A Window on the Water

2018 Annual Report of the
River Dipper volunteer water quality monitoring program of the
Black River Action Team*

Collecting data from Whitney Brook in Cavendish,VT

Prepared by Kelly Stettner & Alison Buhler
February 2019

*This document offers a summary of results from water quality monitoring in the Black River Watershed during the summer of 2018

Vermont's Watershed Grant Program features several license plate designs for donors to choose from. Some of the funding for the BRAT's 2019 River Dipper water quality monitoring program came from this grant program.

ACKNOWLEDGEMENTS

The Black River Action Team wishes to thank Antioch grad student Maura Anderson who was invaluable in keeping the River Dipper program afloat and running smoothly this year, amidst her many other obligations, deadlines, and personal events (getting married, buying a first home, and moving across town!). River Dipper volunteers included Rhonda Benoit, Tammy Wright, Jessica Curtis, Cathryn Feickert, Carroll Veltrop, Rodger Capron, Alison Buhler, Nancy Heatley, Phil Carter, Reuben Allen, Millie Allen, Lucy Georgeff, Eva Georgeff, Randy Gray, Armando Stettner, and Jeff Pelton for donating time, patience, miles, and good humor in keeping the Dipping program going. Sincere thanks also is extended to Matt Durham, who graciously offered to transport samples to the LaRosa labe all summer long. Appreciation is also felt for the staff of the LaRosa Partnership Program and Endyne Labs, Inc for their support and high standards for running the chemical and bacterial tests; to Basin Coordinator Marie Levesque-Caduto for her guidance in all aspects of the Dipper program; and to the Ottauquechee Natural Resources Conservation District for continuing to be the BRAT's umbrella organization and fiscal agent. Special note of gratitude to the State of Vermont Agency of Natural Resources Watershed Grant Program for providing vital funding to allow for expansion of the River Dipper program into a citizen science curriculum in area schools.

OVERVIEW of project goals

The BRAT's River Dipper program continues to be focused on gathering baseline data on the current condition of the Black River and some of her tributaries. The need to recognize trends and identify trouble spots is the underlying goal of the program, yet a strong need for public awareness is key in making any real improvement in water quality. Land use is directly tied to river health, and stakeholders need to understand how their behavior and attitudes can have a direct impact on water quality. From municipal officials to private landowners, from commercial developers to school children, the Black River Action Team is committed to an reaching all corners of the watershed with educational outreach. Ideally, BRAT seeks to encourage stewardship through paradigm shifts.

As part of the LaRosa Partnership Program, we answered the following questions in our application and have listed our 2018 progress below:

1) What will be monitored? Eleven sites in the Black River and three sites in tributary streams were monitored for Total Nitrogen, Total Phosphorus, and Chloride.

2) When will monitoring occur? These sites were sampled monthly on the last Wednesday morning of each month, May through September (inclusive); thanks to a volunteer courier, all bottles were hand-delivered to the LaRosa lab in Burlington.

3) How will samples be collected? Volunteers gathered samples in the bottles provided by the LaRosa Laboratory, placed them in a coolers with ice, and then assembled for transport to the laboratory via BRAT volunteer Matthew Durham. Training for the sample collectors was provided by the BRAT Monitoring Coordinator at the beginning of the season, and reviewed throughout the sampling season. Once the sample results were received from the LaRosa Lab, results were entered into a spreadsheet and reviewed. E.coli samples were collected following protocols set forth by the LaRosa Laboratory, with special care being taken not to contaminate the mouth or cap of the sample bottles. Samples were transported in coolers to the Ludlow wastewater treatment facility, where a courier picked them up to deliver to Endyne Labs in Lebanon NH within the hold-time window.

NARRATIVE & NEW STUFF

The 2018 River Dipper program built on the 2017 program with one notable parameter change: we replaced turbidity with chloride, which should give us a baseline on road salt impacts for some of our sites.

We continued our participation in an ongoing study by the University of Massachusetts, collecting baseline data for an isotopic comparison of surface and groundwaters around New England. River Dipper volunteers collected an additional bottle of water each month at their sites to be mailed to UMASS for their study. A description from project leader and UMASS senior Shawna Laplante:

> "Basically all water has an isotopic signature, and you can use that signature to identify characteristics of the water. For example, arctic waters have a particularly light isotopic signature, while tropic waters are isotopically heavy. The ocean is like the 0 from which everything else is measured against. And heavier waters fall out of rain clouds before the lighter waters. In New England we get a mixture of precipitation originating from the arctic, the tropics, the ocean, etc. When we take our measurements we can identify this in a particularly large rain event, for example hurricanes. Events like hurricanes are particularly interesting for us because we can track how that water moves because it's so heavy;it's unique enough for us to identify the difference between that and water that has been in our systems. Also groundwater and surface water are isotopically different and so we can track how water is discharging and recharging in our systems."

BRAT will continue its collaboration in this study, working with Ms Laplante and her successor to incorporate the data into outreach opportunities in the Black River watershed and beyond, utilizing spatial maps being generated by UMASS for the project.

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The Black River Action Team also participated in the CT River Conservancy's "Samplepalooza" collection program, gathering water samples from the lowest reach of the Black River to share with the CRC as they work to

According to organizer Ryan O'Donnell: "The Samplepalooza is an effort between CRC, VT DEC, and NH DES to collect nutrient data throughout the upper Connecticut River watershed. The idea is to get a snapshot of conditions across political boundaries. While monitoring is happening in all three states, it usually doesn't all happen at the same time. We are concerned about nutrients because of eutrophication in Long Island Sound due to excessive nitrogen. Watershed-wide efforts like Samplepalooza can help us

understand where nutrients are coming from and where we may need to target restoration efforts." Time will tell what the Connecticut River's impact is having on Long Island Sound, and whether any particular tributary is contributing sediment or nutrients.

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For 2018, six swimming holes were again sampled weekly for bacteria levels, with samples being tested at Endyne Labs in Lebanon NH via courier from the Ludlow wwtf. Results are posted by volunteers at Buttermilk Falls in Ludlow and at Greven Field in Proctorsville, as well as at nearby town halls and online at ctriver.org. Funding for the "Adopt-a-Swimminghole" portion of the River Dipper program continues to be sought through outreach to area businesses and organizations. While Okemo Mountain Resort renewed its commitment to Buttermilk Falls for 2018, the funding for Cavendish Gorge was provided this year by Green Mountain Power, owners and operators of the hydroelectric facility at the head of the Gorge.

The relaxing upper pool at Buttermilk Falls on Branch Brook in Ludlow.

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Also continuing from 2017, BRAT again collected data, samples, and observations at the recently-opened Muckross State Park in Springfield. BRAT officially adopted Muckross Pond, a small water body roughly 3 meters deep, hemmed in on both sides by evergreen-lined slopes. BRAT volunteers follow protocols set forth by the VT Lakes Lay Monitoring Program and gather samples to be tested for chlorophyll-a as well as for total phosphorus; we also collect readings for pH, temperature, Secchi depth, TDS, salinity, and conductivity. Observations are noted about weather, rainfall, flora, and fauna; bryozoans are plentiful in the pond, and a freshwater sponge is present on the rocks below the dam at the lower end of the pond.

Armando Stettner assists with data collection at Muckross Pond.

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With financial support from the State of Vermont's Watershed Grant Program, the Black River Action Team was able to begin a public education component to the River Dipper program:

In 2018, several hundred students from Springfield schools engaged in citizen science by performing guided bioassessments and other projects related to water quality. Benthic macroinvertebrates were collected from monitoring sites current and being planned for 2019; an 8th grade class designed and built prototypes of water monitoring devices; a large group of 5th graders made periodic visits to Muckross State Park to record observations and collect data from the stream and forested banks of the pond. A class of 1st graders learned about macronivertebrates living in the stream that will be the future home of trout fry that they will be releasing in Spring 2019.

A display was installed at the Springfield Town Library during summer 2018 to share with the community what the River Dipper program is about and how local students helped deepen our understand and appreciation of the water quality in our surface waters.

Exploring benthic macroinvertebrates with middle schoolers.

Students pose with their prototype water sampler.

Part of the display at the Springfield Town Library, featuring citizen science done by local students.

These activities were filmed, along with interviews with two of the teachers, and recorded to be aired as an episode of "Black River Connections" for public-access television.
http://okemovalley.tv/black-river-connections-citizen-science

Going forward, the 2019 plan for River Dipper outreach involves a large-scale art & science exhibit at The Great Hall in Springfield, featuring displays of artwork as well as citizen science relating to a common appreciation for the Black River. The exhibit will center on connecting people to the river as well as to each other through various media.

METHODS

The sample collection protocols as described in our QAPP document were followed; all samples were collected from mid-depth in the water column using a U-shaped movement while facing upstream, allowing the current to fill the bottle while preventing surface water from entering the bottles:

1) Nitrogen samples required a plastic 50 ml centrifuge tube be filled with the river sample to the 50-ml line. These samples also required that the sample tube be rinsed three times with river water before collecting the sample. Sample bottles were then labeled with the pre-printed labels, organized in racks, packed in a cooled with ice, and shipped to the LaRosa lab by courier.

2) Phosphorus samples were collected using 60 ml glass vials, filled to the line marked on the side of the vial. No rinsing was to be performed, and after collection the vials were labeled, organized, and packed as above.

3) Chloride samples also required a plastic 50 ml centrifuge tube be filled with the river sample to the 50-ml line. These samples also required that the sample tube be rinsed three times with river water before collecting the sample. Sample bottles were then labeled with the pre-printed labels, organized in racks, packed in a cooled with ice, and shipped to the LaRosa lab by courier.

4) E.coli samples were gathered in 100 ml plastic bottles, which were unsealed on site just before use.

Care was taken not to touch the inside of the caps or the bottles, to prevent contamination. Field blanks were also collected using deinoized water, while duplicate samples were collected for Phosphorus on each sample date.

PARAMETERS *Optimal levels are for Class B(2) Ecological Waters per VT Water Quality Standards; http://dec.vermont.gov/sites/dec/files/documents/wsmd_water_quality_standards_2016.pdf*

Quotes from VT Agency of Natural Resources Dept of Environmental Conservation

Total Nitrogen (Measured in mg/L; optimal level is below 5.0 mg/L)
Total Phosphorus (Measured in micrograms/L; optimal level is 12-15 ug/L)
Total Chloride (Measured in mg/L; no standard, but should be below 20 mg/L)

"Phosphorus and nitrogen are both closely tied to the productivity of an aquatic ecosystem. "These nutrients are naturally limited in the environment and high levels cause aquatic plants, especially algae, and cyanobacteria (formerly known as blue-green algae) to grow in much greater densities than the aquatic ecosystem would naturally support. Phosphorus is the limiting nutrient in freshwater systems, while nitrogen is more typically the limiting nutrient in marine systems. The term 'limiting' here means that the amount of nutrients available regulates productivity of the food web in waters. A limiting nutrient is akin to eggs in a cookie recipe - too few eggs means only a small batch of cookies can be baked regardless of how much flour or butter may be available.

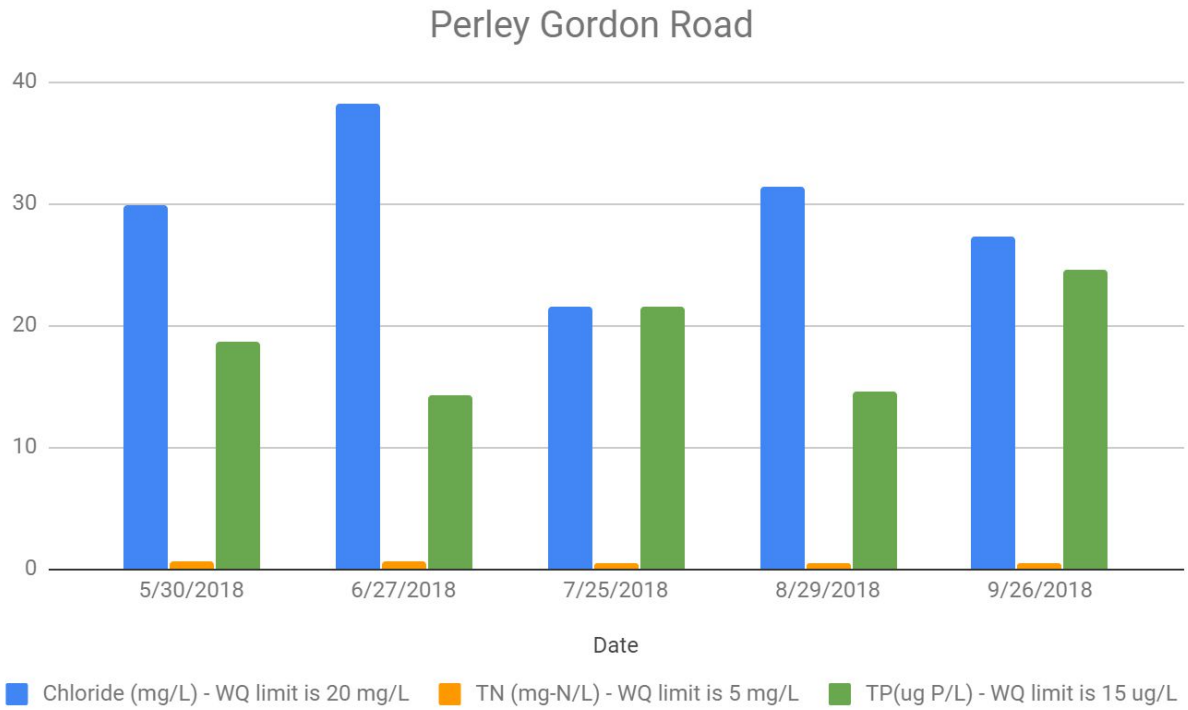
"In excessive amounts, algae and cyanobacteria can impair recreational uses, aesthetic enjoyment, the taste of drinking water, and the biological community. In some cases, cyanobacteria may produce toxins harmful to animals and people." Excess aquatic vegetation will die and decompose, eating up available oxygen which is required by aquatic animals such as fish. Nutrients can enter waterways through animal manure from farms, pet waste, fertilizers on lawns and croplands, erosion, and septic systems. Managing stormwater on private and municipal property is an effective tool for keeping water on land as long as possible to spread out, slow down, and soak in before hitting the river. Some solutions are as simple as rain barrels, rain gardens, and less paved surface.

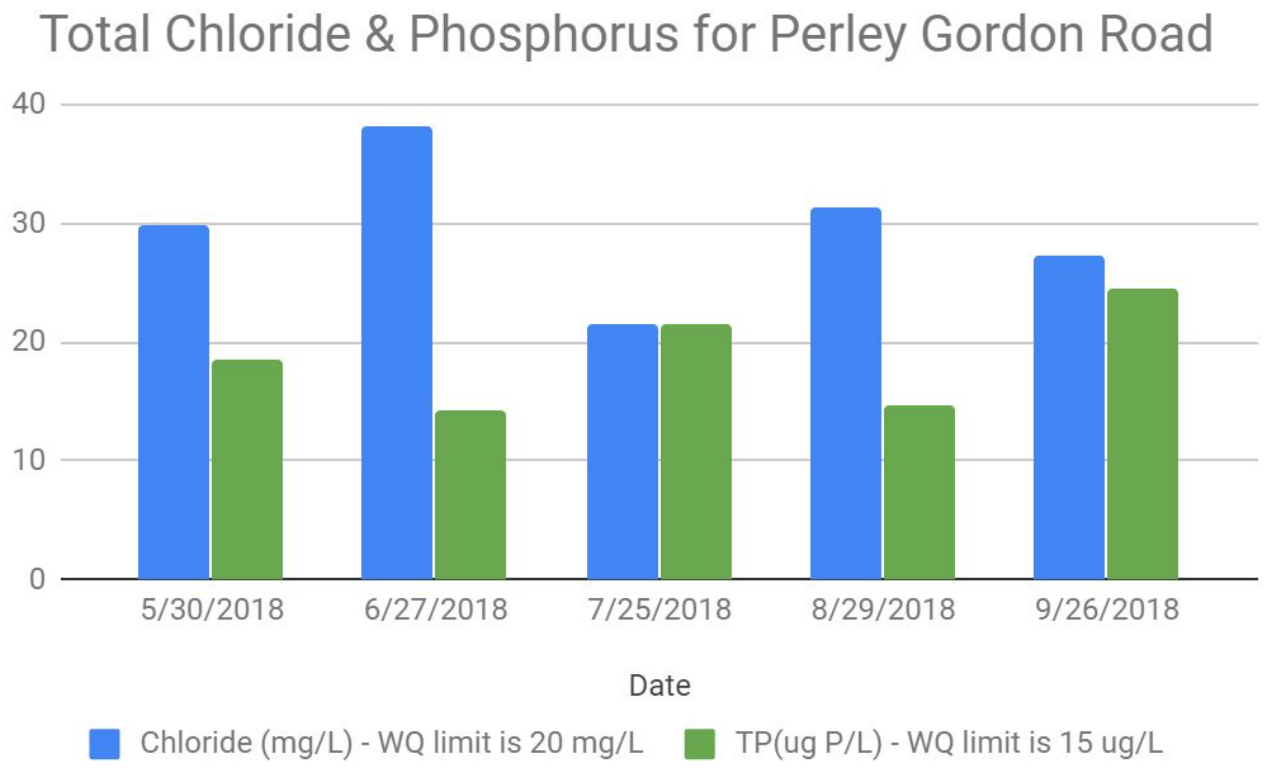
Chloride (Measured in mg/L; should be below 20 mg/L; optimal **chronic** level is below 230 mg/L) This element is naturally occurring in rivers to some extent, if a streambed contains minerals with high salt content, for instance. Chloride may also enter the river through runoff (snow- and ice-melt) from salted roads, but also from septic system effluents, landfill leachate, and agricultural waste. Some organisms, including many fish, are not impacted by chloride concentrations exceeding 10,000 mg/L, but *many* others experience poor health and limited reproductions at chloride levels of 230 mg/L.

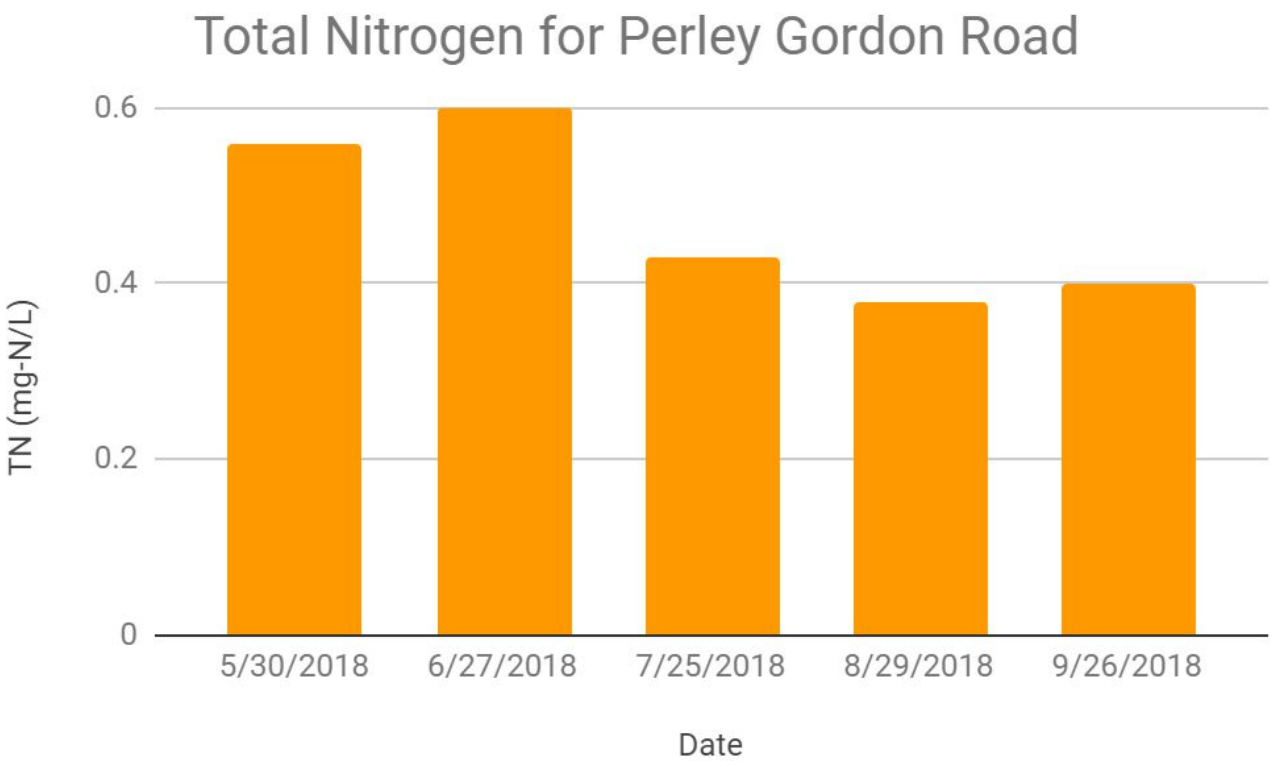
E.coli (Measured in # of colony-forming units/100 ml) Found in the gut of all warm-blooded animals, E.coli bacteria can cause often severe illness in humans who come into full contact with contaminated water. Heavy rains can increase normal (ambient) bacteria levels by washing animal waste, fertilizer, and other substances into water bodies, so it is highly recommended to avoid swimming within 24 hours of a heavy rain or anytime the water appears cloudy. The US EPA has set a "safe swimming" upper limit of 235 cfu/100ml of water; one of BRAT's swimming hole sites tested consistently higher than the ambient level of roughly 70 cfu. BRAT will continue monitoring all swimming holes, to determine if the high bacteria level is an ongoing problem.

Where do we sample?

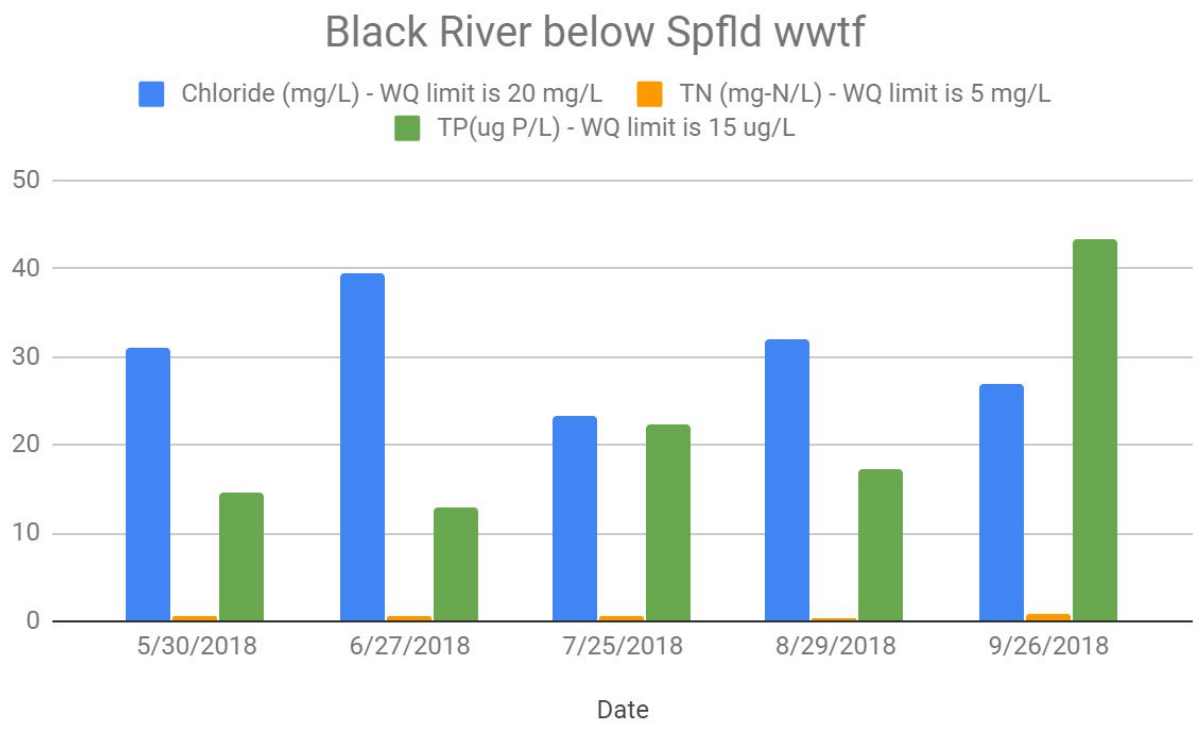
Site #BRAT.BR.1.6 *[43.271162, -72.449806]* -- Perley Gordon Rd is a representation reach that is connected to the Connecticut River just 2 miles downstream; this site is influenced by the flow regime of the hydro dams on the CT River at Bellows Falls and at Hartland Dam. The river here is wide and flat, with a silty bed and a paved road on either bank. About 1/3 mile upstream is a waterfall that once hosted the Gould Mill. Sampled by Kelly Stettner and son Armando.

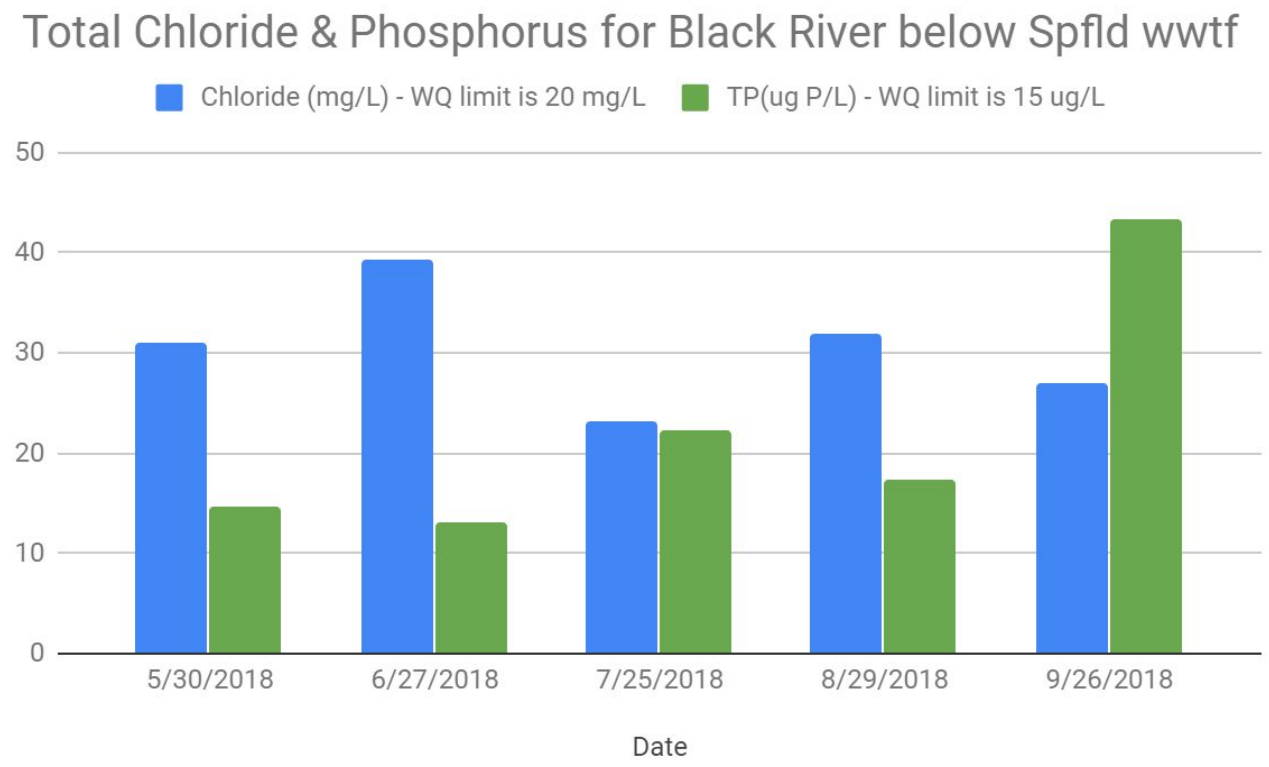


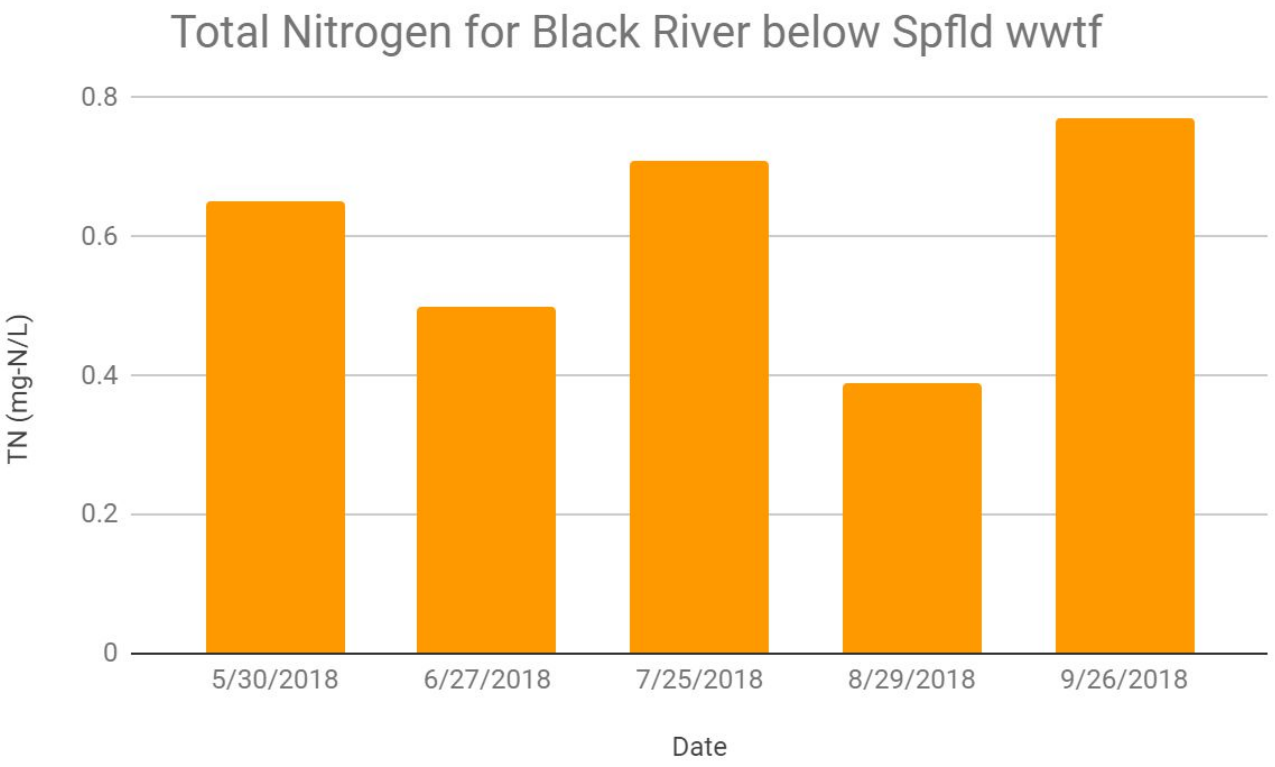

Total Chloride & Phosphorus for Perley Gordon Road
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L


Total Nitrogen for Perley Gordon Road
0.6
0.4
0.2
0
TN (mg-N/L)
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

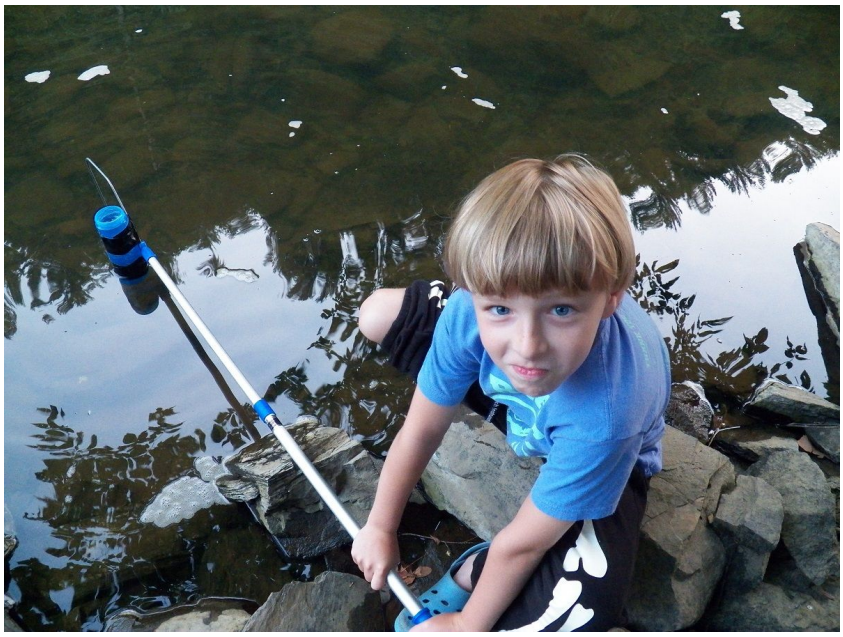
Site #BRAT.BR.2.4 *[43.279674, -72.467553]* -- Downstream of Springfield's wastewater treatment facility. This site is roughly 200' below the outflow of the wwtf and just upstream from the confluence of Seaver Brook. Sampled by Kelly Stettner and son Armando.

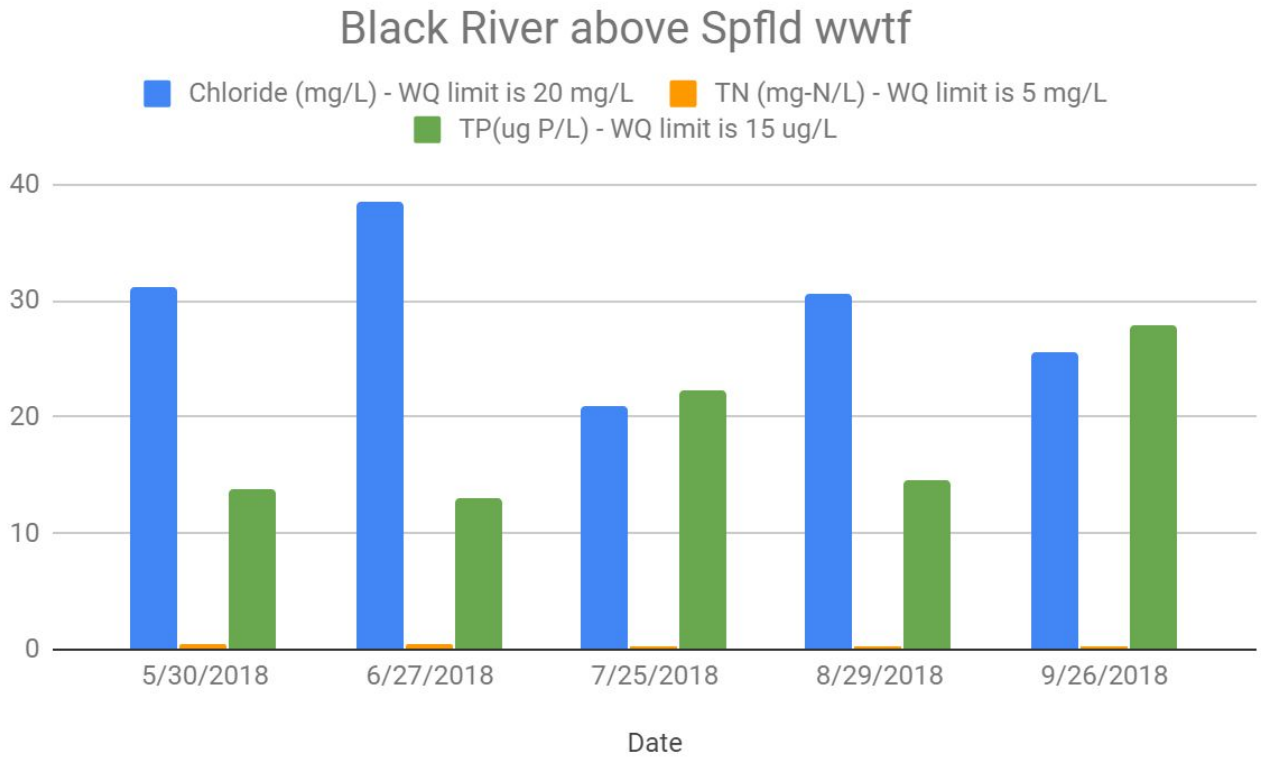


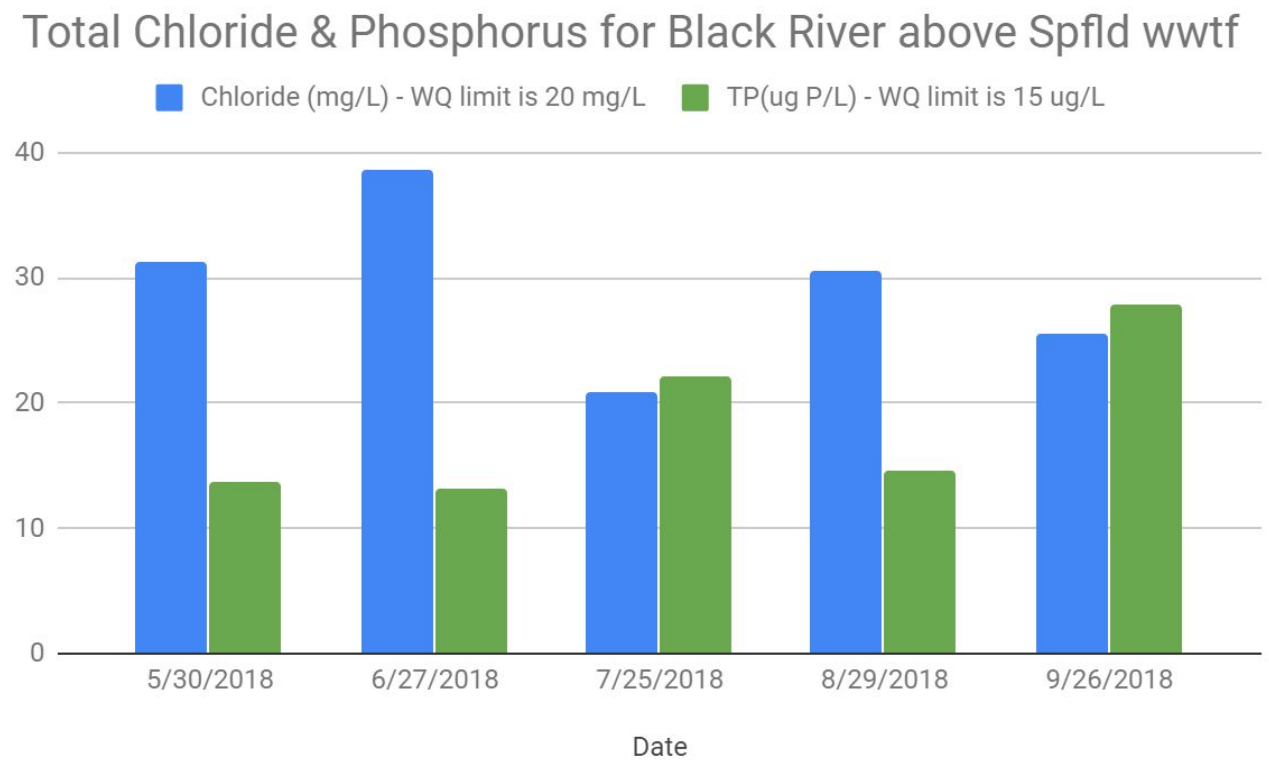

Total Chloride & Phosphorus for Black River below Spfld wwtf
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
50
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

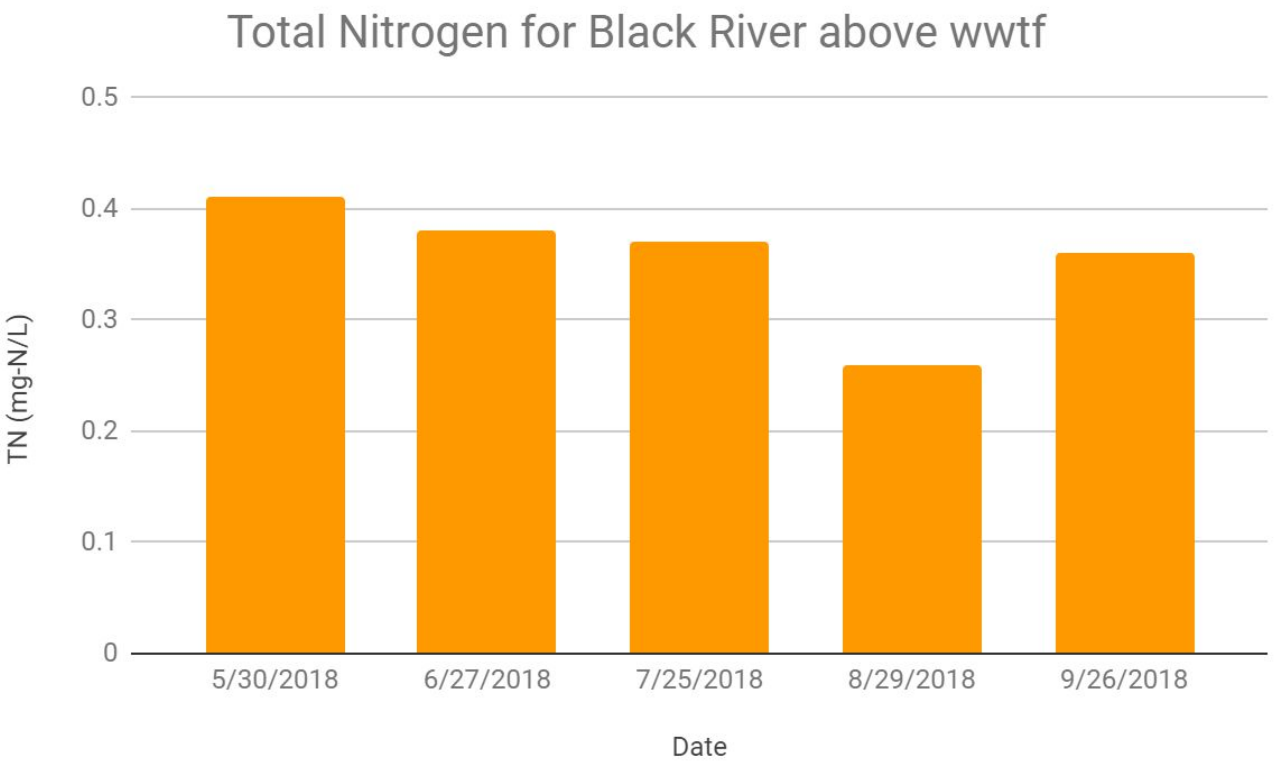

Total Nitrogen for Black River below Spfld wwtf
TN (mg-N/L)
0.8
0.6
0.4
0.2
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

Site #BRAT.BR.2.75 *[43.280659, -72.46846]* -- Upstream of Springfield wwtf. Sited just above the outflow of the wwtf, data "brackets" any potential impact. Sampled by Kelly Stettner & son Armando.

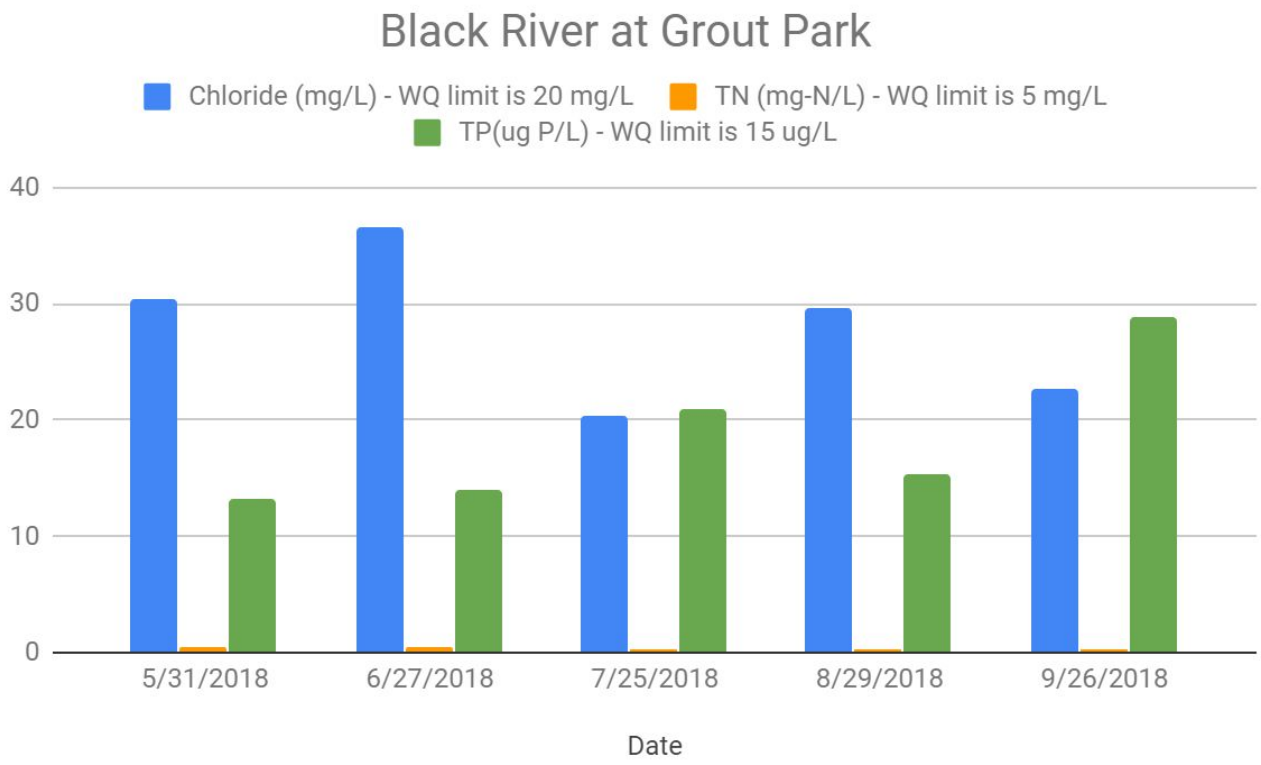


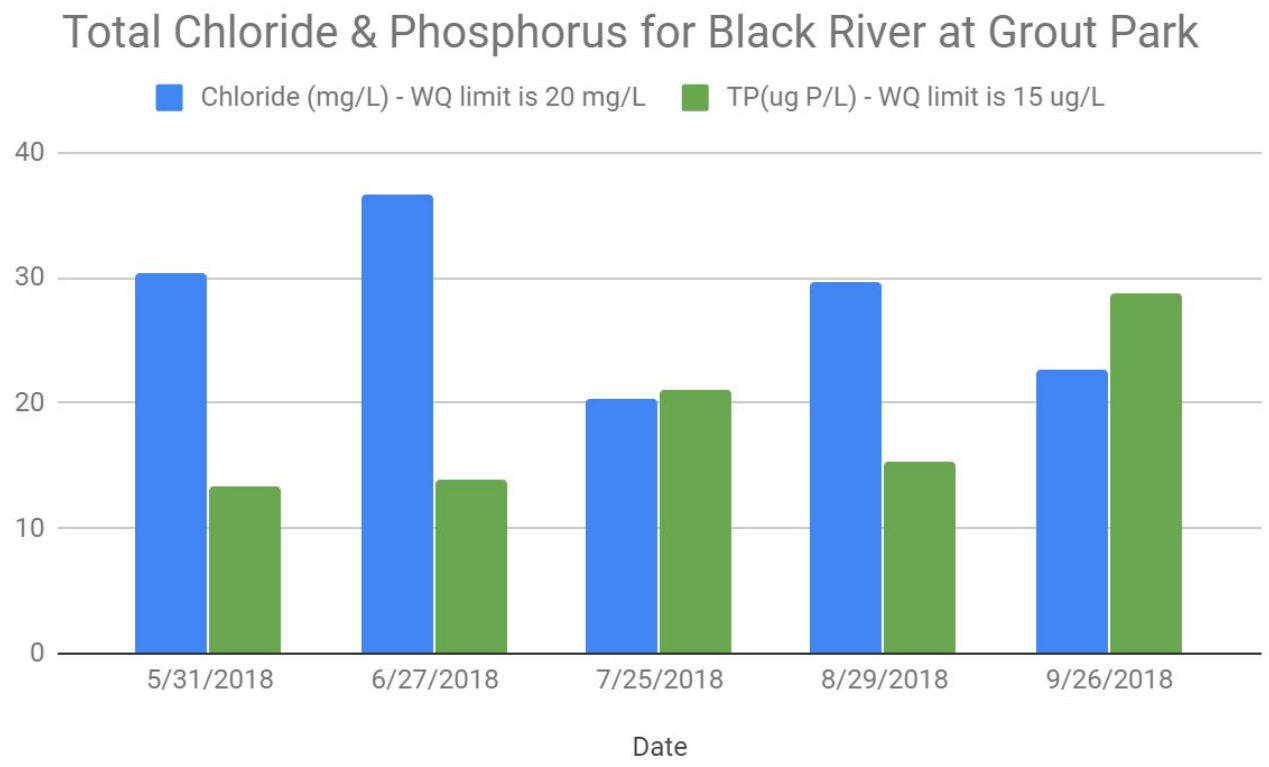


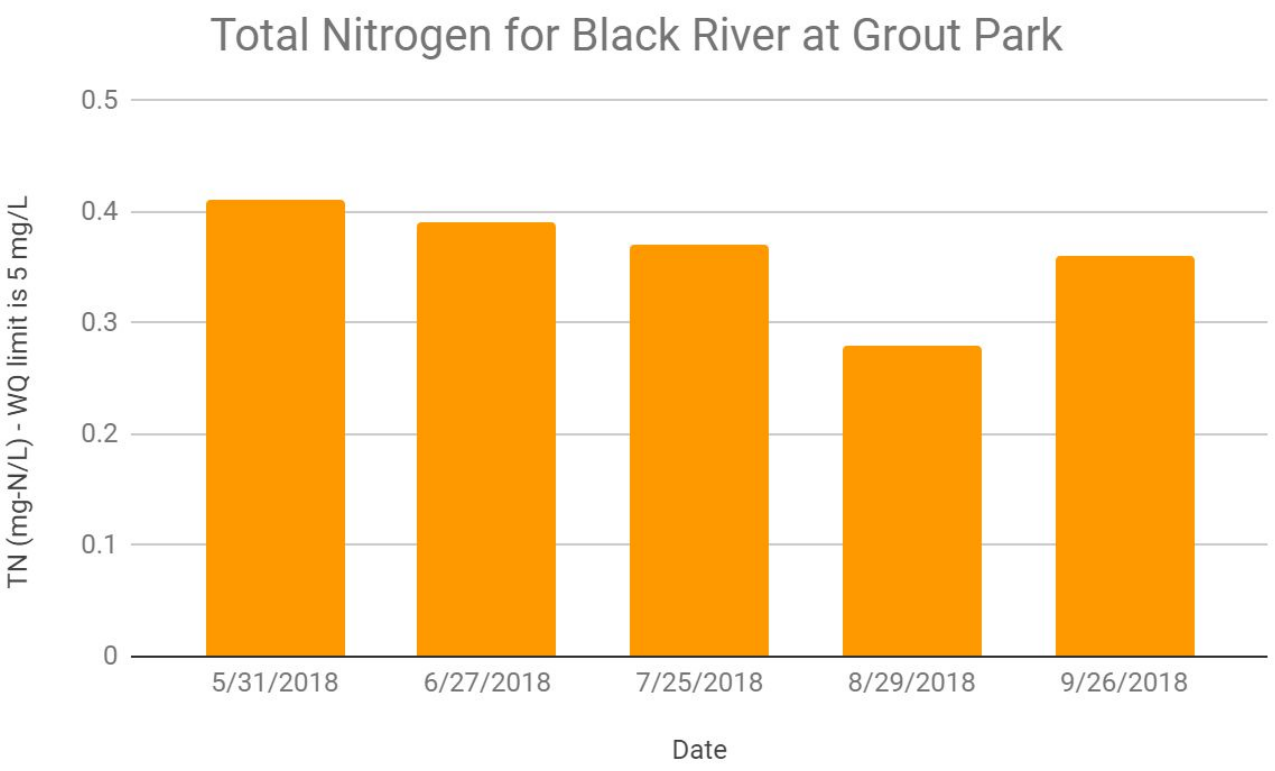

Total Chloride & Phosphorus for Black River above Spfld wwtf
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River above wwtf
TN (mg-N/L)
0.5
0.4
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

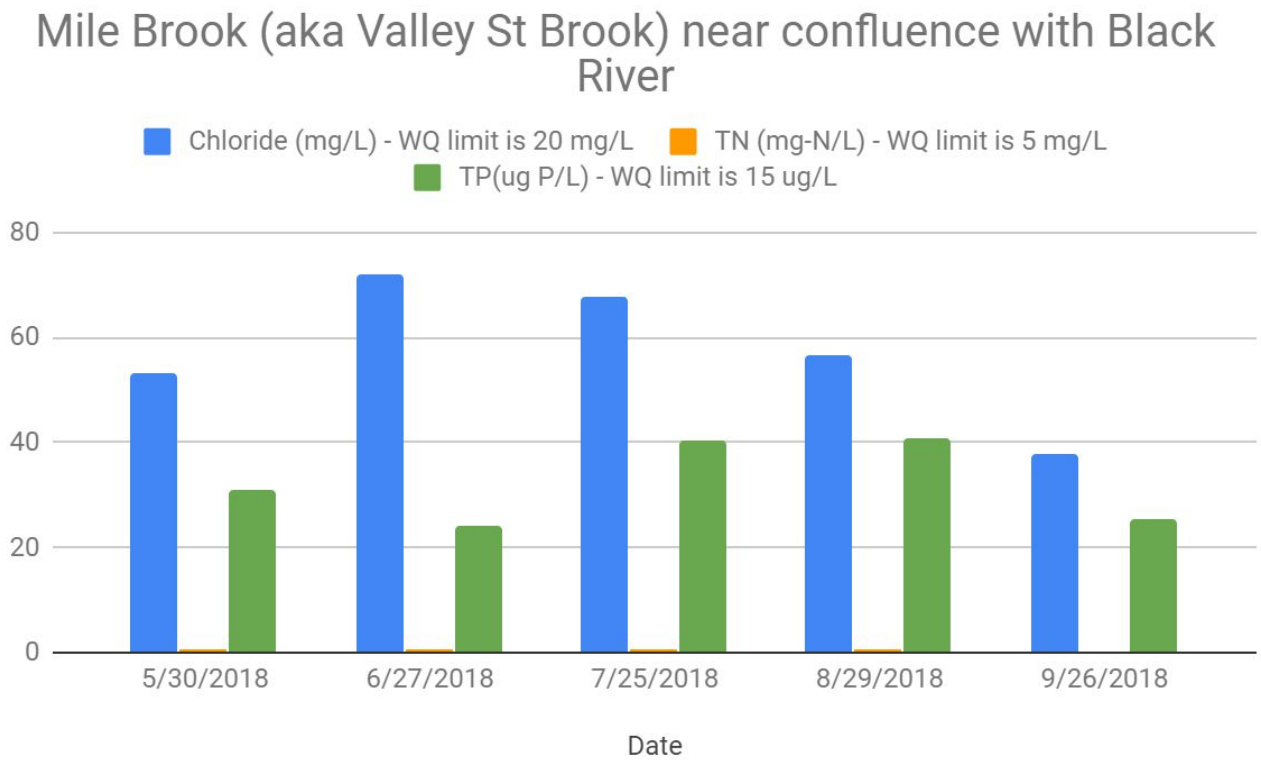
Site #BRAT.BR.3.6 *[43.294897, -72.480513]* -- Grout Park. This site is just below the last man-made dam on the Black River mainstem and below the main industrial area of Springfield. Sampled by Jess Curtis and Cathryn Feickert.

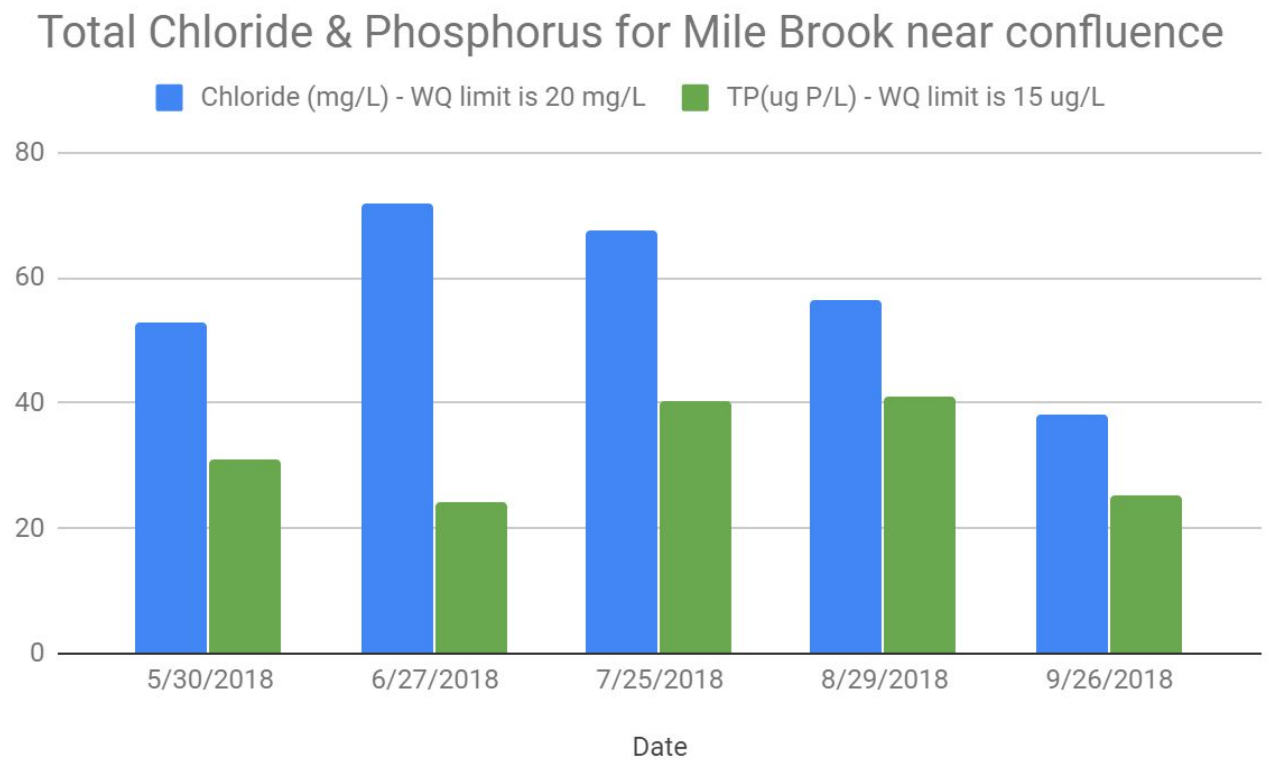


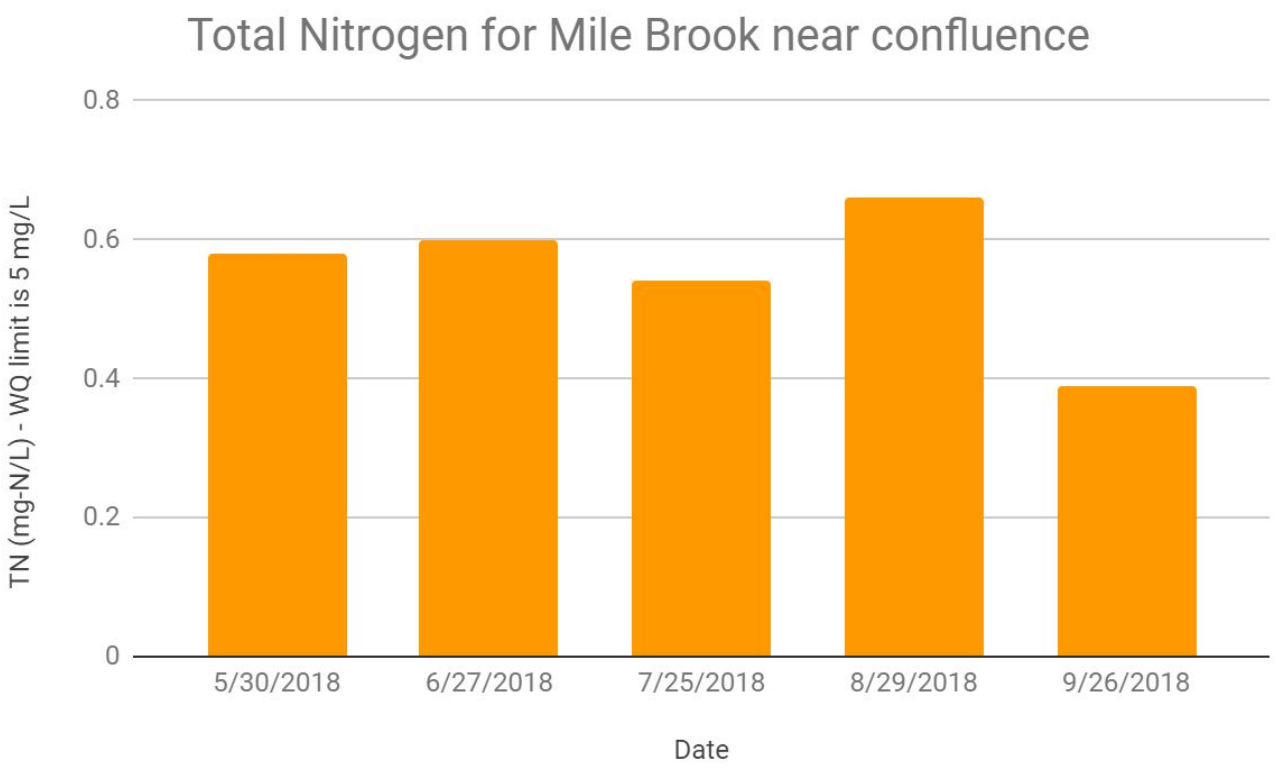

Total Chloride & Phosphorus for Black River at Grout Park
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/31/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River at Grout Park
TN (mg-N/L) - WQ limit is 5 mg/L
0.5
0.4
0.3
0.2
0.1
0
5/31/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

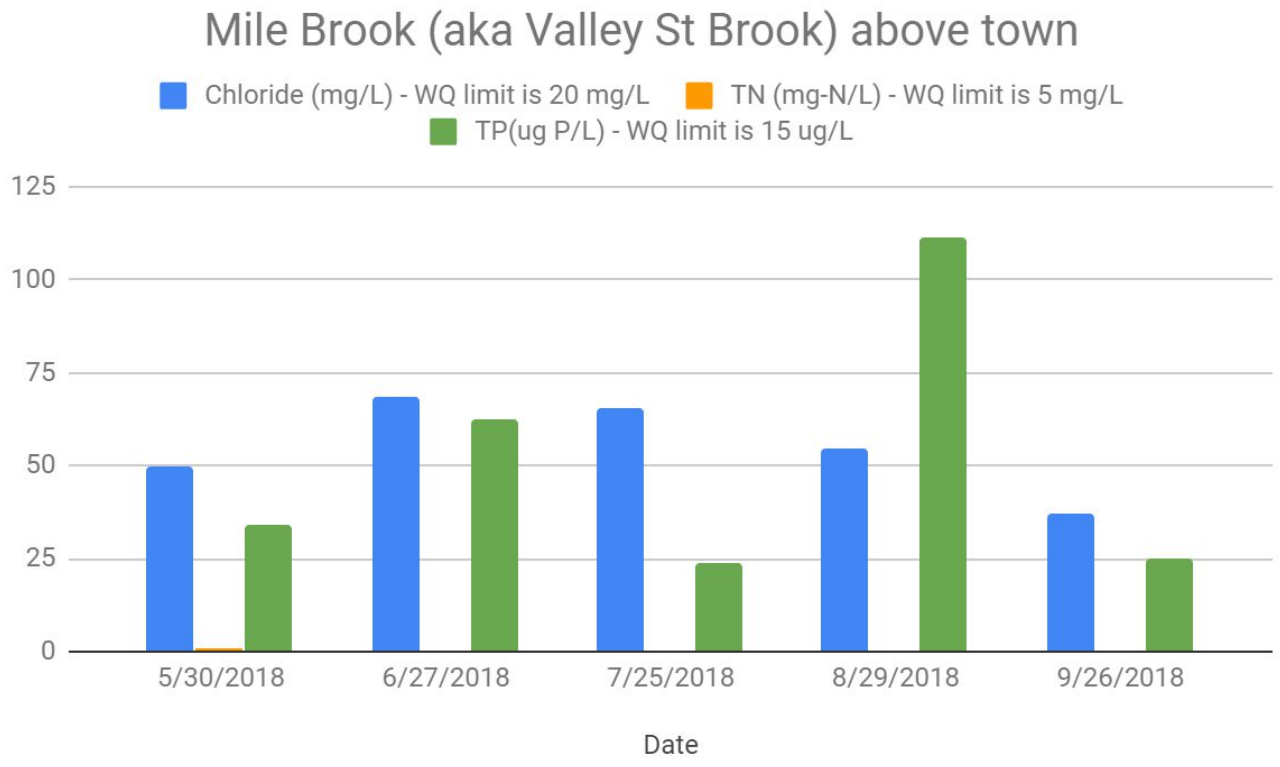
Site #BRAT.MB.0.0 *[43.299249, -72.482152]* -- This site is on Mile Brook (aka Valley Street Brook), just at the confluence of the stream with the Black River, after it emerges from an underground box-culvert below Main Street in downtown Springfield. Sampled by Lucy Georgeff and daughter Eva.

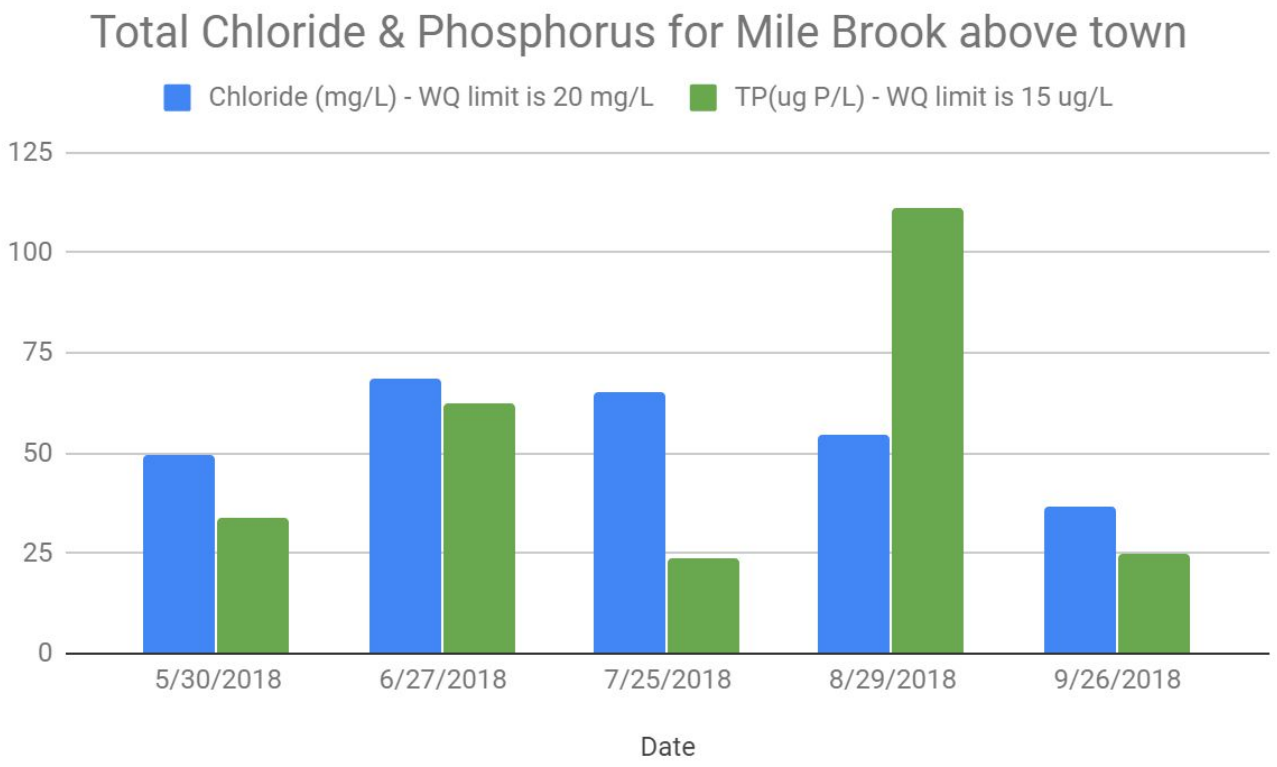


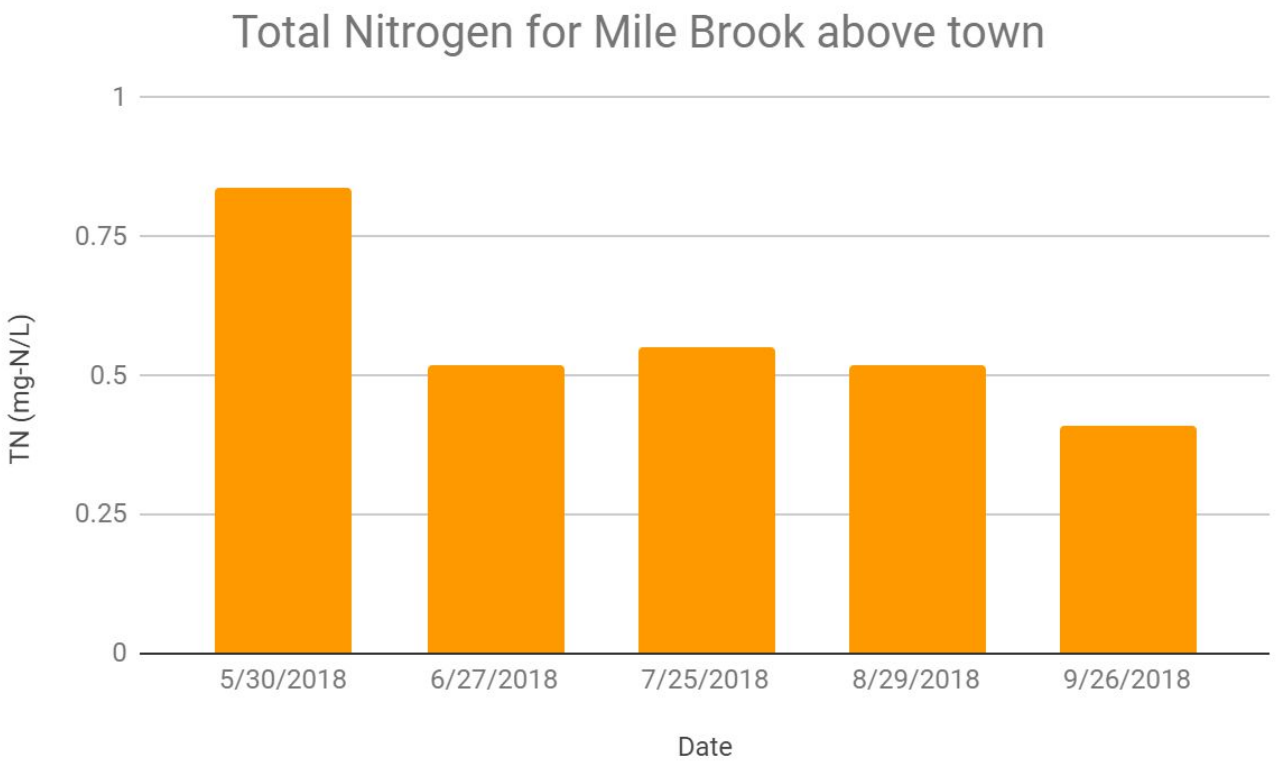

Total Chloride & Phosphorus for Mile Brook near confluence
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
80
60
40
20
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Mile Brook near confluence
TN (mg-N/L) - WQ limit is 5 mg/L
0.8
0.6
0.4
0.2
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

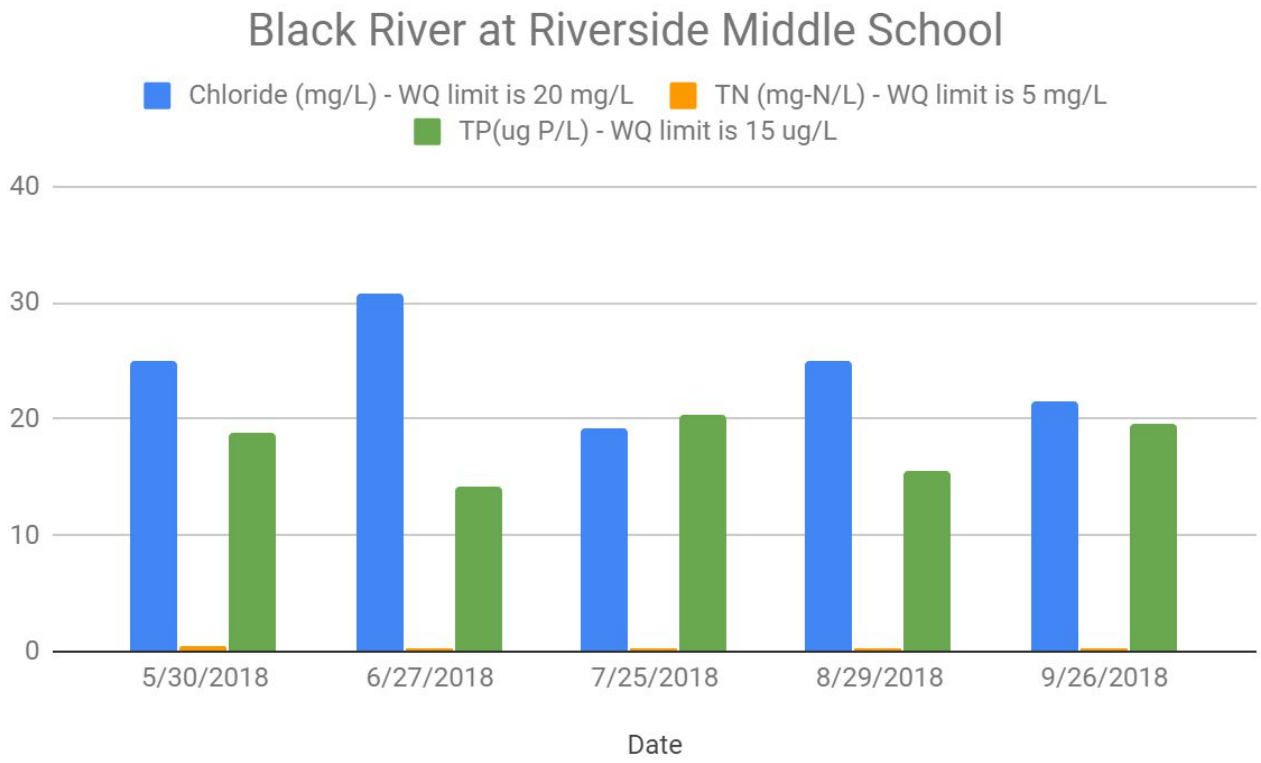
Site #BRAT.MB.0.2 *[43.299487, -72.480961]* -- The second site on Mile Brook (aka Valley St Brook) is sampled just before the stream enters the underground culvert below Main Street, at the upper end of the movie theater parking lot. Sampled by Lucy Georgeff and daughter Eva.

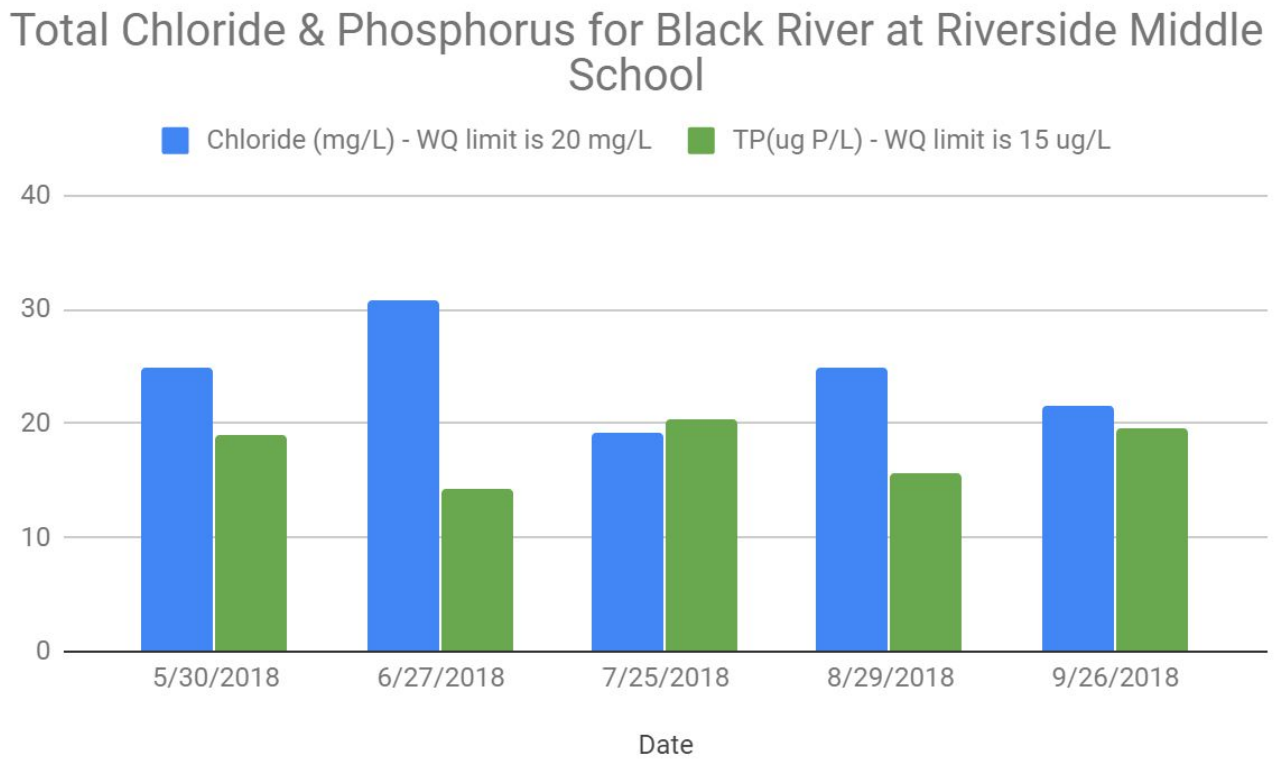


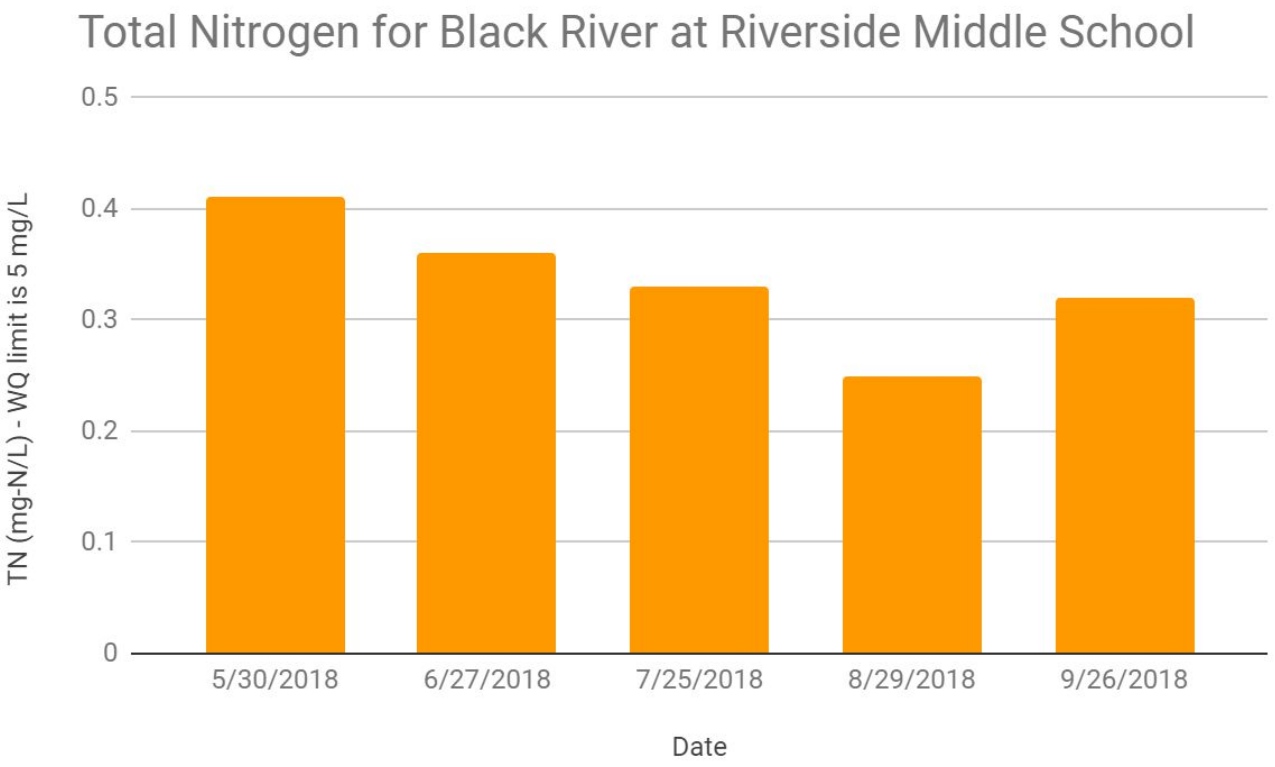

Total Chloride & Phosphorus for Mile Brook above town
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
125
100
75
50
25
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Mile Brook above town
TN (mg-N/L)
1
0.75
0.5
0.25
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

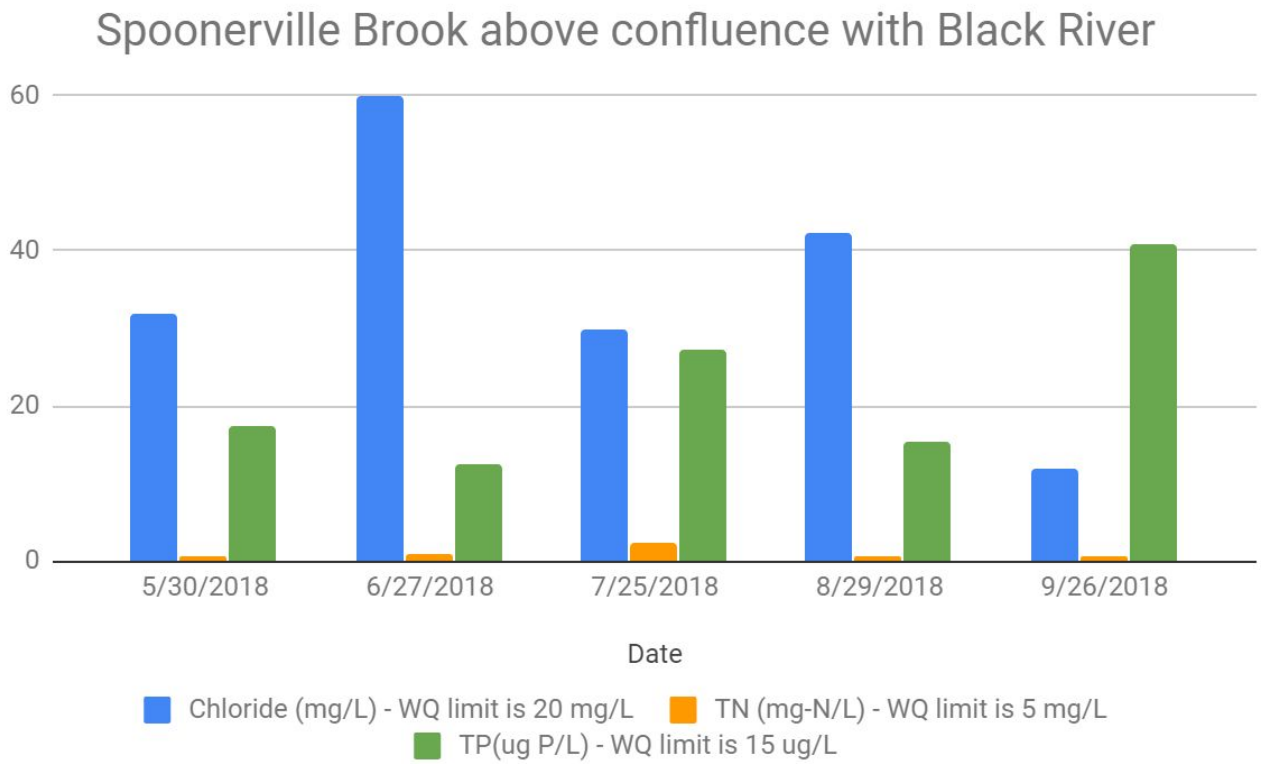
Site #BRAT.BR.5.1 *[43.304581, -72.494394]* -- Riverside Middle School. A wide, flat, sandy-bottomed reach that is influenced by slow flow as the river enters a sharp oxbow bend downstream. The water here tends to be warmer, as there is little shading canopy overhead. Sampled by Carroll Veltrop.

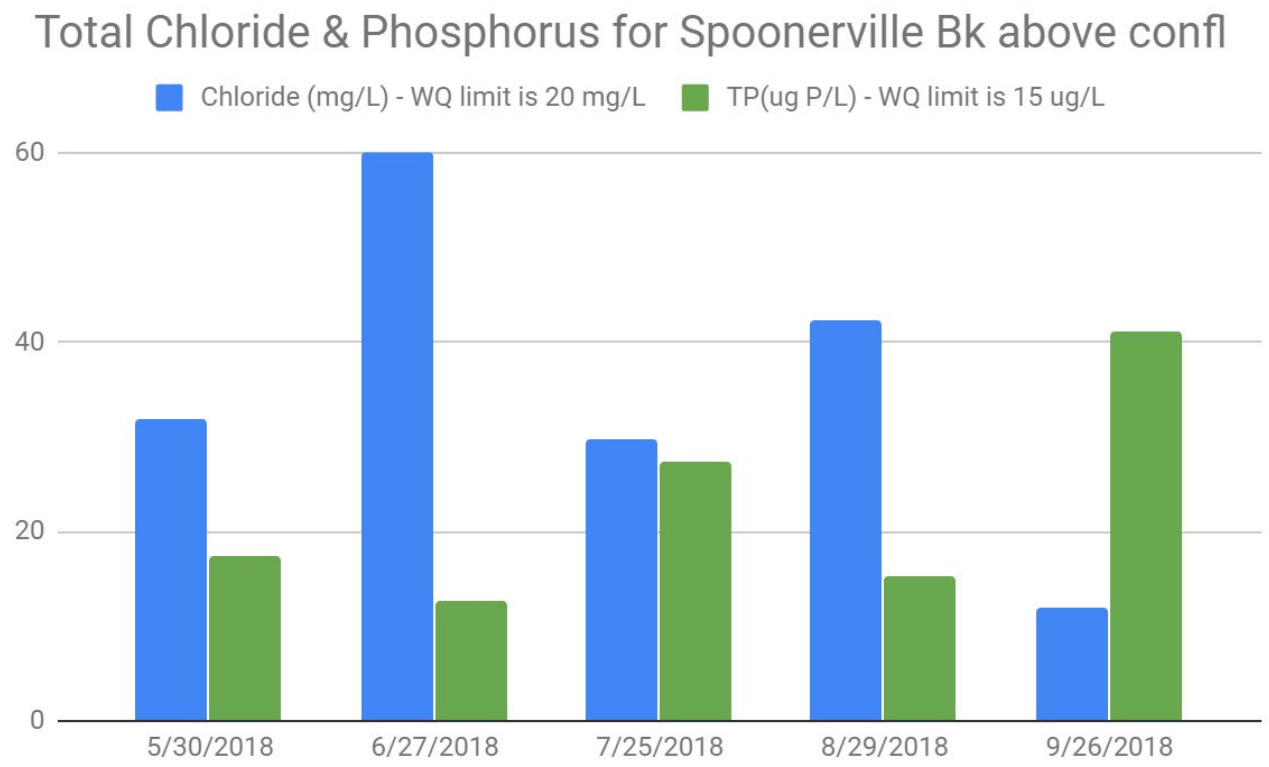


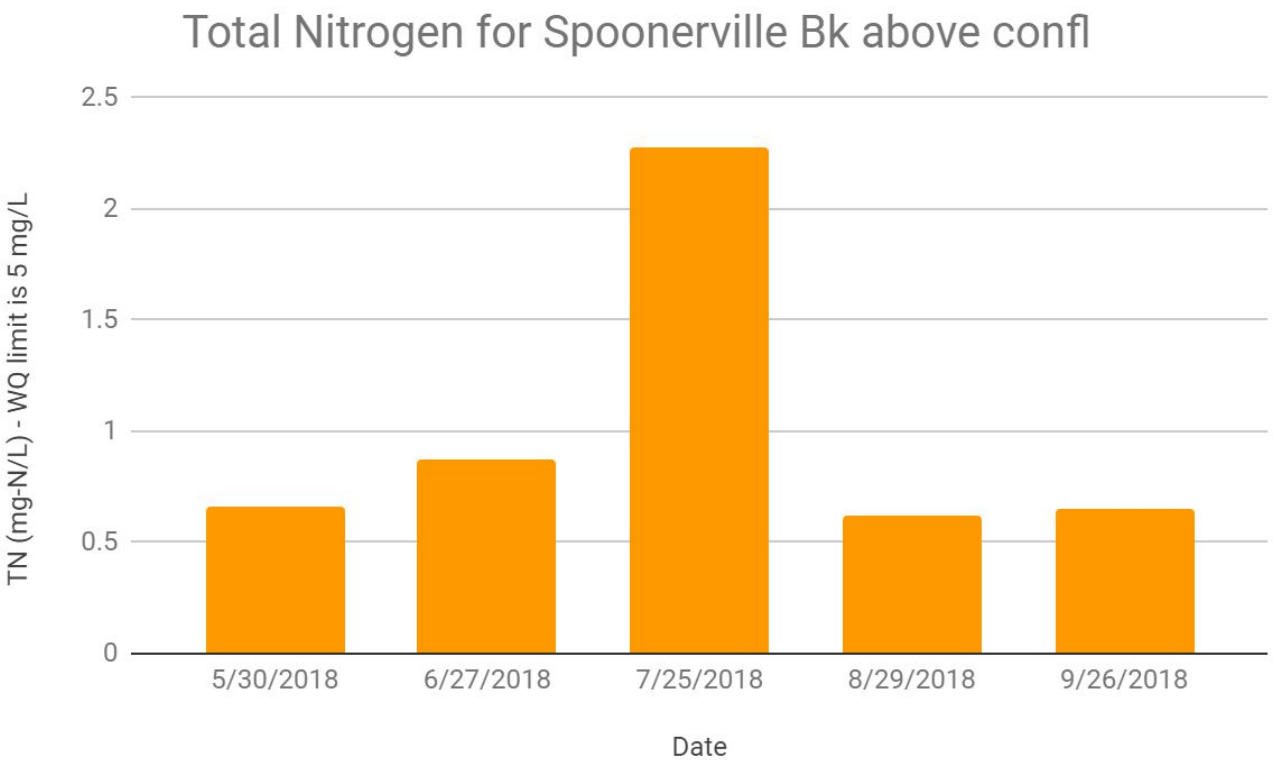

Total Chloride & Phosphorus for Black River at Riverside Middle School
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River at Riverside Middle School
TN (mg-N/L) - WQ limit is 5 mg/L
0.5
0.4
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

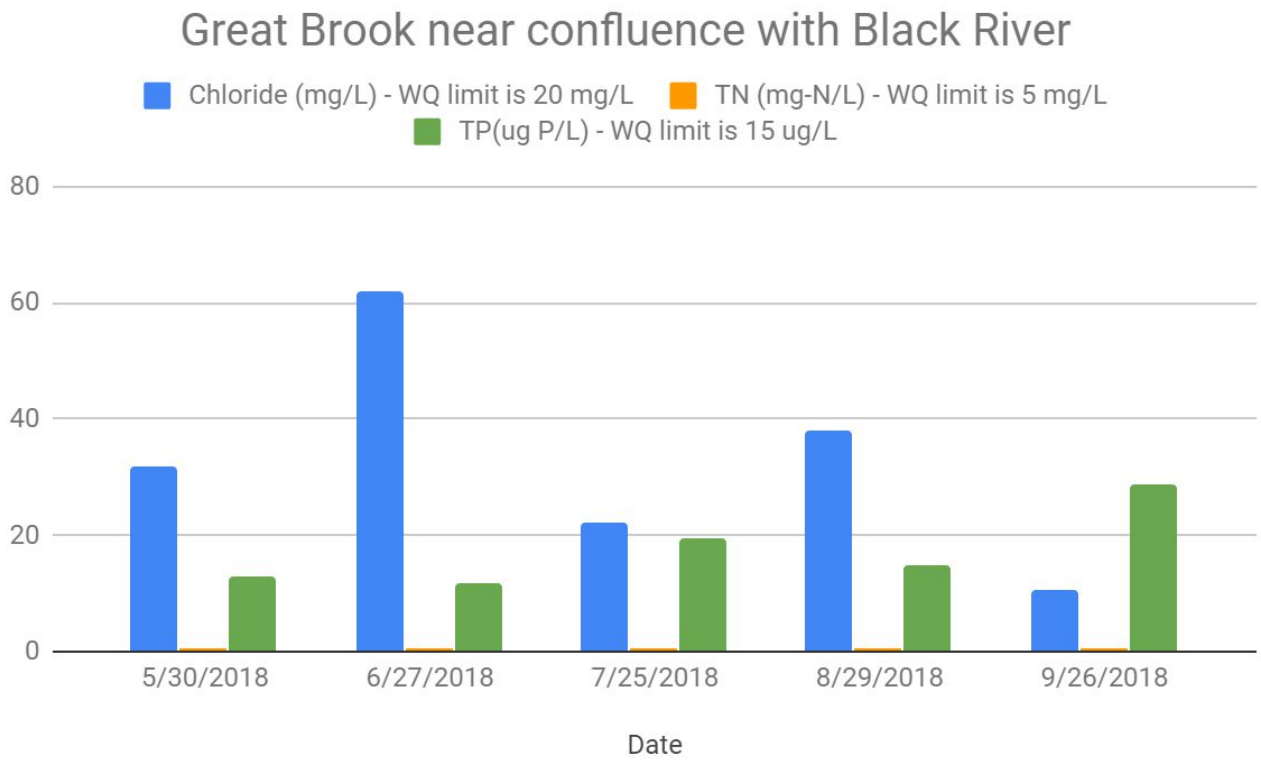
Site #BRAT.SB.0.1 *[43.330792, -72.520739]* -- Spoonerville Brook, North Springfield. A small winding brook, the Spoonerville drains only 5 square miles of watershed but runs very close to the road in many places. Sampled by Randy Gray.

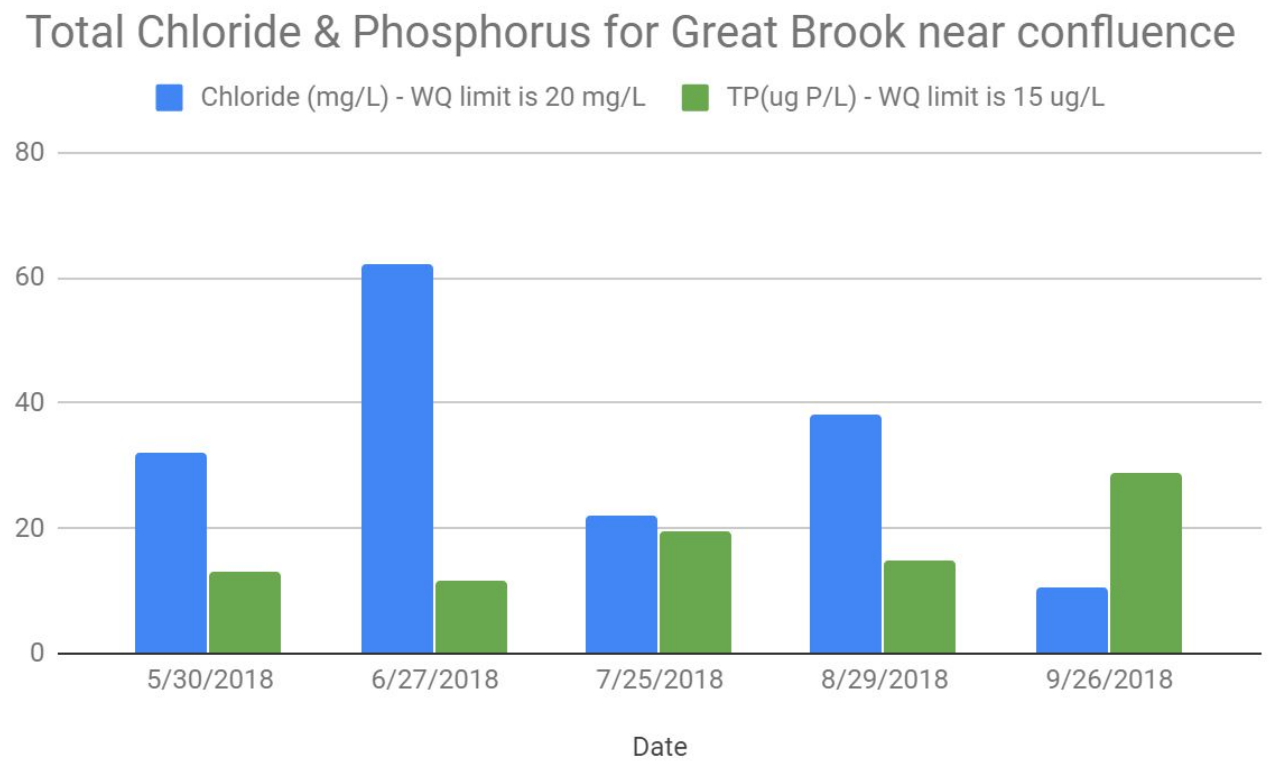


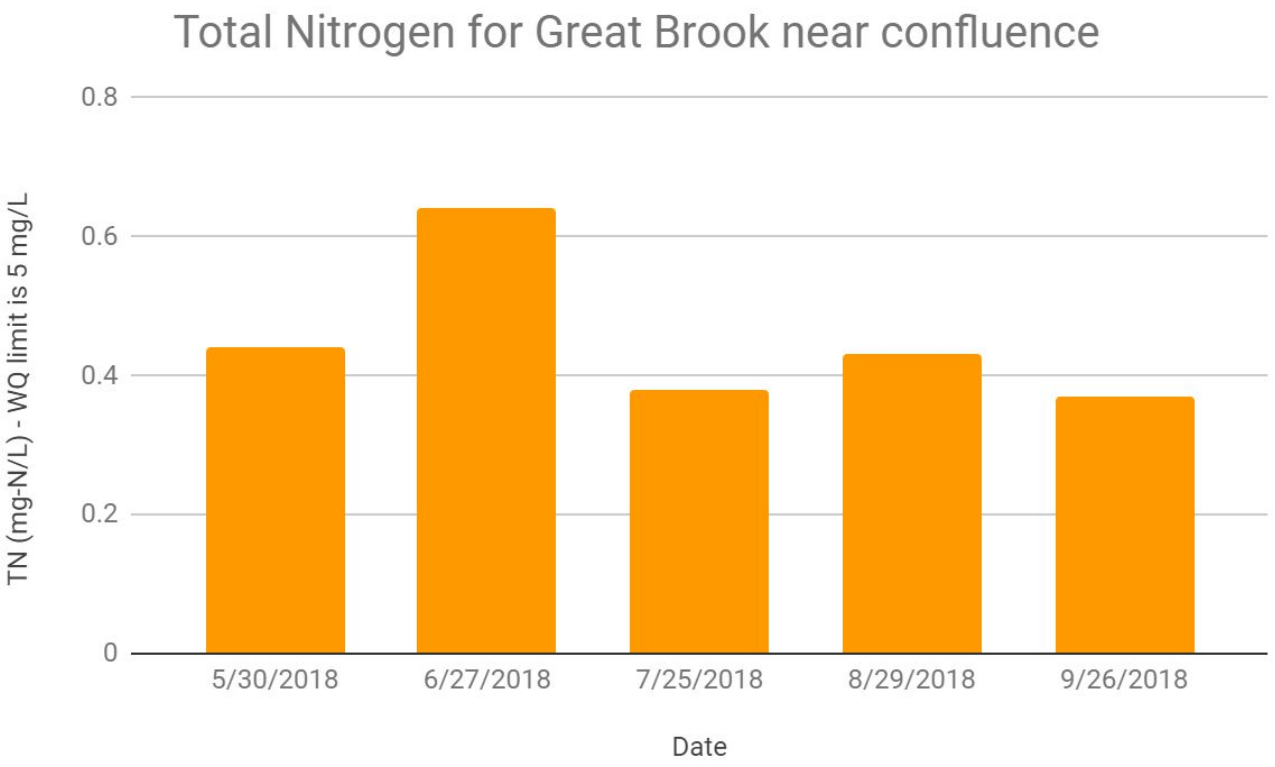

Total Chloride & Phosphorus for Spoonerville Bk above confl
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
60
40
20
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018


Total Nitrogen for Spoonerville Bk above confl
TN (mg-N/L) - WQ limit is 5 mg/L
2.5
2
1.5
1
0.5
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

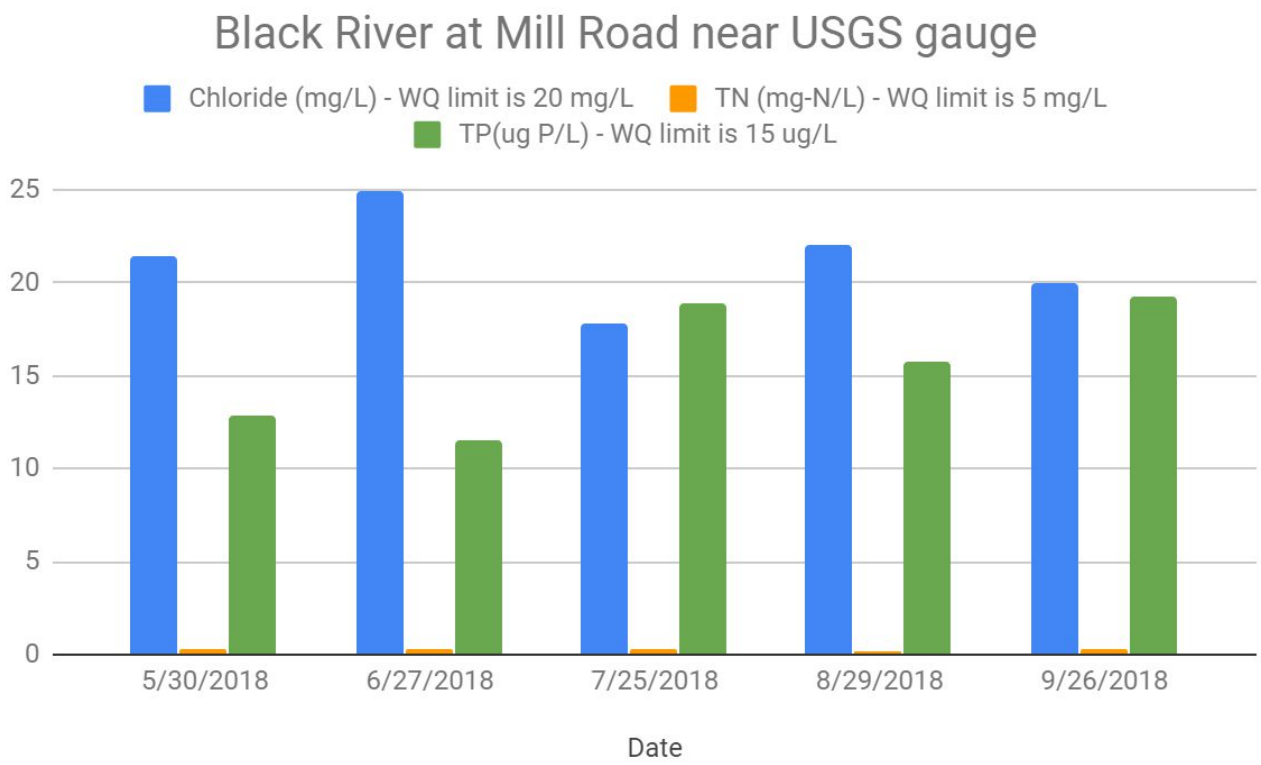
Site #BRAT.GB.0.3 *[43.332602, -72.524993]* -- Great Brook runs along Main St in North Springfield. Draining a much larger watershed than the Spoonerville, Great Brook enters the Black River about 200' upstream from the smaller brook. Sampled by Randy Gray.

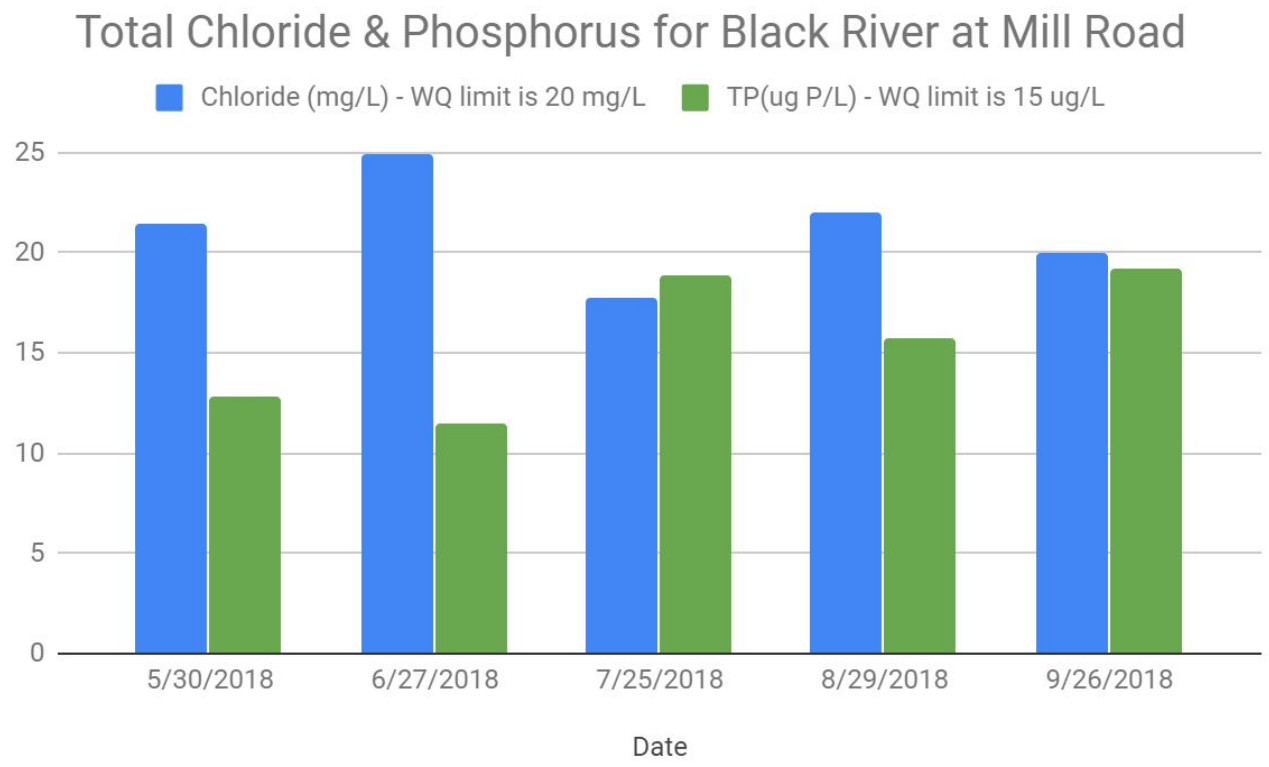


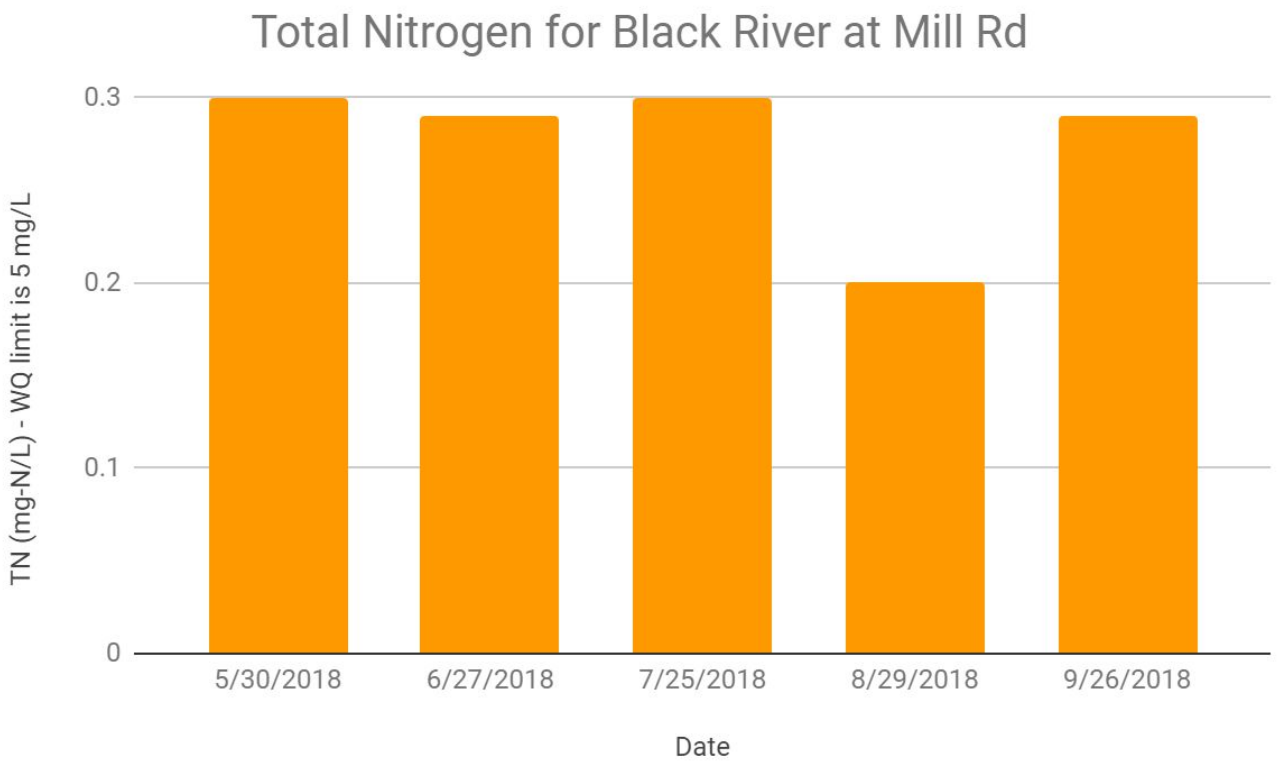

Total Chloride & Phosphorus for Great Brook near confluence
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
80
60
40
20
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Great Brook near confluence
TN (mg-N/L) - WQ limit is 5 mg/L
0.8
0.6
0.4
0.2
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

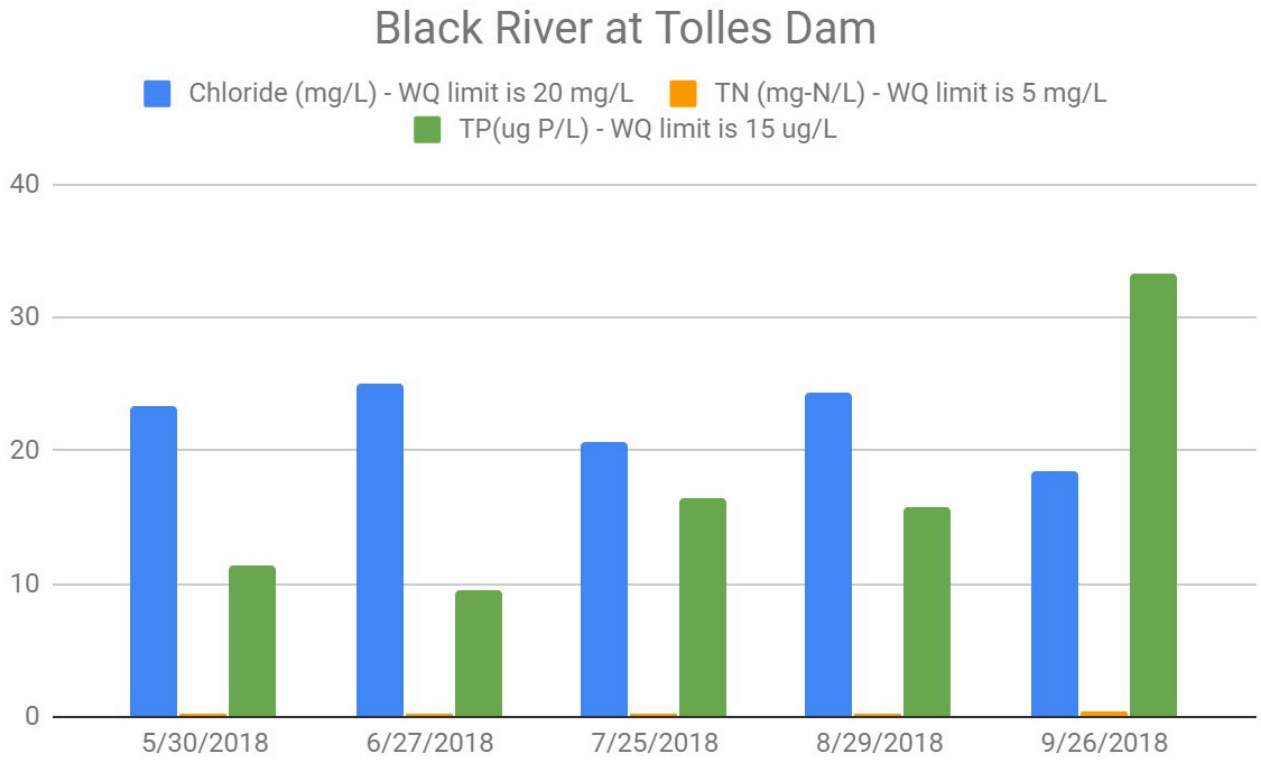
Site #BRAT.BR.8.6 *[43.333445, -72.514757]* -- Mill Road, North Springfield. This spot is just downstream from the flood control dam managed by the US Army Corps of Engineers, which holds back up to 16.7 billion gallons of water from the Black River main stem and the North Branch. Sample is collected by the only USGS gauge on the Black River. Sampled by Reuben Allen and daughter Millie.

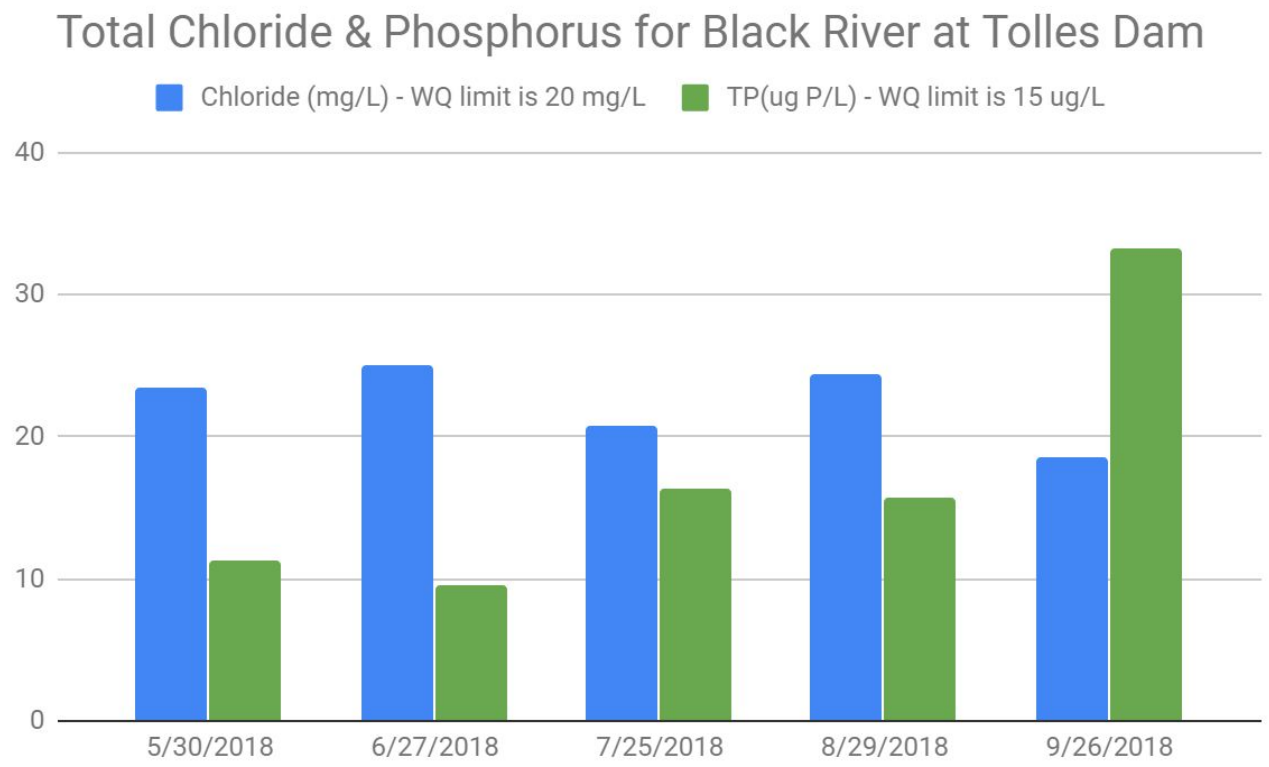


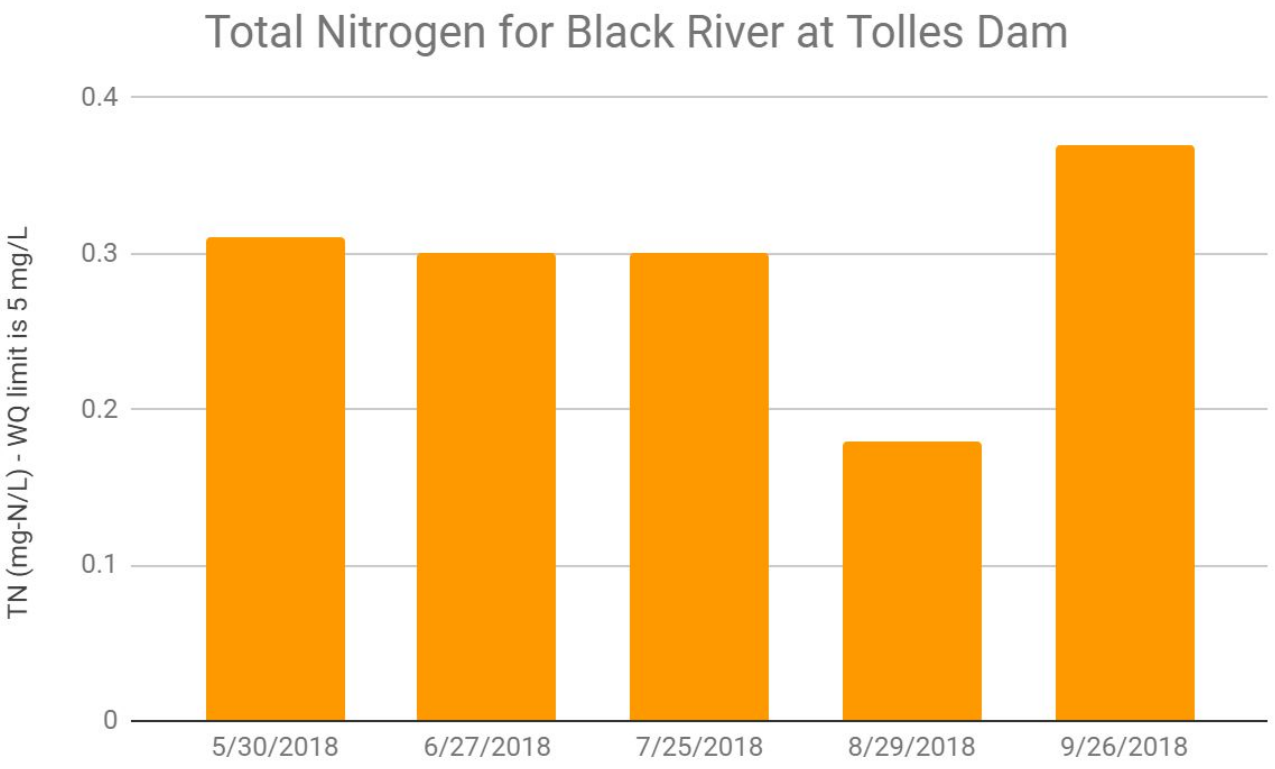

Total Chloride & Phosphorus for Black River at Mill Road
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
25
20
15
10
5
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River at Mill Rd
TN (mg-N/L) - WQ limit is 5 mg/L
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

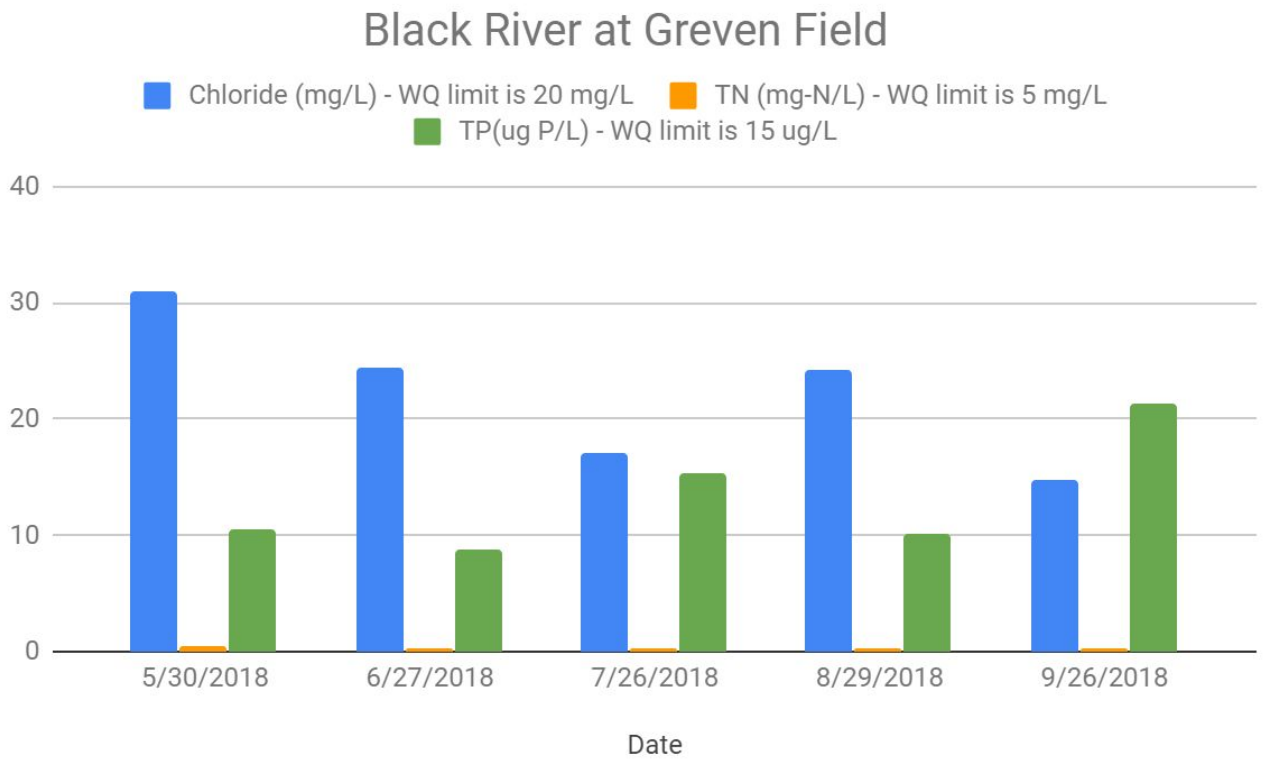
Site #BRAT.BR.12.3 *[43.368773, -72.501317]* **--** Tolles Dam, Maple St, Perkinsville. This sample is collected at a popular swimming spot located on property managed by the US Army Corps of Engineers. Sampled by Rodger Capron.

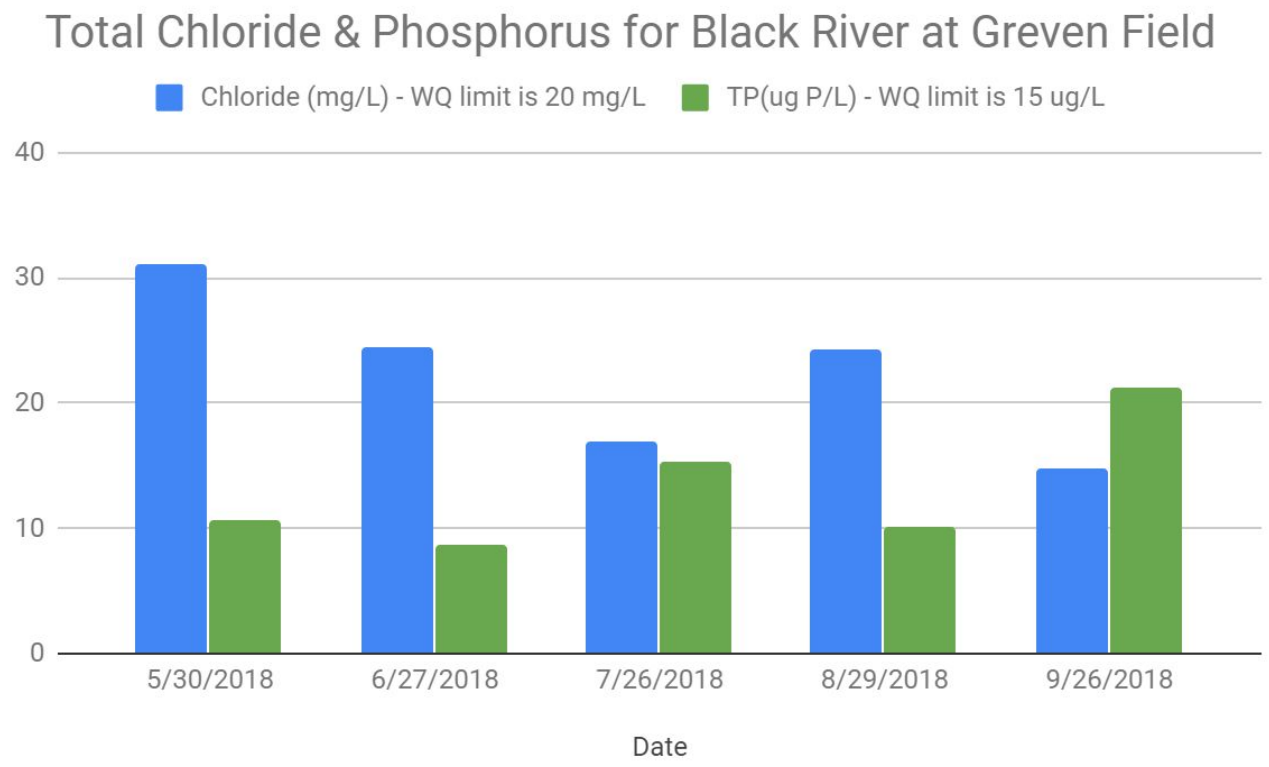


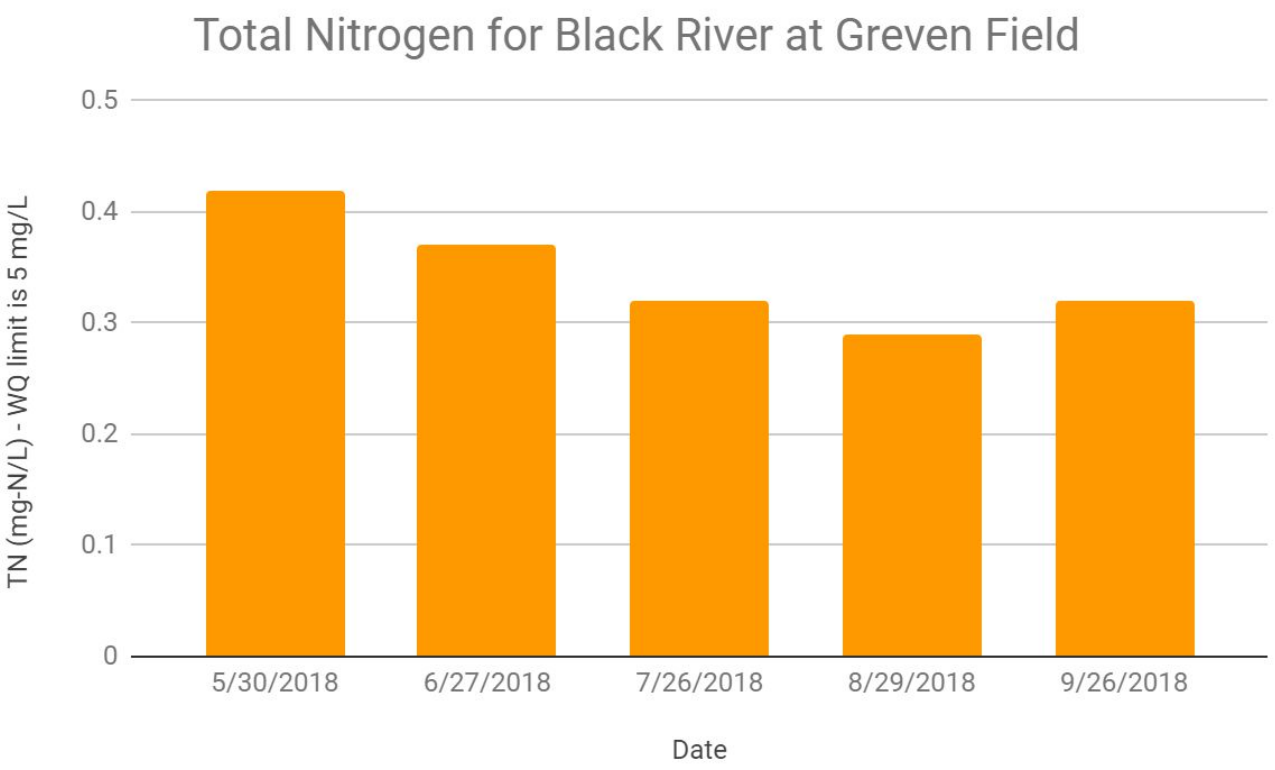

Total Chloride & Phosphorus for Black River at Tolles Dam
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018


Total Nitrogen for Black River at Tolles Dam
TN (mg-N/L) - WQ limit is 5 mg/L
0.4
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018

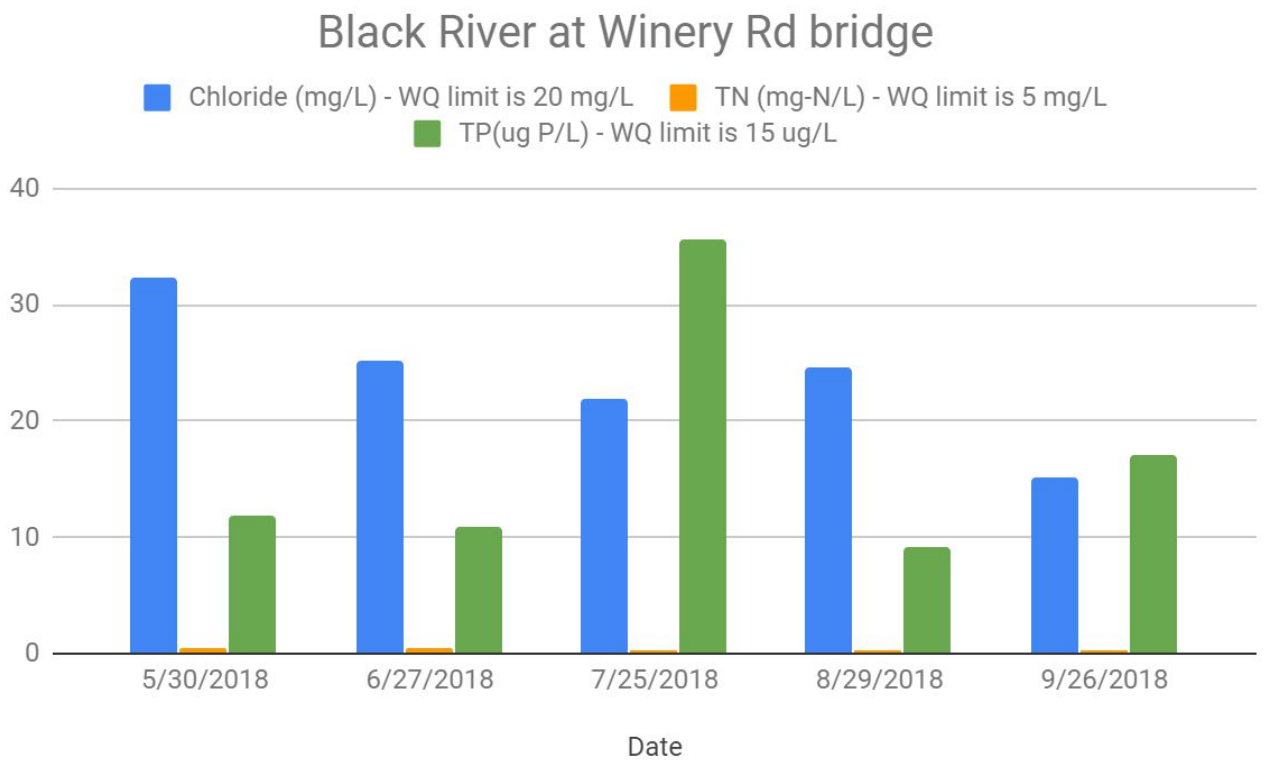
Site #BRAT.BR.23.0 *[43.38071, -72.64011]* -- Greven Field, Cavendish. A popular community recreation area for shallow swimming, wading, and kayak launching, Greven Field was sampled by Tammy Wright.

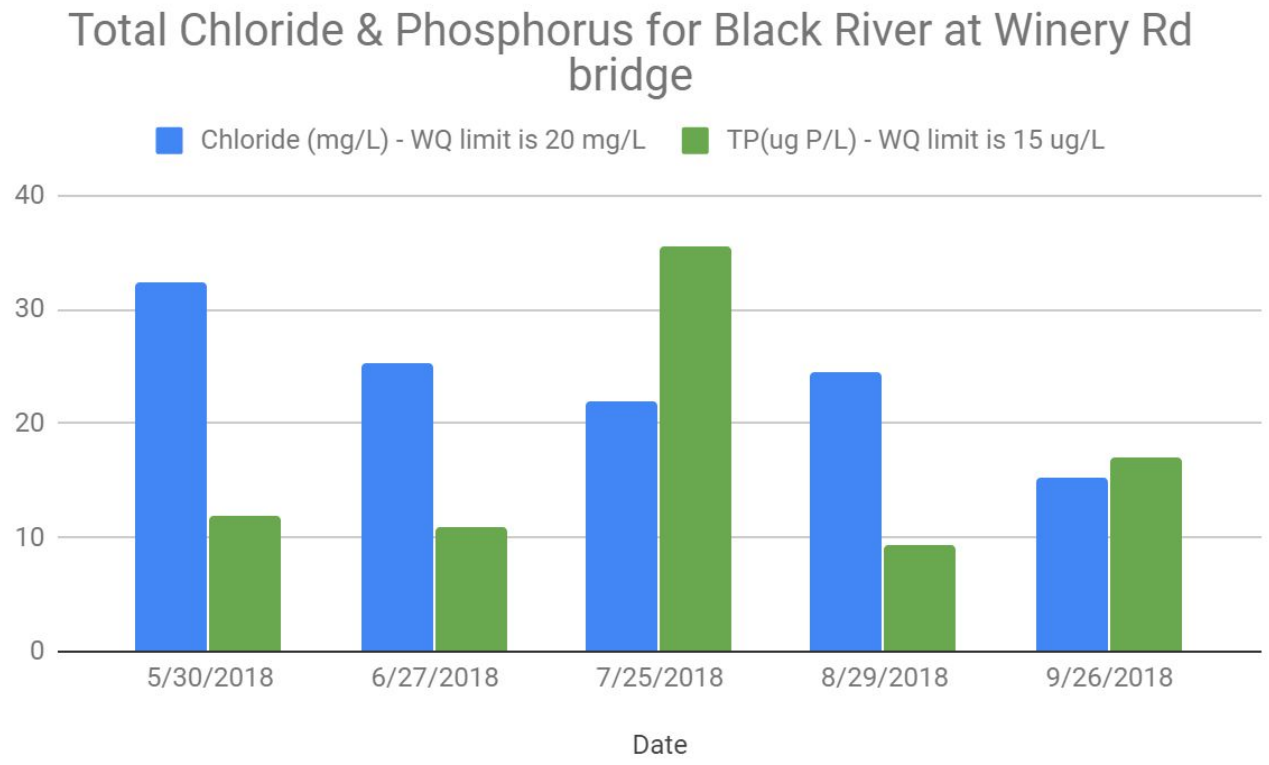


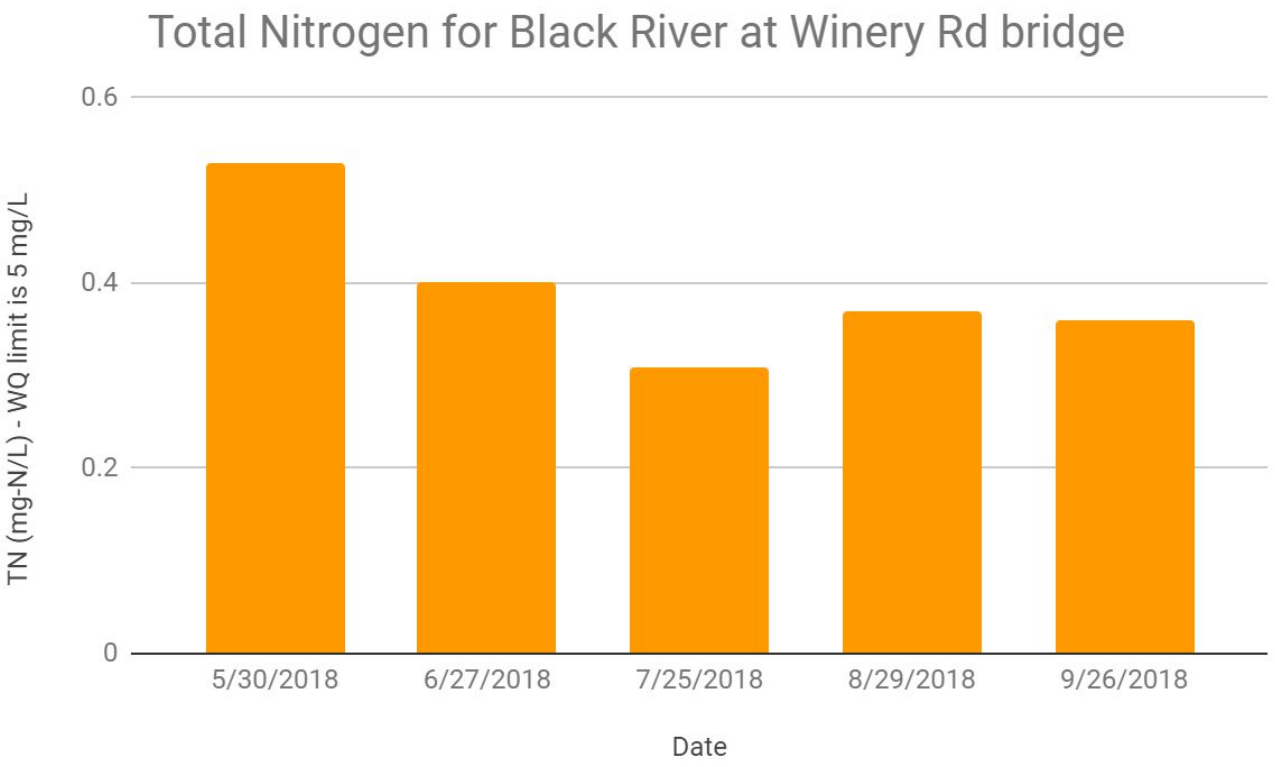

Total Chloride & Phosphorus for Black River at Greven Field
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/30/2018
6/27/2018
7/26/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River at Greven Field
TN (mg-N/L) - WQ limit is 5 mg/L
0.5
0.4
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/26/2018
8/29/2018
9/26/2018
Date

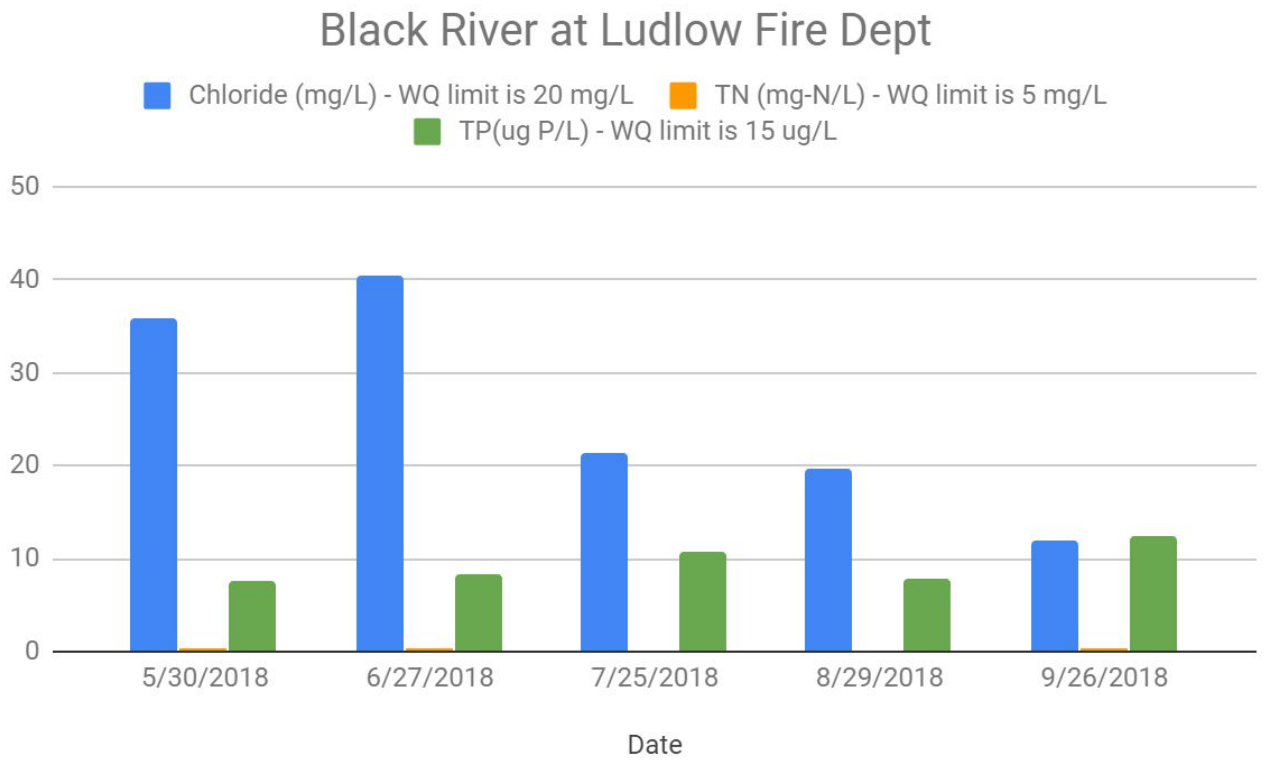
Site #BRAT.BR.24.1 *[43.387369, -72.653637]* -- Winery Road bridge, Cavendish. This site is located at the intersection of Winery Road and Route 103, just downstream from the Ludlow wastewater treatment facility and a canine "day care" facility. Sampled by Sharon Bixby.

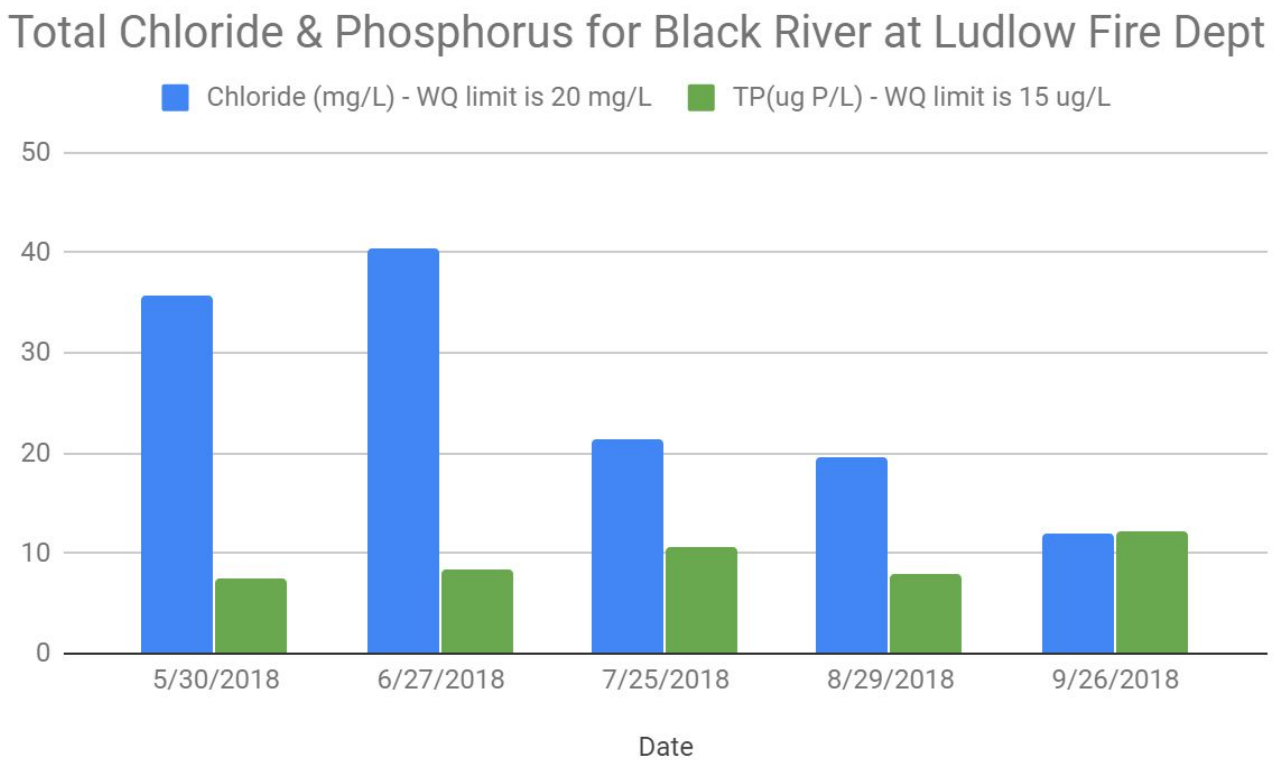


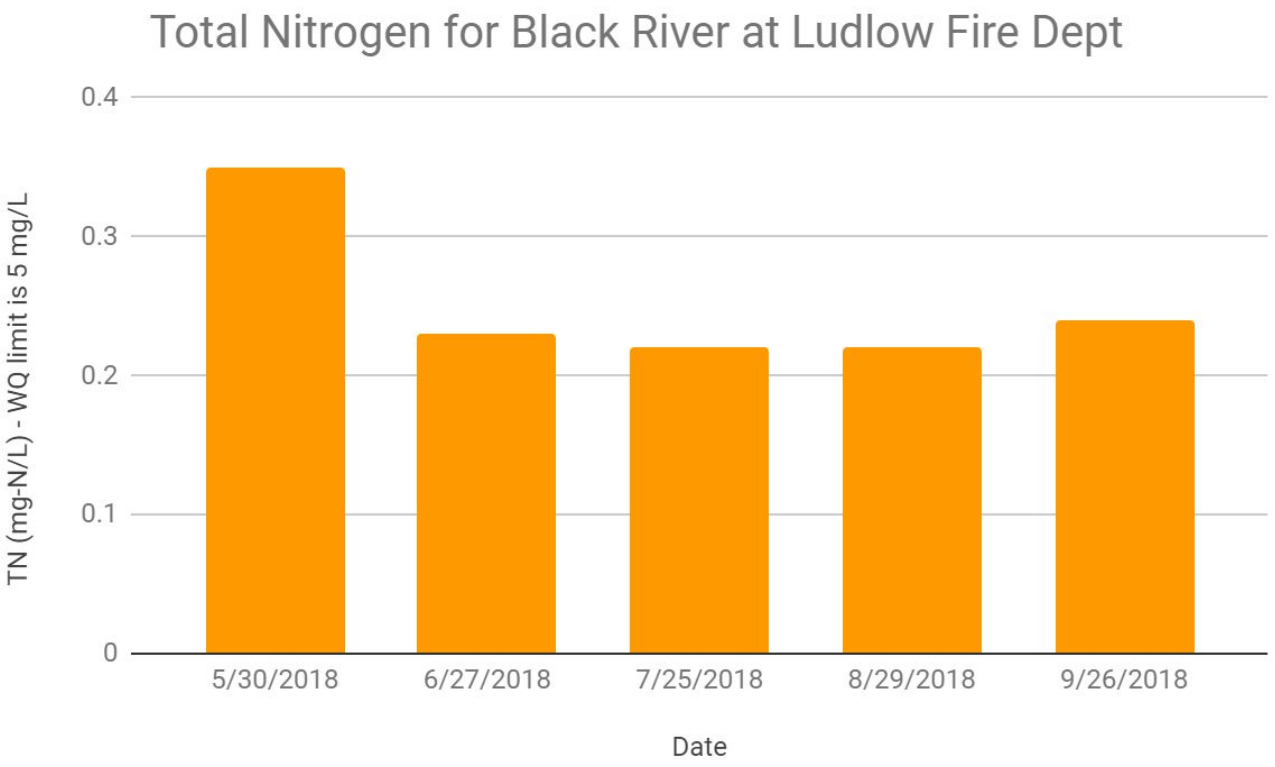

Total Chloride & Phosphorus for Black River at Winery Rd bridge
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

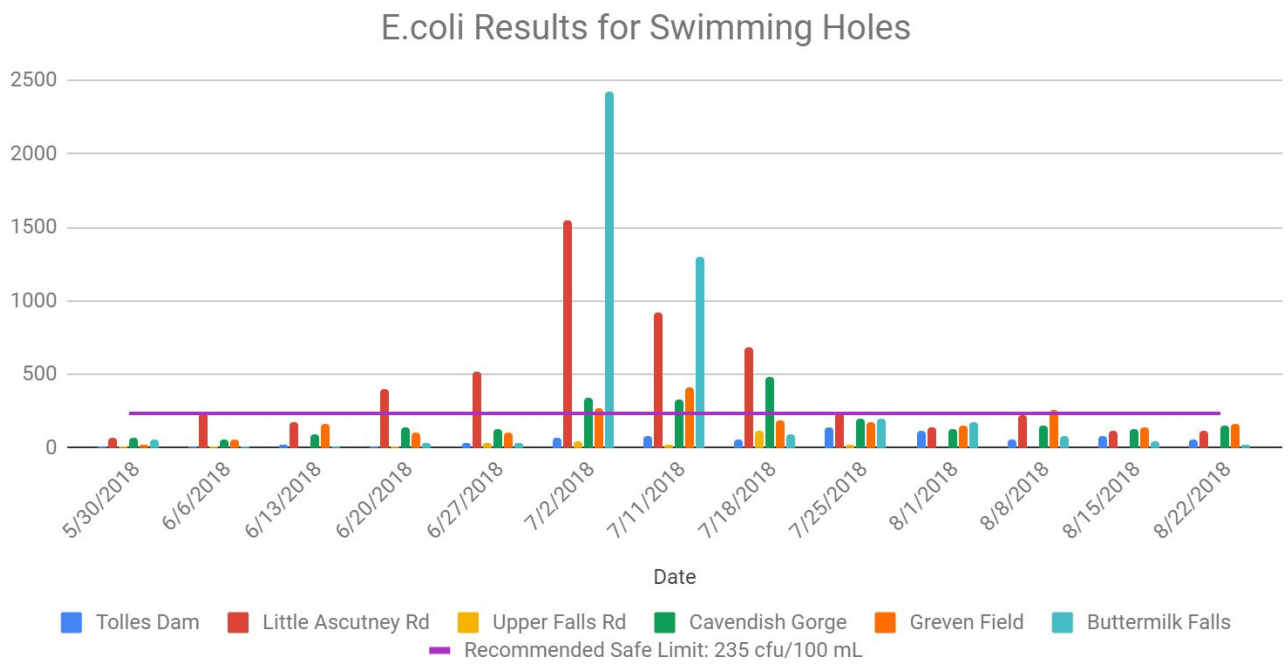

Total Nitrogen for Black River at Winery Rd bridge
TN (mg-N/L) - WQ limit is 5 mg/L
0.6
0.4
0.2
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date

Site #BRAT.BR.27.3 *[43-401529, -72.705827]* -- Ludlow Fire Station, Ludlow. Located behind the Ludlow fire station on Pond Road and just downstream from a golf course, this site is also home to an inflatable diversion dam used by Okemo Resort for snowmaking. Sampled by Phil Carter.




Total Chloride & Phosphorus for Black River at Ludlow Fire Dept
Chloride (mg/L) - WQ limit is 20 mg/L
TP(ug P/L) - WQ limit is 15 ug/L
50
40
30
20
10
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date


Total Nitrogen for Black River at Ludlow Fire Dept
TN (mg-N/L) - WQ limit is 5 mg/L
0.4
0.3
0.2
0.1
0
5/30/2018
6/27/2018
7/25/2018
8/29/2018
9/26/2018
Date



E.coli results from 2018 weekly sampling at 6 swimming areas; results posted weekly at http://connecticutriver.us/site/content/sites-list

Learn more about the Black River Action Team, the River Dipper program, and all our activities at our website at http://www.BlackRiverActionTeam.org or by getting in touch with BRAT Director Kelly Stettner at blackrivercleanup@gmail.com or leave a message at 802-738-0456.