**STUDY SPECIFIC PROCEDURE**

***Sampling Procedures and Routine Maintenance for Assessment of Tile Drainage System Impacts to Lake Champlain and Phosphorus Loads in Tile Drainage in the Jewett Brook Watershed***

SSP Number: 1 Date Issued: 11/14/16

Version Number: 1 Date of Revision: NA

# OBJECTIVE

To facilitate collection of high-quality water samples, preventative maintenance of monitoring stations and equipment, and accurate recording of monitoring activities and data.

# POLICIES

All field staff performing sampling duties for the project must read this SSP and implement the procedures written herein.

# Health and Safety

A health and safety plan (HASP) was prepared for this project identifying possible health and safety risks involved in field activities, how these risks are to be managed, and responsibilities of project management and staff. This HASP must be read and signed by every direct employee of Stone Environmental engaged in fieldwork for this project. Contractors assisting Stone with sampling and other field activities are not similarly bound by the HASP, but should nonetheless remain alert and responsive to potential health and safety risks. Stone Environmental assumes no responsibility and will accept no liability for the health and safety of personnel who are not direct employees of Stone Environmental.

There are several common health and safety risks which demand particular attention, as follows:

## Insects

Hornets, wasps, bees, and yellow jackets are common in edge-of-field settings in Vermont. These insects may build nests in the monitoring shelters. A spray can of insecticide should be available at each monitoring shelter. Personnel known to be allergic to hornet, wasp, bee, and/or yellow jacket stings should carry with them an Epipen or similar medication as directed by their physician.

Mosquitos may carry dangerous pathogens including West Nile virus and eastern equine encephalitis. Use repellant and appropriate clothing to minimize mosquito bites.

Ticks are common in areas bordering agricultural fields. Tick populations should be reduced by mowing work areas. Long pants, tucked into socks, should be worn when possible. Skin and clothing should be checked for ticks upon leaving the field.

## Plants

In addition to poison ivy and stinging nettle, personnel must avoid contact with wild parsnip, a new invasive plant in Vermont that can produce a painful and lasting burning of the skin after exposure of affected areas to sunlight. This plant has been seen in the area of the Ferrisburgh monitoring stations and may exist at other stations as well.

## Severe weather

Sampling activities will often take place shortly following storm events. Under no circumstances should personnel visit monitoring stations during lightning storms. Personnel should also be alert to high wind or other conditions and avoid exposure.

## Cold/heat stress

Personnel will be working under both very cold and very warm conditions in the course of the monitoring program. Standard recommendation for minimizing the risk of heat stress and hypothermia need to be observed.

# Flow Proportional Composite Sampling ProcedureS

An ISCO 6712 or 3700 autosampler will be operated to collect flow-proportional composite samples during times of the year where conditions are expected to remain above freezing. Approximately weekly, field technicians will visit each station to process the bulk composite samples into appropriate splits.

1. Record information from autosampler display (see attached Sample Retrieval Form). Note that the autosampler may display various error messages, some of which may be important, others not. If the display indicates a warning about excessive pump tubing counts, you may disregard this. If the sampler displays “No Liquid Detected”, this may indicate either that the intake was exposed to air during one or more sampling attempts or that there is a clog in the sampling line. If this warning is displayed, inspect the sampling line for a clog, kink, or ice blockage and otherwise ignore it. For all other warning messages, please contact Stone.
2. Stop the sampling program by pressing the red button to pause the program and then selecting STOP PROGRAM. In certain cases, the sampling program may have been stopped remotely by Stone. Stopping the program remotely can mitigate certain problems and potential risks, such as frozen sampling lines on cold nights.
3. Record approximate sample volumes in each carboy.
4. Select the appropriate carboy(s). Carboy 1 should contain a minimum of 300 mL for sample splits to be prepared for analysis. Since the programmed aliquot volume is 100 mL, three aliquots should produce 300 mL of sample. If three or more sample aliquots were attempted and the volume in carboy 1 is substantially less than 300 mL, then the suction line was likely exposed during pumping, drawing air rather than water. You may also view the sampling report for further information about which sampling attempts were unsuccessful.
5. Fill out and affix labels to the appropriate containers. The correct container for each analyte is given in Table 1.

*Table 1. Sample containers, preservation, and permissible holding times*

| **Analyte** | **Container** | **Preservation** | **Hold Time (days)** |
| --- | --- | --- | --- |
| TP | 60-mL glass vial | None | 28 |
| TDP | 60-mL glass vial | Filtered (0.45 µm) in field | 28 |
| TN | 50-mL plastic centrifuge tube, blue cap | Cool (<6°C), 0.1 mL H2SO4 | 28 |

The Sample ID field is a concatenation of the Site ID (JBT01, JBT02, etc.), the collection date (mmddyy), and the carboy(s) from which sample splits are taken [1, 2, 3, 4, or 1/2 (if the samples from carboys 1 and 2 are added together in the churn splitter)]. See step 7 regarding the sample splitting procedure. The following examples illustrate the sample IDs syntax:

* A sample collected at JBT01 on May 2, 2017 only from carboy 1: **JBT01-050217-1**
* A sample collected at JBT02 on September 27, 2017 by combining the contents of carboys 1 and 2 in the churn splitter: **JBT02-092717-1/2**

1. Put on lab gloves
2. Pour sample from the selected carboy(s) into the churn splitter. Try to swirl the water to suspend sediment as you pour the sample into the churn splitter.  
     
   In many cases, only the first carboy will contain sample. If the second carboy also contains sample, this can be added to the churn splitter so long as the combined volume will not exceed 14 liters, the capacity of the churn splitter. For example, if carboy 1 contains 9 liters and carboy 2 contains 4 liters, these can be composited in the churn splitter; and the resulting sample ID would be in the form: SiteID-mmddyy-1/2.   
     
   If the combined volume will exceed 14 L, each carboy should be split individually, resulting in two sets of sample splits for analysis.
3. Operate the churn splitter for 5-10 seconds. With sample containers in hand, open the stopcock and let spill on the ground for 1-2 seconds to clear the line. Then prepare:
   1. TP sample split: While operating the churn splitter, fill the glass vial up to the line.
   2. TN sample split: While operating the churn splitter, fill a blue capped centrifuge tube to the 50 mL line.
   3. Let the contents of the churn splitter settle for 1-5 minutes.
   4. TDP sample split: Sample splits for TDP analyses will be filtered in the field by dispensing sample from the churn splitter directly into a filtration apparatus containing a 45-mm Durapore® 0.45-µm acetate membrane filter. Use forceps to place a clean filter in the filter holder. Wet the filter with a spray of distilled water. Remove the plunger and attach the filter holder to the syringe. Fill a syringe with settled water from the churn splitter. Squirt approximately 10 mL onto the ground and then fill a glass vial to the 50-mL line. If the filter clogs prematurely, it may be replaced with a new filter and the process repeated.
4. Preservation. Put on safety glasses. Add 1 drop of concentrated sulfuric acid to preserve the TN sample. Place all samples on ice and store on ice or refrigerate until delivery to the laboratory. Clean up acid spills with acid neutralizing solution or copious amounts of water. To use acid neutralizing solution, shake bottle of acid neutralizing solution and cover affected area until bubbling stops.
5. Washing equipment. The standard washing procedure is for three rinses with distilled water. After each event, the churn splitter, filter holder, and carboys should be washed.
6. Reinstall carboys in the following clock positions: 1 at 6:00, 2 at 3:00, 3 at 12h, and 4 at 9:00.
7. Press the red button and select “run program” on the autosampler to ready the station for the next event. Confirm that the sampler program is running.
8. Complete the Chain of Custody form, including sample IDs, number of containers of each sample being sent to the lab, and the analyses to be performed. The Chain of Custody form must be kept with the samples, either by sticking it into the plastic sleeve taped to the underside of the cooler lid or in a ziplock bag with the samples.
9. Samples must be delivered to the laboratory within the holding times indicated in Table 1.

# Grab Sampling ProcedureS

The autosampler programs will be stopped during the winter months when temperatures are expected to remain below freezing. During this period, field technicians will visit each station approximately weekly to collect grab samples if tile lines are flowing.

1. Fill out and affix labels to the appropriate containers. The correct container for each analyte is given in Table 1.
2. For grab samples, the Sample ID field is a concatenation of the Site ID (JBT01, JBT02, etc.), the collection date (mmddyy), and the word “GRAB”. The following example illustrate the sample IDs syntax:

* A grab sample collected at JBT01 on February 2, 2017: **JBT01-020217-GRAB**

1. Grab sample collection.
   1. Put on lab gloves
   2. If the air temperature is above freezing:
      1. Collect samples for TP and TN analysis directly into the sample container. The preferred method is to use the autosampler to pump a sample directly into the sample container, using the manual sample mode. The autosampler pump tubing should be detached from the autosampler housing and a stream of water directed into the sample container. Set the sample volume to 200 mL and dispense the first approximately 5 pump cycles (50 mL) onto the ground, then collect sample up to the fill line on the sample container.
      2. Samples for TDP analysis may be dispensed directly into the filtration apparatus containing a 45-mm Durapore® 0.45-µm acetate membrane filter. Use forceps to place a clean filter in the filter holder. Wet the filter with a spray of distilled water. Remove the plunger and attach the filter holder to the syringe. Use the autosampler to pump sample into the syringe, using the manual sample mode. The autosampler pump tubing should be detached from the autosampler housing and a stream of water directed into the syringe. Set the sample volume to 200 mL and dispense the first approximately 5 pump cycles (50 mL) onto the ground, then collect appromately 60 mL of sample in the syringe. Squirt approximately 10 mL onto the ground and then fill a glass vial to the 50-mL. If the filter clogs prematurely, it may be replaced with a new filter and the process repeated.
   3. If the air temperature is below freezing:
      1. The autosampler may be damaged by ice accumulation. If the tile line continues flowing under freezing conditions, grab samples may be withdrawn using a portable centrifugal pump inserted into the flow metering chamber via a sampling port. Using this pump, sample should be dispensed directly into the sample containers, dispensing the first approximately 50 mL onto the ground, then collecting sample up to the fill line on the sample containers.
      2. Because field filtration is not generally successful under freezing conditions, grab samples collected for TDP analysis will be filtered at VAEL. In this case, TDP samples must be brought to VAEL for processing on the day of collection.
2. Preservation. Put on safety glasses. Add 1 drop of concentrated sulfuric acid to preserve the TN sample. Place all samples on ice and store on ice or refrigerate until delivery to the laboratory. Clean up acid spills with acid neutralizing solution or copious amounts of water. To use acid neutralizing solution, shake bottle of acid neutralizing solution and cover affected area until bubbling stops.
3. The filter holder and syringe should be washed by rinsing three times with distilled water after sampling at each station.
4. Complete the Chain of Custody form, including sample IDs, number of containers of each sample being sent to the lab, and the analyses to be performed. The Chain of Custody form must be kept with the samples, either by sticking it into the plastic sleeve taped to the underside of the cooler lid or in a ziplock bag with the samples.
5. Samples must be delivered to the laboratory within the holding times indicated in Table 1.

# Routine Maintenance

## Tasks to be performed by sampler after each sampling event

1. On the Sample Retrieval Form, record the amount of rainfall collected in any manual gauges and the date and time. Record the amount of rainfall collected in the graduated cylinder to the nearest 0.01 inch then empty it. If water is present in the outer (overflow) cylinder, carefully decant this into the graduated cylinder and add this amount to the first reading. Repeat if necessary until the overflow cylinder is empty.
2. Confirm that the sampler program is running.
3. Confirm that the sampling line and pump tubing are attached.
4. Confirm that the sample carboys are installed properly.
5. Describe field/crop condition.
6. Verify that sufficient sampling supplies (bottles, filters, gloves) remain for at least two sampling events. Notify the Stone project manager if any supplies are low.

## Tasks to be performed by Stone approximately monthly

1. Confirm that the sampler program is running.
2. Check the sampling line for any kinks or sags; zip-tie if necessary to maintain a consistent downward slope in the line.
3. Confirm that the sample carboys are installed properly.
4. Check the desiccant cartridges of the flowmeters and 2105ci modules and replace desiccant if necessary.
5. Restock monitoring stations with bottles, sample retrieval forms, labels, filtration supplies, gloves, and distilled water.
6. Refill or replace acid dropper bottles.
7. Cut weeds from around the shelters and flume and along the wingwalls.
8. Describe field/crop condition.

# AUTHORIZATION

Written by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

Dave Braun, Water Quality Scientist, Stone Environmental, Inc.

Approved by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_

Julie Moore, Project Manager, Stone Environmental, Inc.

# Revision history

None

# Forms

**Sample Retrieval Form**

Collected by:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Weather:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Rainfall (if gauge is deployed) \_\_\_\_\_\_\_\_ in.

|  |  |  |
| --- | --- | --- |
|  | **Station JBT01** | **Comment** |
| Station condition | □ OK Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |  |
| Field/crop condition |  |
| SAMPLE COLLECTION | | |
| Type of sample(s) collected (circle) | Composite split Grab None |  |
| Sampler display | \_\_\_\_\_\_\_, \_\_\_\_\_\_\_ bottle\_\_\_\_\_\_ |  |
| Time you stopped the autosampler | \_\_\_\_\_\_\_\_\_\_\_\_\_ AM or PM |  |
| Carboy volume (L) | 1: 2: 3: 4: or NA |  |
| Sample ID assigned | JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_1\_\_\_  (Station) – (mmddyy) – (carboy)  JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_2\_\_\_  (Station) – (mmddyy) – (carboy)  JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_3\_\_\_  (Station) – (mmddyy) – (carboy)  JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_4\_\_\_  (Station) – (mmddyy) – (carboy)  JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_12\_\_  (Station) – (mmddyy) – (carboy)  JBT01 – \_\_\_\_\_\_\_\_\_\_ – \_\_\_\_\_  (Station) – (mmddyy) – (GRAB) |  |
| Splits collected (circle) | TP TDP TN |  |
| Duplicates collected? (circle) | TP TDP TN  Carboy \_\_\_\_\_\_\_\_ |  |
| RESETTING STATIONS | | |
| STOP then Re-RUN SAMPLING PROGRAM (circle) | Yes No |  |
| Carboys and churn splitter triple rinsed? (circle) | Yes No NA |  |
| Desiccant good? (circle) | Yes Changed |  |
| Carboys installed properly? (circle) | Yes No |  |
| Additional comments: | | |

**Chain of Custody Form for Water Samples**

Stone Project ID: 15-309

Lab Program #:

Stone Contact: Dave Braun, 802-272-8819, dbraun[@stone-env.com](mailto:jmoore@stone-env.com)

|  |  |  |  |
| --- | --- | --- | --- |
| **Collection Date** | **Sample ID** | **Total # of**  **Containers** | **Analyses Requested**  **(circle those collected)** |
|  |  |  | TP TDP TN |
|  |  |  | TP TDP TN |
|  |  |  | TP TDP TN |
|  |  |  | TP TDP TN |
|  |  |  | TP TDP TN |
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|  |  |  | TP TDP TN |
|  |  |  | TP TDP TN |

Sampled by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

print name signature

**Routine Maintenance Form**

Technician:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ACTIVITY | SITE: \_\_\_\_\_\_\_\_\_ | SITE: \_\_\_\_\_\_\_\_\_ | SITE: \_\_\_\_\_\_\_\_\_ | SITE: \_\_\_\_\_\_\_\_\_ | |
| Sampler program running | □ | □ | □ | □ | |
| Sampler tubing is attached | □ | □ | □ | □ | |
| Sample carboys installed properly | □ | □ | □ | □ | |
| Signal converter desiccant | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | |
| 2105ci module desiccant | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | □ OK  □ Replaced  □ NA | |
| Restock sampling supplies | □ | □ | □ | □ | |
| Restock forms and labels if needed | □ | □ | □ | □ | |
| Mow weeds | □  □ NA | □  □ NA | □  □ NA | □  □ NA | |
| Field Condition: |  |  |  |  |
| Comments: | | | | |