Standard Operating Procedure for Water Column Profile Lakes, Ponds, and Reservoirs

SOP-WR-W-30

APPROVALS:

Deputy Chief of Water Resources:

Sue Kiernan	Sue Kiernan	5/31/11
Printed Name	Signature	Date

Quality Assurance Manager:

Connie Carey	Connie Carey	5/11/11
Printed Name	Signature	Date

DISTRIBUTION

(x) Surface Water Monitoring & Assessment (Connie Carey) ..... By: cgc Date : 5/11/11

(x) TMDL Program (Elizabeth Scott) ..... By: ___ Date : ___

(x) Quality Assurance Manager (Tom Getz) ..... By: ___ Date : ___

Title: Standard Operating Procedure for Water Column Profile – Lakes, Ponds, and Reservoirs
Originator Name: Jane Sawyers

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1. APPLICABILITY

This SOP applies to all Office of Water Resources (OWR) staff involved in collecting water column profile measurements in lakes, ponds, and reservoirs using a multi-probe meter. 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 quantitative field measurements of a water column profile in lakes, ponds, and reservoirs, using a multi-probe meter. 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 Multi-probe meter – An instrument that measures water quality data, such as temperature, dissolved oxygen, specific conductivity, and pH, in a waterbody.

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 water column profile measurements using a multi-probe meter 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 does not require any additional special training or certification.

To properly measure water column profile data with a multi-probe meter, 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 multi-probe meter to measure water column profile data 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 multi-probe meter is in proper operating condition prior to use (i.e. batteries have enough power for the sampling event; multi-probe securely attached to handheld display) and communicating to the project manager when equipment is in need of repair or replacement. As delegated by the project manager, the field analyst may be responsible for calibrating the multi-probe meter according to SOP WR-W-14 Standard Operating Procedure for the Measurement of Dissolved Oxygen, Temperature, Specific Conductance, and Salinity using a Handheld YSI Model 85 Instrument (SOP WR-W-14) prior to departure and at the end of the sampling event. If responsibility is delegated to the field analyst, the field analyst will be responsible for adhering to the calibration and verification procedures and schedule in SOP WR-W-14. The field analyst is also responsible for ensuring that all supplementary equipment (canoe or kayak, 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 multi-probe meter 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 multi-probe meter is maintained in proper operating condition according to the calibration and verification schedule and procedures in SOP WR-W-14. At the project manager's discretion, this responsibility may be designated to the field analyst. The project manager will ensure that the field analyst is proficient in the requirements of SOP WR-W-14 prior to designation of the responsibility to the

field analyst. The project manager will ensure that this training is documented as required in the project and/or program QAPP(s). 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 renewal 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 MEASUREMENT OF WATER COLUMN PROFILE

5.1.1 REQUIRED MATERIALS

The following materials are necessary for this procedure:

- Multi-probe meter with cable marked with depth (Figure 1, similar to YSI Model 85 or ProPlus)
- Handheld display (Figure 1, similar to YSI Model 85 or ProPlus)
- Datasheet or field notebook printed on waterproof paper (paper similar to Grainger Item Number 3XFR7)
- Clipboard
- Pencil or Rite in the Rain Pen (similar to Forestry Suppliers Item Number 49237)
- Boat, canoe or kayak
- Paddles and motor
- Anchors
- Lifejackets
- Depth finder

5.1.2 USING THE MULTI-PROBE METER IN THE FIELD

For most purposes, the multi-probe meter is used specifically for in situ water quality measurements taken directly in the field, in lake, ponds, and reservoirs. 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 multi-probe meter:

Dissolved Oxygen %……..% saturation

Dissolved Oxygen ……..mg/L

Specific Conductance……µS/cm

Temperature……..……..^{o}C

pH (if available)……None

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, the order of the field procedures, and whether quality control procedures should be completed. Prior to performing this analysis, the field analyst should ensure the water column profile measurement is taken at an appropriate time of day and in the correct order. This procedure may disrupt fish and microscopic organisms, such as phytoplankton and zooplankton, which can interfere with other field procedures and sample collections in lakes, ponds, and reservoirs. Water column profile measurements with a multi-probe meter should be measured after these samples have been collected, unless the biological collection requires determination of a thermocline. Furthermore, water column profile measurements with a multi-probe meter should be taken before any sampling procedure or activity that may disturb bottom sediments to avoid increasing turbidity at the location. The field analyst should note any disturbance to the bottom sediment in the Comment/Notes section of the field datasheet (Figure 2) or appropriate field notebook.

5.2.2 POSITION THE BOAT AT THE DEEPEST POINT OR DESIRED DEPTH

If a bathymetric map is available, the field analyst should use the map and distinguishing land characteristics (i.e. outfall structures, points, inlets, boat launch) to find the general location of the deepest spot or desired depth in the lake, pond, or reservoir. The field analyst should verify the location by confirming several depth locations with the depth finder around the general location of the deepest spot or desired depth. Once the deepest location or desired depth is established, the field analyst should carefully lower the anchor so that bottom sediment is not disturbed into the water column. The field analyst should record the depth of the deepest location or desired depth to the nearest tenth of a meter on the field datasheet (Figure 2) or appropriate field notebook. For

monitoring section sampling events, the field analyst should fill out the information at the top of the field datasheet (Figure 2) prior to measurement of a water column profile.

5.2.3 TAKING THE WATER COLUMN PROFILE MEASUREMENTS

When taking water column profile measurements the multi-probe meter should remain in the water directly below your hand holding the cable attached to the multi-probe meter.

NOTE: The second field analyst should record all numbers read aloud on the datasheet (Figure 2) or appropriate field notebook.

- Unwind the cable attached to the multi-probe to equal the deepest spot or desired depth. Place your foot gently on the cable not unwound in the bottom of the boat in case you drop the equipment.
- In one hand using the cable, hold the multi-probe over the water. In your other hand, hold the handheld display (securely attached).
- Using the cable, slowly lower the multi-probe over the side of the boat into the water until the top of the multi-probe is just under the surface of the water.
- Press MODE until a "%" appears on the right side at the top of the LCD screen.
- Allow instrument at least 6 seconds to stabilize the measurement and read aloud the % dissolved oxygen displayed.
- Below the % dissolved oxygen, the field analyst should observe a "°C"
- Read aloud the temperature displayed.
- Press MODE and read aloud the next parameter displayed.
    - Note: If the unit is reading specific conductance in mS (indicated by a small number), press enter to change the units back to µS/cm.
    - Note: The "°C" should be flashing when specific conductance is read. If "°C" is not flashing, then press MODE.
- Continue until all parameters have been recorded.
- Slowly lower the multi-probe to the 0.5 meter marking on the cable.
- Read aloud the depth to the nearest tenth of a meter to the second field analyst.
- Repeat the steps above until all parameters have been recorded for the 0.5 meter depth.
- Slowly lower the multi-probe to the 1.0 meter marking on the cable.

- Read aloud the depth to the nearest tenth of a meter to the second field analyst.

- Repeat the steps above until all the parameters have been recorded for the 1.0 meter depth.

- For lakes greater than 5 meters at maximum depth, continue to lower the multi-probe at 1 meter intervals. For lakes less than 5 meters at maximum depth, continue to lower the multi-probe at 0.5 meter intervals.

    - For example, the next reading in a lake greater than 5 meters would be at the 2.0 meter marking on the cable, and the next reading in a lake less than 5 meters would be at the 1.5 meter marking on the cable.

- Continue to take water quality measurements at each interval for all parameters until the multi-probe is 1.0 meters above the maximum depth.

- Slowly bring the multi-probe to the surface.

    - At 15-20% of sites as designated by the project manager, a second reading of water quality parameters will be completed by stopping at the 1.0 meter depth and taking another compete set of water quality parameter readings. Following this reading, remove all equipment from the water and rewind the cable.

6. QUALITY CONTROL

6.1 QUALITY CONTROL

Quality control will be assessed by calculating the 5% error of the repeated measurements at the 1.0 meter depth. This will give a measure of precision 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

YSI Model 85: Handheld Oxygen, Conductivity, Salinity, and Temperature System Operations Manual. YSI incorporated. Yellow Springs Ohio, USA.

Wetzel, R.G. and Likens, G.E. 2001. *Limnological Analyses*, 3rd ed. New York: Spring Science and Business Media, Inc., 429 pp.

Figure 1. YSI 85 and Associated Equipment

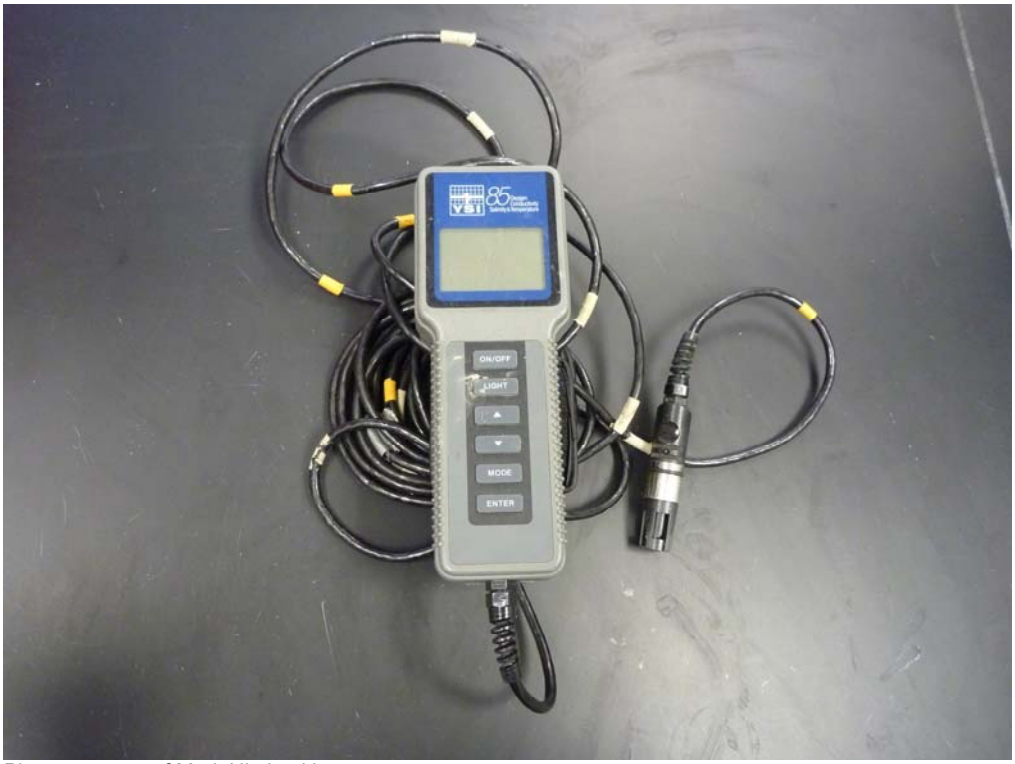

Photo courtesy of Mark Nimiroski

Figure 2. Lake Datasheet for Monitoring Section Sampling Events

Lake Sampling Datasheet

Lake Name:	_____			**Town:**	_____
		Military			
Date:	_____	**Time:**	_____	**Collectors:**	_____
Meter #	_____				_____
Max Depth:	_____	m			
Weather: (Circle one)	**Clear**		**Partly Cloudy**		**Overcast**
	Raining		**Windy**		**Sunny**
Air Temperature:	_____		°C		
Comments/Notes:					
Secchi Depth #1	_____ m				
Secchi Depth #2	_____ m				
QC Range (5%)	_____ m			**Accepted?**	_____
Secchi Depth #3	_____ m			**Action?**	_____
Secchi Depth #1 redo	_____ m				
Secchi Depth #2 redo	_____ m				
					QC Measurement (20% of sites)
Water Column Readings (reading taken at 1m)	**Temperature**		_____ °C		_____ °C
	pH		_____		_____
	Specific Conductivity		_____ µS/cm		_____ µS/cm
	Dissolved Oxygen		_____ mg/L		_____ mg/L
			_____ %		_____ %

Figure 2. (cont.) Lake Datasheet for Monitoring Section Sampling Events

Water Column Profile Readings

Depth	Temp	pH	SpCond	DO

Macrophyte Survey Complete?	YES	NO
Water Collection Complete?	YES	NO