**1. Title and Approval**

1. **Specific Project in cooperation with VTDEC/VAEL “2018 Volunteer LaRosa Partnership Program Analytical Services Grant:**

**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’s Name)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Name of Your Organization)

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Date)

**Project Coordinator Signature/Date**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Project QA Officer Signature/Date**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Project QAPP Prepared by**: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**VTDEC LaRosa Partnership Program Coordinator’s Approval/Date***:*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*James Kellogg*

*VTDEC LaRosa Partnership Program Coordinator*

1. **Generic Volunteer-Based Water Quality Monitoring Project QAPP:**

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

(Project Name)

VT Department of Environmental Conservation

(Responsible Agency)

April 9, 2018

(Date)

*Initial 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.)***

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| A. | Examples of Acceptable Field Standard Operating Procedures (Field SOPs) |  |
| B. | Examples of Acceptable Field Sheets and LaRosa Laboratory Sample Submission Prelog Form |  |
| C. | VTDEC Citizen’s Guide to Bacteria Monitoring |  |

**3. Distribution List**

1. Names and telephone numbers of those receiving copies of this QAPP.
2. Jim Kellogg, VT Department of Environmental Conservation. Watershed Management Division, 1 National Life Drive, Main Building – 2nd Floor, Montpelier, VT 05602-3522. 1(802) 490-6146. Jim.Kellogg@vermont.gov
3. Elijah Schumacher, Vt Department of Environmental Conservation. Watershed Management Division, 1 National Life Drive, Main Building – 2nd Floor, Montpelier, VT 05602-3522. 1(802) 422-4323. Elijah.schumacher@partner.vermont.gov
4. Daniel Needham, Vt. Agricultural and Environmental Laboratory. University of Vermont, 105 Carrigan Drive, Hills Building, Burlington, VT 05405. 1(802) 585-9808. [daniel.needham@vermont.gov](mailto:daniel.needham@vermont.gov)
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
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***INSTRUCTIONS: please fill in the above 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**

1. Table 4a – VTDEC/VAEL – Primary Contact and their Responsibilities.

|  |  |
| --- | --- |
| **Project Title/Responsibility** | **Name** |
| VTDEC LaRosa Partnership Program (LPP) Coordinator | Jim Kellogg |
| AmeriCorps LPP Assistant Coordinator | Elijah Schumacher |
| VT Agriculture and Env. Laboratory (VAEL) Director | Guy Roberts |
| VAEL Supervisor | Dan Needham |
| Environmental Scientist | Karen Brack |
| Environmental Scientist | Danielle Gregoire |

1. 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. |  |
| **Project Volunteer Coordinator** – responsible for overseeing. volunteer activities, including recruiting, maintaining training and participation records. |  |
| **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. |  |
| **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. |  |
| **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. |  |
| **Project Data Management Coordinator** – Maintains the data systems for the organization, performs data entry, and checks entries for accuracy against field and laboratory forms. |  |

**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 VAEL/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://agriculture.vermont.gov/vael>

***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 must be of interest to both the local association sponsoring the project and to VTDEC - MAPP. Refer to Section 10 B for information in regards to sits selection criteria. 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.

1. **Individual Project Purpose/Task Description**

***Instructions - For Parts A and B below, please check the boxes that apply to your project and add specific information as needed. 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.***

1. **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” (see Appendix B) 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 inr early April organized by VTDEC but held at VAEL. Project coordinators, field and QC coordinators or must attend, but other are welcome. 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. For that reason, VAEL has instituted a sample check in policy. When samples arrive, samples will be checked against the accompanying prelog form to immediately alert the deliverer of any discrepancies, so the issue can be resolved. If not, contact will be made with the project coordinator to remedy.**
* Information must be presented to the local community in a suitable format, be it a press release, public meeting, or another event. Do not release the information until it has been thoroughly validated by the program coordinator.
* 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.

1. **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.

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

1. **Map of Area and Waterbody**

A map is to be provided here that identifies the waterbody and sample sites.

***Instructions: Insert the map for your project here.***

1. **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 |  |  |
| Fill out and submit this QAPP to VTDEC |  |  |
| QAPP Approved by VTDEC |  |  |
| Training Volunteers/Samplers |  |  |
| Sampling Begins |  |  |
| Sampling Ends |  |  |
| Analytical Results Evaluated  \* Check/Correct Errors Due to Math Miscalculations or Transferring Data from Field/Lab Forms  \* Confirm Useable Data  \* Separate Unusable Data |  |  |
| Data Entered into Project Database |  |  |
| QC Review of Database |  |  |
| Data Summarized |  |  |
| Submit Final Report |  |  |
| Presentation(s) of Information at Local Meeting (s) or other venue(s) |  |  |

**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 Reference¹** | **Accuracy2** | **Precision2** |
| 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  VAEL, SOP 5.4 update 9, 1-2014 |
| Total and dissolved phosphorus | 5 μg/l | 85-115% | ≤30% | 15%**B** | *Std. Methods* (21st ed.) 4500-P H  VAEL, SOP 1.6 update 6, 1-2015 |
| 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)  VAEL SOP 3.6 update 6, 1-2015 |
| Chloride (Cl) | 2 mg/l | 85-110% | ≤ 5% | ≤ 5% | *Std. Methods* (21st ed.) 4500-Cl G  VAEL SOP 5.19  Update 3, 1-2015 |
| Total Suspended Solids (TSS) | 1 mg/l | 80-120% | ≤15% | ≤ 15% | *Std. Methods* (21st ed.) 2540D  VAEL SOP 5.11, update 11, 1-2015 |
| Turbidity | 0.2 NTU | N/A | ≤ 15% | ≤15% | EPA 180.1  VAEL SOP 5.12 update 12, 1-2015 |
| Alkalinity | 1 mg/l | N/A | ≤5% (>20 mg/l) <15% (<20 mg/l) | ≤5% (>20 mg/l) <15% (<20 mg/l) | *Std. Method*s (21st ed.) 2320B  VAEL SOP 5.11 update 12, 1-2015 |
| Total nitrogen (TN) (persulfate digestion) | 0.1 mg/l | 85%-115% | ≤20% | ≤10% | *Std. Methods* (21st ed.) 4500-N C  VAEL SOP 1.8  Update 7, 1-2015 |
| Total NOx | 0.05 mg/l | 85%-110% | ≤10% | ≤5% | EPA 353.2  VAEL SOP 1.5  Update 8, 1-2015 |

(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**

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

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.

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”.

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**Table 7c – Project Completeness**

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

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

**8. Training Requirements and Certification**

1. **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 or Assistant Project Coordinator. | Once during sampling season |
| On-site visit by LPP staff | Once/season |

**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 sheet to this QAPP before submitting.** All samples submitted for laboratory analysis must be accompanied by VAEL’s Sample Submission Form.

**10. Sampling Process Design**

1. **Rationale for Selection of Sampling Sites**

***Instructions: There are several acceptable sampling designs depending on the purpose of your project. Please refer to Appendix A for notes on selecting sampling sites best suited to the specifics of your project. 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. Examples of the level of detail sought in site descriptions are included below **All new sites must be clearly marked as new so that they can be added to the data base, simplifying the year end data entry and QC process.**

|  |  |
| --- | --- |
| Site # | Description |
| **LaRosa\_01** | Sampled below Ball Mt bridge on Jamaica Rd. at intersection with Washboro Rd. looking upstream, blue house with lawn on left bank. |
| **South Trib** | Route 111 to Jordan Rd., Jordan Rd. to Birch Point Road to Quigg’s, test on right side of road between spring pipe and culvert |
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**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). Where this is the case, please describe the rationale for site selection. **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. Example descriptions included below

|  |  |
| --- | --- |
| Site # | Physical habitat/surrounding features |
| **Sykes01** | The upstream reaches are steep and forested, with the valley reach experiencing encroachment by development and agriculture. Narrow, intact buffer present. Sample collected from the first driveway to the left off Sykes Hollow Brook Road. |
| **Beaver01** | Beaver Brook upstr of Pawlet. Trib to Flower Brook. Site has grassy buffer. Entire reach is open with no trees. Bottom fairly featureless- may have been cleaned as a ditch in the past, some wetland/E-type stream characteristics. |
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**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** |
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**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:

* 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.

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

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |
| --- |
| **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? \_\_\_\_\_\_\_ |  |  |  |
| Name of River/Stream: | * Upstream of \_\_\_\_\_\_\_\_\_\_ * Downstream of \_\_\_\_\_\_\_\_\_\_\_ * 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: | * Upstream of \_\_\_\_\_\_\_\_\_\_ * Downstream of \_\_\_\_\_\_\_\_\_\_\_ * Wadeable * Deepwater | * Surface * Mid-Depth * Near Bottom * Bottom * Surface to Bottom Profiles * Bottom Substrate | * Upstream to Downstream Transect * Cross Transect |
| Name of River/Stream: | * Upstream of \_\_\_\_\_\_\_\_\_\_ * Downstream of \_\_\_\_\_\_\_\_\_\_\_ * Wadeable * Deepwater | * Surface * Mid-Depth * Near Bottom * Bottom * Surface to Bottom Profiles * Bottom Substrate | * Upstream to Downstream Transect * Cross Transect |
| Name of River/Stream: | * Upstream of \_\_\_\_\_\_\_\_\_\_ * Downstream of \_\_\_\_\_\_\_\_\_\_\_ * Wadeable * Deepwater | * Surface * Mid-Depth * Near Bottom * Bottom * Surface to Bottom Profiles * Bottom Substrate | * Upstream to Downstream Transect * Cross Transect |
| Name of River/Stream: | * Upstream of \_\_\_\_\_\_\_\_\_\_ * Downstream of \_\_\_\_\_\_\_\_\_\_\_ * Wadeable * Deepwater | * Surface * Mid-Depth * Near Bottom * Bottom * Surface to Bottom Profiles * Bottom Substrate | * Upstream to Downstream Transect * Cross Transect |

1. **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 |  |  |  |
|  | Transparency |  |  |  |
|  | Dissolved Oxygen |  |  |  |
|  | Temperature |  |  |  |
|  | pH |  |  |  |
|  | Alkalinity |  |  |  |
|  | Total Nitrogen (persulfate digestion) |  |  |  |
|  | Total NOx |  |  |  |
|  | Si, dissolved |  |  |  |
| Physical | Secchi Disk Transparency |  |  |  |
|  | Total Suspended Solids |  |  |  |
|  | Turbidity |  |  |  |

1. **Summary of Sample Collection (cont’d)**

**Table 10b – Sample Collection**

|  |  |
| --- | --- |
| 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 belowpresents 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. H2SO4 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. H2SO4 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 |
| 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 absolutely shall not 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. |

**13. Analytical Methods Requirements**

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

**14. Quality Control Requirements**

|  |
| --- |
| **Instructions: Check only those that are applicable to your project.** |

1. **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.

+

**Required QC checks**

* **Field Duplicate (required)** – 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.
* **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.
* **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.

**Discretionary QC checks**

* **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

**Discretionary QC checks cont’d**

* **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.
* **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**

See Section 11.2 of the VAEL QMP for a detailed description of the sample analyses performed by the VAEL (VAEL 2016). EPA certified laboratories with current EPA approved laboratory QAPPs are selected for any parameters that needs to be contracted outside of the VAEL.

**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 identify 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. Partners are expected to make use of the water quality reporting templates available on the** [**LaRosa page**](http://dec.vermont.gov/watershed/map/monitor/larosa) **of the DEC website. These templates are intended to standardize reporting conventions across the program and assist in the comparability of results. Partners should use whichever of the five reporting templates best suits the specific goals and purposes of their project. Refer to Appendix A for notes on which template best fits specific project types. Contact Jim Kellogg or Kristen Underwood (**[**southmountain@gmavt.net**](mailto:southmountain@gmavt.net)**) with additional questions regarding the templates.** VTDEC strongly encourages project leaders to plan at least one presentation of their project and its results to the local community.

The full set of data, including flow, temperature, pH, or any other additional parameters not processed by the VAEL (IE: *E.coli* tests from Endyne) will be included as an appendix to the report, following a template provided by the VTDEC.

**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 field duplicate pair 1 = absolute value (sample1-sample2) / average (sample1 and sample2);

and,

The Mean RPD for “n” duplicate pair = average (RPD pair 1 + RPD pair 2 + ... + RPD 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.

**LaRosa Analytical Service Grant Monitoring Categories**

| **Monitoring Category and Reporting Template** | **Monitoring Goal** | **Geographic Targeting** | **Parameters** | **Frequency and Time Frame** | **Flow Targeting\* *Category* (base, freshet or Hydro related) and *Level* (High, Moderate, or Low)** | **Some of the Current LaRosa Partners** |
| --- | --- | --- | --- | --- | --- | --- |
| Waterbody Status:  Spatial/Temporal trend | To understand existing conditions and possible trends, or to identify reference waters, or to confirm established stressors  (i.e. stressor identification) impacting stressed or impaired waters. | Streams or lake tributaries in a watershed that have not been previously sampled or sampled recently, potential reference waters, and stressed or impaired waters where the stressors are not determined. | Total Phosphorus  Total Nitrogen  Turbidity  Conductivity  Alkalinity  Chloride  Total Metals  Also relevant: Temperature  Dissolved Oxygen pH | Biweekly or monthly for 1-3 years, or as needed to meet VT assessment and listing methodology  Generally targeting June - October. | Targeting range of both category and level, if possible | Black River Action Team  ACRWC  Friends of Winooski River  Rethink Runoff Stream Team  SE VT Watershed Alliance  Poultney-Mettawee NRCD  Allen Brook - WCC  Friends of the Mad River |
| Swimming Hole Monitoring: E.coli bar chart/Health Safety Report | Bacteria monitoring so citizens will know when conditions are safe to swim. | Active swimming hole sites where there is none or limited data on E. coli monitoring or where there is a history of elevated E. coli levels. | E. coli  Temperature  Turbidity | Weekly/Biweekly  Generally targeting June -September. | Flows at which swimming use is likely. Generally Base, Low-Moderate | SE VT Watershed Alliance  Friends of the Mad River  Black River Action Team  Huntington River Conservation Commission |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Source Identification:  Loading estimate/flow duration curve | To identify sources of nutrient or bacteria loading (especially NPS) or instances where high flow targeting is essential. | Select sites upstream of reaches yielding elevated pollutant levels or on tributaries to bracket potential sources.  Monitoring can be continued at established sites to evaluate remediation (see treatment effectiveness as well).  Sites may include intermittent streams and drainage swales. | Total Phosphorus Total Nitrogen  Turbidity  Total Suspended Solids (TSS)  *E. coli* | Monthly or biweekly plus targeting high flow conditions. | Targeting event category resulting in moderate to high levels when runoff is increasing stream flow. | Memph. Watershed  Association  Lake Seymour Tributary  Monitoring  Stevens River  ACRWC  So. Chittenden River Watch (SCRW)  Four Rivers Partnership |
| Evaluation of a treatment or management practice: Treatment Effectiveness | To test a specific experimental question on the effectiveness of a treatment. | Variable; often involves sampling off stream (e.g. discharge or drainage). | Total/Dissolved Phosphorus  Nitrogen series  Turbidity or TSS  Other pollutants of concern | Variable based on experimental design | Flow regime often targeted  (freshet or runoff) | Green Wind Farms Project  Friends of No LC |
| Evaluation of a treatment or management practice: Treatment Effectiveness | Waste Water Treatment Facility (WWTF) to assist State in reasonable potential determination. \* | Above and below a WWTF; groups will need to work with VTDEC-MAPP and WWTF operators to ensure sampling occurs during active discharge periods and the downstream site is placed below the waste management zone | Total Phosphorus  Total Nitrogen  Ammonia  Turbidity  Metals  Also relevant: Temperature,  Dissolved Oxygen pH | Generally, the last 2 years of a National Pollutant Discharge Elimination System (NPDES) permit cycle of WWTF | Targeting Base, Low median monthly flows or below | SCRW  Friends of the Mad River  Black River Action Team  SE VT Watershed Alliance  Ottauquechee River Group |

**Guidance on Streamflow Observations at time of**

**Water Quality Sampling of Rivers and Streams**

VT DEC

Flow (discharge magnitude) is an essential observation to be made during the collection of water samples from rivers and streams. The water quality of a river or stream can change dramatically during and immediately following a precipitation or snow melt event. Numerous water quality standards are based on the discharge of a river or stream at the time of sample collection by considering the concentration of a parameter and the duration of that condition. Examples in Vermont are the bacteria standards, proposed nutrient standards, and all potentially toxic parameters including those in Vermont’s Water Quality Standards and Part C list of priority pollutants. A quantitative discharge measurement in a gaged stream is the most precise method and necessary when collecting water quality samples for loading studies. However, a two-part qualitative streamflow observation can greatly increase the value of a water sample when this is not possible. Gaged streamflow data is *not* a requirement for making these qualitative flow observations, which can be made on the spot with little to no ancillary data (though a knowledge of recent weather conditions is helpful).

The VTDEC records the following two stream flow related observations (flow level and category) during the collection of a river or stream water quality sample, and requests its use in conjunction with all stream water quality sampling. The VTDEC will have the ability to incorporate this information into VT DEC’s WQX database.

**Identify flow level - *Low*, *Moderate*, *High*, or *Flood***

**Low -** Streamflow conditions are believed to be low relative to the entire range of flows experienced at the site. If continuous stream gage data were available, streamflow conditions are generally expected to be greater than or equal to these levels 75% of the time (>Q75). Such low flows often occur during the late winter (January-February) and late summer (July-September). Often, the streambed is partially dry with channel bars exposed and it is possible to walk along the edge of a dry streambed.

**Moderate -** Stream is believed to be at a mid-level or average streamflow conditions. These conditions exist approximately 25-75% of the time (Q25-75). This level can occur at any time of the year, and are the most typical flows experienced in the stream. Approximately 90-100% of the stream bed is under water, and the stream bed will be almost full, but not up the sharp incline of the stream bank.

**High -** Stream is well-above an average level of flow. Streamflow conditions are generally expected to be greater than or equal to these levels only 25% of the time (<Q25). These flows generally occur for extended durations in the spring and fall, but can also occur for shorter periods of time in direct response to large rain events at any time of year. The stream may be full from bank to bank (“bankfull flows”), but is neither over its banks nor spilling onto the floodplain along most of its course. This streamflow level is never considered a “base flow” (see below).

**Flood** **–** The stream is experiencing “flood” conditions, as indicated by water levels exceeding bankfull elevation and accessing the floodplain (should a well-defined floodplain exist at the site). Should there be no obvious floodplain feature adjacent to the channel, submergence of terrestrial and woody vegetation or active transport of large woody debris are other indicators of flood conditions. Flows of this magnitude are generally expected to occur less than 5% of the time.

**Identify flow category – *Baseflow*, *Freshet*, or *Hydro***

**Base flow –** A stream’s flow is considered to be at a relatively constant level at the time of sampling, not rising nor dramatically falling in direct response to a rainfall event or snow melt runoff. Subsurface flows account for almost all water reaching streams. The hydrographs of nearby gaged streams have not begun to rise, have fallen to a similar level of that before the flow level rise began, or have leveled off to a steady but higher flow level. A base flow can exist under both low and sometimes moderate flows, but not under a “high” or “flood” streamflow level. The USGS maintains real-time streamflow data at <http://waterwatch.usgs.gov/?m=real&r=vt>. This map and the hydrographs of current and recent conditions can be a helpful tool in identifying baseflow conditions.

**Freshet flow –** A stream is actively rising or falling in response to a rain event or snow melt. The hydrograph of a stream shows an increase in flow, has not leveled off to the pre-event flow levels or stabilized to slightly higher than pre-event levels. Streams can be turbid under these conditions due to stormwater runoff and increased re-suspension of stream bed sediments.

**Hydro flow** – A stream’s flow level is rapidly rising or falling solely due to the abrupt release of water from an upstream dam. A rise in streamflow with no recent precipitation or snowmelt events and when similar rises are not observed for local stream gages are good indicators of artificial releases from dams. The Vermont Natural Resources Atlas, available at <http://anrmaps.vermont.gov/websites/anra/>, also contains a *watershed protection* layer depicting known dams throughout the state, including whether they are operated for generation of electricity. Note: the occurrence of natural freshet flows in direct response to rainfall or snowmelt are still possible below such facilities.