



Outdoor Monitoring Series

# Water Quality Monitoring

Code 5870



Lesson Plans are provided to help organize an existing curriculum, allowing the teacher to spend more time on hands-on activities that meet key classroom learning objectives and improve student achievement. The Lesson Plans will aid the teacher in integrating LaMotte test kits and equipment into classroom activities that meet National Science Education Standards.



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### **Concept/Topic:**

Water Quality Monitoring of Natural Water

### **Time Requirement:**

One day or longer, depending on goals and depth of study.

### **Subject Area(s):**

Biology, Chemistry, Ecology, Environmental Science, Mathematics

### **General Goals:**

- 1 The students will determine water quality from biological and chemical test results.

### **Specific Objectives:**

- 1 Students will be able to set up a monitoring program.
- 2 Students will be able to choose an appropriate sampling site and collect samples.
- 3 Students will be able to follow instructions to perform biological and chemical analyses of the samples.
- 4 Students will be able to use their understanding of the test results to analyze data and determine water quality.
- 5 Students will be able to present data and draw a conclusion.

### **Materials, Required:**

Order Code	Description
5870	The Water Quality Educator & Monitoring Outfit Sample Collection Container with Leak Proof Cap
2-2146	Safety Goggles
2-2234	Gloves Timer/Clock

## Materials, Optional:

Order Code	Description
1048	Rain Gauge
3-0022-P	Seine Net
3-0021-P	Kick Net
1063	Plankton Net
0171-CL	Secchi Disk
1066	Armored Thermometer
1077	Water Sampler
1097	Bottom Sampling Dredge
5882	Leaf Pack Experiments Stream Ecology Kit
5882-SA1	Aquatic Macroinvertebrate Flashcard Set

## Anticipatory Set (Lead-In):

About 80% of the Earth's surface is covered by water, but only 1% of that is fresh water that can directly be used for domestic, industrial, commercial, and recreational purposes. Although there is the same amount of water as millions of years ago, the demand for water has increased dramatically. Increased demand and diverse use for water has put enormous stress on our water supply, its quality and the aquatic life and habitat it sustains.

Through the process of the water cycle, the same water is continually recycled. Pollution from human activities upsets this delicate natural purification process. Land and water use are interconnected and water quality is affected by how the surrounding land is used. Almost everything we do on the land impacts the water. Farming contributes to erosion and excessive nutrient levels in surface and ground water. In suburbs, septic system waste and lawn fertilizer run-off from millions of homes enter waterways, and water that is used by industrial processes is often put back into the river at a higher temperature or polluted. The water quality of streams, lakes, rivers, estuaries, and coastal and ocean waters has declined due to human pollution.

Every day, more of us become aware of how pollution impacts aquatic life and water quality. The difference between "good" and "bad" water must be interpreted according to the intended use of the water. For example, the perfect balance of water chemistry that assures a sparkling, clear, sanitary swimming pool would not be acceptable as drinking water and would be a deadly environment for many types of fish larvae. Monitoring helps us assess the present level of water quality and our

need to keep water “clean” prompts us to actively protect and preserve our finite resources.

### Preparation:

After defining why and where you will monitor, the following pre-monitoring sequence of activities is recommended: watershed survey, site selection, and sampling schedule. If using LaMotte Leaf Pack Experiments kit for collection of aquatic macroinvertebrates, follow instructions to place leaf packs at each site 3-4 weeks prior to sample collection date.

### Step-By-Step Procedures:

1. Have students prepare for sampling by reviewing test procedures and aquatic macroinvertebrate identification on included CD.
2. Accompany students to the pre-determined sampling site(s). Keep access and safety in mind.
3. Follow the instructions to take the temperature of the water in degrees Celsius.
4. Use a water sampler or a bucket to obtain a representative water sample. Perform chemical tests for Dissolved oxygen, pH, Nitrate-Nitrogen, Phosphate, Total Alkalinity and Turbidity immediately. All test procedures should be performed promptly. If immediate analysis is not possible, follow instructions for the dissolved oxygen test to “fix” sample. Fill water sample collection container to the top with the water sample and cap for later analysis of remaining test factors.
5. As an optional activity, collect aquatic macroinvertebrates for identification from Leaf Packs or with a kick net. Treat organisms with care to keep them alive. Return them to the stream after identification.
6. Follow Dissolved Oxygen test procedure to determine dissolved oxygen concentration of the water sample. For better accuracy, collect and “fix” two samples from each site. Titrate each sample twice
7. Follow pH test procedure to determine pH of water sample. Perform the test twice for better accuracy.
8. Follow Nitrate-Nitrogen test procedure to determine nitrate-nitrogen concentration of the sample. Perform the test twice for better accuracy.

9. Follow Phosphate test procedure to determine phosphate concentration. Perform the test twice for better accuracy. Avoid washing glassware and apparatus with detergents that contain phosphates.
10. Follow Total Alkalinity test procedure to determine the alkalinity of the water sample. Perform the titration twice for better accuracy.
11. Follow Turbidity procedure to determine turbidity of the water sample. Perform the test twice for better accuracy. If time elapses between sampling and measurement, be sure to shake the sample well to suspend the particles before performing the test.
12. Record test results and observations for each site on a data sheet.
13. Analyze data to determine water quality.

### **Plan for Independent Practice:**

Read Monitor's Handbook for background information on monitoring programs, test parameters and interpreting and understanding results. Review test procedures and aquatic macroinvertebrate identification on included CD

### **Closure (Reflect Anticipatory Set):**

People, animals, plants, and aquatic insects are all part of the ecosystem of a stream or river. Many stream/river ecosystems are polluted but they can recover and water quality can improve once the problem has been identified. Use the knowledge and experience gained from this project to take responsibility and take action to reduce pollution.

### **Assessment Based on Objectives:**

Have students:

- Explain the goal of the monitoring program
- Describe their sampling sites and the reasons why they were chosen
- Explain biological and chemical test procedures
- List test results and explain the significance as water quality indicators
- Present data

## Adaptations (For Students With Learning Disabilities):

Students can become familiar with test procedures and macroinvertebrate collecting by watching the included CD. Set up a mentoring program with volunteer water quality monitors in your area.

## Extensions (For Gifted Students):

Have students prepare and present a report to local government officials detailing water quality results and any problem areas that may have been discovered during the monitoring project. Have students enter data on a national water quality monitoring website. Use data to issue a report summarizing the findings and comparing data to other sites in the area.

## Possible Connections To Other Subjects:

- Geography—map reading
- Math—statistical analysis of data
- Social studies—land use and urbanization

## Resources:

<b>Literature</b>	Environmental Protection Agency, <a href="http://www.epa.gov">www.epa.gov</a> , volunteer monitoring, water quality issues Fish and Wildlife Service, <a href="http://www.fws.gov">www.fws.gov</a> , biology report Save Our Streams, Izaak Walton League, <a href="http://www.saveourstreams.org">www.saveourstreams.org</a> , invertebrate identification
<b>Methods</b>	Standard Methods for the Examination of Water and Waste Water <a href="http://www.standardmethods.org">www.standardmethods.org</a> , details of test methodology
<b>Equipment</b>	LaMotte Company, <a href="http://www.lamotte.com">www.lamotte.com</a> , review and order additional equipment
<b>Maps</b>	US Geological Survey, <a href="http://www.usgs.gov">www.usgs.gov</a> , maps EPA Watershed Information Network, <a href="http://www.cleanwater.gov">www.cleanwater.gov</a> , identify your watershed

# National Science Content Standards Addressed

## **A Science as Inquiry**

All students should develop:

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

## **C Life Science**

All students should develop understanding of:

- Biological evolution
- Interdependence of organisms
- Behavior of organisms

## **E Science and Technology**

All students should develop:

- Abilities of technological design
- Understandings about science and technology

## **F Science in Personal and Social Perspectives**

All students should develop understanding of:

- Natural resources
- Environmental quality
- Natural and human-induced hazards
- Science and technology in local, national, and global challenges

## **G History and Nature of Science**

All students should develop understanding of:

- Science as a human endeavor
- Nature of scientific knowledge