Standard Operating Procedure for

Stream Flow Measurements

This Standard Operating Procedure was Officially Adopted in May 2014 by the Sauk River Watershed District.

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and
Previously Published Stream Flow Measurement SOP’s
This Standard Operating Procedure was created by the Sauk River Watershed District (SRWD) using expertise and feedback from the Minnesota Pollution Control Agency Staff, as well as previously published Standard Operating Procedures that were found during research.

The specific equipment described within this document is currently being used by the Sauk River Watershed District. This SOP was designed for use by SRWD staff and interns to ensure that proper techniques are being used during stream flow measurements and that consistency is maintained throughout the agency staff.

Although this is the approved Standard Operating Procedure for the Sauk River Watershed District, the Water Resource Manager and other authorized staff members have the authority to use alternative methods, processes, or procedures as deemed appropriate to collect data in a safe and efficient manner. Deviation from this SOP will be noted by staff in field notes.
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Section 1.0 – Scope and Applicability

This Standard Operating Procedure (SOP) represents the Sauk River Watershed District (SRWD)’s approved procedures for collecting stream flow measurements. Flow is also referred to as discharge, and is measured at all stream/river sampling sites on a monthly basis. At newly established sampling sites, or sites that have a history of inconsistent or difficult flow measurements, stream flow measurements will be taken more frequently to establish a rating curve.

Stream flow data is used by the SRWD for purposes including, but not limited to:

- Determining pollutant loading and inputs into the Sauk River and its tributaries
- Characterizing current water quality conditions and detecting long-term changes, including those that occur due to Best Management Practice (BMP) project implementation
- To Assist Other Agencies with:
  - Understanding groundwater/surface water interactions
  - Setting permit requirements for discharge of treated water
  - Understanding the effect of hydrologic condition on aquatic life uses

This SOP applies to any and all SRWD Staff, Interns, and Volunteers that will be collecting stream flow measurement data. This SOP provides procedures for performing flow measurements in wadeable and non-wadeable conditions using the following equipment:

**Wadeable**

- SonTek Flow Tracker Handheld-ADV

**Non-Wadeable**

- River Surveyor M9

**Important Considerations:**

- When collecting stream flow measurements at sites that have equipment installed to continuously and automatically monitor water level, flow measurements can be taken any time as long as proper field notes (date, time, weather, and water body conditions) are recorded.
- Some sampling sites do not have equipment installed to continuously and automatically monitor water level. Flow measurements collected at these sites should take place on the same day as samples are collected (flow measurement should be started immediately after the sample has been collected and placed in the cooler).
This SOP is not a substitute for the official product user manuals provided by the product manufacturers. Consult manufacturer’s manuals for a complete guide of proper equipment use, maintenance, and troubleshooting of discharge measuring equipment.

Section 2.0 – Summary of Methods

Section 2.1 – SonTek Flow Tracker Handheld-ADV (Wadeable Sites)
A stream cross-section is established and the Flow Tracker is used to determine the velocity at selected locations across the stream. The handheld meter is attached to a wading rod, which is used to measure the depth of the stream, and to keep the meter properly positioned in relation to the water current. The monitor faces the meter upstream while standing downstream of the meter and tagline.

The Flow Tracker uses acoustic Doppler technology to measure 2D flow in a small sampling volume located at a fixed distance (10 cm) from the probe. Sound generated by the transmitter bounces off suspended particles in the water. This reflected sound returns to the receivers, is averaged together by the processor, and results in water velocity measurements that are recorded at a rate of one per second. At the end of the measurement, the Flow Tracker calculated the discharge.

Section 2.2 – River Surveyor M9 (Non-Wadeable Sites)
The M9 is used when stream depth or velocity creates conditions that are unsafe for a staff member to wade the water body to collect a stream flow measurement. This piece of equipment is designed for operation in streams with depths ranging from 0.66 feet to 262 feet.

The equipment is pulled across the stream as the monitor walks across a bridge. If a bridge is not present, the unit can be attached to a tagline or pulley system and pulled from bank to bank by two staff members. The M9 has multiple acoustic frequencies that are used for shallow to deep measurements, and also have a vertical beam that assists with accurate channel definition. Data is collected in profiles as the unit is pulled across the stream and is sent via Bluetooth to the field laptop being operated by staff. The laptop contains the RiverSurveyor software, which saves the data. The complete discharge measurement is computed in the RiverSurveyor program.

Section 3.0 – Definitions

- ADV: acoustic Doppler velocimeter
- Discharge: Used throughout this SOP interchangeably with “flow”. This is the volume of water flowing past a fixed point per unit of time. Units are typically cubic feet/second (ft³/s or cfs).
- Flow/Discharge Measurement: A manual measurement of flow/discharge performed by an SRWD staff member, intern, or volunteer.
- Non-Wadeable: If the stream depth (in feet) multiplied by its velocity (feet/second) is greater than your height (in feet), then DO NOT WADE.
- Velocity: The distance that water travels per unit of time. Units are typically centimeters or meters/second (cm/s or m/s) or feet/second (ft/s).
• Wadeable: If the stream depth (in feet) multiplied by its velocity (feet/second) is \textit{less than} your height (in feet), then the site is usually safe to wade.

Section 4.0 – Health and Safety Warnings

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of a flow measurement, it is recommended that an alternate method that could eliminate hazards is used, or that the measurement be rescheduled. If hazardous conditions arise during measurements, including but not limited to: lightning, high winds, rising water, or flash flood warnings, personnel should stop the measurement and move to a safe location. This could include returning to the office if conditions allow, however, if driving conditions are not favorable, staff should seek shelter close to the monitoring site.

Field personnel should take appropriate precautions when operating equipment and working on, in, or around water, as well as possibly steep and unconsolidated banks. All field crews should follow EPA, OSHA, and specific health and safety procedures, and be equipped with safety equipment such as proper wading gear, personal floatation devices (PDFs), gloves, first aid kits, cellular phone, etc.

When collecting stream flow measurements at wadeable sites, staff should wear personal floatation devices if they are feeling insecure or are collecting the measurements without another staff member or intern present. A second staff member or intern should be present for the collection of flow measurements at wadeable sites whenever possible. If unsure of water depth or stream bottom, a fence post can be used to test depth while wading across a stream.

As a general rule, if the stream depth (in feet) multiplied by its velocity (feet/second) is greater than your height (in feet), then \textbf{DO NOT WADE}.

While collecting stream flow measurements at non-wadeable sites, staff should use orange road cones to direct traffic safely around the area in which staff will be working, as well as the area where the SRWD vehicle is parked. Orange or yellow safety vests must also be worn to ensure the visibility of staff while collecting the stream flow measurement.

Always use caution when collecting flow measurements. No data is worth your life. If hazardous/unsafe conditions exist, re-evaluate the procedure being used and suspend the measurement if necessary.

Section 5.0 – Cautions

Use caution when handling flow equipment. Equipment should be placed securely in the vehicle to prevent damage during transport.

Always be observant of potential debris floating from upstream that could potentially damage equipment and/or cause harm to the operator.
Section 6.0 - Interferences

The physical makeup of a stream may prevent an accurate flow measurement. If the stream is shallow and has a substrate dominated by cobble, the equipment may have a difficult time reading the speed of the particles. When establishing the cross section, look for an area of laminar, smooth flow with minimal obstructions. Obstructions, including large rocks, can be moved out of the way of the cross section, but only before flow measurements begin, never during the measurement. Ideal conditions for a stream flow measurement consist of uniform, straight stream reaches, stream bottoms made up of smaller substrate material with little or no aquatic vegetation or debris, little turbulence, no standing waves, and no eddies.

A quality control test must be performed each day prior to taking a flow measurement to ensure that the equipment is operating properly.

For wadeable sites, be sure to place the Flow Tracker downstream of the tape measure and be sure to stand downstream (facing upstream) of the Flow Tracker.

Any observations of unstable banks or streambeds, submerged trees or other vegetation, and any other potential interferences should be documented in the field notes. Photos should also be taken.

Section 7.0 – Personnel Qualifications/Responsibilities

Monitors collecting stream flow measurements are required to read this Standard Operating Procedure annually and acknowledge that they have done so via a signature page (Appendix 1) that will be kept on file at the SRWD, along with the official hard copy of this SOP.

New and seasonal personnel must be trained in collecting stream flow measurements by an experienced monitor. Monitors must be familiar with the product manuals for the discharge equipment described in this SOP. The product manuals (for the M9 and FlowTracker) should be easily accessible for troubleshooting and maintenance of the equipment, since this SOP has not been designed to cover all details regarding equipment setup and use, troubleshooting, precautions, software setup and use, and downloading/reviewing of data.

All monitors have the responsibility of maintaining flow meters and flagging the equipment if it is in need of repair. The Water Resource Manager should be informed of any maintenance/repair needs that may arise while the equipment is being used by other staff or interns.
Section 8.0 – Equipment and Supplies

**FlowTracker Stream Flow Measurement Supplies:**
- FlowTracker Handheld and Wading Rod
- 100’ Tape Measure (Tagline)
- Fenceposts/Stakes (for Stabilizing Tagline – 2 or 3)
- Waders or Hip Boots
- Field Notebook
- Permanent Markers
- Camera
- CR10/CR850 Downloading Supplies
- Bridge Down Tape Measure
- Toolbox for Repairs (Phillips Screwdriver)
- Extra Batteries (8 AA)
- Yard Stick
- Copy of this SOP
- User Manual(s)

**M9 Stream Flow Measurement Supplies:**
- M9
- Laptop (Toughbook)
- Tagline/Tow Ropes
- Waders, Hip Boots, or Mud Boots
- Field Notebook
- Permanent Markers
- Camera
- CR10/CR850 Downloading Supplies
- Bridge Down Tape Measure
- Toolbox for Repairs (Allen Wrenches)
- Extra Batteries
- Copy of this SOP
- User Manual(s)
Section 9.0 – Procedures

Section 9.1 – Preparing Site for Measurement

Section 9.1.1 – Wadeable Sites

Appendix 2 provides a flow guidance diagram for collecting stream flow measurements at wadeable sites.

Establish a stream cross section for flow measurement to occur. Ideal conditions for the site location include:

- A straight section of stream, away from stream bends
- Stream flow approximately parallel to stream banks
- A constant stream gradient
- No obstacles protruding from water surface (such as stones, sand bars, plants, bridge piers, etc.)

Attach the tape measure to one of the fence posts and secure on stream bank (starting point will be on the left bank when facing downstream, tape measure should be placed accordingly). String tape measure across the stream, securing it to the second fence post on the opposite bank (if unsure of water depth, use a third fence post to test water depth while wading across stream). The tape should create a line perpendicular to the flow of the stream. Make sure that the tape is tightly stretched across the stream and not in danger of sagging onto the water surface.

Section 9.1.2 – Non-Wadeable Sites

Typically the M9 is dragged across the site from a bridge. If the edges of the water are not deep enough or pose other concerns with the accuracy of the measurement (such as eddies or backwater areas), the M9 should be stopped prior to that point. The distance from that point to the shoreline should be measured and entered into the RiverSurveyor data collection program as the “Left Edge of Water” and “Right Edge of Water” measurements. Left Edge of Water always refers to the left edge while looking downstream.

If a bridge is not available, a second rope can be attached to the M9. One staff member will hold rope 1 and stand on the left bank while a second staff member will hold rope 2 and stand on the right bank. If necessary, a tagline can be used to help control the M9 in case of a strong current, however it is not needed for all measurements since the equipment is able to adapt to small movements up and downstream during measurements and still process accurately. In addition the M9 has fins on either side for stability in windy and/or high flow conditions for stability.
Section 9.2 – Performing the Flow Measurement

Section 9.2.1 – SonTek Flow Tracker Handheld-ADV

Flow Tracker Assembly

Assemble the wading rod by matching up the two sections of the graduated rod (marked in 10ths of feet). Raise the adjustable rod up so that it is easier to tighten the graduated rod. Once the graduated rod is assembled and secure, lower the adjustable rod to match up with the threaded section. Twist the top of the adjustable rod to tighten.

Attach the SonTek handheld display to the top of the wading rod and tighten using the attached wing-nut.

Secure the Doppler probe to the appropriate outlet and secure using a Phillips screwdriver or by tightening the wing-nut (if available).
**Determine Measurement Interval**

If the cross section being measured is < 10 feet in width, collect a data reading every 0.5 feet, starting 0.25 feet (half of the interval) from the edge if possible. If eddies or other potential problems occur near the bank, start measurement further away or look for a better cross section.

If the cross section being measured is > 10 feet in width, collect no more than 20 evenly divided measurement across the entire stream. Start at half of the determined interval from the edge if possible.
Figure 2 shows the proper orientation of the probe while performing discharge measurements. Be sure to take flow measurements on the downstream side of the tape measure while standing downstream of the flow meter.

Data Collection

On the SonTek handheld, hold the on/off button down for one second.

Select Main Menu. Setup Parameters and System Functions will be set, please refer to manufacturers’ user manual for additional details.

Press “3” for “Start Data Run”. Follow the instructions on the screen, using the first 8 characters of the site name for “Input File Name”. For “Extension Name” use the numeric month and day. Press “9” to accept name.

Press “1” to enter full site name. Press “2” to enter operator initials. Press “9” to start.

Select “QC Menu” to enter “1:Height” (WSE or measured stage) and “2:RatedQ” (from rating curve if applicable). Once that information has been entered, select “0=Exit”.

When the “Automatic QC Test” screen appears, press “1:Run Test”. Then select “Enter” to start. If errors occur, test should be repeated. If errors still occur, it may be necessary to start further from the bank or to look for a better cross section.

Once the QC test has been passed, the “Starting Edge” screen will appear.

Move to the water’s edge on the left side of the river (looking downstream) and place the wading rod into the water to measure the depth. Press “Set Location” to enter the distance value (number on the tape measure at the water’s edge). Press “Set Depth” to enter the depth of the water at the starting location (measure this depth using the graduated rod). If the bank is sloping, this depth will likely be zero but there will be a depth measurement if the bank is undercut. Press “Next Station” to continue to the next measurement interval.

Move the Flow Tracker to the next measurement interval by lining it up with the measuring tape. This location should be at ½ the determined measurement interval. (For example, if the stream is <10 feet wide, the intervals will be 0.5 feet. If the edge of the water is at 0.0 feet on the tape, the first interval will be at 0.25 feet. The next measurement should be at 0.5 feet beyond the first location = 1.75 feet). Enter in the appropriate depth on the handheld and move the adjustable rod to the corresponding depth. Press “Measure” to record the flow at that interval. Keep the Flow Tracker parallel to the stream flow.

After 20 seconds of recording, the handheld will give the velocity of the interval in feet/second. If something has caused the accuracy of the flow data to be degraded, error warnings will pop up. Some
common errors include: High Angle, High SNR, and QC out of bounds. Refer to the Flow Tracker manual for instructions to correct these errors.

Follow the instructions on the screen to accept the measured flow and the handheld will automatically move to the next measurement interval.

Continue to enter in the depth, move the adjustable rod, and measure flow for each interval until you reach the last measurable interval. This may be at the opposite bank or at a point where the water is no longer flowing or is flowing backward or in an eddy. At this location, press “End Section”. The Flow Tracker will ask for confirmation of ending section and go through all of the errors found for the entire cross section. After going through the errors, determine whether additional measurements need to be added (typically when station discharge is over 5% - measurement locations should never be closer than 0.5 feet). Once additional measurements have been added (if necessary) select “End Section” again to enter the correct “End Location” information (“Set Depth” and “Set Location” should be selected to enter this information).

Press “Calculate Discharge” to calculate the flow in cubic feet per second (ft³/s or cfs) for the cross section. The Flow Tracker will ask the operator to confirm this action. Once this action has been confirmed, the Flow Tracker will calculate the flow/discharge reading. Record this number in the field notes sheet under “Measured Flow”. Include any notes on site condition (large rocks, sediment buildup, debris, etc.) or factors that could impact the measurement under the “Notes” section of the field notes sheet, then exit out to the “Main Menu” before turning the Flow Tracker off by holding the power button for 7 seconds.

Section 9.2.2 – M9
The M9 should be assembled according to the manufacturer’s user manual. Visually inspect all components for damage. Pay close attention to rope for frays or weak sections. If any are found, replace the rope and/or fix damages before collecting the flow measurement. Check that the transducer beams are aligned correctly and that the transducer head is set to the correct depth (this should be set, see user manual for specific instructions if necessary). Insert battery packs into the M9 and attach antenna to Toughbook. A Toughbook Laptop is used to view and store the data being collected. Before placing the M9 into the river, the laptop must be turned on and connected to the M9.

Once the laptop has been turned on, open the RiverSurveyor program located on the desktop by double clicking the icon. When the program is open, click on “Connect to a RiverSurveyor system”. A box will then appear listing the M9. Click “M9” and then press “Connect”. If connection fails try the connection again (make sure the M9 has been turned on and the Bluetooth connector has been inserted into the laptop).

When the connection is successful a new page will appear.

The “Set Units” should be English. Next click on “Set System Time” button. In the popup box click “Match System to Computer Time”, then click “Close” after the time has adjusted. Next click on “System Test” which verifies that the components of the hardware are functional.
Once that test passes click on “Site Information”. In the new tab enter the following items (fields not addressed below should be left as is):

- **Site Name**: Site Name
- **Station Number**: Hydstra ID
- **Location**: location of site
- **Party**: SRWD
- **Boat/ Motor**: Type of site (box culvert, bridge, etc.)
- **Meas. Number**: Site
- **Comments**: List any pertinent information that affect the flow (debris, wind, sandbar, etc.) and the flow according to the curve.

The M9 should also be calibrated at the first flow site of each day. Move to a location on land away from the bridge, vehicle, etc. Select the calibration option on the Toughbook, and press start. Slowly rotate your body in a 360 degree circle, while also rotating the M9 in all directions. Do this for a minimum of one minute, then stop the timer. If the calibration was acceptable, move on to the next step. If it was not acceptable, repeat the calibration until the results are acceptable.

Next click on “System Settings” and a new pop-up window appears. Enter the “Transducer Depth” = (0.17) and the “Screening Distance” = (0.52) according to the number recorded in the front cover of the Field Notes binder.

Before conducting a flow measurement a Stationary Moving Bed Assessment (SMBA) needs to be completed. This is done on the same Smart Page. Under “Measurement Method” select “SMBA and Moving Boat”. This will allow you to complete an SMBA before the flow measurement.

As soon as all the information has been entered and the connection has been established between the M9 and Toughbook a staff member can place the M9 in the river. Select “Start SMBA Measurement” at the bottom of the Smart Page. The measurement interval will be 300 and the number of stations will vary depending on the site. Most narrow sites will be 1-2 measurements, depending on the width of the channel, and at main river sites three measurements should be taken, one on the left bank, one in the middle and one on the right bank.

Starting on the left bank looking downstream, select location for station #1. Select “Start Station 1” and keep the boat in the same position during the measurement. After the assessment is complete a pop-up window will appear. Look at the “% Potential Error” and whether a correction is recommended. Once Station #1 is complete move the M9 to the next station and repeat the process. Do the same if there is a third station. After the last station is complete continue to “Start Measurement” and continue to the flow measurement. Make notes in the Field Notes binder of any “% Potential Error” or if a correction is recommended. If a correction is recommended for any of the 3 stations, a stationary measurement or a loop test with regular measurements should be completed (see M9 manual for directions).
Both a right and left bank edge needs to be established before measurements can start. Staff should determine the right and left (looking downstream) edge of water before the measurement starts—the point where the M9 will be stopped during each pass due to shallow water (less than 2 cells appearing in the RiverSurveyor program), eddying water, etc. These edges should be measured with a measuring tape, recorded in the field notes, and entered into the RiverSurveyor program when prompted.

The M9 should be held at the edge for 10 recordings. This number appears in the “System” tab on the left hand side of the screen under “Step” in the parentheses. Once there are 10 recordings press “Start Moving” and move the M9 across the channel while keeping the speed and direction as constant as possible.

Once the M9 reaches the opposite edge of water, it should again be held for 10 recordings. At that time, press the “End Transect” button to tell the program that the M9 will be changing directions. When there are 10 recordings press “Start Edge” so the next pass begins recording and wait for 10 recordings and then press “Start Moving”. Move the M9 toward the left bank. Repeat these steps until you have reached at least 12 minutes and end on the left bank.

Two staff members are needed to operate the M9 efficiently; one staff member operates the laptop while the other operates the M9 itself. When a pulley system and/or tagline is being used where bridges are not available, one staff member will need to operate the laptop while pulleying the M9. When collecting flow measurements from a bridge the measurements should be collected on the downstream side of the bridge for the safety of the equipment.

As of October 1st, 2011, the USGS has changed the time requirement for collecting a flow measurement. A site needs to be measured for a minimum of 12 minutes (NOT including the 10-20 minutes for the SMBA test) with at least one complete pass in each direction, never ending in an odd number of passes. Time between passes does not count towards the 12 minute requirement.

The above requirement means that it is possible for a transect discharge to be more than 5% different from the mean discharge of the total number of transects (passes). Analysis from the USGS has confirmed that no other requirement is necessary. However, if the measurement does not plot within 5% of the rating curve or if it is not in line with previous measurements, an explanation should be noted/pictured or another check measurement should be made. This information can be monitored during the measurement by selecting “Discharge Summary”.

Once the measurement is completed, the laptop operator should select the “Discharge Summary” to record the final discharge measurement in the field notes for that site. Once the final discharge has been recorded click “Abort” and close the program. Remove the batteries from the battery pack when all sites have been completed.

Section 10.0 – Data and Records Management

**Flow Tracker:** All flow readings are stored in the handheld of the Flow Tracker until they are deleted by the user (this should only be done once the readings have been transferred to the appropriate file in the District’s datapool). See the Flow Tracker user manual for instructions on how to recover stored flow readings. Once the flow has been calculated by the Flow Tracker, the operator should record that
number on the field notes sheet. These notes will be entered into the Hydstra and EQuIS field note spreadsheets (if applicable) throughout the season as time allows.

**M9:** Measurement files will be stored on the laptop until the Water Resource Manager, Technician and/or Intern transfers them to the appropriate file on the District’s datapool. Rename the files in the SonTek folder named as the day the flow taken so that it reads with the date and file number with the site name added to the end. Next move the files to their own folder within the SonTek folder labeled with the site name and the date the flow was taken. The final discharge measurement should be recorded in the field notes, which will eventually be entered into the Hydstra and EQuIS field note spreadsheets (if applicable) throughout the season as time allows.

**Field Note Tips:** Regardless of the piece of equipment used, there are additional pieces of information that should always be recorded in the field notes when flow measurements are taken. Those items include, but are not limited to:

- Stream bed vegetation
- Stream bed material
- Stream bank vegetation
- Anything controlling the water surface elevation
- Estimate of amount of water in stream in relation to being at bankfull (for example – at bankfull, 2 feet below bankfull, out of its banks/flooded, etc.)
- Any obstructions downstream of the sensor (tree limbs, beaver dams, etc.)
- Any changes in stream bed (such as scour holes)
- Any changes to stream banks (ditch clean out, rerouting, etc.)
- Anything that looks different than the last site visit

Pictures should be taken during each site visit, especially of any changes downstream of the flow measurement cross section.

**Section 11.0 – Quality Assurance and Quality Control**

Most of the quality control for flow measurements involves reviewing data in the field, paying close attention to changes at the site, and taking detailed field notes (including pictures). Resolution of data collection and data quality problems may include selecting a different cross section, measuring additional transects (M9), troubleshooting equipment issues, adjusting settings/configurations, etc.

A quality control test must be performed at the beginning of each flow measurement to ensure that the Flow Tracker is operating properly. If the QC test fails, the operator must repeat it until the test is passed and no errors are found. If the Flow Tracker continuously fails the QC test and no visible obstructions are found, it must be sent in for repair.

A quality control test must be performed at the beginning of each flow measurement collection day to ensure that the M9 is operating properly and maintaining a good Bluetooth connection with the laptop. See section 9.2.2 above for step-by-step instructions for completing the compass calibration. Always make sure the M9 is communicating with the laptop properly before placing it into the river.
If variation between passes/transects by the M9 is greater than 5%, try repeating the measurement by moving the M9 more slowly across the stream (this typically needs to be done for slow-moving, shallow streams).

Duplicates are unable to be performed for quality control since stream conditions can change rapidly.

**Equipment Cleaning and Decontamination**

Materials Needed: distilled water, sprayer that is used only for distilled water, towels

- Thoroughly spray equipment with distilled water.
  - Be sure to closely examine any crevasses or areas that could easily trap water and/or debris in equipment
  - This rinsing process should occur after each flow measurement is collected to ensure that equipment is rinsed and ready for the next site (example – FlowTracker, M9, measuring tape, etc.)

When possible, let air—dry until moisture is completely evaporated.

**Regarding sites that are known to be infested with Aquatic Invasive Species (AIS):**

- Whenever possible, all AIS sites should be scheduled at the end of the week/flow measurement trip
  - Ideally this means that equipment will have a chance to dry out for a minimum of 48 hours before being used again
  - Sites with zebra mussels should be sampled last
- The rinsing procedure described above should be used for AIS sites and equipment as well, being sure to remove any visible debris from equipment prior to leaving the site
  - Use a towel to wipe down and visually inspect equipment in between sites to ensure that all visible debris is being removed
- Due to costs of flow measurement equipment, having a second set of equipment for AIS sites is not usually feasible, which means it is critical to take the time to carefully inspect and decontaminate equipment in between sites

**Other Considerations**

All field equipment should be thoroughly cleaned and decontaminated at least annually, ideally at the beginning of the monitoring season. Also clean carefully after each flow measurement at sites with heavy contamination.

Equipment used at multiple sites per day should examined between each site, removing and visible material. When possible, there should be a separate set of equipment to use at sites that are known to be infested. When it is not possible to have a separate set of equipment, sites with invasive species should be visited last. This equipment includes, but is not limited to: Van Dorn, Kemmerer, integrated sampler, waders, M9, Flow Tracker/wading rod, and any other equipment that contacts the water from site to site.

When possible, collect flows from lowest to highest suspected levels of contamination to minimize the chance of cross contamination.
Decontaminate equipment at a separate location from the flow measurement site (decontamination should take place in the truck, not on the bridge or boat near the sampling location).

Section 12.0 – References


Flow Tracker User Manual (on file in District office)

M9 User Manual (on file in the District office)
Section 13.0 – Appendices

Section 13.1 – SOP Acknowledgement and Training Sign-Off

This SOP must be read and signed annually. This form must be kept on file with the current version of the SOP.

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Please sign below in accordance with the following statement: “I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved version. Any differentiation from the procedures outlined in this document will be documented in the field notes and the Water Resource Manager will be made aware of the circumstances.”

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**Trainee:** Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer (Water Resource Manager).

**Trainer:** Sign below to acknowledge that training on this SOP was completed for the individual listed and that trainee is competent to perform the procedures described within. The trainer (Water Resource Manager) may sign as that “trainee” if training on these pieces of equipment was attended when hosted by another organization/agency such as the Minnesota Pollution Control Agency.

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