STANDARD OPERATING PROCEDURE

MAINE VOLUNTEER RIVER MONITORING PROGRAM

METHODS FOR USING THE HACH 2100P TURBIDIMETER IN RIVERS AND STREAMS

Note: The mention of brand names does not constitute recommendation of a specific company.

Volunteer River Monitoring Program

Standard Operating Procedure
Methods for using the Hach 2100P Turbidimeter

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1. Applicability. This standard operating procedure is used by the Volunteer River Monitoring Program (VRMP) of the Maine Department of Environmental Protection's Division of Watershed Management. It applies to the collection of turbidity (in NTU units) from rivers and streams in Maine using a Hach 2100P turbidimeter.

2. Purpose. The purpose of this SOP is to provide standardized methods for volunteer groups to determine turbidity of rivers and streams as an instantaneous reading using the Hach 2100P turbidimeter.

3. Definitions.

A. **Hach.** Manufacturer of water quality monitoring equipment.

B. **Calibration.** Set of procedures established by the manufacturer to ensure that the meter is operating properly; a critical quality assurance step in meter preparation prior to use.

C. **Standard Solutions.** The Hach 2100P turbidimeter is supplied with four sealed-vial StablCal® Stabilized Formazin Standards (<0.1-NTU, 20-NTU, 100-NTU, and 800-NTU) and are used to calibrate the turbidimeter.

D. **NTUs.** Nephelometric Turbidity Units. The units of measurement from a calibrated turbidity meter referred to as a nephelometer.

4. Responsibilities.

A. Volunteer Monitors & Volunteer Groups

- **Certification.** It is the responsibility of the individual obtaining this data to maintain current certification for the parameter(s) they collect if they wish their data to be entered into the VRMP database. Training will be provided to volunteers on an annual basis by VRMP/DEP staff, and certification will last for one year from the date of training.

- **Data recording.** It is the responsibility of the individual obtaining this data to record the results and additional qualifying information on current VRMP field sheets obtained from their affiliated watershed association or through the VRMP program of the DEP.

- **Data Quality Checks and Data Submission.** The data manager for the volunteer group will collect and enter volunteer field sheet data onto the appropriate computer file, perform quality assurance checks (refer to Section 5.10 of the Quality Assurance Program Plan), and submit data to the VRMP following protocols outlined in the volunteer group's latest sampling and analysis plan (SAP) that has been approved by the VRMP.

B. Volunteer River Monitoring Program (VRMP) Staff

- **Oversight of Volunteer Groups and Volunteers.** VRMP staff will oversee volunteer groups and volunteers through a variety of ways including maintaining an up-to-date VRMP quality assurance program plan (QAPP); reviewing sampling and analysis plans (SAPs) of the volunteer groups; providing annual training/certification sessions for volunteers; conducting quality assurance checks on data submitted by volunteer groups and laboratories; and uploading data into the DEP's EGAD database. These tasks are described in greater detail in the VRMP's latest QAPP.

5. Guidelines and procedures

A. Hach 2100P Turbidimeter Preparation:

- **First time use.** Follow manufacturer's instructions for preparing meter for first time use. (Refer to Appendix A; section 0 "Operation" and section 1 "Description" (topics: general description, accessories, principle of operation, preparation for use, etc.), pgs. 11 – 17).

- **Beginning of field season.** Before each field season, volunteer monitoring groups shall conduct a full inspection of the meter including sample cells and expiration dates of all turbidity standards. Sample cells should be clean and free from lint, fingerprints, dried spills, and significant scratches (refer to Appendix A; sections 2.3.1 "Cleaning Sample Cells" and 2.3.2 "Oiling the Sample Cell", pg. 23-24 for more information about cleaning and oiling sample cells). New batteries shall be installed in the meter at the start of the sampling season and additionally, as needed (refer to Appendix A; section 1.4.2 "Battery Installation", pg. 16).

- **Prior to field sampling.** Before each field sample collection, the volunteer shall inspect the meter including an inspection of the meter and sample cells for any defects, as well as the expiration dates of the turbidity standards.

- **Hach 2100P Turbidimeter Standard Use/Preparation and Calibration.** The Hach 2100P turbidimeter shall be calibrated at the beginning of each field season and at the beginning of each day of use. It is recommended by the manufacturer to use StablCal Stabilized Formazin Standards for calibration with the Hach 2100P for more consistent results. All four sealed-vial standards that come with the meter (<0.1-NTU, 20-NTU, 100-NTU, and 800-NTU) will be used for calibrating the meter since they cover the approximate range of turbidity values that might be seen in Maine streams and rivers under various flow conditions.

    - For instructions on storing, handling, and preparing the calibration standards, refer to Appendix A, sections:
        - 2.3.8 "Calibration" (pgs. 31-32);
        - 3.6 "Calibration" (pg. 37);
        - 3.6.1 "StablCal Stabilized Formazin Standards" (pg. 37);
        - 3.6.1.1 "Storing and Handling StablCal Stabilized Standards" (pgs. 37 – 38)
        - 3.6.1.3 "Preparing StablCal Stabilized Standards in Sealed Vials" (pg. 39).
    - For instructions on calibrating the meter, refer to Appendix A, section 3.6.3 "Calibration: Calibrating the Turbidimeter" (pgs. 44 -48).

C. *Turbidity Measurements*:

- **Sample period and location.** Sampling period and site location will be documented in SAPs (that require approval by the VRMP) which are submitted by the volunteer groups prior to the beginning of a sampling season. (Detailed information regarding how volunteer groups are to obtain and document site location information can be found in VRMP SOP-02 [Documenting Site Location].)

- **Familiarize Yourself With the Meter.** Volunteers shall familiarize themselves with the basic operation, keypad, protocols for measurement, and readouts of the meter. In Appendix A, refer to the follwing sections:
    - Section 2 "Turbidity Measurement" (pgs. 19-32);
    - Section 3 "Operation" -- sub-sections 3.0 through 3.3 (pgs. 33-36).

- **General Sampling Protocol.**
    - Record site location on data sheet.
    - Follow the directions for filling sample cells with sample water, cleaning and oiling sample cells, for preparing to obtain turbidity measurements, as presented in Appendix A, section 2 "Turbidity Measurement" (pgs. 19 – 32).
        - VRMP volunteers will be not expected to follow the rigorous procedures outlined in section 2.3.5, "Removing Bubbles (Degassing)" (pgs. 28-30), to remove air bubbles that are trapped in their water sample. Volunteers should make a reasonable effort to dislodge air bubbles from the sample tubes (if any exist) by tapping the side of the

cell – mindful to not scratch the tube (e.g., handle on the top of the tube; see pg. 23).
- Collect water sample at the site where you are monitoring, as described in your group's approved SAP. (Detailed information regarding how to collect a water sample can be found in VRMP SOP-01 [Methods for Collecting Water Grab Samples in Rivers and Streams].)
- Follow the instructions specific to measuring turbidity below.

- **Turbidity Measurements.**
  (1) Review and follow the instructions for making turbidity measurements in section "Turbidity Measurement" (Appendix A, pg. 19 – 22). Make sure units are taken in NTU.

- **Quality Control:**
  (1) At the beginning of each field season, all VRMP staff and VRMP volunteers who will collect turbidity data will have a training/refresher/certification session to (re)familiarize themselves with the contents of this SOP.
  (2) For every volunteer, a field duplicate shall be obtained for all parameters for at least 10% of their own sampling efforts. A field duplicate will be collected for every 10 samples monitored.
  (3) Refer to the VRMP quality assurance program plan (QAPP) for more QA/QC details.

7. Equipment Care:

A. *Start of Field Season.*

1. Follow manufacturer's instructions for preparation of turbidimeter including sample cells.
   - Refer to Appendix A:
     - section 1.4 "Preparations for Use"(pg. 15-17);
     - section 2.3 "Measurement Techniques" (pg. 22 – 28), including:
       - 2.3.1 "Cleaning Sample Cells;
       - 2.3.2 "Oiling the Sample Cell";
       - 2.3.3 "Orienting Sample Cells"
2. Use new batteries (sections 1.4.2 and 4.2) at start of sampling season. Extra sample cells and an extra set of appropriate size batteries should be included in the meter carrying case.

B. *Field Season.*

1. Ideally the meter should be in a water-resistant case with padding to protect it from damage.
2. Allow the case and contents to air-dry at the end of each day. This may be accomplished by simply propping the protective's case's lid open. When contents are very wet, remove the contents and spread out to facilitate drying.
3. Clean sample cells at the end of each sampling day (refer to Appendix A; section 2.3.1 "Cleaning Sample Cells" [pg. 23]).

4. Keep meter from freezing.
5. Refer to Appendix A; section 4 "Maintenance", pg. 59 - 65 for manufacturer's recommendations for maintenance requirements.

C. *End of Field season.*

1. Completely dry meter and case and all items in the case before storing.
2. Remove batteries.
3. Clean sample cells according to manufacturer's instructions (Refer to Appendix A; section 2.3.1 "Cleaning Sample Cells" [pg. 23]).
4. Keep meter dry and at room temperature to prevent corrosion of electronic parts.
5. Record winterization date and equipment repairs in Equipment Log.
6. Label the meter and case as "WINTERIZED" in an obvious manner (so users will know the current status of the unit.)

8. Specifications

Display	Range	Accuracy	Resolution
Turbidity (NTU)	0.00 – 1000 NTU	± 2% of readings plus stray light from 0 – 1000 NTU	0.01 NTU on lowest range

8. Appendix.

A. Hach Turbidimeter 2100P owner's manual:
Hach Company. 2008. Instrument and Procedure Manual: Hach 2100P Portable Turbidimeter. Ames, IA.

9. References.

A. Maine VRMP QAPP:

- Maine Department of Environmental Protection (MDEP). 2009. Maine Volunteer River Monitoring Program (VRMP) Quality Assurance Program Plan (QAPP). Portland, ME. DEPLW-0984