Name

STUDENT ACTIVITY 10.4

Calculating the Overall Water-Quality Index for Your River or Stream

Purpose

To use the results of the water-quality tests you have performed in *Rivers Chemistry* and determine the overall water-quality index for your river or stream at your field site.

Background

As you recall from Lesson 1, when the results of all nine water-quality tests are weighted according to their importance and added together, they comprise the overall water-quality index for a waterway. Ideally, before computing the overall water-quality index for your river or stream, you will have conducted all nine water-quality tests. This activity includes steps on how to calculate water quality if you do not have results from all nine tests; in such cases, refer to the result as water-quality index, not overall water-quality index.

For most accurate results, all tests should be run on samples taken at the same site and at nearly the same time. If your testing took place at multiple times or locations, annotate your results to show what happened.

As you consider the significance of your results, remember that the use of the waterway determines which tests are most important in assessing quality and safety. For example, if the river or stream is used for swimming, a high fecal coliform count would indicate that no swimming should be permitted, even though the other eight tests may show excellent quality. On the other hand, a low fecal coliform count with poor results in other categories may indicate water that is acceptable for swimming but threatening to many aquatic species.

The water-quality index was developed as a guide for judging water. It is a very general index that gives an overview of the quality of a water system. The index includes measurements of many common pollutants, the importance of which have been ranked by experts. Excluded from the index and the rankings are some dangerous materials, such as heavy metals, pesticides, and herbicides. The weighting scheme that is part of the index allows analysts to condense complex test results into a common water-quality measurement that can be readily communicated to the public.

Materials

Per student

- calculator
- completed Observations and Data Tables from Student Activities 2.5, 3.3, 4.5, 5.4, 6.3, 7.2, 8.2, 9.3, and 10.3

Optional

- topographic map of field-site area

Procedure

1. Enter the field-site description in the accompanying Water-Quality Index (WQI) sheet. Adapt as necessary to reflect multiple field sites. Give specific information so others using your data can locate your field site. If available, use a topographic map for your area.
2. Using the Observations and Data Tables from earlier Student Activities, fill in information about test results on the WQI sheet.

Calculations

3. Multiply each Q-value by the corresponding weighting factor on the WQI sheet and record your weighted value in the "Total" column on the WQI sheet.
4. Sum the totals to obtain your overall water-quality index.
5. If you do not have data for all tests, sum the weights of all the tests for which data are available. Then divide the water-quality index obtained in Step 4 by the sum of the weight of the tests, obtained in Step 5. For example, if all tests were completed except fecal coliform, and the calculated water quality without this test was 65%, and the total of all the weighting factors except the one for fecal coliform is 0.84, then the water-quality index is 65% divided by .84 = 77%.

Analyses and Conclusions

1. Using the overall water-quality index value you obtained and the chart at the bottom on the WQI sheet, determine the overall quality of your water.
2. Reviewing your observations throughout *Rivers Chemistry,* what natural factors do you think have significantly impacted the water quality of your river or stream positively? Which have had significant negative impact? Explain your answers.
3. Reviewing your observations throughout *Rivers Chemistry,* what human factors do you think have significantly impacted the water quality of your river or stream positively? Which have had significant negative impact? Explain your answers.

Critical Thinking Questions

1. If you made a prediction in Lesson 1 about the water quality of your river or stream, how does your finding compare with your prediction? Explain why your prediction and result are the same or different.
2. Do you think students such as yourself can do something to improve quality of the waterway? If so, describe your suggestions.
3. What are the most important steps public agencies and private industries and businesses can do to improve the quality of your river or stream?

Keeping Your Journal

1. What do you feel about the overall quality of your waterway now? Do you feel different having a quantitative value for that water quality? Explain your thoughts.
2. Do you have a different relationship with your river or stream now compared with when you began *Rivers Chemistry?* Explain your thoughts.

Water-Quality Index (WQI)

River/Stream _____ River Mile Marker _____

School _____ Location Latitude: _____ ° _____ ' _____ "

Date _____ Time _____ Longitude: _____ ° _____ ' _____ "

Water Conditions _____ County _____ Quadrangle _____

Weather Conditions _____ Legal Description: ____ 1/4 of the ____ 1/4 of the ____ 1/4

_____ Section _____ of Township _____ Range _____

Air temperature _____ °C Nearest Town _____ _____

Flow rate _____ m/s Site Location or Address _____

Test	Test Results (mean values)	Standard Deviation	Q-Value	Weighting Factor	Total (%)
Dissolved Oxygen	_____ mg/L ($DO_{day\ 1}$) _____ % Sat			0.17	
Fecal Coliform	_____ colonies/100 mL			0.16	
pH	_____ units			0.11	
BOD	DO_{day1} _____ mg/L – DO_{day5} _____ mg/L BOD = _____ mg/L			0.11	
Temperature Change	$Temp_{site\ 1}$ _____ °C $Temp_{site\ 2}$ _____ °C ΔT = _____ °C			0.10	
Phosphate	_____ mg/L			0.10	
Nitrate	_____ mg/L			0.10	
Turbidity	_____ meters or JTU/NTU			0.08	
Total Solids	_____ mg/L			0.07	
			OVERALL WATER-QUALITY INDEX _____ %		

Overall Water-Quality Index	Quality of Water
90–100%	Excellent
70–89%	Good
50–69%	Medium
25–49%	Bad
0–24%	Very Bad