TEACHER INFORMATION

Watershed Testing

1. Editable Microsoft Word versions of the student pages and pre-configured TI-Nspire files can be found on the CD that accompanies this book. See Appendix A for more information.

2. This lab can be done by monitoring the Meter View readings and recording the values instead of using Events with Entry data collection.

3. To make data collection more efficient, you may choose to have each group collect data for only one sensor and then share the data.

4. In order for the Dissolved Oxygen Probe to warm up and stay polarized, **power to the sensor must be continuous**. Go! Link or EasyLink, with a computer, and the TI-Nspire Lab Cradle deliver continuous power once the data-collection software is started. However, EasyLink or Go!Link with a handheld will lose power when the TI handheld goes to sleep (APD™). If power to the sensor is disrupted, the sensor must be warmed up for 10 minutes again before calibrating or taking readings. To avoid having to warm up the sensor again, students must press a button on the handheld every few minutes to keep it awake.

5. When using a TI-Nspire handheld with an EasyLink or Go!Link interface, we recommend that the handhelds power standby feature be set to 30 minutes. To set this feature, select Settings ►Handheld Setup from the TI-Nspire home screen. Change the Power Standby feature to 30 minutes. You may want to set this back after completing this experiment.

6. The Dissolved Oxygen Probe must be calibrated the day of use. Follow the pre-lab procedure to prepare and calibrate the Dissolved Oxygen Probe. To save time, you may wish to calibrate the probe and record the calibration values. The students can then skip the pre-lab procedure and they will have the calibration values available for manual entry in case the values stored in the program are lost. We strongly recommend that your students store the calibration values to the document after calibrating the probe the first time.

7. To ensure the most accurate measurements of pH in water quality experiments, the pH System should be calibrated prior to use. For instructions on calibration, refer to the sensor documentation, and *Appendix B* or *C*.

8. When transporting the Dissolved Oxygen Probe to the field site, you should store it in the plastic calibration bottle filled with distilled water. This plastic bottle is shipped with the Dissolved Oxygen Probe. It is important that the students understand the fragile nature of the electrode membrane and proper handling procedures. When setting up the Dissolved Oxygen Probe, be sure to remove the blue plastic cap from the end of the probe. The cap is made of a soft plastic material and easily slides off the probe end.

9. A glass-stoppered water sampling bottle is recommended for collecting samples. Filling this bottle to the brim, followed by stoppering, will prevent additional oxygen from dissolving after water is collected.

10. Two sites 1.6 km (1 mile) apart should be selected for comparison. Have students take samples at two points for each site. Each of the sample points should be approximately 6 m (20 feet) apart.

11. To determine the D.O. concentration for a solution saturated with dissolved oxygen, refer to Table 9 and Table 10. **Important:** Be sure to bring a copy of these tables on the day you collect and test water samples! Use Table 10 to estimate barometric pressure using your approximate elevation above sea level. Temperature and barometric pressure values can then be used in Table 9 to determine the saturated level of dissolved oxygen, in mg/L. Use this formula to calculate % saturation of dissolved oxygen:

$$\% \text{ saturation} = \frac{\text{measured D.O. level}}{\text{saturated D.O. level}} \times 100$$

12. To ensure the most accurate measurements of TDS in water quality experiments, the conductivity probe should be calibrated prior to use. For instructions on calibration, refer to the sensor documentation and *Appendix B* or *C*.

13. When measuring total dissolved solids, you may wish to have students use the 0–200 µS/cm (equal to 100 mg/L TDS) range to improve accuracy. This should only be done if TDS levels are below 100 mg/L.

14. A more complete water quality index can be obtained by measuring fecal coliform counts; biological oxygen demand, phosphate and nitrate levels, and turbidity. It is also very valuable to do a "critter count"—that is, examine the macroinvertebrates in the stream.

    For more information on the Water Quality Index, you may be interested in the Vernier book, *Water Quality with Vernier*.

SAMPLE RESULTS

Table 1				
Location	Dissolved oxygen (mg/L)	pH	Total dissolved solids (mg/L)	Temperature (°C)
Sites 1 & 2 average	10.2	7.4	88.4	11.0
Sites 3 & 4 average	8.1	7.4	94.0	8.0

Table 2 - DO (% Saturated)			
	Dissolved oxygen (mg/L)	DO in saturated water	% saturated
Sites 1 & 2	10.2	11.1	91.9
Sites 3 & 4	8.1	11.9	68.0

Table 3 - Sites 1 & 2			
Test	Q-value	Weight	Total Q-value
DO	97	0.38	36.9
pH	95	0.24	22.8
TDS	84	0.16	13.4
Temperature	85	0.22	18.7
		Overall Quality:	91.8

Table 4 – Sites 3 & 4			
Test	Q-value	Weight	Total Q-value
DO	70	0.38	26.6
pH	95	0.24	22.8
TDS	83	0.16	13.3
Temperature	85	0.22	18.7
		Overall quality:	81.4

ANSWERS TO QUESTIONS

1. The water quality indices for the above sites are 91.8 and 81.4. These are very high indices, considering that they were obtained in an urban Seattle watershed. The first site was from a small, rapidly moving stream (~3.4 m^3/s), and the second from a pond 1.6 km upstream. Other measurements corroborated these measurements—the water quality was very high.

2. Answers will vary.

3. Answers will vary. The two sites compared equally except for the DO value. Since water at the second site was hardly moving, it had less dissolved oxygen than in rapidly moving, highly aerated water.

4. Answers will vary.

5. Water in rapidly moving stream is aerated as it flows through riffles, and may have more dissolved oxygen than in slowly moving water.

6. Answers will vary.