Standard Operating Procedure for Stream Canopy Measurements by Densiometer

SOP-WR-W-35

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan	Sue Kiernan	8/12/11
Printed Name	Signature	Date

Quality Assurance Manager:

Connie Carey	Connie Carey	8/1/2011
Printed Name	Signature	Date

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: cgc Date : 8/1/11

(x) TMDL Program (Elizabeth Scott) ..... By:_____Date :_____

(x) Quality Assurance Manager (Tom Getz) ..... By:_____Date :_____

Title: Standard Operating Procedure for Densiometer Canopy Measurements
Originator Name: Jane Sawyers

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1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting canopy cover measurements in streams using a densiometer. Exemption from the use of this SOP for project work shall be allowed for reasons of inapplicability determined by management discretion.

2. PURPOSE

This SOP establishes a standardized method for performing semi-quantitative field measurements of canopy cover in streams using a densiometer. It sets a consistent protocol to ensure the quality of OWR's data collection—resulting in improved uniformity, reproducibility, verifiability, and defensibility of the data, as well as increased program credibility.

3. DEFINITIONS

3.1 RIDEM – Rhode Island Department of Environmental Management

3.2 OWR – RIDEM Office of Water Resources

3.3 SOP – Standard Operating Procedures

3.4 Densiometer – A convex or concave mirror with twenty-four ¼" square engraved on the surface.

3.5 QA – Quality Assurance refers to a systematic process to ensure production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.6 QC – Quality Control refers to the activities performed to affirm production of valuable, accurate, reliable, reproducible and defensible environmental data.

3.7 QI – Quality Improvement refers to any act or process performed to enhance the value, accuracy, reliability, reproducibility or defensibility of environmental data collected by RIDEM OWR.

4. RESPONSIBILITIES

4.1 TRAINING

Any RIDEM/OWR personnel collecting canopy cover measurements for a RIDEM project or program should have completed RIDEM's Quality System Awareness Training Program with appropriate documentation from the Quality Assurance Manager. This training ensures the field analyst recognizes the importance of

proper data collection and management and he/she comprehends the significance of the environmental decisions that may be made with the data. It is suggested that field analysts have also completed the USEPA Water Quality Standards Academy Basic Course and Supplemental Topic Modules online, but it does not require any additional special training or certification.

To properly employ the densiometer, the field analyst must be familiar with and comply with the data collection techniques stated in this SOP. The field analyst is required to read and understand this SOP. The field analyst should complete and submit any required training forms and/or field assessments for project and/or program QAPPs to document proficiency with this procedure. Any field analyst not familiar with the use of the densiometer should be assisted by OWR staff who are accustomed to using the equipment.

4.2 RESPONSIBILITIES OF FIELD ANALYST

The field analyst is responsible for checking the required equipment in the Sampling Center at the beginning of the sampling event before taking measurements in the field. The field analyst is responsible for verifying that the densiometer is in proper operating condition prior to use (i.e. no cracks in the mirror or level; taped areas covered) and communicating to the project manager when equipment is in need of repair or replacement. The field analyst is also responsible for ensuring that all supplementary equipment (hand-held tally counter, waders, hip boots, etc.) is present and in working condition. The field analyst is also responsible for using best professional judgment to determine if site conditions are safe for performing the procedure. The field analyst is accountable for employing proper measurement procedures and data recording in accordance with this SOP.

4.3 RESPONSIBILITIES OF PROJECT OR PROGRAM MANAGER

The project or program manager is responsible for providing the materials, resources, and/or guidance necessary to perform the measurements in accordance with this SOP. The project manager is responsible for ensuring that the field analyst operates the densiometer correctly in accordance with this SOP and that any additional, project-specific requirements are communicated to the project team. The project manager is responsible for ensuring the densiometer is maintained in proper operating condition annually. This includes ensuring the densiometer mirror and level are not cracked and the taped areas are covered. The project manager is also responsible for repairing the densiometer or reordering equipment when necessary. The project manager will determine and communicate with field analysts what procedures and order of procedures are to be accomplished during each sampling event to a sampling location. Further, the project manager shall ensure annual review and periodic revisions to this SOP as necessary to reflect current needs and standards as well as renew this SOP every five years.

5. GUIDELINES AND PROCEDURES

5.1 PROPER USE OF DENSIOMETER

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Densiometer – convex, modified as described in Strickler (1959) (Figure 1, similar to Forestry Suppliers Item Number 43887)
- Datasheet or field notebook printed on waterproof paper (Figure 2; paper similar to Grainger Item Number 3XFR7)
- Hand-held tally counter (Similar to Grainger Item #2PAU4)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Waders or hip boots

5.1.2 USING THE DENSIOMETER IN THE FIELD

For most purposes, the densiometer is used specifically for in situ canopy cover measurements taken directly in the field in streams. This method does not require sample containers or preservation.

5.1.3 RECORDING PARAMETER UNITS

The following units should be used when recording measurements taken with the densiometer:

Canopy cover.....# of dots

5.2 FIELD MEASUREMENT PROCEDURES

5.2.1 DETERMINE FIELD PROCEDURE SCHEDULE

Prior to departure, the project manager will communicate with the field analysts what procedures should be accomplished for each sampling trip to the sampling location and the order the field procedures should be completed. Prior to performing this analysis, the field analyst should ensure the densiometer measurement is taken in the correct order. This procedure may disrupt fish and microscopic organisms, such as benthic macroinvertebrates, fish, and algae, which can interfere with other field procedures and sample collections in streams. Furthermore, this procedure can dislodge sediment, which can interfere with water quality

sample collections. Densiometer measurements should be measured after these samples have been collected.

5.2.2 DETERMINE THE LOCATION OF TRANSECTS AND SAMPLING POINTS

This procedure will typically occur in conjunction with SOP-WR-W-36 Standard Operating Procedure for Measurement of Benthic Algae Cover by Viewing Bucket. The procedure for determining the location of transects and sampling points are described in Sections 5.2.2 and 5.2.3 of SOP WR-W-36. Densiometer measurements should be taken at the same time as viewing bucket measurements.

5.2.3 TAKING THE CANOPY COVER MEASUREMENT

Each transect will have a left bank, middle, and right bank sampling point. At each of three transects, the field analyst will take measurements at all sampling points along each transect. At each transect, the field analyst will take one canopy measurement at the left bank sampling point, four canopy measurements at the middle sampling point, and one canopy measurement at the right bank sampling point (Figure 3). A total of 18 canopy cover measurements will be taken at each stream segment.

- The field analyst will enter the stream at the most downstream transect at the left bank sampling point (1A). Standing at the left bank sampling station, the field analyst will face the left bank. It is important to begin at the left bank, because it is the most downstream station. By starting at the most downstream station, the possibility for disruption of sediment will be minimized for other analyses.

- The field analyst will hold the densiometer 12”-18” in front of them with the mirrored surface closest to their body.

- The field analyst should raise or lower the densiometer’s height until it is 0.3m (a little less than 1ft) above the surface of the water.

- The field analyst should note the position of the bubble level in the lower right-hand corner of the densiometer face. The field analyst should rotate the densiometer until the air bubble is in the middle of the gray circle to indicate the densiometer is level. The field analyst should ensure that the densiometer stays level by observing the air bubble is in the middle of the gray circle throughout the procedure.

- The field analyst will move their head until it is just outside the field of view at the bottom of the triangle area of visible mirrored surface.

- The field analyst will observe and count the number of dots on the mirror obscured by canopy vegetation. The field analyst will use the hand-held tally counter to keep track of the number of dots obscured. The field analyst will read aloud the number of dots obscured by canopy vegetation. The recording field analyst will record the number of dots on the datasheet or in the appropriate field notebook.

  - Note: The dots are not marked on the face of the mirrored surface. The field analyst must observe the etched lines on the mirrored surface. The corners of the squares formed by the etched lines are the location of dots imagined by the field analyst (Figure 4).

  - Note: There are 17 available points. The field analyst will observe and report to the recording field analyst a number between 0 (no points covered) to 17 (all points covered).

- The field analyst move to the middle sampling station (1B). The field analyst will face upstream and repeat the above procedure to determine the number of dots obscured by canopy vegetation.

  - The field analyst will turn to face the left bank. The field analyst will repeat the above procedure to determine the number of dots obscured by canopy vegetation.

  - The field analyst will turn to face downstream. The field analyst will repeat the above procedure to determine the number of dots obscured by canopy vegetation.

  - The field analyst will turn to face the right bank. The field analyst will repeat the above procedure to determine the number of dots obscured by canopy vegetation.

- The field analyst move to the right bank sampling station (1C). The field analyst will face the right bank and repeat the above procedure to determine the number of dots obscured by vegetation.

- The field analyst will move to the next transect upstream. The field analyst will locate and move to the left bank sampling station (2A). The field analyst will repeat the above procedure for all sampling points located on transect 2.

- The field analyst will then move upstream to transect 3 and locate the left bank sampling station (3A). The field analyst will repeat the above procedure for all sampling stations located on transect 3.

- Sampling is complete when 18 canopy measurements have been recorded by the recording field analyst.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

Quality control will be assessed by the recording field analyst repeating the measurements at 10% of stream segments. This will give a measure of bias for the procedure.

6.2 QUALITY ASSURANCE PLANNING CONSIDERATIONS

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. Unless specified otherwise in a site or project-specific work plan, Quality Assurance Project Plan (QAPP), Quality Assurance Program Plan (QAPP) or laboratory Quality Assurance Manual (QAM), all data collected following the protocols set forth in this document will be collected in accordance with the minimum QAQC requirements of Section 6.1. Further quality assurance requirements will be defined in project specific work plans and may include duplicate or replicate measurements or confirmatory analyses.

7. REFERENCES

Kaufmann, P.R., P. Levine, E.G. Robinson, C. Seeliger, and D.V. Peck. 1999. *Quantifying Physical Habitat in Wadeable Streams*. EPA/620/R-99/003. U.S. Environmental Protection Agency, Washington, D.C.

OWEB. 1999. “Chapter 14: Stream Shade and Canopy Cover Monitoring Methods.” *Water Quality Monitoring: Technical Guide Book*. Oregon Watershed Enhancement Board. http://www.oregon.gov/ODF/privateforests/docs/ShadeProt.pdf?ga=t

Strickler, G.S. 1959. Use of the densiometer to estimate density of forest canopy on permanent sample plots. Forest Service, U.S. Department of Agriculture, Research Note No. 180.

Figure 1. <u>Densiometer Modification from Strickler (1959)</u>

J. Sawyers

Figure 2. Densiometer Datasheet for Monitoring Section Sampling Events

Densiometer Canopy Measurements

Stream Segment : _____ Town: _____

Site Number: _____

Date: _____ Military Time: _____ Collectors _____

Sampling Point	Upstream	Left bank	Downstream	Right bank
1A				
1B				
1C				
2A				
2B				
2C				
3A				
3B				
3C				

Figure 3. Canopy Measurements Taken at Each Sampling Station

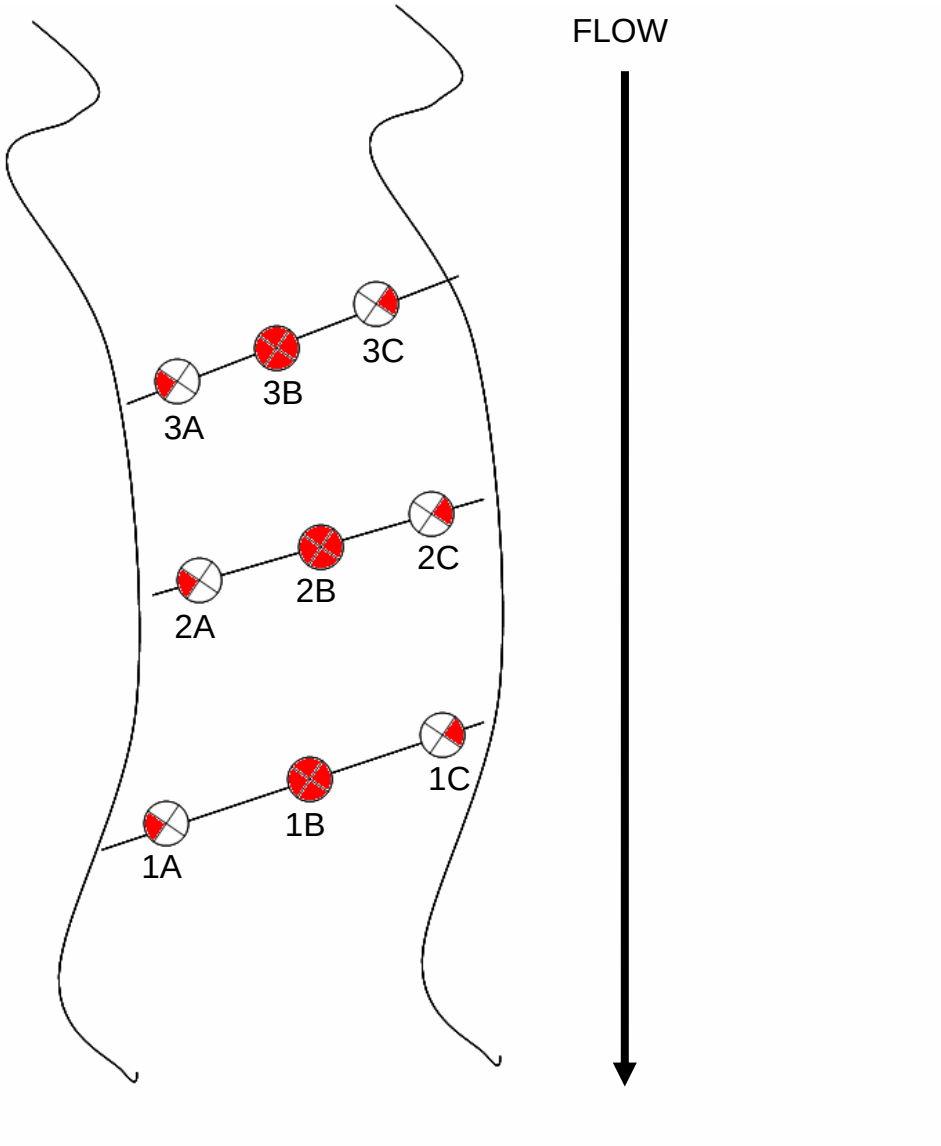

Figure 4. Location of Coverage Points on Densiometer

J. Sawyers