Missisquoi River Basin Association

2018 LaRosa Partnership Organizational Support


A water sampling site along the Jay Brook. Photo credit: Brodie Haenke

Prepared by:
Lindsey Wight, MRBA coordinator
Missisquoi River Basin Association
2839 VT Route 105, East Berkshire, VT 05447
(802) 393-0076
mrba@pshift.com

Executive Summary

The Missisquoi River Basin Association has been collecting water quality data throughout the Missisquoi watershed for fourteen years. Although we have data from a total of 63 sites within the watershed, much of the data has come from the same locations year-after-year. While this provided us with a strong long-term dataset, because of the large geographic area of our watershed and the necessary limitation on sampling, we have not been able to utilize this data to truly target place-based implementation projects that would improve individual waterways. In 2018, we revamped our monitoring program to have a more targeted approach on subwatersheds. We will continue to annually monitor nine sentinel sites throughout the watershed, but we will focus the rest of our sampling efforts within subwatersheds in a rotating fashion. In 2018, the first year of this method, we focused on the Upper Missisquoi and Mud Creek, sampling along each of the major tributaries that enter these subwatersheds; through this method, we identified a small unnamed tributary that seems to be contributing a larger-than-expected amount of phosphorus to this region. We will continue to sample along this tributary and will work with the landowners to identify where this phosphorus input may be coming from.

In addition to this new targeted sampling method, we had an opportunity to directly monitor the impacts of a remediation project that happened during our 2018 sampling season. In 2017, the MRBA received funds through the Ecosystem Restoration Program (2017-ERP-M-16) to repair logging roads that were never properly closed out. These logging roads provide an influx of sedimentation – especially during the spring melt in this steep mountainous terrain – to the Jay Brook, a tributary of the Trout River. This project, consisting primarily of the installation of waterbars and other improvements on the eroding loggin roads, was completed in August 2018.

In 2017, the MRBA began monitoring two water sampling sites along the Jay Brook – one above the project area, which presumably will not be impacted by the remediation, and one below the project, which should show a reduction in turbidity and sedimentation after the project. We also collected water samples from along the Trout River, below where the Jay Brook and other tributaries join. In anticipation of this project, we collected 10 samples from these three sites in 2017 – a subset of pre-project data. We also collected from these three locations in 2018, which gave us several more pre-project samples, as well as some during-project samples, and a few post-project samples. Unfortunately, the post-project sample dataset is currently too small to draw strong conclusions, but we will continue to monitor these three sites during our 2019 sampling season and use this full three-years dataset to discern the water quality impact of the logging road remediation project.

Introduction

The Missisquoi River Basin Association

The Missisquoi River Basin Association (MRBA) is a non-profit organization whose mission is “to restore and maintain the ecological integrity of the Missisquoi River system so that the uses and values desired by the community are supported by the river and quality of its water”. Officially formed in 1997, the MRBA holds an annual program of activities focused on reducing the amount of non-point source phosphorous from entering Missisquoi Bay and Lake Champlain. These activities (which include implementation projects to improve bank stabilization, planting riparian buffers, eradicating invasive plants, holding public forums to increase watershed residents' knowledge of water quality issues, conducting clean-ups to remove trash from our rivers and streams, and monitoring water quality through our water sampling program) improve our watershed, help to educate our communities, and engage watershed residents in volunteerism and citizen science aimed at improving water quality.

Since 1997, the MRBA has generated over 19,000 volunteer hours performing these activities, has planted over 25,000 trees along watershed streams and rivers, stabilizing banks and providing a buffer to potential runoff, and has collected approximately 5,000 water samples from our watershed.

The Missisquoi Watershed

The Missisquoi watershed drains into Missisquoi Bay, located in the northeast corner of Lake Champlain, and accounts for the highest concentration of phosphorus in any of the Lake's eleven watershed subbasins. From 2005-2015, Missisquoi Bay has averaged around 200 metric tons of phosphorus loading per year; this is significantly higher than the target loading capacity of 97.2 metric tons/year established by the State of Vermont and Province of Quebec (Lake Champlain Basin Program, State of the Lake 2015). Continued monitoring of the water quality in this area will help pinpoint sources of phosphorus and other nutrients, and target efforts to reduce loading in both the watershed and the Lake.

In our mountainous areas, the largest impact to our tributaries is sedimentation. While still impacted by phosphorus to some degree, our steeper terrain leads primarily to erosion problems. These cannot always be tied to increased phosphorus levels, so different parameters – such as turbidity – are often used to monitor water quality at these locations.

Water Sampling

In 2018, the MRBA completed its fourteenth year of water sampling with the LaRosa Partnership Program. We greatly appreciate the assistance, in the form of the laboratory analytical services, that this partnership has provided; without this program, we would not have been able to collect extensive water quality monitoring data over the past decade.

Over the last fourteen years, the MRBA has coordinated volunteers to collect bi-weekly samples during the summer months all throughout our large watershed. At our peak, we had 33 volunteers assisting our monitoring program. Some of these superstar volunteers have been sampling since we began this program, but we have also connected with a rotating population of watershed residents – over the years, we have had help from more than 55 individuals.

Throughout the years, our volunteers have monitored between 19 and 28 sites annually, with a grand total of 63 sites throughout the watershed that have been monitored for at least one year. Since the start of our monitoring program, we have sampled total phosphorus, total nitrogen, and turbidity; we have 14 consistent years of data from 6 of our sites. With such a large agricultural presence in our watershed, the ability to monitor phosphorus loads, in particular, has enabled us to target areas in dire need of streambank buffers, livestock exclusion, or application of BMPs.

Methods

Planned monitoring design

For many years, the MRBA's water sampling program collected data from the same or similar locations year-after-year. While this provided us with a strong long-term dataset, because of the large geographic area of our watershed and the necessary limitation on sampling, we were not able to utilize this data to truly target place-based implementation projects that would improve individual waterways. In 2018, we revamped our monitoring program to have a more targeted approach on subwatersheds. We will continue to annually monitor nine sentinel sites throughout the watershed, but we will focus the rest of our sampling efforts within subwatersheds in a rotating fashion. In 2018, we focused on the Upper Missisquoi and Mud Creek, sampling along each of the major tributaries that enter these subwatersheds so that we can more effectively identify where nutrient and sedimentation problems are originating. In 2019, we are continuing this sampling method, and intend to focus on the mid-Missisquoi, primarily in the towns of Richford and Berkshire.

Remediation project

In 2017, the MRBA received funds through the Ecosystem Restoration Program (2017-ERP-M-16) to repair logging roads that were never properly closed out. These logging roads provide an influx of sedimentation – especially during the spring melt in this steep mountainous terrain – to the Jay Brook, a tributary of the Trout River. In the summer of 2017, we worked with the Department of Forest, Parks and Recreation to identify locations for waterbars and other improvements. In 2018, a contractor was hired to do the repair work, which was completed in August 2018.

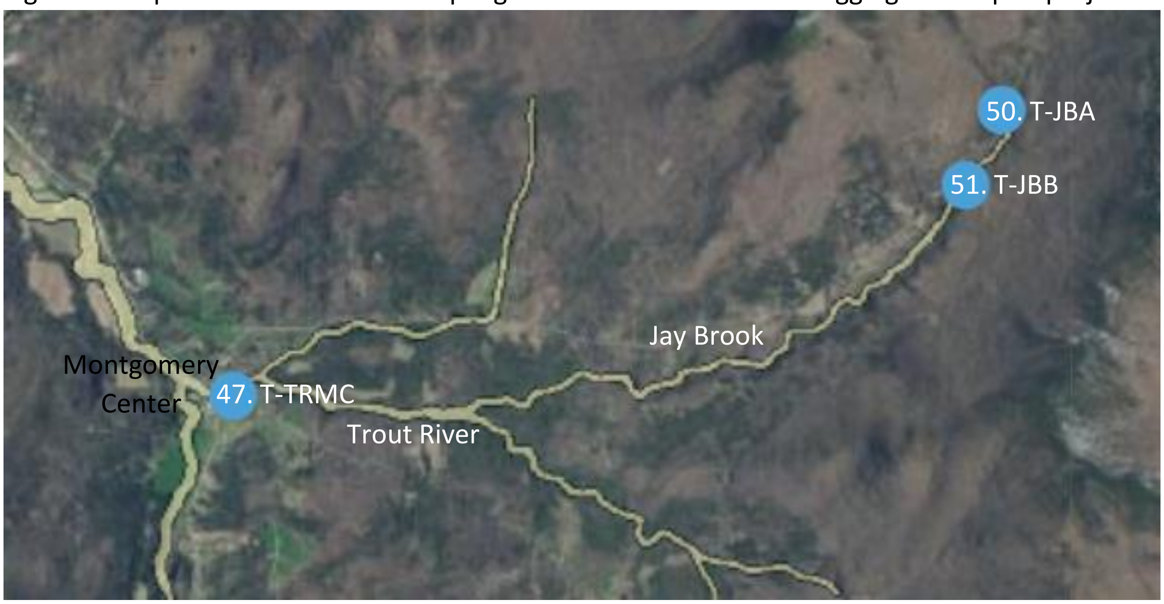
In preparation for these improvements, the MRBA began monitoring two water sampling sites along the Jay Brook, which runs along Route 242 and flows into the Trout River in Montgomery Center, VT. Sedimentation has been identified in the Tactical Basin Plan as a problem in this steep watershed, and the logging road repairs should decrease the turbidity of the Jay Brook and improve overall erosion problems and sedimentation load in both Jay Brook and the Trout River. Although the Jay Brook and Trout River subwatersheds were not within our targeted area for 2018, nor are they within the area we are focusing on for 2019, we have and will continue to monitor three locations that we began sampling in 2017, so that we can see the before-and-after numbers and assess the impacts of the logging road repairs.

Two sampling sites (MRBA site numbers and codes 50. T-JBA and 51. T-JBB) are located along the Jay Brook, one above where the majority of the impacts of the logging roads should enter the Jay Brook (50), and one below (51). The third sampling site is below where Jay Brook flows into the Trout River, in Montgomery Center (47. T-TRMC). We monitored these sites in 2017 to get baseline numbers, in 2018 as the repair work was being done, and have begun monitoring them during our 2019 season as well, to fully assess the impact of the logging road repairs on the sediment loading of these two waterways. This full three-year dataset will serve as a comparison of before-and-after the repairs, and we expect to see improved turbidity in our sampling data. The subwatershed of the project site encompasses 27% of the Trout River watershed; this could result in significant improvement to the impaired hydrology of this basin, and reduce sedimentation in the Trout River.

Table 1: Jay Brook and Trout River water sampling sites; monitored during 2017, 2018, and 2019 to assess the impact of logging road repair work that was completed in 2018.

Site ID	Site Code	Latitude (DD)	Longitude (DD)	Description
50	T-JBA	44.900080	-72.517527	Tributary to Jay Brook, upstream of a large box culvert across 242 (above project location)
51	T-JBB	44.893919	-72.521766	Jay Brook, behind last house heading north on 242, downstream of tributaries to stream (below project location)
47	T-TRMC	44.876928	-72.60528	Trout River, off Rte 58 in Montgomery Center, below Three Holes swimming area

Figure 1: Map of the three water sampling sites associated with the logging road repair project.



We will monitor these sites in conjunction with the rest of our LPP monitoring program (they are already accounted for in our 2019 proposal): we will collect samples for Total Phosphorus, Total Nitrogen, and Turbidity testing on 12 occasions throughout the summer, from mid-May to mid-October. We expect to see load levels reduce (especially turbidity) after the repairs to the logging roads have been completed.

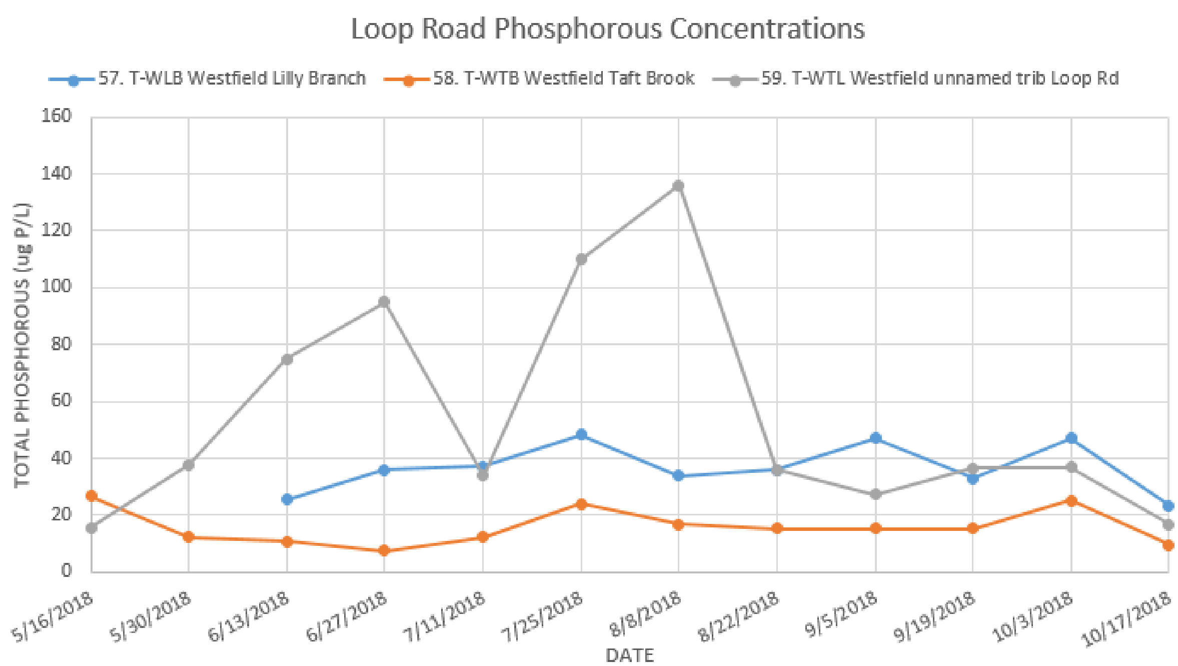
Water sampling

To ensure that we are collecting quality samples and acquiring quality data on the health of our watershed, our sampling coordinators attend the annual training offered by the VTDEC and VAEL employees. Mandatory training sessions are then held for all of our volunteers to assure that all samples are being collected in a proper manner. We also check-in with our volunteers regularly, and give feedback if samples have shown to be of diminished quality.

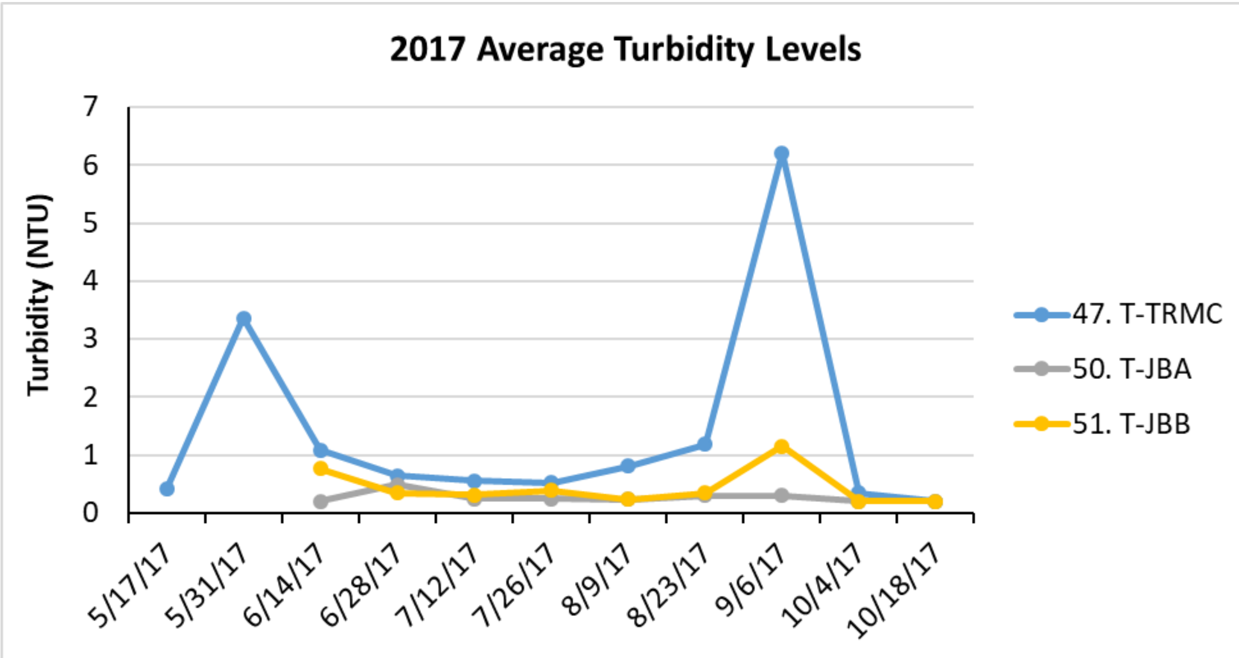
Results

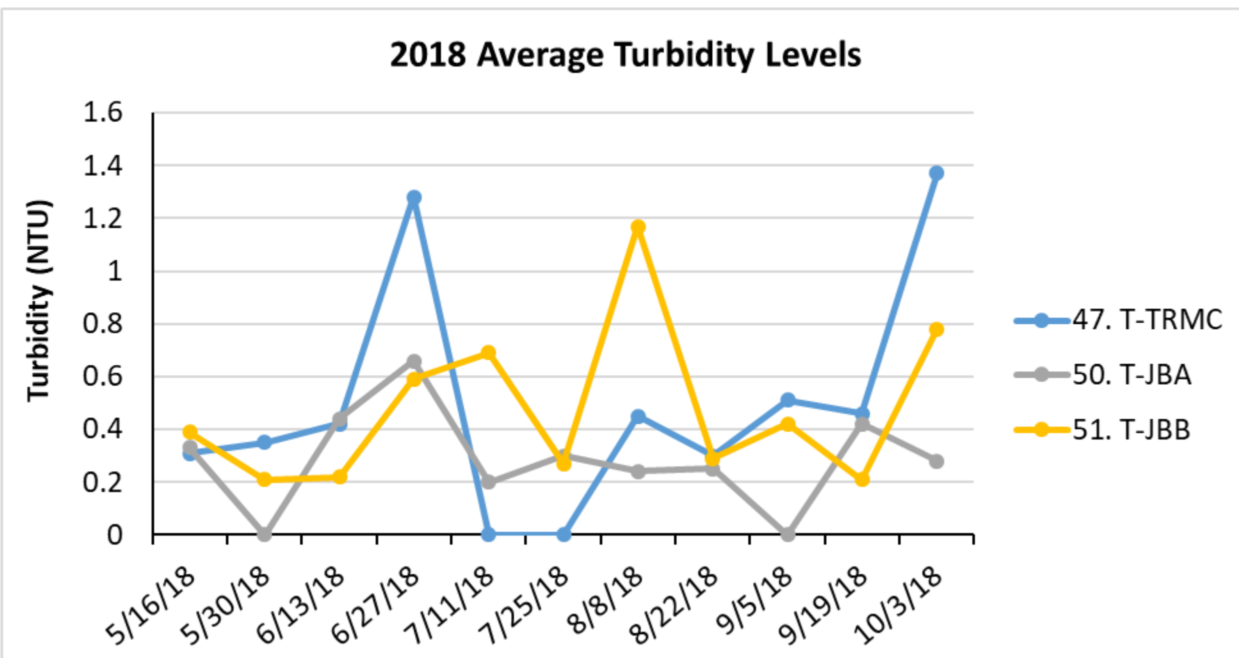
The new sampling site selection method implemented by the MRBA in 2018 enabled us to get a much closer and more detailed look at water quality within the upper Missisquoi and Mud Creek subwatershed, and a better idea of which tributaries may be impaired. This will enable us to continue to narrow down locations of impairment, and places where implementation projects may have the most impact toward improving water quality. We will continue monitoring a rotating targeted subwatershed – in 2019, we will be focusing on the Richford and Berkshire area of the mid-Missisquoi, along with our sentinel sites that will continue to grow our long-term dataset.

Below is an example of the targeted data that we collected in 2018 along Loop Rd in Westfield. We sampled several tributaries leading to the Missisquoi River and identified one – a small unnamed trib – that seems to be contributing a larger-than-expected amount of phosphorus to this region. We will continue to sample along this tributary and will work with the landowners to identify where this phosphorus input may be coming from.

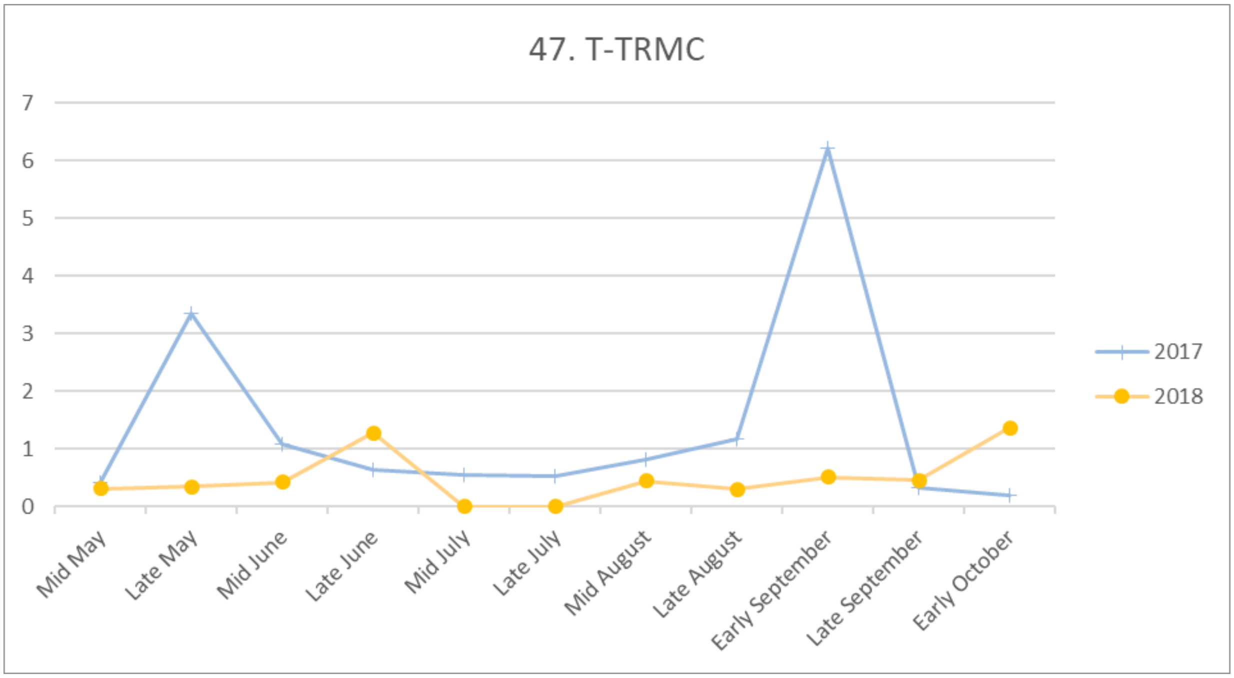


We are also continuing an additional year of targeted sampling on the Jay Brook and Trout River, to assess the impacts of the logging road repairs that were completed in August 2018. While we sampled for all three of the parameters that we measuring in our water sampling program (phosphorus, nitrogen, and turbidity), phosphorus was generally below the target levels for the Missisquoi watershed at all three sites, and nitrogen levels were similarly low at all three locations; this is not unexpected, as the project site and surrounding area are primarily forested – the goal of the remediation project was to reduce erosion and sedimentation. Therefore, the main focus at these sites is the turbidity values. Below are the turbidity data that were gathered at these three locations during 2017 and 2018.

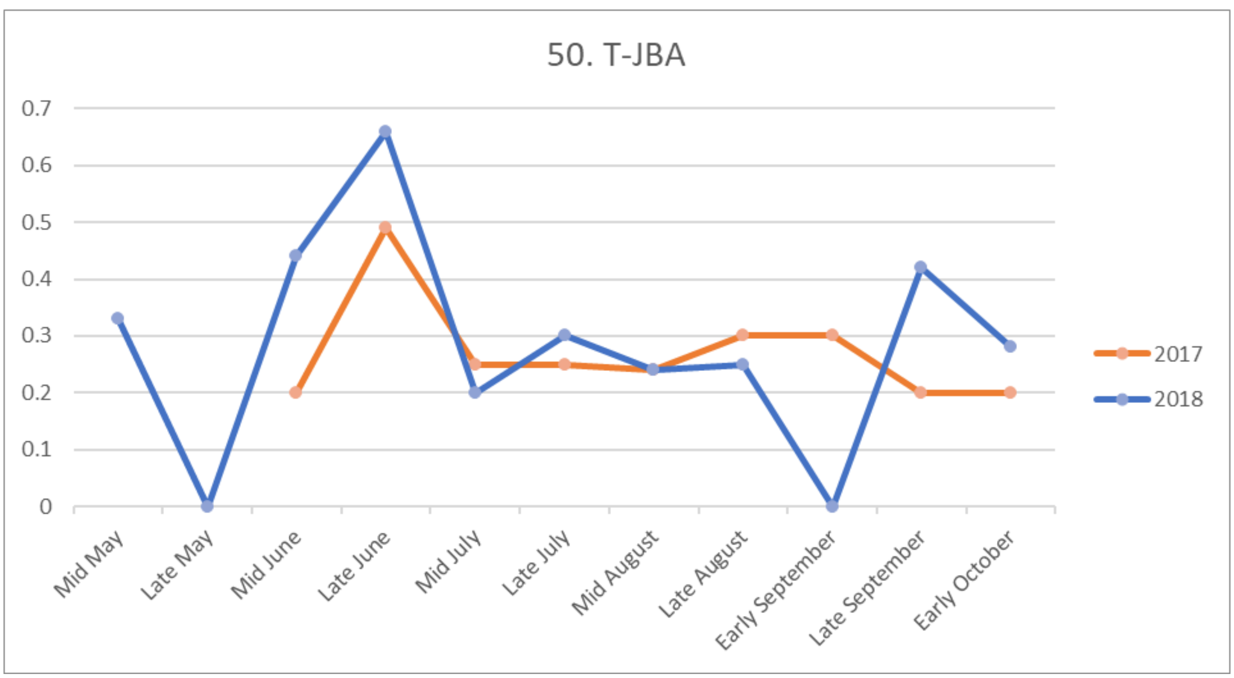




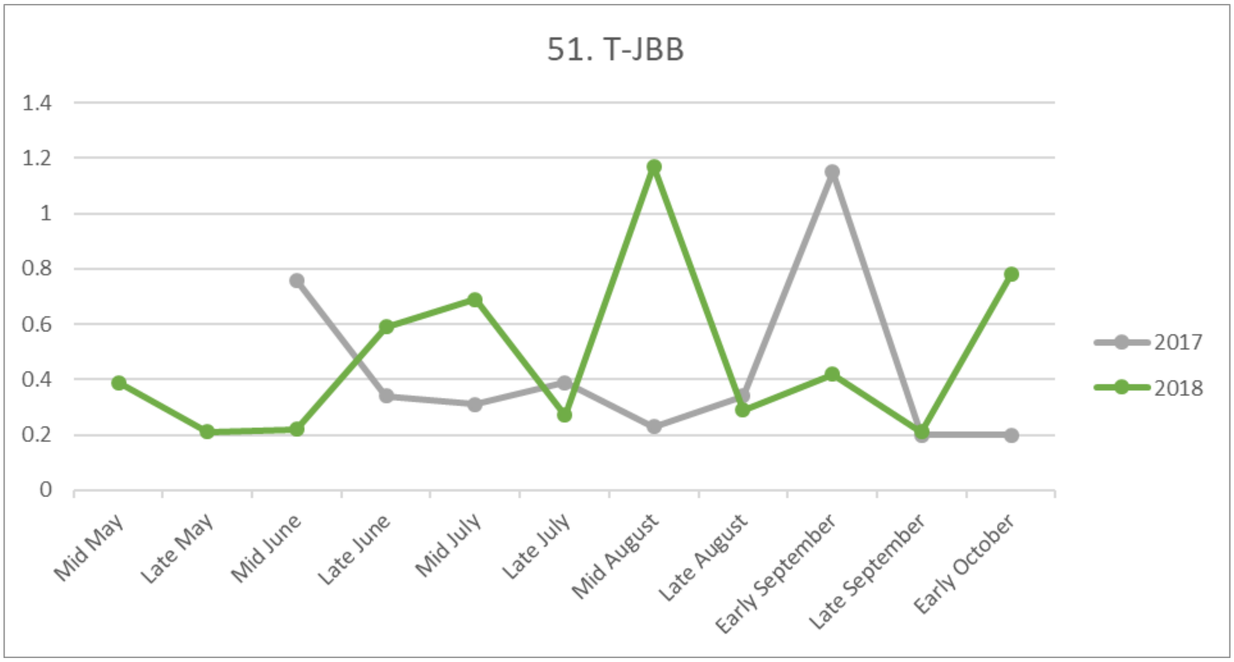
Turbidity levels varied across the three sites, especially in 2018. Below are graph comparing the two years of data at each location.



Site 47. T-TRMC, the site that is located along the Trout River, after the Jay Brook and other tributaries flow together, showed higher overall turbidity levels during 2017 than the other sites, and show some spikes during 2018.



Site 50. T-JBA, the site that is above the logging roads and is not expected to see impacts from the remediation project, showed similar turbidity levels in 2017 and 2018.

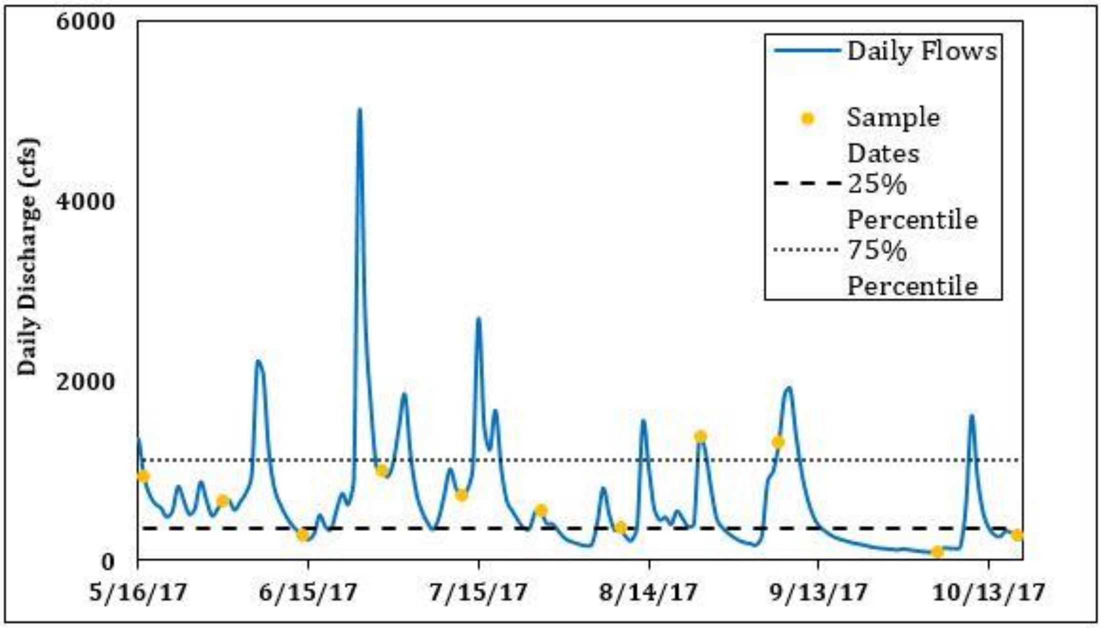


Site 51. T-JBB, the site that is below the logging roads and IS expected to reflect impacts from the remediation project, also showed fairly similar turbidity levels in 2017 and 2018. The remediation project was completed in late August 2018; more monitoring in required to see the results of this project.

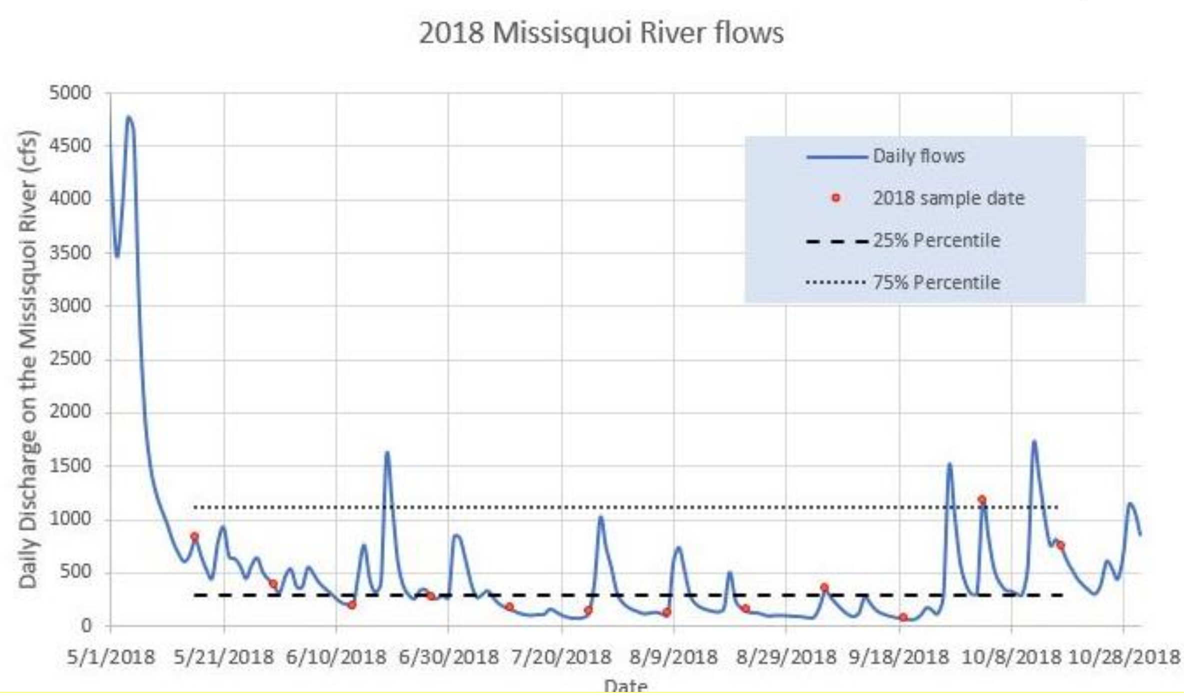
<u>Conclusions</u>

The targeted sampling method balances monitoring the entire watershed at sentinel sites throughout the watershed with targeting subwatersheds so that we may begin to pinpoint potential problem areas – and have a chance to address these problems with implementation projects. In Westfield in 2017, we discovered higher-than-expected phosphorus inputs from a very small tributary; we will continue to monitor along this tributary and begin to try to identify the source of this phosphorus. We intend to continue using this targeted method so that we may better implement remediation projects that will have real impacts in the overall water quality of the Missisquoi watershed.

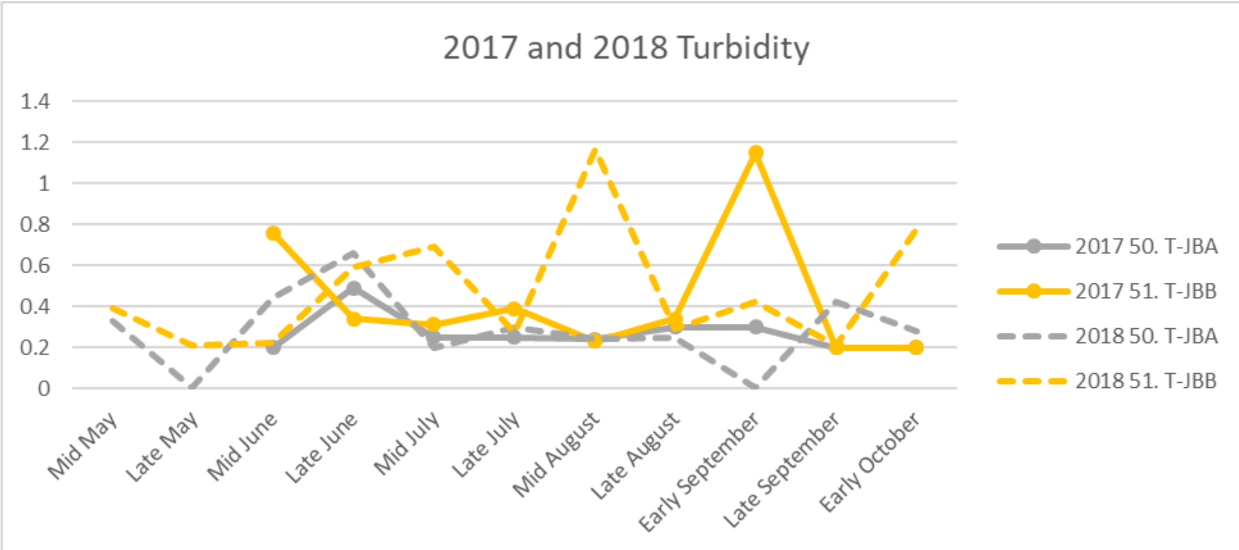
The logging road remediation project was identified before we had implemented this targeted monitoring approach. However, we were able to get a full year of pre-project data. In fact, most of 2018 ended up being pre-project, simply due to how the timeline worked out. Since we only captured a few days of post-project data during 2018, we will continue monitoring at these three sites during 2019. We expect to see an improvement between 2017/2018 and 2019 data, especially at site 51. T-JBB, which is below the project area. We will also compare the data from site 50. T-JBA, above the project site, with that from site 51. T-JBB, and expect to see that site 51. T-JBB will begin to look more like site 50. T-JBA. Daily flow must be taken into account with our data; below you can see the daily discharge collected nearby along the Missisquoi River at the USGS station in East Berkshire for both 2017 and 2018.



6000
4000
2000
0
Daily Discharge (cfs)
5/16/17
6/15/17
7/15/17
8/14/17
9/13/17
10/13/17
Daily Flows
Sample Dates
25% Percentile
75% Percentile



2018 Missisquoi River flows
Daily Discharge on the Missisquoi River (cfs)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
5/1/2018
5/21/2018
6/10/2018
6/30/2018
7/20/2018
8/9/2018
8/29/2018
9/18/2018
10/8/2018
10/28/2018
Date
Daily flows
2018 sample date
25% Percentile
75% Percentile



The peaks can be compared to our data (pictured above, for just the two sites directly above and below the project area) – you can see that there was a high flow event during our early September 2017 sampling date, on which we had high turbidity at site 51. T-JBB, but not at site 50. T-JBA. We also had high turbidity at site 51. T-JBB but not at site 51. T-JBA during mid-August in 2018. There is no high flow event during that date, but that was during the remediation project, and the high turbidity may be related to that.

Our post-project data is limited and must, therefore, cause our conclusions to be as well. For this reason, we will be sampling these three sites again during our 2019 season, so that we may have a more robust post-project dataset. The expectation is that our full three-year dataset surrounding this project will enable us to see the improvements that the logging road repairs have on the hydrology of the surrounding forest and the associated streams.

<u>Appendix A:</u> 2018 Quality Assurance Project Plan

<u>Appendix B:</u> Photos of the Logging Road Repair Site

Appendix A: 2018 Quality Assurance Project Plan (see following 38 pages)

1. Title and Approval

A. Your Specific Project in cooperation with VTDEC/VAEL "2018 Volunteer LaRosa Partnership Program Analytical Services Grant:

_____Missisquoi River Basin Association 2018 Sampling Program_______________________
(Your Project's Name)

____Missisquoi River Basin Association____
(Name of Your Organization)

_____4/17/18____
(Date)

INSTRUCTIONS: Please fill in the spaces below with appropriate information for your project and organization. Collection of samples for this project must not take place until the QAPP is delivered to VTDEC for signature.

Project Coordinator Signature/Date: ___________________________________

Project QA Officer Signature/Date: ___________________________________

Project QAPP Prepared by: ___Lindsey Wight______________________________

Approval by*:* ____

James Kellogg

VTDEC Environmental Scientist
LaRosa Partnership Program Coordinator

Date

B. Generic Volunteer - Based Water Quality Monitoring Project QAPP:

Vermont General Quality Assurance Project Plan for Volunteer, Educational and Local Community Monitoring and Reporting Activities

(Project Name)

VT Department of Environmental Conservation

(Responsible Agency)

April 17, 2018

(Date)

QAPP Prepared by:
Lee Steppacher & Diane Switzer, EPA New England
and *Modified by James Kellogg, VTDEC.*

2. Table of Contents

INSTRUCTIONS: Change page numbers and appendices as needed for your project. Insert information for any pages of additional information you attach (e.g., maps, manuals, written procedures, etc.)

3. Distribution List

A. Names and telephone numbers of those receiving copies of this QAPP.

i. Jim Kellogg, VT Department of Environmental Conservation. Watershed Management Division, 1 National Life Drive, Main Building - 2cd Floor, Montpelier, VT 05602-3522. 1(802) 490-6146. Jim.Kellogg@vermont.gov

ii. Multiple 2017 LaRosa Partnership Program (LPP) participant – complete list available upon request.

iii. Lindsey Wight, MRBA Coordinator, 2839 VT Route 105, East Berkshire, VT 05447, mrba@pshift.com, (802) 393-0076

iv. Heather Murphy, MRBA Outreach Technician, ECO AmeriCorps member, 2839 VT Route 105, East Berkshire, VT 05447, heathermurphy.americorps@gmail.com, (802) 393-0076

v. Karen Bates, Watershed Coordinator, VT DEC, 111 West St, Essex Junction, VT 05452, Karen.bates@state.vt.us, (802) 879-2339

vi. John Little, MRBA President, 737 Rushford Valley Road, Montgomery Center, VT 05471, jalittle58@gmail.com, 326-4164

INSTRUCTIONS: please fill in the following section with the names and contact information (i.e., address, phone #, email address) of those involved with your project who should be familiar with your QAPP. This should include the project leader, field/sampling leader and quality assurance leader.

4. Project/Task Organization

A. Table 4a – VTDEC/VAEL – Primary Contact and Their Responsibilities.

Project Title/Responsibility	Name
VTDEC LaRosa Partnership Program (LPP) Coordinator	Jim Kellogg
VT Agriculture and Env. Laboratory (VAEL) Director	Guy Roberts
VAEL Supervisor	Dan Needham

B. Table 4b - Key Project People and Their Responsibilities

INSTRUCTIONS: Fill in the name and affiliation (if not from your organization) of the person that corresponds to the title and description in the left column. Note that one person may have more than one responsibility and may be listed more than once, however, the person responsible for QA should not be the project leader. If you are not using a laboratory, put an N/A (Not Applicable) in the name space. Add other key people as needed.

Project Title/Responsibility	Name/Affiliation
Project Coordinator – responsible for all project aspects and primary contact with LPP Coordinator.	Lindsey Wight, MRBA
Project Volunteer Coordinator – responsible for overseeing. volunteer activities, including recruiting, maintaining training and participation records.	Heather Murphy/Lindsey Wight, MRBA
Project Field/Sampling Leader – responsible for training and supervising volunteers in field work, filling out field forms, and performing QC checks to make sure procedures are followed or corrected, as needed.	Heather Murphy/Lindsey Wight, MRBA
Project QA Coordinator – responsible for ensuring that procedures in the field and laboratory are performed in accordance with this QAPP and keeps other leaders informed of project status in relation to QAPP. Works with other leaders in conducting QC checks on sampling and analysis techniques. A primary contact with LPP Coordinator.	Heather Murphy/Lindsey Wight, MRBA
Project Laboratory Contact – primary contact with lab to ensure analysis done according to QAPP. Ensure the QAPP, sample delivery, lab instructions, training, holding times are met and laboratory provides complete documentation. Works closely with the QA Coordinator.	Heather Murphy/Lindsey Wight, MRBA
Project Data Management Coordinator – Maintains the data systems for the organization, performs data entry, and checks entries for accuracy against field and laboratory forms.	Lindsey Wight, MRBA Karen Bates,WMD

5. Background of Volunteer LaRosa Partnership Program Analytical Services Grant.

The Vermont Department of Environmental Conservation (VTDEC), through the Vermont Agriculture and Environment Laboratory, has made available to interested lake, river, and watershed associations grants for sample analyses since the 2003 field season. The purpose of this program is to help volunteer associations and monitoring groups to implement new and/or on-going surface water monitoring projects, for waters in need of water quality assessment.

What are laboratory services?
One of the costliest items involved in a monitoring program is laboratory analysis. VTDEC recognizes that the cost of laboratory services hinders the widespread application of volunteer surface water quality monitoring in Vermont. Analytical services provided under this grant program are essentially 'slots' for tests to be run at the LaRosa Laboratory, free of charge to grantees. VAEL is a full-service analytical facility with complete capabilities for routine water quality monitoring tests. Examples of such tests include: phosphorus, nitrogen, chlorophyll-a, total suspended solids, *E. coli*, turbidity, alkalinity, conductivity, pH, priority pollutants and metals; and numerous other compounds. More information about the VAEL's services are available online (http://dec.vermont.gov/about-dec/laboratory).

Who is eligible?
Volunteer associations across Vermont are eligible for this project. Such associations include river, lake, and watershed groups, secondary-level educational groups, and water quality and conservation committees associated with local municipalities. Post-secondary academic institutions and statewide not-for-profit non-governmental organizations are eligible provided that the projects are either: designed jointly with a local association to assess current water quality conditions; or, structured to address a water quality problem of statewide importance.

What are the eligible project types?
Many project types are eligible for this program. Waters under evaluation should be of interest to the local association sponsoring the project and of interest to VTDEC-MAPP. Waters of interest to VTDEC include impaired and state priority waters, waters on which minimal or no monitoring has been performed in the past, waters with significant public swimming use, waters where a suspected water quality problem needs further assessment, and waters where the causes of known problems remain undiagnosed. Proposals for projects exceeding one field season in duration will be accepted, although subsequent years will be approved only subject to continued availability of state funding for this program. Please note that participants in this program shall share with VTDEC ownership of all laboratory data produced by individual projects.

6. Individual Project Purpose/Task Description

Instructions - For Parts A and B below, please <u>check the boxes that apply to your project and add specific information as needed</u>. Include all pertinent background information that helps support the purpose of your project, including a brief summary of previously collected data. The summary can either be in table format or a brief narrative.

Attach a map in Part C, to identify waterbodies being sampled and sampling sites. If you are unable to locate sampling sites until the project is initiated, please explain your circumstances below.

A. Objectives of Projects

The principal objectives of projects under this QAPP are to 1) provide a perspective on the range of water quality conditions across Vermont; 2) describe water quality conditions of individual waterbodies; 3) establish a data base for waterbodies for use in documenting future changes in water quality; and, 4) educate and involve residents in waterbody protection.

General guidelines for projects under this QAPP are:

- Data should be collected the during spring, summer and early fall months at regular intervals, but not in severe weather, such as thunderstorms or high winds (safety comes first!). Projects addressing *E. coli* should be designed specifically to address either dry-only weather conditions, or segregate between wet and dry weather conditions. Current and the previous 24 hours' weather conditions must be recorded for all *E. coli* sampling events.
- Follow VTDEC guidelines as outlined in the RFP to fully understand the LPP criteria for selection and monitoring objectives.
- If some data will be collected every week, and other data will be collected only once during the sample season or appropriate index period (e.g., low flow, high temperature, etc.), such should be noted in Section 10B, Sample Design Logistics, in this QAPP.
- Report flows according to the VTDEC "Guidance on Streamflow Observations at Time of Sampling of Rivers and Streams" in addition to your own projects flow categorization methodology.
- Data will be analyze and reviewed for quality assurance, summarized and interpreted on an annual basis. Projects will be required to report to VTDEC at the completion of the project. There will be a training and orientation meeting held in late March or early April organized by VTDEC, but held at VAEL. The Project Coordinator, Field Leader or a designated representative must attend. Besides the

above individuals, that person who will be interacting the most with VAEL from the individual projects should attend. For instance, if a person has been designated the responsibility of sample transport and transfer of the cooler to VAEL staff, that would be a key individual to attend. **Notification of sample delivery is critical for time dependent samples such as turbidity and E. coli.**

- Information should be presented to the local community in a suitable format, be it a press release, public meeting, or another event.
- Data that meets project quality objectives will enter VTDEC's Water Quality data management system as well as the EPA's national water quality data storage system known as STORET.

B. Intended Uses of Data

Instructions: Please place a checkmark beside the uses which are applicable for your project's data.

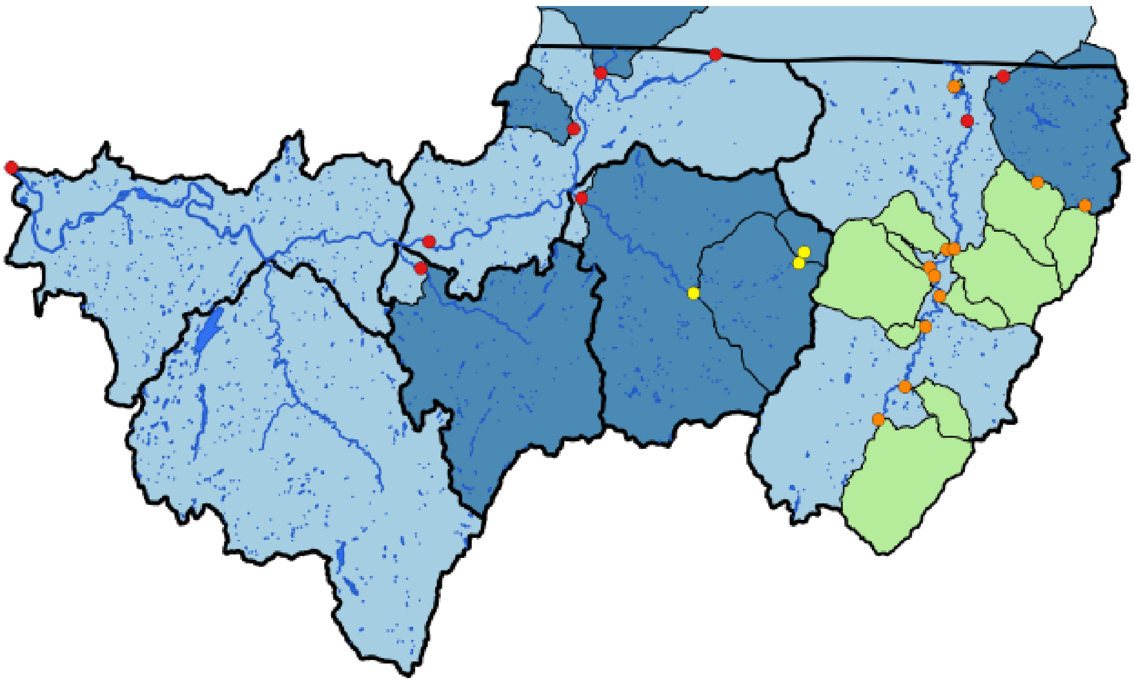
The data generated by projects under this Generic QAPP will serve at least one of the following uses, as specified in project proposals and work plans.

X Track phosphorus concentrations and/or loadings
❑ Identify the presence, density and spread of nuisance aquatic species
X Describe water quality conditions at specific locations
❑ Document the presence and severity of localized problems (e.g. bacteria as pathogen indicators)
X Identify sources of local problems
X Evaluate sedimentation and erosion problems
❑ Evaluate habitat & embeddedness with regards to aquatic life use
X Educate school children and local communities about water quality, and any problems and improvements.
X Evaluate the effectiveness of restoration projects and other management activities
❑ ____
____
____

C. Map of Area and Waterbody

For individual projects under this generic QAPP, a map is to be provided here that identifies waterbody and sample sites.

Instructions: Insert the map for your project here.



D. Table 6a - Project Timetable

Instructions: Fill in the following table with the correct dates for your project. If your project does not include any of the listed activities, note why. If there are activities not listed, add them to the table. If you have already completed a timetable you may attach it in lieu of this one.

Activity	Projected Start Date	Anticipated Completion Date
Project Planning Meeting	March 2018	April 2018
Fill out and submit this QAPP to VTDEC	April 2018	April 2018
QAPP Approved by VTDEC	April 2018	May 2018
Training Volunteers/Samplers	April 2018	May 2018
Sampling Begins	May 2018	May 2018
Sampling Ends	October 2018	October 2018
Analytical Results Evaluated * Check/Correct Errors Due to Math Miscalculations or Transferring Data from Field/Lab Forms * Confirm Useable Data * Separate Unusable Data	January 2019	February 2019
Data Entered into Project Database	January 2019	February 2019
QC Review of Database	January 2019	February 2019
Data Summarized	February 2019	March 2019
Submit Final Report	March 2019	April 2019
Presentation(s) of Information at Local Meeting (s) or other venue(s)	March 2019	March 2019

7. Project Quality Objectives

Instructions: Please check to ensure that you can meet the accuracy and precision requirements, and if you cannot please indicate and explain. Check the appropriate boxes on the left for parameters to be sampled in your project. If you plan to use a different field or laboratory method add your information to this table and provide the written procedures when submitting this completed project QAPP.

A. Data Precision, Accuracy, Measurement Range Requirements

Table 7a – Field Analysis Protocols for Water Samples

Parameter	Field Analysis Method	Method Reference[1]	Accuracy[2]	Precision[2]
Transparency	Secchi Disk	Vermont Lay Monitoring Program Manual, 2000	--	+/- 0.1 meter
Dissolved Oxygen by Meter	DO Meter or multiprobe	*Standard Methods for the Examination of Water and Wastewater*, 20 ed., 4500-O G. Membrane Electrode Method	+/- 0.5 mg/l	+/- 0.5
Temperature	Alcohol Thermometer	Testing the Waters; Chemical & Physical Signs of a River, River Network,1997	+/- 1.0º C	+/- 1.0º C
pH	pH Meter or multiprobe	*Standard Methods*, etc.,20th ed., 4500-H^+B Electrode Method	± 0.2 std.un.	± 0.2 std.un.

Footnotes:
1–The full citations for each of these publications are:
APHA, AWWA & WEF. Standard Methods for the Examination of Water and Wastewater, prepared and published jointly by the American Public Health Association, American Water Works Association and Water Environment Federation, 20th ed., 1998
Behar, Sharon. Testing the Waters; Chemical & Physical Vital Signs of a River, published by River Network, 1997
Vermont Agency of Natural Resources. Vermont Lay Monitoring Program Manual; 2000, by Water Quality Division, Vermont Dept. of Env. Conservation.

2– Accuracy of field protocols will generally not be measured in the field**,** but at training and quality control check sessions. Accuracy and Precision measures given are generic. Individual protocols may themselves provide more accurate and precise measures than expressed here.

Table 7b – Primary Laboratory Analysis Protocols for Water Samples:

Parameter	Reporting Limit [A]	Accuracy [B] (% Recovery)	Estimated Precision for Field Duplicates [C] (RPD)	Laboratory Precision (RPD)	Analytical Method Reference [B]
Chlorophyll-*a*	0.5 ug/l	--	≤15%	10%	EPA 445.0
Total and dissolved phosphorus	5 μg/l	85-115%	≤30%	15% [B]	*Std. Methods* (21st ed.) 4500-P H
E. coli [D, E]	1 MPN /100ml	N/A	125% (<25cfu) 50% (>25 mpn)	125% (<25cfu) 75% (>25 mpn)	*Std. Methods* (21st ed.) 9223 (Colilert)
Chloride (Cl)	2 mg/l	85-110%	≤ 5%	≤ 5%	*Std. Methods* (21st ed.) 4500-Cl G
Total Suspended Solids (TSS)	1 mg/l	80-120%	≤15%	≤ 15%	*Std. Methods* (21st ed.) 2540D
Turbidity	0.2 NTU	N/A	≤ 15%	≤15%	EPA 180.1
Alkalinity	1 mg/l	N/A	≤5% (>20 mg/l) <15% (<20 mg/l)	≤5% (>20 mg/l) <15% (<20 mg/l)	*Std. Methods* (21st ed.) 2320B
Total nitrogen (TN) (persulfate digestion)	0.1 mg/l	85%-115%	≤20%	≤10%	*Std. Methods* (21st ed.) 4500-N C
Total NOx	0.05 mg/l	85%-110%	≤10%	≤5%	EPA 353.2

(A) - Reporting Limit is the minimum reported value (lowest standard in calibration curve or MDLx3)
(B) - Section 5.0, Vermont Dept. of Conservation Laboratory QA Plan, 2008
(C) - Generated by the analysis of field duplicates
(D) - EPA's New England Regional Laboratory recommends that all samples resulting in Too Numerous to Count (TNTC) growth, defined as greater than 200 colonies on the membrane filter, be recorded as "TNTC."
(E) -As a quality control check on bacteria counts, if two or more analysts are available, each should count colonies on the same membrane plate for about 10% of the samples, and agree on the # of colonies within 10%.

Instructions: For the following sections (B, C, D), which address data representativeness, comparability and completeness, the VTDEC maintains a minimum goal of 80%. On rare occasions a project requires higher goals and this may be a point of discussion during the review of your QAPP. If you think your project might be unable to meet the minimum goal, please provide the information in the lines provided below each element.

B. Data Representativeness

Samples collected at locations and depths described in this QAPP will reflect conditions of individual waterbodies and tributaries in Vermont. To ensure representativeness all samples will be collected, preserved and analyzed according to the procedures in this QAPP, and within the specified holding times. Those results not meeting the project quality objectives of this program will be flagged and reviewed to determine if appropriate quality controls are in place. They should be discussed in the data report and may be excluded from entry into VTDEC's long-term water quality data archive referred to as WQX.

C. Data Comparability

All samples for each specific parameter will be collected and analyzed using the respective procedures described in this QAPP to ensure that comparisons between different sample sites, sample dates, depths and projects can be appropriately made.

NOTE: The information in Table 7c – Project Completeness (below) about field samples, and field and lab duplicate samples collected, is <u>not needed for the QAPP submission</u>; however, please review it so you will be able to submit it at the end of the project.

If a project compares historical data with the data generated under this QAPP, the historical data should have used SOPs that provide the same data quality as defined here.

D. Data Completeness

At least 80% of the anticipated number of samples will be collected, analyzed and determined to meet data quality objectives for the project to be considered successful. Individual projects may have different completeness goals, which will be presented in the table below. The data report for each project will contain information, similar to that presented below, containing the number of samples meeting the data quality objectives and the resulting calculation of "Percent Complete".

Table 7c – Project Completeness

Parameter	Number of Samples Anticipated	Number of Valid Samples Collected & Analyzed	Percent Complete *
Chlorophyll-*a*			
Chloride			
Total and Dissolved Phosphorus	372		
E. coli			
Total Suspended Solids			
Transparency			
Alkalinity			
pH			
Turbidity	234		
Total nitrogen (persulfate digestion)	372		
Total NOx			
Si, dissolved			
Dissolved Oxygen			
Conductivity			
Temperature			

* Percent Complete = # of Valid Samples Collected and Analyzed / # of Samples Anticipated

8. Training Requirements and Certification

A. Training Logistical Arrangements

Instructions: Make changes as needed to the table below to reflect your project. Note however that what is contained in this table is, for the most part, considered minimal training.

The Project Coordinators will arrange in-house volunteer training sessions and keep a record of each volunteer's training needs and accomplishments. Project Coordinators are encouraged to discuss their training needs with the VTDEC-LPP Coordinator.

Table 8a - Training Process

Type of Volunteer Training	Frequency of Training/Certification
Initial orientation to the Project	Each March or April
Recruitment and training of citizen scientists in sampling and analysis to be provided by project coordinator	One full training session annually before each sampling season begins
On-site visit by Project Coordinator	Once during sampling season
Other: Under consideration: On-site visit by LPP Coordinator or other VTDEC staff On-line testing Video Suggestions???	

9. Documentation and Records

Instructions: Add any additional information on documentation and records, if applicable.

Documentation for each project will include 1) sample forms 2) field sheets and 3) written assessments from on-site visits of Project Leader & QA Coordinator (see Section 8A). The Project Coordinator will maintain a record of each volunteer's training and participation in projects. Field sheets will be filled out by the Sampling Volunteer and maintained by the Project Coordinator. **Each group will attach a copy of their field sheets to the individual project's version of this QAPP they submit.** All samples submitted for laboratory analysis will be accompanied by VTDEC's sample submission form (Appendix B).

10. Sampling Process Design

A. Rationale for Selection of Sampling Sites

Instructions: There are several acceptable sampling designs depending on the purpose of your project. Please review the descriptive information, adding project specific information as needed in the space provided. On the following table check the appropriate box(es) and insert the numbers that reflect your project sampling design. Submit an additional map or diagram which locates all sampling sites and important landmarks, if map under #6 does not show this. If you have this information prepared in another format, it can be substituted here.

SAMPLE SITE DESCRIPTION – Please provide a description of each sample site, and note the approximate location on the submitted map. Provide road names if sampled from bridges and if sampled up/downstream from bridge. If sampled from private property please get permission and record street address here. **All new sites from previous years must be clearly marked as new so that they can be readily added to the LaRosa site simplifying the year end QC process.**

Site #	Description
4. (M-NTBF)	N. Troy - Missisquoi River, Big Falls, below the falls
6. (M-ER)	East Richford - Missisquoi River, Richford Village downstream of border bridge
12. (M-EF)	Enosburg Falls - Missisquoi River, below Falls & Village
19. (M-SMR)	Swanton - Missisquoi River, Monument Rd. at 1578 Monument Rd
5. (T-NTMC)	N. Troy – Mud Creek, Bear Mountain Rd.

8. (T-EBTR)	East Berkshire – Trout River
10. (T-ETBDH)	Enosburgh - Tyler Branch, Duffy Hill downstream of bridge
22. (T-RNB)	Richford – North Branch, Pinnacle Rd
33. (T-BGB)	Berkshire – Godin Brook, Marvin Rd
50. (T-JBA)	Westfield – Jay Brook, off 242, above logging road repairs
51. (T-JBB)	Westfield – Jay Brook, off 242, below logging road repairs
47. (T-TRMC)	Montgomery - Trout River, above Montgomery Center below Three Holes swimming area
20. (T-NCMC)	Newport Center – Mud Creek, Route 100
26. (T-NCTM)	Newport Center – trib to Mud Creek
54. (T-LEB)	Lowell – East Branch
55. (T-LLCB)	Lowell – LeClaire Brook
56. (T-WT)	Westfield – Unnamed trib
57. (T-WLT)	Westfield – Lilly Branch
58. (T-WTB)	Westfield – Taft Brook
59. (T-WTL)	Westfield – Unnamed trib, Loop Rd
60. (T-TCB)	Troy – Coburn Brook
61. (T-TBB)	Troy – Beetle Brook
62. (T-TT)	Troy – unnamed trib
63. (T-NHDB)	Newport Center – Headwaters Dunn Brook
64. (T-NTDB)	North Troy – Dunn Brook

PHYSICAL HABITAT & SURROUNDING FEATURES – Characteristics of the physical habitat, land use in the immediate area, or specific features like distance from point source discharges. This will help determine where sample sites are located (e.g., macroinvertebrate sampling may take place only in riffle areas). <u>Where this is the case, please describe the rationale for site selection</u>. **Sampling below waste water treatment plants (WWTP) must be done with consultation with the LPP Coordinator. VTDEC values this sampling approach, but for this data to be meaningful it must be collected below the waste management zone (WMZ) and VTDEC will provide the minimum distance and appropriate location in the stream. In many cases, it will line up with an existing monitoring station and provide chemistry data to supplement the VTDEC's Ambient Bio Monitoring Network.** The intensity of the description will depend on individual projects, and must meet the requirements necessary to use the data for the project's purpose.

Site #	Habitat/Surrounding Features
4. (M-NTBF)	Forested, town-owned land used for recreation
6. (M-ER)	Lawn, paddler take-out, Border station
12. (M-EF)	Recreation land, paddler put-in
19. (M-SMR)	Residential, lawn
5. (T-NTMC)	Agricultural, dirt road
8. (T-EBTR)	Agricultural, paved road
10. (T-ETBDH)	Agricultural, dirt road
22. (T-RNB)	Agricultural, dirt road
33. (T-BGB)	Agricultural, dirt road – large farm complex North of site
50. (T-JBA)	Forested, paved road
51. (T-JBB)	Forested, near paved road
47. (T-TRMC)	Forested, swimming area, dirt road
20. (T-NCMC)	Business, lawn
26. (T-NCTM)	Agricultural, dirt road
54. (T-LEB)	Agricultural
55. (T-LLCB)	Forested, near agriculture
56. (T-WT)	Forested
57. (T-WLT)	Agricultural
58. (T-WTB)	Agricultural
59. (T-WTL)	Agricultural
60. (T-TCB)	Open, near agriculture
61. (T-TBB)	Agricultural
62. (T-TT)	Forested, near town recreation lands
63. (T-NHDB)	Forested, culvert, paved road

64. (T-NTDB)	Forested, near agriculture

LOCATIONAL DATA – The latitude/longitude of each sample site will be recorded in decimal degrees using a Global Positioning System. If this is not available, map coordinates including the map datum from which the coordinates were derived must be provided.

Site #	**Latitude**	**Longitude**
4. (M-NTBF)	44.973888	-72.388054
6. (M-ER)	45.011391	-72.588058
12. (M-EF)	44.905560	-72.815002
19. (M-SMR)	44.945831	-73.146667
5. (T-NTMC)	44.998890	-72.358444
8. (T-EBTR)	44.930279	-72.694168
10. (T-ETBDH)	44.890560	-72.821388
22. (T-RNB)	45.000832	-72.679169
33. (T-BGB)	44.969231	-72.700562
50. (T-JBA)	44.900080	-72.517527
51. (T-JBB)	44.893919	-72.521766
47. (T-TRMC)	44.876928	-72.60528
20. (T-NCMC)	44.948901	-72.305283
26. (T-NCTM)	44.96915000	-72.31564000
54. (T-LEB)	44.805890	-72.459120
55. (T-LLCB)	44.825040	-72.439120
56. (T-WT)	44.859530	-72.422060
57. (T-WLT)	44.877150	-72.410270
58. (T-WTB)	44.888270	-72.413350
59. (T-WTL)	44.892610	-72.416780
60. (T-TCB)	44.901510	-72.403850
61. (T-TBB)	44.902320	-72.398300
	44.993400	-72.398520

62. (T-TT)		
63. (T-NHDB)	44.921720	-72.302030
64. (T-NTDB)	44.93442000	-72.29769000

LAKES/PONDS WATER QUALITY– Generally, each Lake/Pond will be sampled for water quality parameters by the state-directed, and citizen monitored Lay Monitoring Program (LMP), or other entity of VTDEC's Monitoring, Assessment, and Planning Program (MAPP). However, lake tributaries can be significant sources of sediment and nutrients. So, the LPP encourages LMP lakes with increasing nutrients and potentially contributing tributaries to apply to the LPP. If you are not sure of the trophic status, contact the VTDEC's LMP.

RIVERS/STREAM WATER QUALITY – Wadeable stream samples will generally be collected away from the edge of the stream, near the center of the stream (centroid of flow). Water quality samples will be taken from just below surface to near bottom. Individual grab samples, composited grab samples or a core sample can be collected from the water column. Specific projects will designate the type of sample, which must be in accordance with quality control requirements and the purpose of each project.

Depending on the bottom substrate, water quality samples from deep rivers should be collected at mid-depth, but no closer than 0.5 meters from the sediment interface. If the substrate is very soft/silty a greater distance may be designated so as not to contaminate the water sample or the sampling device

Instructions: Please check the types of samples that will be collected for your project. If your sampling method(s) differ from the description, please describe what you intend to do.

For this specific project, the samples will be collected by:

X Individual grab samples that will be analyzed separately
❑ Time composite samples – the same volume is collected at constant time intervals (e.g., 4 hours apart) at the same site, and combined to form a composite sample for that site
❑ Core samples – a single sample collected vertically in the water column across a series of depths.

<u>If sampling for your project will vary from this design, please describe it below.</u>

Instructions: Please fill in and modify the following table as appropriate for your project. If you have a separate summary of this information, you can attach it in place of this table.

Table 10a – Overview of Types of Waterbody, Sample Site(s) & Sample Depth(s)

TYPE OF WATERBODY	SAMPLE SITE(s) (at each waterbody)	SAMPLE DEPTH(s) (at each site)	
How many LAKE or POND tributaries will be sampled? ____			
Name of Lake/Pond tributary:	❑ Inflow ❑ Outflow ❑ At Mouth ❑ Other Location	❑ Surface Water ❑ Mid-Depth ❑ Near Bottom ❑ Bottom Water ❑ Surface to Bottom Profile ❑ Bottom Substrate	❑
Name of Lake/Pond tributary:	❑ Inflow ❑ Outflow ❑ At Mouth ❑ Other Location	❑ Surface Water ❑ Mid-Depth ❑ Near Bottom ❑ Bottom Water ❑ Surface to Bottom Profile ❑ Bottom Substrate	❑
How many RIVERS & STREAMS will be sampled? 2 rivers and 15 streams			
Name of River/Stream: Missisquoi River, Site 4	❑ Upstream of __________ X Downstream of Big Falls, N. Troy X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect Name of River/Stream:
Name of River/Stream: Missisquoi River, Site 6	❑ Upstream of __________ X at Quebec border, E. Richford	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom	❑ Upstream to Downstream Transect ❑ Cross Transect

TYPE OF WATERBODY	SAMPLE SITE(s) (at each waterbody)	SAMPLE DEPTH(s) (at each site)	
	X Wadeable ❑ Deepwater	❑ Surface to Bottom Profiles ❑ Bottom Substrate	
Name of River/Stream: Missisquoi River, Site 12	❑ Upstream of ___________ X Downstream of dam, Enosburg Falls X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Missisquoi River, Site 19	❑ Upstream of ___________ X at Monument Rd., Swanton X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Mud Creek, Site 5	❑ Upstream of ___________ X East of Newport Ctr. X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Trout River, Site 8	❑ Upstream of ___________ X Downstream of Rte 118 crossing, East Berkshire X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Tyler Branch, Site 10	❑ Upstream of ___________ X at Duffy Hill Rd., Enosburg X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: North Branch, Site 22	❑ Upstream of ___________ X at Pinnacle Rd., Richford	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom	❑ Upstream to Downstream Transect ❑ Cross Transect

TYPE OF WATERBODY	SAMPLE SITE(s) (at each waterbody)	SAMPLE DEPTH(s) (at each site)	
	X Wadeable ❑ Deepwater	❑ Surface to Bottom Profiles ❑ Bottom Substrate	
Name of River/Stream: Godin Brook, Site 33	X Upstream of Marvin Road junction X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Jay Brook, Site 50	❑ Upstream of ___________ X Upstream of culvert that crosses 242 above where the backcountry skiing access is X Wadeable Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles Bottom Substrate	❑ Upstream to Downstream Transect Cross Transect
Name of River/Stream: Jay Brook, Site 51	❑ Upstream of ___________ X through forest behind the last house on 242, heading up to Jay Peak X Wadeable Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles Bottom Substrate	❑ Upstream to Downstream Transect Cross Transect
Name of River/Stream: Trout River, Site 47	❑ Upstream of ___________ X of Route 58, below Three Holes swimming area, above Montgomery Center X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Mud Creek, Site 20	❑ Upstream of ___________ X Behind LNM Auto, Newport Center X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream:		❑ Surface	

TYPE OF WATERBODY	SAMPLE SITE(s) (at each waterbody)	SAMPLE DEPTH(s) (at each site)	
Mud Creek, Site 26	❑ Upstream of ___________ X at Bear Mountain Rd., North Troy X Wadeable ❑ Deepwater	❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: East Branch, Site 54	X Upstream of Burgess Branch, off Rte 58, Lowell ❑ ___________ X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: LeClair Brook, Site 55	X Upstream of confluence with Missisquoi, off Rte 100, Lowell ❑ ___________ X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Unnamed Trib, Site 56	❑ Upstream of ___________ X off Rte 100, Westfield X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Lilly Branch, Site 57	X Upstream of confluence with Missisquoi, near Cemetery Rd, Westfield ❑ ___________ X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Taft Brook, Site 58	❑ Upstream of ___________	❑ Surface ❑ Mid-Depth ❑ Near Bottom	❑ Upstream to Downstream Transect

TYPE OF WATERBODY	SAMPLE SITE(s) (at each waterbody)	SAMPLE DEPTH(s) (at each site)	
	X near confluence with Missisquoi, off Loop Rd, Westfield X Wadeable ❑ Deepwater	❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Cross Transect
Name of River/Stream: Unnamed Trib, Site 59	❑ Upstream of ___________ X near confluence with Missisquoi, off Loop Rd, Westfield; North of Taft Brook X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Coburn Book, Site 60	X Upstream of confluence with Missisquoi, off Rte 100, Troy ❑ ____________ X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Beetle Brook, Site 61	X Upstream of confluence with Missisquoi, through fields off Loop Rd, Troy ❑ ____________ X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Unnamed tributary, Site 62	❑ Upstream of ___________ X Behind Town recreation area, off Sewer Plant Rd, North Troy X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
		❑ Surface	

TYPE OF WATERBODY	**SAMPLE SITE(s) (at each waterbody)**	**SAMPLE DEPTH(s) (at each site)**	
Name of River/Stream: Dunn Brook, Site 63	❑ Upstream of ___________ X at culvert on Rte 105, North of 100/105 Junction, Newport X Wadeable ❑ Deepwater	❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect
Name of River/Stream: Dunn Brook, Site 64	❑ Upstream of ___________ X Off Rte 105, through farm field north of Hillakers Store, Newport X Wadeable ❑ Deepwater	❑ Surface ❑ Mid-Depth ❑ Near Bottom ❑ Bottom ❑ Surface to Bottom Profiles ❑ Bottom Substrate	❑ Upstream to Downstream Transect ❑ Cross Transect

B. Summary of Sample Collection

Individual projects will identify the number of samples, sampling frequency and specific sampling method for each parameter in accordance with their objectives. During sample collection, all sample apparatuses are to be rinsed 3x in sample water prior to collection of the actual sample (**except where noted**). Filtration apparatuses and bottle rinse guidelines are shown in Table 11a.

Table 10b – Sample Collection

	Type of Sample/ Parameter	Total Number of Samples (Indicate if this is for the project or per week, etc.)	Sampling Frequency (How often – once/weekly/bi-weekly?)	Sampling Method (Grab, Discrete-depth sampler, depth-integrating core sampler, meter) *
Biological	*E. coli*			
Chemical	Chlorophyll-*a*			
	Chloride			

	Total and Dissolved Phosphorus	372 (25 sites; 12 sampling dates plus 72 field blanks, duplicates and spikes)	Every 2 weeks	grab
	Transparency			
	Dissolved Oxygen			
	Temperature			
	pH			
	Alkalinity			
	Total Nitrogen (persulfate digestion)	372 (25 sites; 12 sampling dates plus 72 field blanks & duplicates)	Every 2 weeks	grab
	Total NOx			
	Si, dissolved			
Physical	Secchi Disk Transparency			
	Total Suspended Solids			
	Turbidity	234 (16 sites; 12 sampling dates plus 42 field blanks & duplicates)	Every 2 weeks	grab
Meters used for data collection (please list make/model of meter(s) or multiprobe(s)	Multiprobe model:			
	pH meter model:			
	Conductivity meter model:			
	Turbidity meter model:			
	DO meter model:			

* see Appendix A, please list sampler type (e.g., Kemmerer, Van Dorn, Hose etc.).

11. Sampling & Analysis Methods

Field and laboratory analytical methods are provided in Section 7, and Field Sampling Methods are listed in Section 10 and in Appendix A. The table below presents containers, preservation and holding times used for projects under this QAPP.

INSTRUCTIONS: If your sampling methods are listed in Appendix A, please list the specific protocols you are using in the table above. If your sampling

protocol is different from the descriptions in Sections 7 and 10 or the examples in Appendix A, please attach your protocol(s) to this QAPP.
Check off the appropriate parameters in the table below.

Table 11a –Sample Containers, Preservation & Holding Times [A]

Parameter/Measure	Container	Field Rinse	Preservation	Hold Time [B]
Total / Dissolved Phosphorus	60 ml glass tube [C]	**NO RINSE**, 3X rinse of filtration apparatus w/ sample water or DI	Dissolved phosphorus filtered using *new* 0.45 *u* filter membrane	28 days
E. coli	290ml or 120ml sterile plastic round	**NO RINSE**	Cool to <10°C	8 hours
Chlorophyll-*a*	Filter - Whatman GF-F, 47mm diam., 0.7 µm pore size, stored in black jar	**NO RINSE** of filter, 3X Rinse of filtration apparatus w/ sample water or DI	Freeze (20 to -70ºC), Dark	21 days
Chloride	50 ml polycarbonate centrifuge tube	3x rinse with sample	Cool to <6°C	28 days
Total Suspended Solids	1L plastic, round	3x rinse with sample	Cool to <6°C	7 days
Turbidity	250 ml plastic square	3x rinse with sample	Cool to <6°C	48 hours
Total Nitrogen (persulfate digestion)	50 ml polycarbonate centrifuge tube	3x rinse with sample	Cool to <6°C, acidified within 48h with conc. H_2SO_4 to pH <2	28 days
Total NOx	**50 ml polycarbonate centrifuge tube**	3x rinse with sample	Cool to <6°C, acidified within 24h with conc. H_2SO_4 to pH <2	28 days
Si, dissolved	50 ml polycarbonate centrifuge tube	3x rinse with filtrate or with DI	Cool to <6°C, filter using *new* 0.45*um* filter membrane	28 days
Alkalinity	250 ml plastic square	3x rinse with sample	Cool to <6°C	14 days
DO - Meter	(*in situ*)	3x rinse of probe	None	Direct Analysis
pH Meter	(*in situ*)	3x rinse of probe	None	Direct Analysis
Temperature - Thermometer [D] or meter	(*in situ*)	**NO RINSE**	None	Direct Analysis

Parameter/Measure	Container	Field Rinse	Preservation	Hold Time [B]
Conductivity meter	*(in situ)*	3x rinse of probe	None	Direct Analysis
Turbidity meter	(*in situ*)	3x rinse of probe	None	Direct Analysis

Footnotes:
A – A copy of some field SOPs are attached as Appendix A.
B – Holding times are in accordance with the Code of Federal Regulations, title 40 (Protection of Environment), part 136, section 3 (or 40CFR136.3), and are defined in the VTDEC LaRosa Laboratory Quality Assurance Project Plan.
C – The VT DEC analyzes the entire sample volume in the sampling container, so no acidification is needed. Extra containers of sample will be needed to allow the VT DEC lab to analyze spiked samples.
D – Mercury **thermometers <u>absolutely shall not</u> be used in the field**.

12. Sample Handling and Custody Procedures

Instructions: Please attach copy of your project-specific field form here.
All samples collected in conjunction with the project will be accompanied by a field sampling form identifying at minimum the sample location, date, time, and collector. In addition, a laboratory sample submission form must accompany all samples submitted to the laboratory. **All changes from prelog through collection must be made on the laboratory printout received along with the bottles.** Sample field forms, and a laboratory submission form, are in Appendix B.

Attached at end of document.

13. Analytical Methods Requirements

Information for this section is included in Tables 7a and 7b.

14. Quality Control Requirements

Instructions: For sections A, B, and C, check only those that are applicable to your project. The goal for quality control checks is 10% replication and blank analysis. Please note if your goal varies from this.

A. Field QC Checks

At least one Field Duplicate and one Field Blank will be submitted for every ten samples collected. Additional types of field quality control samples needed will depend on the parameter and the collection method, and are at the discretion of the Project Manager and QA Manager.

<u>X Field Duplicate (required)</u> – a check on water quality, sampling & analysis consistency. This is a replicated sample collected at the same point in time and space to be considered identical. A field duplicate is a second sample from a second sampling event, collected immediately after the first sampling and given a separate Lab ID number. Otherwise put, these separate samples are said to represent the same population and are carried through *all steps* of the sampling and analytical procedures in an identical manner. They are used to assess precision of the total method, including sampling, analysis, and site heterogeneity.

X Field Blanks (required) – a check for contamination (Accuracy/Bias) in the field by processing laboratory-supplied deionized through the sampling train. This checks for contamination introduced from the sample container(s) or from field contamination.

X Matrix Spike (required only for phosphorus) - This allows the laboratory to perform analytical replication that separates variability in sampling from variability in analytical processing. A spike is a second sample bottle, filled from the same sample collection as the first sample. For grab samples, there is no functional difference between a field duplicate and a matrix spike.

* **Equipment Blanks** – measures contamination (accuracy/bias) – a sample of water, free of measurable contaminants, is poured over or through decontaminated field sampling equipment that is considered ready to collect or process an additional sample. The purpose of this is to assess the adequacy of the decontamination process and whether equipment needs special cleaning to make sure it doesn't have something that contaminates the sample or influence the results

* **Field Split Samples** – Two or more representative subsamples are taken from one environmental sample in the field and sent to two different labs for analysis. Prior to splitting, the environmental sample is well-mixed to correct for sample inhomogeneity that would adversely impact sample data comparability. Field splits are used to assess sample handling procedures from field to laboratory and inter-laboratory comparability and precision.

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* **Equipment Calibration Checks** – A check on a meter's accuracy – the verification of the initial calibration that is required at certain times during the sampling day or while analyzing a large number of samples. Checking to see if a pH meter is maintaining its calibration would involve taking a reading of standard solutions (e.g., pH buffers of 4, 7, or 10, etc.). For projects that include long-term repetitive sampling at several sites, the site at which a field quality control sample is collected should change to include at least one duplicate sample at each sample location during the course of the project.

B. Laboratory QC Checks

Laboratory QC samples may include any of the following, depending on the parameter, and are handled by the VAEL as described in the VAEL Quality Assurance Plan.

15. Instrument/Equipment Testing, Inspection, and Maintenance Requirements

The Project Coordinator is responsible for ensuring equipment and instruments are maintained according to standard operating procedures and manufacturer requirements. In preparing for a sampling event, equipment will be inspected and tested by the sampler prior to its intended use. A maintenance log will be maintained by the Project Coordinator for all mechanical and electronic equipment. Any equipment that does not meet the requirements necessary for producing data in accordance with the data quality objectives of specific projects will not be used for sample collection or analysis. Additional equipment (non-mechanical and non-electrical), including buckets, rope, thermometers etc. should be maintained according to the standard operating procedure.

Table 15a - Equipment for Project

Equipment Type	Manufacturer	Inspection Frequency	Type of Inspection
DO Meter			
Multiprobe model:			
pH meter model:			
Conductivity meter model:			
Turbidity meter model:			
GPS Unit			

6. Instrument Calibration and Frequency

***Instructions: Please complete the table below*.**

The Project Coordinator will ensure that all field instruments are checked for good working order prior to the day of sample collection, preferably at least 24 hours prior to sampling. On the day of sample collection, or on a routine schedule as defined below, equipment will be calibrated and checked for accuracy before any samples are collected in accordance with the standard operating procedures. The recalibration of meters will be verified by recording each meter's reading of a standard used (or against a calibration instrument). If the amount of drift in instrument readings is not acceptable, data will be flagged as suspect. Calibration checks and readings of standards will be recorded on field sheets or another form set up for that purpose. All documentation regarding instrument calibration will be maintained by the Project Coordinator or their designated individual.

Table 16a - Equipment Calibration

Equipment Type	Calibration Frequency	Standard or Calibration Instrument Used

17. Inspection/Acceptance Requirements

The Project Coordinator will ensure that all equipment, instruments and supplies are clean and maintained according to the standards and conditions required to meet project objectives. Sample containers will be of the appropriate size, pre-cleaned for the parameter for which the sample will be analyzed, and supplied by VAEL. Appropriate containers must be used. Bottles not supplied by the VAEL are considered suspect and samples will be rejected, unless lot certification of bottles is provided along with the sample submission. Other materials, such as nets, gloves, rinse bottles, sampling apparatus, buckets, line, etc., will be kept clean and stored properly to prevent contamination that interferes with producing samples and analytical results that meet project objectives.

18. Data Acquisition Requirements

External data (data that is not generated by the project but is to be used as part of the project e.g., meteorological data, flow data) will be used in accordance with the objectives stated in Section 6B of this QAPP, and should have sufficient documentation that it is at least equivalent to the data quality generated as part of this project (see Section 7).

19. Data Management

The generation of accurate data with accompanying documentation, such as field sheets and quality control sample results, is the responsibility of the individual Project Coordinators. Field sheets are inspected daily and signed by the people performing the sampling before leaving a site or completing a sampling "run." Field sheets are given to the Field Leader after the sampling event for review. Within 72 hours, the Leader will contact any samplers whose field sheets contain significant errors or omissions.

The LPP Coordinator will review results after the VAEL Supervisor validates and authorizes the samples that allows sample downloads to begin. The Project Coordinator and QA Coordinator initially review analytical results, and identifies questionable data with regards to results or documentation, as described in the LaRosa Laboratory QA Plan. They are the responsible project members to review all field and lab data to determine usability in the project. The LPP Coordinator also goes through a series of QC processes leading up to the electronic storage of results.

All environmental data generated by projects funded by VTDEC under this project will be submitted to the VTDEC in a commonly used format (such as Microsoft EXCEL© or ACCESS©). After additional QA review, this data will be stored in WQX and later uploaded to STORET, the national water quality data storage system.

The data generated under the laboratory services grants project is the joint property of the VTDEC and the project leads.

20. Assessment and Response Actions

For each project funded, there will be an on-site visit by the Project Coordinator or Quality Assurance Coordinator to observe field sampling and field analysis procedures. Generally, this will be done near the beginning of the project. This is in addition to training procedures described in Section 8. A written checklist should be used for the assessments, maintained by the Project Leader, and copies will be provided with the data report. The Project Coordinator and QA Coordinator will determine if field work follows the written procedures or if there needs to be corrections by additional training or revising protocols. Please refer to Section 22 for additional evaluations and response actions regarding data evaluations.

21. Reports

Written final project reports will be submitted to the LPP Coordinator for all funded projects. These need not be excessively long, but should document data results, quality assurance findings, and any specific local actions suggested by the data results. The reports may vary in content according to the type of project and the expected uses of the information. VTDEC will be working to streamline these report for next year. VTDEC strongly encourages project leaders to plan at least one presentation of their project and its results to the local community.

In addition to a written report, data and metadata (information about the data) will be provided as described in Section 19 above.

22. Data Review, Validation, and Verification

All data are reviewed by the individual Project Coordinator, QA Coordinator, and Data Management Coordinator to determine if data meet QAPP requirements.

Data Analysis QC Checks will include:

- Data entry checks by a second person
- Calculation of measures of data quality.

To validate and verify project data, the Project QA Coordinator will compare computer entries to field or laboratory data sheets; look for data gaps and unexpected, or nonsensical results; inspect field forms and information; review field quality control checks and resulting information; and review graphs, tables and other presentations of data, as needed. Graphing data results with time, by parameter, is a useful way to observe problem data points.

Errors in data entry will be corrected. Data that are outside the expected range will be flagged for further review or rejected. A second field sample and/or laboratory aliquot will be taken, if possible, to verify the condition and a determination of necessary corrections, if any, will be made. **The LPP Coordinator should be contacted if assistance is needed to identify sources of errors.** Problems with data quality will be discussed in the draft and final reports to the VTDEC. The Percent Completeness table presented in Section 7c will be filled in and included with the data report.

23. Validation and Verification Methods

The following simple measures of data quality should be calculated, and included in the final report:

1) To screen for contamination, the average blank concentration, by parameter, should be calculated. This average value should be as close as practical to the Reporting Limit listed in Table 7b.

2) To assess the precision of results, the “Mean Relative Percent Difference” between field duplicate samples should be calculated. The average RPD should be less than or equal to the Estimated Precision listed in Table 7b. This simple measure is calculated as follows:

$RPD_{\text{field duplicate pair 1}}$ = absolute value ($sample_1$-$sample_2$) / average ($sample_1$ and $sample_2$);

and,

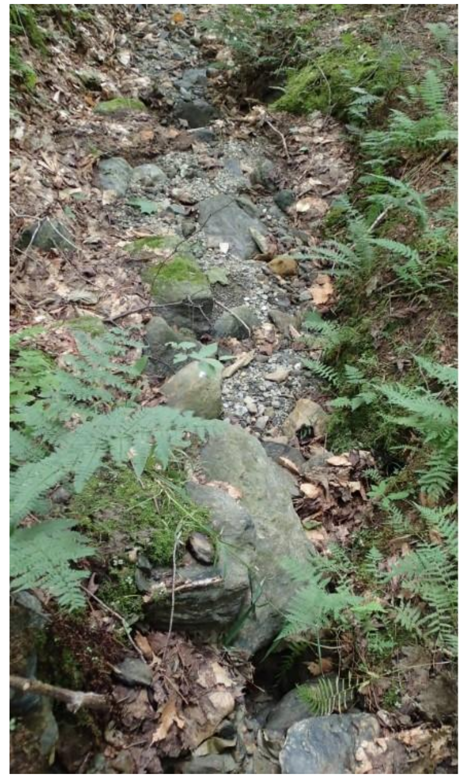
The Mean RPD for “n” duplicate pair = average ($RPD_{\text{pair 1}}$ + $RPD_{\text{pair 2}}$ + ... + $RPD_{\text{pair n}}$)

24. Reconciliation with Project Quality Objectives (PQOs)

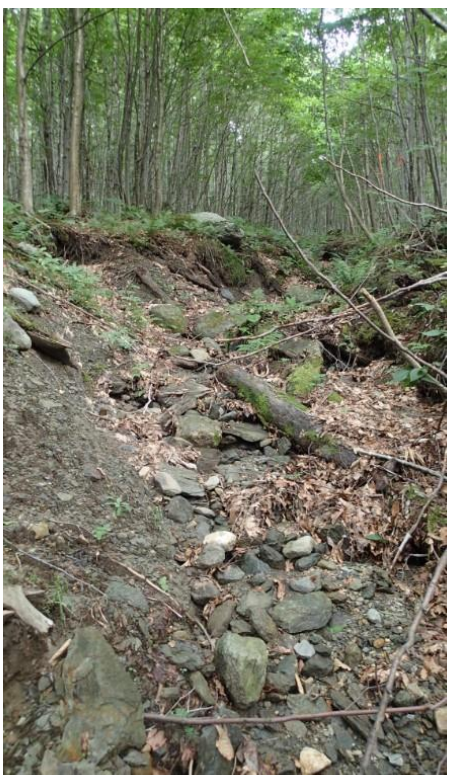
As indicated above, mean blank concentrations and mean relative percent differences will be compared to data quality objectives established in Table 7b.

Appendix B: Photos of the Logging Road Repair Site

Before photos show the erosion and gullies that were rampant along the skid trails.








After photos show repaired gullies and functioning water bars.