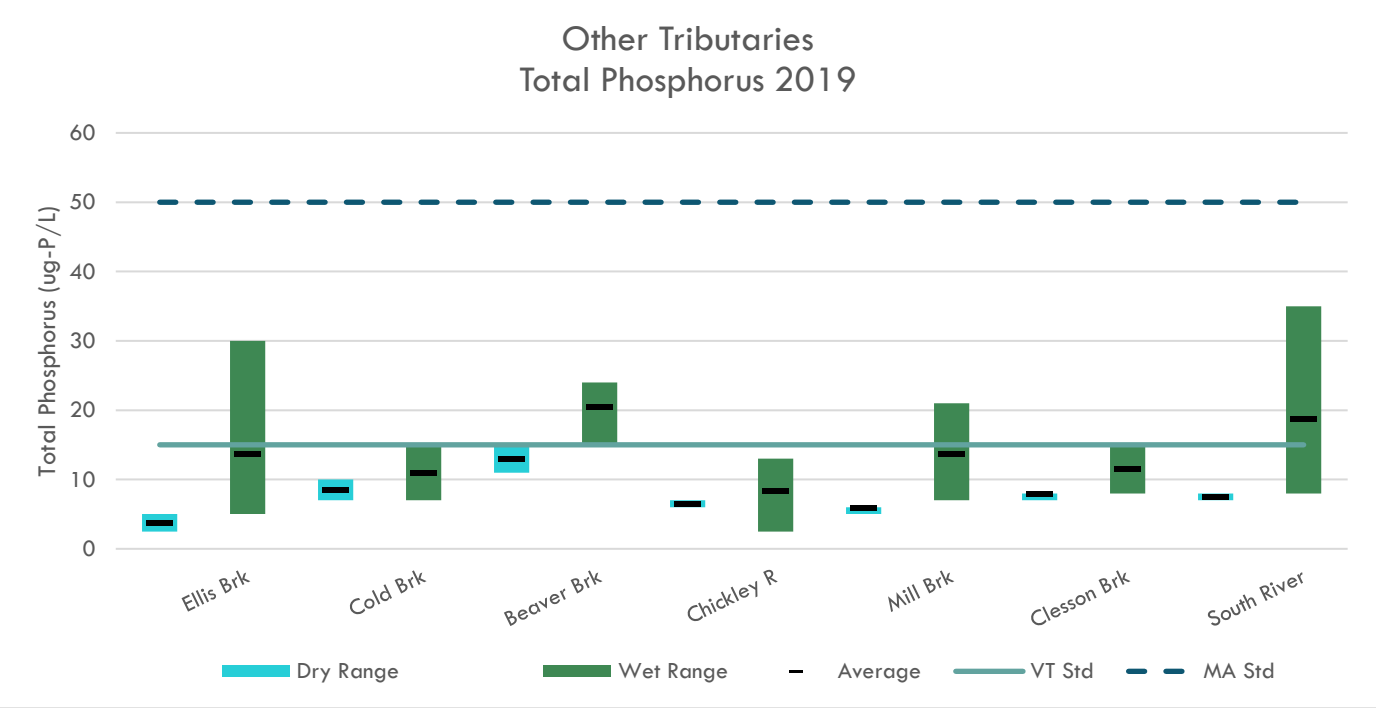
* Wet weather (>0.1" rain) in 24 hours prior to sampling

Ellis Brook was a new site selected to monitor downstream of the North Branch Fire District # 1 wastewater treatment following some upgrades; the August 21 high result is therefore particularly concerning. Beaver Brook often exceeded

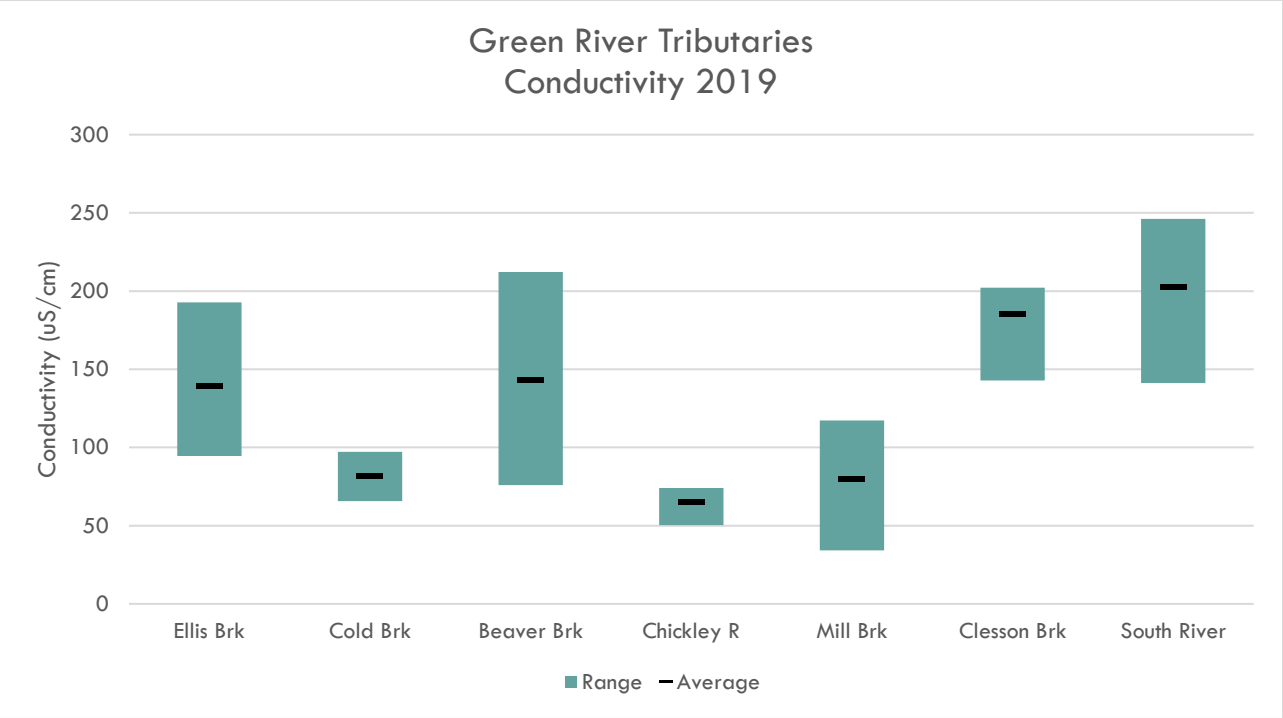
the swim standard in either wet or dry weather. The South River also continued to exceed the swim standard frequently. The Clesson Brook exceeded the standard only after wet weather. The Cold Brook, Chickley River (which is currently listed as impaired for bacteria), and Mill Brook all had consistently low results.



The averages for all these tributary sites were below the VT standard of 5.0 mg-N/L and, on average, met the EPA's suggestion for the Ecoregion.



All tributaries met both the MA and VT standards during dry weather. During wet weather, Ellis Brook met the VT standard on average, Cold Brook always met the standard, and Beaver Brook always exceeded it. All MA tributaries met the MA standard in wet weather, but the South River had the highest average; there is a significant amount of agriculture in the South River watershed.



There is no standard for conductivity in either state. Despite the range of conditions, no site stands out as particularly impacted.

Quality Assurance/Quality Control

As part of participation with the VT ANR LaRosa Partnership program and in order to receive funding from Mass DEP, DRWA is required to prepare and follow an approved Quality Assurance Project Plan (QAPP) to ensure that the data we collect are scientifically valid. The following charts illustrate our commitment to quality assurance and quality control within our program. The full QAPP is available from DRWA by request.

QAPP Part 7b – Quality Control Samples

Anomalies (highlighted in bold) from the following two tables will be discussed in the next section.

Table 4 - Field Duplicate Relative Percent Difference (RPD) Results

Site ID	QC ID	Date	CRC	VAEL		DRWA
			E. coli	TN	TP	Cond
VT-NBD_02.0	VT-QCA	6/26/2019	10%	7%	**55%**	0%
MA-MPL_00.1	GR-QCA	6/26/2019	0%	**2%**	1%	1%
MA-CHI_00.1	MA-QCA	6/26/2019	9%	9%	8%	1%
VT-COB_00.3	VT-QCA	7/10/2019	6%	8%	13%	4%
MA-MPL_00.1	GR-QCA	7/10/2019	0%	1%	0%	2%
MA-CHI_00.1	MA-QCA	7/10/2019	6%	4%	**33%**	5%
VT-EBN_15.0	VT-QCA	7/24/2019	9%	2%	12%	2%
VT-PND_00.1	GR-QCA	7/24/2019	3%	7%	25%	2%
VT-GRN_16.8	MA-QCA	7/24/2019	7%	17%	8%	0%
VT-NBD_06.4	VT-QCA	8/7/2019	2%	3%	0%	1%
MA-GRN_09.8	GR-QCA	8/7/2019	13%	0%	0%	1%
MA-CLS_00.3	MA-QCA	8/7/2019	20%	0%	0%	1%
VT-BVR_01.1	VT-QCA	8/21/2019	5%	6%	15%	4%
VT-GRN_20.2	GR-QCA	8/21/2019	2%	**REJ**	**REJ**	3%
MA-CLS_00.3	MA-QCA	8/21/2019	6%	0%	12%	1%
VT-ELS_00.2	VT-QCA	9/4/2019	6%	**34%**	18%	23%
VT-GRN_16.8	GR-QCA	9/4/2019	7%	0%	15%	0%
MA-DFR_01.1	MA-QCA	9/4/2019	0%	27%	**50%**	11%
Mean RPD			6%	7%	16%	3%
RPD Goal			≤30% log10 trans. results	≤20%	≤30%	≤30%

RPD formula used: $RPD_{field\ duplicate\ pair} = \frac{|sample_1 - sample_2|}{Average(sample_1, sample_2)}$

Table 5 - Field Blank Results

Site ID	Sample ID	Date	CRC	VAEL		DRWA
			E. coli	TN	TP	Cond
VT-QCB	VT-ELS_00.2	6/26/2019	< 1.0	<0.10	<5	4.9
GR-QCB	MA-GRN_09.8	6/26/2019	< 1.0	<0.10	<5	3.3
MA-QCB	MA-EBN_02.4	6/26/2019	< 1.0	**<0.10**	<5	3.1
VT-QCB	VT-ELS_00.2	7/10/2019	< 1.0	<0.10	<5	4.7
GR-QCB	MA-GRN_09.8	7/10/2019	< 1.0	<0.10	<5	5.5
MA-QCB	MA-DFR_27.6	7/10/2019	< 1.0	<0.10	<5	5
VT-QCB	VT-NBD_02.7	7/24/2019	< 1.0	<0.10	<5	5.5
GR-QCB	VT-GRN_23.4	7/24/2019	< 1.0	<0.10	<5	4.3
MA-QCB	MA-SOU_02.4	7/24/2019	< 1.0	<0.10	<5	3.6
VT-QCB	VT-EBN_14.7	8/7/2019	< 1.0	<0.10	6	**16.1**
GR-QCB	MA-GRN_00.8	8/7/2019	< 1.0	<0.10	<5	5.7
MA-QCB	MA-DFR_24.0	8/7/2019	< 1.0	<0.10	<5	3.3
VT-QCB	VT-NBD_01.8	8/21/2019	< 1.0	<0.10	7	5.9
GR-QCB	VT-PND_00.1	8/21/2019	< 1.0	<0.10	<5	2.9
MA-QCB	MA-CHI_00.1	8/21/2019	< 1.0	<0.10	<5	4.8
VT-QCB	VT-EBN_15.0	9/4/2019	< 1.0	<0.10	<5	4.8
GR-QCB	MA-CHI_00.1	9/4/2019	< 1.0	<0.10	<5	3.1
MA-QCB	MA-GRN_02.0	9/4/2019	< 1.0	<0.10	<5	2.7
Reporting Limit:			**1**	**0.1**	**5**	**0**

Table 6 - QAPP Part 7c – Project Completeness

Parameter	Number of Samples Anticipated	Number of Valid Samples Collected & Analyzed	Percent Complete
E. coli	210	202	96%
Total nitrogen	210	202	96%
Total Phosphorus	210	202	96%
Conductivity	210	199	95%

Table 7 - Quality Control Completeness

	Parameter			
	E. Coli	TN	TP	Cond
Total Number of Samples	202	202	202	199
Total Number of Field Duplicates	18	17	17	18
% of Field Dups (Goal is ≥ 10%)	9%	8%	8%	9%
Total Number of Field Blanks	18	18	18	18
% of Field Blanks (Goal is ≥ 10%)	9%	9%	9%	9%

We are satisfied with submitting 10% or close to 10% of QC samples since we are regularly asked to round down the number of QC samples we submit to reduce costs.

QA Discussion

In 2019, DRWA collected samples to test for *E. coli*, total nitrogen (TN), total phosphorous (TP), and conductivity; volunteers also recorded air and water temperature measurements at each site using and alcohol thermometer and observed flow level and type while collecting their samples. *E. coli* samples were analyzed by the CRC lab in Greenfield, MA; TN, TP, and turbidity samples were analyzed by the Vermont Environmental and Agricultural Laboratory (VAEL); conductivity samples were analyzed by DRWA personnel using a handheld meter in Greenfield, MA.

Field Duplicates: Most field duplicates were within acceptable RPD goals (see Table 4) and all RPD goals for the season were met. Some individual results did not meet the goals and they are discussed here:

- VT-NBD_02.0 & VT-QCA, 6/26/2019 – This pair failed for TP. There is no obvious reason. We have found that sometimes TP pairs fail when there is turbid water but funding for turbidity was cut this year so we cannot check the condition of the water. The original sample is within reasonable values for this site, so we used it in this report.
- MA-MPL_00.1 & GR-QCA, 6/26/2019 – Initially, this pair failed for TN as GR-QCA came back below the detectable limit. Upon further inspection, GR-QCB (Field Blank) also failed as it was not a blank. Swapping the values resulted in both passing.
- MA-CHI_00.1 & MA-QCA, 7/10/2019 – This pair failed for TP. The values are very close to each other but low, so we accepted these results despite the QC pair failing to meet the RPD goal.
- GR-QCA, - Both the TN & TP pairs failed significantly. We believe that the results may have been switched with another sample but it is impossible to figure out which one. We have rejected these results and used the original sample results in this report.
- VT-ELS_00.2 & VT-QCA, 9/4/2019 – This pair failed for TN. There is no obvious reason, but the original sample is within reasonable values for this site, so we used it in this report.
- MA-DFR_00.1 & MA-QCA, 9/4/2019 – This pair failed for TP. This sample was collected downstream of bridge construction, so it was likely turbid which could account for the large difference. Once again, we cannot corroborate this due to lack of turbidity testing this year. The original result is within reasonable values for this site, so we used it in this report.

Field Blanks: Most field blanks were at or below the detection limit for all parameters. It appears as if a few TP samples may have been slightly contaminated. DRWA volunteers will be instructed to be extra careful when handling TP vials in the future. One conductivity blank failed; we have found that sometimes DI water sent to us from VAEL has sediment on it so we attribute possible conductivity failures to that.

Through the analysis of the QC samples, we found a few instances where it was clear that bottles were swapped at the VAEL. Because we process some of our own samples, we know that the bottle submitted were labeled correctly. We find this extremely concerning because there is often no way to determine if a sample is mixed up if it is not part of a QC pair.

Temperature: All thermometers used for air and water temperatures were calibrated with a NIST thermometer at the CRC laboratory before the 2019 monitoring season began. Thermometers that were not accurate were taken out of circulation.

Next Steps

DRWA is planning on continuing to monitor again in 2020. At the time of writing this report, unfortunately, funding for the LaRosa Partnership Program was cut completely and the monitoring season start was delayed due to the COVID-19 pandemic. DRWA will monitor only for *E. coli* and mostly in Massachusetts due to receiving a Mass DEP grant for a second year in a row to do so. We hope to return to a full, robust monitoring program in 2021.

We will continue our partnership with the Green River Watershed Alliance (GRWA) as members of the steering committee. We had hoped for a third year of intensive monitoring in the watershed, however that will not be happening. We do believe that our two years of results are sufficient to support GRWA's goal to have the Green River in Vermont reclassified as Class A.

DRWA will be doing some stormwater tracking in 2020 using equipment loaned from the EPA in both Wilmington and Jacksonville. The goal is to help understand potential sources of *E. coli* in those two communities.

Finally, in future years, we recommend working to understand the full nutrient regime of the Deerfield River in Massachusetts and identify potential sources.

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Appendix – 2019 Full Results

Site ID	Date	Time	CRC Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	VAEL Sample #	TN (mg-N/L)	TP (µg P/L)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
VT-NBD_06.4	6/26/2019	7:57 AM	19-7-2	83.9	Y	1900298-001	0.26	10	119.6	19	13	mod	base	
VT-NBD_02.7	6/26/2019	7:45 AM	19-7-4	195.6	Y	1900298-002	0.27	15	97.9	16	13.5	mod	base	
VT-NBD_02.0	6/26/2019	7:18 AM	19-7-5	228.2	Y	1900298-003	0.28	44	103.6	17	15	mod	freshet	
VT-NBD_01.8	6/26/2019	7:25 AM	19-7-6	110.6	Y	1900298-004	0.25	13	96.4	17.5	14.5	mod	freshet	
MA-DFR_28.9	6/26/2019	8:45 AM	19-7-9	51.2	Y	1900298-005	0.2	8	55	18	15	mod	base	
MA-DFR_27.6	6/26/2019	7:32 AM	19-7-11	53.7	Y	1900298-006	0.21	9	54.6	15	14	mod	regulated	
MA-DFR_24.0	6/26/2019	7:10 AM	19-7-13	96	Y	1900298-007	0.37	12	50.4	16	14	mod	regulated	
MA-DFR_01.1	6/26/2019	9:25 AM	19-7-29	1732.9	Y	1900298-008	0.3	51	76.5	21.5	16	mod	regulated	
VT-EBN_15.0	6/26/2019	8:40 AM	19-7-14	238.2	Y	1900298-009	0.28	21	70.4	19	17	mod	base	
VT-EBN_14.7	6/26/2019	8:55 AM	19-7-15	307.6	Y	1900298-010	0.3	27	72.9	19	17	mod	base	
MA-EBN_02.4	6/26/2019	7:00 AM	19-7-16	920.8	Y	1900298-011	0.39	41	74.9	17	15	high	freshet	
MA-NOR_00.1	6/26/2019	8:00 AM	19-7-17	980.4	Y	1900298-012	0.37	38	73.8	17	15	high	freshet	
VT-PND_00.1	6/26/2019	7:15 AM	19-7-18	90.6	Y	1900298-013	0.17	9	34.9	15	13.5	low	freshet	
VT-GRN_23.4	6/26/2019	7:40 AM	19-7-19	111.2	Y	1900298-014	0.2	19	49.8	17	15	mod	freshet	
VT-HBG_00.1	6/26/2019	6:30 AM	19-7-20	178.5	Y	1900298-015	0.17	15	74.2	14	13	mod	base	
VT-GRN_20.2	6/26/2019	8:08 AM	19-7-21	139.6	Y	1900298-016	0.2	14	58.8	17	15	mod	freshet	
VT-GRN_16.8	6/26/2019	9:00 AM	19-7-22	209.8	Y	1900298-017	0.2	17	63.1	18.5	15	mod	freshet	
MA-GRN_09.8	6/26/2019	11:15 AM	19-7-23	436	Y	1900298-018	0.24	22	78.4	30	18	mod	freshet	
MA-MPL_00.1	6/26/2019	8:57 AM	19-7-24	> 2419.6	Y	1900298-019	1.78	83	652	20	17	mod	base	
MA-GRN_02.0	6/26/2019	9:15 AM	19-7-25	1119.9	Y	1900298-020	0.39	55	120.4	27	17	high	freshet	
MA-GRN_00.8	6/26/2019	9:00 AM	19-7-26	2419.6	Y	1900298-021	0.48	64	125.2	23	17.5	mod	base	
VT-ELS_00.2	6/26/2019	7:30 AM	19-7-1	50.4	Y	1900298-022	0.17	7	94.6	7	13	mod	base	
VT-COB_00.3	6/26/2019	7:25 AM	19-7-3	99	Y	1900298-023	0.23	11	66.3	16	13	mod	freshet	
VT-BVR_02.9T	6/26/2019	6:40 AM	19-7-7	43.5	Y	1900298-024	0.18	12	68.2	16	18	mod	base	
VT-BVR_01.1	6/26/2019	7:00 AM	19-7-8	1119.9	Y	1900298-025	0.29	22	75.9	15	15.5	mod	freshet	
MA-CHI_00.1	6/26/2019	8:00 AM	19-7-10	193.5	Y	1900298-026	0.22	13	50.4	18	15	mod	freshet	
MA-MBK_00.1	6/26/2019	7:55 AM	19-7-12	124.6	Y	1900298-027	0.22	13	60.7	15	14	mod	freshet	

Site ID	Date	Time	CRC Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	VAEL Sample #	TN (mg-N/L)	TP (µg P/L)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
MA-CLS_00.3	6/26/2019	8:28 AM	19-7-27	980.4	Y	1900298-028	0.36	15	NT	18	15	high	freshet	
MA-SOU_02.4	6/26/2019	8:45 AM	19-7-28	980.4	Y	1900298-029	0.46	35	141.2	20	19.5	mod	freshet	
VT-QCA	6/26/2019	7:32 AM	19-7-30	137.6	Y	1900298-030	0.3	25	103.3	NA	NA	NA	NA	VT-NBD_02.0
VT-QCB	6/26/2019	7:33 AM	19-7-31	< 1.0	Y	1900298-031	<0.10	<5	4.9	NA	NA	NA	NA	VT-ELS_00.2
GR-QCA	6/26/2019	9:01 AM	19-7-32	> 2419.6	Y	1900298-032	<0.10	82	643	NA	NA	NA	NA	MA-MPL_00.1 - TN swapped w GR-QCB
GR-QCB	6/26/2019	11:10 AM	19-7-33	< 1.0	Y	1900298-033	1.81	<5	3.3	NA	NA	NA	NA	MA-GRN_09.8 -TN swapped w GR-QCA
MA-QCA	6/26/2019	8:15 AM	19-7-34	123.6	Y	1900298-034	0.24	12	49.8	NA	NA	NA	NA	MA-CHI_00.1
MA-QCB	6/26/2019	7:00 AM	19-7-35	< 1.0	Y	1900298-035	<0.10	<5	3.1	NA	NA	NA	NA	MA-EBN_02.4
VT-NBD_06.4	7/10/2019	7:31 AM	19-11-2	178.9	N	1900299-001	0.4	<5	218.1	nr	nr	mod	base	
VT-COB_00.3	7/10/2019	7:45 AM	19-11-4	70.3	N	1900299-002	0.27	8	84.5	13	16	low	base	Mixed up with VT-NBD_02.7, values corrected
VT-NBD_02.0	7/10/2019	7:50 AM	19-11-5	410.6	N	1900299-003	0.41	7	165.4	15	17	moderate	base	
VT-NBD_01.8	7/10/2019	7:40 AM	19-11-6	365.4	N	1900299-004	0.42	8	170.7	14	17	mod	base	
MA-DFR_28.9	7/10/2019	8:50 AM	19-11-9	15.5	N	1900299-005	0.23	5	53.2	19.5	17.5	low	base	
MA-DFR_24.0	7/10/2019	7:47 AM	19-11-13	52	N	1900299-006	0.26	8	59.9	18	16	mod	regulated	
MA-DFR_01.1	7/10/2019	7:23 AM	19-11-30	96	N	1900299-007	0.55	29	117.2	8	10	mod	regulated	
VT-EBN_15.0	7/10/2019	8:17 AM	19-11-14	686.7	N	1900299-008	0.37	12	119.4	nr	nr	low	base	
VT-EBN_14.7	7/10/2019	8:26 AM	19-11-15	275.5	N	1900299-009	0.52	60	128.4	nr	nr	low	base	
MA-EBN_02.4	7/10/2019	7:45 AM	19-11-16	38.8	N	1900299-010	0.38	26	90.3	16	18	low	base	
MA-NOR_00.1	7/10/2019	8:15 AM	19-11-17	156.5	N	1900299-011	0.56	35	148.9	16	18	low	base	
VT-PND_00.1	7/10/2019	7:35 AM	19-11-18	17.3	N	1900299-012	0.28	8	62.9	14	14	low	base	
VT-GRN_23.4	7/10/2019	7:38 AM	19-11-19	8.6	N	1900299-013	0.27	7	77.4	16	16	low	base	
VT-HBG_00.1	7/10/2019	6:25 AM	19-11-20	19.7	N	1900299-014	0.21	6	100.2	15.5	14	low	base	
VT-GRN_20.2	7/10/2019	8:08 AM	19-11-21	24.6	N	1900299-015	0.23	7	91.1	17	16	mod	base	
MA-GRN_09.8	7/10/2019	7:40 AM	19-11-23	28.5	N	1900299-016	0.24	5	122.9	18.5	19	mod	base	
MA-MPL_00.1	7/10/2019	9:32 AM	19-11-24	> 2419.6	N	1900299-017	2.05	36	972	24	16	low	base	
MA-GRN_02.0	7/10/2019	9:02 AM	19-11-25	95.9	N	1900299-018	0.42	11	184.1	21	20	low	base	
MA-GRN_00.8	7/10/2019	9:00 AM	19-11-26	488.4	N	1900299-019	0.45	14	200.6	23	20	low	base	
VT-ELS_00.2	7/10/2019	7:19 AM	19-11-1	77.1	N	1900299-020	0.32	<5	126.8	nr	nr	mod	base	
VT-NBD_02.7	7/10/2019	7:24 AM	19-11-3	613.1	N	1900299-021	0.45	10	162.4	11.5	15.5	low	base	Mixed up with VT-COB_00.3, values corrected
VT-BVR_02.9T	7/10/2019	7:25 AM	19-11-7	816.4	N	1900299-022	0.32	25	87.8	14	18	low	none	
VT-BVR_01.1	7/10/2019	7:40 AM	19-11-8	435.2	N	1900299-023	0.35	15	167.2	13.5	16	low	base	

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MA-CHI_00.1	7/10/2019	8:23 AM	19-11-10	31.8	N	1900299-024	0.24	7	69.9	18.5	17	mod	base	
MA-MBK_00.1	7/10/2019	7:45 AM	19-11-12	21.3	N	1900299-025	0.22	6	89.2	22	17	low	base	
MA-CLS_00.3	7/10/2019	8:15 AM	19-11-27	137.6	N	1900299-026	0.47	8	191.1	19	16	mod	base	
MA-SOU_02.4	7/10/2019	8:15 AM	19-11-28	344.8	N	1900299-027	0.38	8	226.3	20.5	19.5	NR	NR	
VT-GRN_16.8	7/10/2019	8:40 AM	19-11-22	16.1	N	1900299-028	0.18	7	99.8	17.5	16.5	low	base	
MA-DFR_27.6	7/10/2019	8:35 AM	19-11-11	22.6	N	1900299-029	0.21	6	58.2	22	17	low	regulated	
VT-QCA	7/10/2019	7:28 AM	19-11-31	54.6	N	1900299-030	0.25	7	87.9	NA	NA	NA	NA	VT-COB_00.3
VT-QCB	7/10/2019	7:22 AM	19-11-32	< 1.0	N	1900299-031	<0.10	<5	4.7	NA	NA	NA	NA	VT-ELS_00.2
GR-QCA	7/10/2019	9:36 AM	19-11-33	> 2419.6	N	1900299-032	2.03	36	955	NA	NA	NA	NA	MA-MPL_00.1
GR-QCB	7/10/2019	7:35 AM	19-11-34	< 1.0	N	1900299-033	<0.10	<5	5.5	NA	NA	NA	NA	MA-GRN_09.8
MA-QCA	7/10/2019	8:38 AM	19-11-35	26.2	N	1900299-034	0.23	5	73.4	NA	NA	NA	NA	MA-CHI_00.1
MA-QCB	7/10/2019	8:50 AM	19-11-36	< 1.0	N	1900299-035	<0.10	<5	5	NA	NA	NA	NA	MA-DFR_27.6
VT-ELS_00.2	7/24/2019	8:51 AM	19-15-1	80.9	Y	1900636-001	0.26	13	130.2	19	16	mod	freshet	
VT-NBD_06.4	7/24/2019	8:59 AM	19-15-2	275.5	Y	1900636-002	0.3	12	146	19	15	high	freshet	
VT-COB_00.3	7/24/2019	7:15 AM	19-15-3	365.4	Y	1900636-003	0.48	15	65.7	14	15	high	freshet	
VT-NBD_02.7	7/24/2019	7:40 AM	19-15-4	344.8	Y	1900636-004	0.41	15	107.4	15	15	high	freshet	
VT-NBD_02.0	7/24/2019	7:45 AM	19-15-5	365.4	Y	1900636-005	0.36	16	102	15	16	high	freshet	
VT-BVR_02.9T	7/24/2019	6:55 AM	19-15-7	118.7	Y	1900636-006	0.24	31	78.5	14	21	low	freshet	
VT-BVR_01.1	7/24/2019	7:15 AM	19-15-8	488.4	Y	1900636-007	0.35	24	88.6	14	16	mod	freshet	
MA-DFR_28.9	7/24/2019	8:39 AM	19-15-9	45	Y	1900636-008	0.24	9	58.1	18	17.5	low	base	
MA-CHI_00.1	7/24/2019	8:49 AM	19-15-10	110	Y	1900636-009	0.2	12	56.7	19	17	mod	freshet	
MA-DFR_27.6	7/24/2019	8:22 AM	19-15-11	69.7	Y	1900636-010	0.21	9	60.7	20	17	low	regulated	
MA-DFR_24.0	7/24/2019	8:00 AM	19-15-12	111.9	Y	1900636-012	0.27	10	NT	17.5	16	mod	regulated	
VT-EBN_15.0	7/24/2019	9:29 AM	19-15-13	648.8	Y	1900636-013	0.4	23	66	20	18	high	freshet	
VT-EBN_14.7	7/24/2019	9:44 AM	19-15-14	547.5	Y	1900636-014	0.41	32	69.7	20	18	high	freshet	
VT-PND_00.1	7/24/2019	8:05 AM	19-15-15	104.6	Y	1900636-017	0.31	14	49.3	14	16	mod	freshet	
VT-GRN_23.4	7/24/2019	7:43 AM	19-15-16	82	Y	1900636-018	0.22	14	56.9	15	16	mod	freshet	
VT-HBG_00.1	7/24/2019	7:45 AM	19-15-17	62.4	Y	1900636-019	0.16	11	88.6	14	15	mod	base	
VT-GRN_16.8	7/24/2019	9:10 AM	19-15-18	129.1	Y	1900636-021	0.22	12	72.9	15	16	mod	freshet	
MA-GRN_09.8	7/24/2019	8:50 AM	19-15-19	248.9	Y	1900636-022	0.22	16	87.4	20.5	17	mod	freshet	
MA-MPL_00.1	7/24/2019	9:04 AM	19-15-20	> 2419.6	Y	1900636-023	1.94	66	666	23	18	mod	base	

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MA-GRN_02.0	7/24/2019	9:15 AM	19-15-21	648.8	Y	1900636-024	0.39	23	134.2	23	18	mod	freshet	
MA-GRN_00.8	7/24/2019	9:05 AM	19-15-22	1119.9	Y	1900636-025	0.41	28	135.6	21	18.5	mod	base	
MA-CLS_00.3	7/24/2019	8:50 AM	19-15-23	461.1	Y	1900636-026	0.31	14	142.8	19	17	mod	freshet	
MA-SOU_02.4	7/24/2019	8:15 AM	19-15-24	298.7	Y	1900636-027	0.33	18	149.2	20	19.5	mod	freshet	
MA-DFR_01.1	7/24/2019	7:30 AM	19-15-25	1203.3	Y	1900636-028	0.36	32	77.8	19	19	mod	regulated	
VT-QCA	7/24/2019	9:29 AM	19-15-27	365.4	Y	1900636-029	0.41	26	67.4	NA	NA	NA	NA	VT_EBN_15.0
VT-QCB	7/24/2019	7:50 AM	19-15-28	< 1.0	Y	1900636-030	<0.10	<5	5.5	NA	NA	NA	NA	VT-NBD_02.7
GR-QCA	7/24/2019	8:05 AM	19-15-29	117.8	Y	1900636-031	0.29	18	48.4	NA	NA	NA	NA	VT-PND_00.1
GR-QCB	7/24/2019	7:50 AM	19-15-30	< 1.0	Y	1900636-032	<0.10	<5	4.3	NA	NA	NA	NA	VT-GRN_23.4
MA-QCA	7/24/2019	9:10 AM	19-15-31	185	Y	1900636-033	0.26	13	73.1	NA	NA	NA	NA	VT-GRN_16.8
MA-QCB	7/24/2019	8:20 AM	19-15-32	< 1.0	Y	1900636-034	<0.10	<5	3.6	NA	NA	NA	NA	MA-SOU_02.4
VT-NBD_01.8	7/24/2019	7:35 AM	19-15-6	488.4	Y	1900636-035	0.34	16	102.5	15	16	high	freshet	
MA-EBN_02.4	7/24/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
MA-MBK_00.1	7/24/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
MA-NOR_00.1	7/24/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
VT-GRN_20.2	7/24/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
VT-ELS_00.2	8/7/2019	7:45 AM	19-19-1	57.6	N	1900541-001	0.24	5	155.5	18	15	mod	base	
VT-NBD_06.4	8/7/2019	7:54 AM	19-19-2	30.1	N	1900541-002	0.3	6	246.7	18	16.5	mod	base	
VT-COB_00.3	8/7/2019	7:30 AM	19-19-3	2	N	1900541-003	0.21	7	97.2	17	17.5	low	base	
VT-NBD_02.7	8/7/2019	7:45 AM	19-19-4	2419.6	N	1900541-004	0.35	8	179.2	19	18	low	base	
VT-NBD_02.0	8/7/2019	7:50 AM	19-19-5	185	N	1900541-005	0.3	7	190	20	18	low	base	
VT-NBD_01.8	8/7/2019	7:40 AM	19-19-6	178.2	N	1900541-006	0.32	9	198.5	20	18	low	base	
VT-BVR_01.1	8/7/2019	7:35 AM	19-19-7	60.9	N	1900541-008	0.26	11	212.1	16.5	18	low	base	
MA-DFR_28.9	8/7/2019	8:45 AM	19-19-9	18.7	Y	1900541-009	0.23	7	52.4	21.5	19.5	low	base	
MA-CHI_00.1	8/7/2019	8:32 AM	19-19-10	34.5	N	1900541-010	0.17	6	74	22	18	mod	base	
MA-DFR_27.6	8/7/2019	8:13 AM	19-19-11	19.5	N	1900541-011	0.23	7	53.9	20.5	19	low	regulated	
MA-MBK_00.1	8/7/2019	8:24 AM	19-19-12	16	N	1900541-012	0.23	6	99.4	20.5	16	low	base	
MA-DFR_24.0	8/7/2019	8:06 AM	19-19-13	60.9	N	1900541-013	0.28	8	56.1	22	20	low	regulated	
VT-EBN_15.0	8/7/2019	8:47 AM	19-19-14	1203.3	N	1900541-014	0.31	10	138.8	18.5	17	mod	base	
VT-EBN_14.7	8/7/2019	8:55 AM	19-19-15	344.8	N	1900541-015	0.28	19	147.9	18.5	17	mod	base	
MA-EBN_02.4	8/7/2019	7:30 AM	19-19-16	101.4	N	1900541-016	0.25	8	131.4	20	20	low	base	

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MA-NOR_00.1	8/7/2019	8:00 AM	19-19-17	35.5	N	1900541-017	0.67	50	214.7	20	20	low	base	
VT-PND_00.1	8/7/2019	8:00 AM	19-19-18	6.3	N	1900541-018	0.37	16	68.9	17	15.5	low	base	
VT-GRN_23.4	8/7/2019	7:41 AM	19-19-19	6.3	N	1900541-019	0.14	6	84.8	18.5	15	low	base	
VT-HBG_00.1	8/7/2019	6:00 AM	19-19-20	14.5	N	1900541-020	0.13	6	103.4	19	17	low	base	
VT-GRN_20.2	8/7/2019	8:35 AM	19-19-21	53.7	N	1900541-021	<0.10	6	100.3	20	19	low	base	
VT-GRN_16.8	8/7/2019	8:55 AM	19-19-22	14.8	N	1900541-022	<0.10	6	109.1	19.5	19	low	base	
MA-GRN_09.8	8/7/2019	7:30 AM	19-19-23	17.1	N	1900541-023	<0.10	6	133.8	20.5	20	mod	base	
MA-MPL_00.1	8/7/2019	9:16 AM	19-19-24	> 2419.6	N	1900541-024	1.95	39	998	23	18	low	base	
MA-GRN_02.0	8/7/2019	9:26 AM	19-19-25	166.4	N	1900541-025	0.3	10	209.4	23	20	low	base	
MA-GRN_00.8	8/7/2019	8:44 AM	19-19-26	1299.7	N	1900541-026	0.39	15	94.8	23	21.5	mod	regulated	
MA-CLS_00.3	8/7/2019	8:42 AM	19-19-27	135.4	N	1900541-027	0.34	8	202.1	20	18	low	base	
MA-SOU_02.4	8/7/2019	8:20 AM	19-19-28	59.8	N	1900541-028	0.26	7	246.2	21	20	low	base	
MA-DFR_01.1	8/7/2019	8:05 AM	19-19-29	> 2419.6	N	1900541-029	0.38	17	218.2	21.5	22	mod	regulated	
VT-QCA	8/7/2019	7:57 AM	19-19-30	28.2	N	1900541-030	0.29	6	244.3	NA	NA	NA	NA	VT-NBD_06.4
GR-QCA	8/7/2019	8:35 AM	19-19-32	12.2	N	1900541-031	<0.10	6	135.6	NA	NA	NA	NA	MA-GRN_09.8
MA-QCA	8/7/2019	8:46 AM	19-19-34	54.8	N	1900541-032	0.34	8	200.7	NA	NA	NA	NA	MA-CLS_00.3
VT-QCB	8/7/2019	7:57 AM	19-19-31	< 1.0	N	1900541-033	<0.10	6	16.1	NA	NA	NA	NA	VT-EBN_14.7
GR-QCB	8/7/2019	8:56 AM	19-19-33	< 1.0	N	1900541-034	<0.10	<5	5.7	NA	NA	NA	NA	MA-GRN_00.8
MA-QCB	8/7/2019	8:17 AM	19-19-35	< 1.0	N	1900541-035	<0.10	<5	3.3	NA	NA	NA	NA	MA-DFR_24.0
VT-BVR_02.9T	8/7/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
VT-ELS_00.2	8/21/2019	7:52 AM	19-23-1	1203.3	Y	1900728-001	0.39	30	192.7	15	13.5	high	freshet	
VT-NBD_06.4	8/21/2019	8:00 AM	19-23-2	410.6	Y	1900728-002	0.32	8	202.5	15	14	mod	freshet	
VT-NBD_02.7	8/21/2019	7:40 AM	19-23-4	248.9	Y	1900728-004	0.32	8	160.5	17	16	mod	freshet	
VT-NBD_02.0	8/21/2019	7:55 AM	19-23-5	410.6	Y	1900728-005	0.28	10	165	15.5	18	low	base	
VT-NBD_01.8	8/21/2019	7:55 AM	19-23-6	816.4	Y	1900728-006	0.31	11	176	18	18	low	base	
VT-BVR_01.1	8/21/2019	7:35 AM	19-23-7	547.5	Y	1900728-008	0.3	21	170.4	15	18	low	base	
MA-DFR_28.9	8/21/2019	8:41 AM	19-23-8	48.7	Y	1900728-009	0.25	6	53.1	18	18.5	low	base	
MA-CHI_00.1	8/21/2019	8:50 AM	19-23-9	50.4	Y	1900728-010	0.24	6	72.7	17	18	mod	freshet	
MA-DFR_27.6	8/21/2019	8:12 AM	19-23-10	69.7	Y	1900728-011	0.25	6	55.3	16	18	low	freshet	
MA-MBK_00.1	8/21/2019	8:24 AM	19-23-11	275.5	Y	1900728-012	0.32	21	117.2	16	16	low	freshet	
MA-DFR_24.0	8/21/2019	8:25 AM	19-23-12	46.4	N	1900728-013	0.27	7	53.7	18	19	low	regulated	

Site ID	Date	Time	CRC Sample #	Final E. Coli. (mpn/ 100ml)	Wet? (Y/N)	VAEL Sample #	TN (mg-N/L)	TP (µg P/L)	Spec. Cond. (µS/cm)	Air Temp. °C	Water Temp °C	Water Level	Flow Type	Sample or QA Notes:
VT-EBN_15.0	8/21/2019	8:34 AM	19-23-13	770.1	Y	1900728-014	0.32	18	145.1	15.5	17	mod	freshet	
VT-EBN_14.7	8/21/2019	8:44 AM	19-23-14	201.4	Y	1900728-015	0.9	150	146.7	15	16	mod	freshet	
MA-EBN_02.4	8/21/2019	6:40 AM	19-23-15	124.6	Y	1900728-016	0.33	9	115.2	20	20	low	base	
MA-NOR_00.1	8/21/2019	7:04 AM	19-23-16	85.7	N	1900728-017	0.7	62	190.7	20	20	low	base	
VT-PND_00.1	8/21/2019	8:00 AM	19-23-17	23.8	Y	1900728-018	1.16	105	68.4	15	15	mod	freshet	
VT-GRN_23.4	8/21/2019	8:05 AM	19-23-18	21.3	Y	1900728-019	0.21	8	83.4	14.5	16.5	mod	freshet	
VT-HBG_00.1	8/21/2019	6:15 AM	19-23-19	30.5	N	1900728-020	0.2	8	119.5	18	16	low	base	
VT-GRN_20.2	8/21/2019	8:35 AM	19-23-20	186	Y	1900728-021	0.37	23	97.6	16	17	mod	freshet	
VT-GRN_16.8	8/21/2019	8:50 AM	19-23-21	44.1	Y	1900728-022	0.15	7	103.7	17	17.5	mod	freshet	
MA-GRN_09.8	8/21/2019	7:30 AM	19-23-22	49.5	Y	1900728-023	0.11	6	119.6	18	19.5	mod	base	
MA-MPL_00.1	8/21/2019	9:19 AM	19-23-23	24000	Y	1900728-024	1.3	280	70	18	20	flood	freshet	
MA-GRN_02.0	8/21/2019	9:07 AM	19-23-24	> 2419.6	Y	1900728-025	0.93	184	186.6	20	18	flood	freshet	
MA-GRN_00.8	8/21/2019	9:30 AM	19-23-25	> 2419.6	Y	1900728-026	0.49	79	168.8	20	20.5	mod	freshet	
MA-CLS_00.3	8/21/2019	8:20 AM	19-23-26	160.7	Y	1900728-027	0.43	9	197.6	18	18	mod	base	
MA-SOU_02.4	8/21/2019	8:45 AM	19-23-27	579.4	Y	1900728-028	0.38	14	228.4	20	20	low	base	
MA-DFR_01.1	8/21/2019	9:36 AM	19-23-28	261.3	Y	1900728-029	0.44	23	92.5	20	22.5	mod	regulated	
VT-QCA	8/21/2019	7:40 AM	19-23-29	410.6	Y	1900728-030	0.32	18	164.4	NA	NA	NA	NA	VT-BVR_01.1
VT-QCB	8/21/2019	7:55 AM	19-23-30	< 1.0	Y	1900728-031	<0.10	7	5.9	NA	NA	NA	NA	VT-NBD_01.8
GR-QCA	8/21/2019	8:37 AM	19-23-31	206.4	Y	1900728-032	0.6	~~85~~	~~100.1~~	NA	NA	NA	NA	TN/TP swapped with another site? REJECTED
GR-QCB	8/21/2019	8:05 AM	19-23-32	< 1.0	Y	1900728-033	<0.10	<5	2.9	NA	NA	NA	NA	VT-PND_00.1
MA-QCA	8/21/2019	8:27 AM	19-23-33	122.3	Y	1900728-034	0.43	8	199.4	NA	NA	NA	NA	MA-CLS_00.3
MA-QCB	8/21/2019	9:47 AM	19-23-34	< 1.0	Y	1900728-035	<0.10	<5	4.8	NA	NA	NA	NA	MA-CHI_00.1
VT-BVR_02.9T	8/21/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
VT-COB_00.3	8/21/2019	NT	NT	NT	NT	NT	NT	NT	NT	NA	NA	NA	NA	
VT-NBD_06.4	9/4/2019	7:48 AM	19-27-2	40.8	Y	1900843-001	0.24	<5	203.6	14	13	high	base	
VT-NBD_02.7	9/4/2019	7:55 AM	19-27-4	275.5	Y	1900843-002	0.24	7	162.2	14	14	mod	base	
VT-NBD_02.0	9/4/2019	7:55 AM	19-27-5	275.5	Y	1900843-003	0.22	6	163.5	15	15	low	base	
VT-NBD_01.8	9/4/2019	7:45 AM	19-27-6	290.9	Y	1900843-004	0.24	8	165	16	15	low	base	
MA-DFR_28.9	9/4/2019	8:23 AM	19-27-8	18.9	Y	1900843-005	0.22	5	54.7	18	17	low	base	
MA-DFR_27.6	9/4/2019	8:00 AM	19-27-10	16.1	Y	1900843-006	0.22	6	55.8	14.5	17	low	regulated	
MA-DFR_24.0	9/4/2019	8:18 AM	19-27-12	40.4	Y	1900843-007	0.25	7	NT	17	17	low	regulated	

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MA-DFR_01.1	9/4/2019	8:20 AM	19-27-28	307.6	Y	1900843-008	0.47	15	113.4	19	19.5	low	base	
VT-EBN_15.0	9/4/2019	8:27 AM	19-27-13	325.5	Y	1900843-009	0.24	12	109.3	16	14.5	high	base	
VT-EBN_14.7	9/4/2019	8:42 AM	19-27-14	178.9	Y	1900843-010	0.24	13	114	16	14.5	mod	base	
MA-EBN_02.4	9/4/2019	7:40 AM	19-27-15	152.9	Y	1900843-011	0.2	8	100.4	14	16	mod	base	
MA-NOR_00.1	9/4/2019	8:15 AM	19-27-16	172.2	Y	1900843-012	0.58	51	139.5	16	17	mod	base	
VT-PND_00.1	9/4/2019	7:55 AM	19-27-17	18.9	Y	1900843-013	0.26	7	64.1	13.5	13.5	low	base	
VT-GRN_23.4	9/4/2019	7:48 AM	19-27-18	11	Y	1900843-014	0.14	6	74.5	15	14	low	base	
VT-HBG_00.1	9/4/2019	6:30 AM	19-27-19	27.5	Y	1900843-015	0.15	7	107.6	16	15	low	base	
VT-GRN_20.2	9/4/2019	8:21 AM	19-27-20	27.5	Y	1900843-016	0.13	7	90.4	17	15	mod	base	
VT-GRN_16.8	9/4/2019	8:40 AM	19-27-21	37.3	Y	1900843-017	0.1	7	94.3	17	15.5	mod	base	
MA-GRN_09.8	9/4/2019	8:40 AM	19-27-22	24.9	Y	1900843-018	<0.10	6	113.4	19	nr	mod	base	
MA-MPL_00.1	9/4/2019	9:26 AM	19-27-23	> 2419.6	Y	1900843-019	1.94	66	829	22	18	mod	base	
MA-GRN_02.0	9/4/2019	9:15 AM	19-27-24	178.2	Y	1900843-020	0.4	11	173.5	22	19	mod	base	
MA-GRN_00.8	9/4/2019	9:00 AM	19-27-25	248.1	Y	1900843-021	0.28	14	182	19.5	19	low	base	
VT-ELS_00.2	9/4/2019	7:37 AM	19-27-1	38.8	Y	1900843-022	0.31	5	134.8	15	12	high	base	
VT-COB_00.3	9/4/2019	7:45 AM	19-27-3	6.3	Y	1900843-023	0.2	7	95.1	14	14	mod	base	
VT-BVR_01.1	9/4/2019	7:30 AM	19-27-7	78	Y	1900843-025	0.25	15	146.7	15	14	low	base	
MA-CHI_00.1	9/4/2019	8:40 AM	19-27-9	14.6	Y	1900843-026	0.12	<5	69.5	16	16	mod	freshet	
MA-MBK_00.1	9/4/2019	8:20 AM	19-27-11	12	Y	1900843-027	0.17	7	34.2	14.5	14	low	base	
MA-CLS_00.3	9/4/2019	9:00 AM	19-27-26	201.4	Y	1900843-028	0.32	8	192.6	17	16	mod	base	