

**Learning Set 2**  
**Back to the Big Question and Challenge**

**Overview**

Students have learned about several water quality indicators in this learning set and they learned about how land use can affect the water in a watershed in *Learning Set 1*. In this students apply what they have learned about water quality indicators in *Learning Set 2* to the land use that they explored in *Learning Set 1*. In their groups, students discuss and determine what type of water indicators should be tested for in their assigned land use. They use these discussions to answer the question: *How do you determine the quality of water in a community?* For a context, students will refer to the features of their land use as shown in the Rouge River photographs they studied earlier in the unit.

| Targeted Concepts, Skills, and Nature of Science  | Performance Expectations  |
|---|---|
| Explanations are claims supported by evidence, accepted ideas, and facts.   | Students should be able to write an explanation and recommendations based on science knowledge and evidence from their investigations that back their claims. |
| Scientists make claims (conclusions) based on evidence (trends in data) obtained from reliable investigations.          |   |
| Scientists design investigations to test their claims.  |   |
| Humans affect water quality in rivers through residential, commercial, industrial, and agricultural activities.         |   |
| Water quality indicators often used are pH, dissolved oxygen levels, temperature, turbidity, and fecal coliform levels. |   |

| <b>Materials</b> |  |
|------------------|--|
| 1 per group      | set of land use images along the Rouge River                 |
| 1 per group      | poster materials   |
| 1 per student    | <i>Applying Indicators to My Land Use</i> (Blackline Master) |
| 1 per student    | <i>Idea Briefing Note</i> (Blackline Master)                 |

**Homework Options**

- **Science Content and Process:** Edit and add to the rough draft of recommendations for the Wamego Town Council that you started at the end of *Learning Set 1*. Modify any recommendations or comments you made at that point by incorporating new information you acquired in *Learning Set 2*. (*Updated*)

*statements should contain expanded recommendations supported by evidence collected in investigations conducted during Learning Set 2.)*

- **Science Process:** While out in the field, you take two samples of water from two different locations along the same stream. Back in the lab, you decide to test them for pH. Sample A tests green and Sample B tests in the pink-purple range. Explain how you would test the water samples for pH and what ranges these color reactions mean. Is Sample B more acid or more basic than Sample A? (*You would use a pH indicator solution or pH indicator paper to test each sample. The green sample has a pH reading of 13 to 14. The pink-purple sample has a pH reading of 5 to 6. Sample B is more acid than Sample A.*)

1 class period

## **Learning Set 2**

### ***Back to the Big Question and Challenge***

#### ***How does Water Quality Affect the Ecology of a Community?***

*Students begin to think about how to connect what they know about water quality indicators to land use.*

10 min.

#### **[icon] Engage**

Review with the class what they have accomplished in this *Learning Set*. They have investigated how plant growth can be an indicator of water quality. They have tested solutions for pH and learned that certain aquatic organisms can tolerate only certain ranges of pH. They have learned about other water quality indicators such as temperature, dissolved oxygen, turbidity, and fecal coliform bacteria.

#### **[icon] Guide**

Now ask students to recall their investigation about land use from *Learning Set 1*. Have them summarize what happened to water in their particular investigation. Explain that they will be using this information again as they come to the end of this *Learning Set*. Explain that connecting what they have learned in both *Learning Sets* will enable them to begin to answer the question: *How does water quality affect the ecology of a community?* To focus students' attention on the *Big Challenge*, you might rephrase the question and change the word *community* to *Wamego*.

#### **TEACHER TALK**

“The information you learned about and investigated in *Learning Set 1* isn't separate from what we have been talking about in *Learning Set 2*. Now it is time to make a connection between the two. Think about the land use investigation you did in *Section 1.6*. You're going to look at the land use again and add some new information—the information about water quality indicators. To do this, you will use photographs from the Rouge River. This activity will help you to build a more realistic picture of how land use might be affecting water quality because now you have a better idea of how to test the

water. It will also help you to answer the question, “*How does water quality affect the ecology of Wamego?*”

Explain to the students that you will all review the example of the activity in the text so that everyone understands how they are to use the photographs. Tell students that the example of the car wash in the text is just one scene. Then use the bulleted statements on p. 80 in the student text to illustrate how evidence from investigations and science knowledge about water quality indicators has been used to *apply* information to the car wash scene.

As students what questions they have. Even if they appear to understand what to do now, they will probably have more questions once they begin to work with their own land use photographs.

Divide the class into their original eight groups so that, once again, there are two groups working on each type of land use- namely residential, commercial, industrial, and agricultural land uses. Explain that they will work in their groups and create a poster that summarizes the groups’ decisions.

Explain that after completing their discussion, the class will hold an *Idea Briefing* during which time, each group will present their findings and recommendations. Other students will be able to ask questions and groups will be able to improve their posters.

### **Applying Indicators to My Land Use**

10 min.

#### **[icon] Get Going**

Distribute a copy of the *Applying Indicators to My Land Use* page to each student and the appropriate Rouge River land use photograph to each group. Let students know where poster materials are available. Let students know that they have about 10 minutes to complete their group discussion and plan their poster.

#### **[icon] Assess**

Circulate through the room listening to group discussions. Some groups may have difficulty identifying possible problems in the photographs. Assist these groups by asking questions such as: What type of land use is this? How many trees are in the photograph? Does this scene look like a place where you would picnic? Do you think the houses affect the pond because they are so close to it? How do you think the smoke from that smokestack might affect the water?

Some students might look at the photo and think of actions or situations that are plausible for the scene, but not explicitly shown in the photo. This is acceptable so long as students justify their conclusions with evidence from the photo.

Tell students that you will give them a two minute warning to prepare them for the start of the *Idea Briefing*. Use a timer if you have one.

## **Communicate Your Ideas**

### *Idea Briefing*

20 minutes

*Having two groups present each land use provides an opportunity for more in-depth analysis and application of information about that land use.*

### **[icon] Guide Presentations and Posters**

Explain to students what they will accomplish during an *Idea Briefing*. Remind students that their *Idea Briefing* needs to focus on the three points listed on p. 82 in the student text. These three points must also be shown on the group's poster.

Remind students that their posters need to indicate the tests they wish to conduct and reasons for using these particular tests. Also tell them that posters can be modified as a result of the *Idea Briefing* when other students have given them new ideas to think about.

#### TEACHER TALK

“The purpose of an *Idea Briefing* is to share your conclusions with the class, hear advice from the class, and help other groups improve on their ideas. In many ways, sharing information is similar to how scientists often work when they solve a problem. Sharing information about how land use affects ecology will help you to develop recommendations for the challenges faced by Wamego.”

Remind students again of the three points to include in their presentations. Tell them that you and the rest of the class will be listening for these factors during the presentation.

#### TEACHER TALK

“Your presentations should clearly describe the question you are answering. Include the kind of land use in your opening statement. You might say something like: ‘We investigated how agricultural land use might affect the water quality in a community.’ Then be clear about the water quality indicators that you recommend using and explain why these indicators are the ones to use.”

Inform groups that they will have 5 to 7 minutes for their presentation. Tell them that you will let them know when they have two minutes left, then one minute so they can sum up their discussion.

### **[icon] Guide and Assess**

Let the rest of the class know that during the presentations, they are to look at the photo used by the group, listen to the types of indicators the group thinks they would use and their reasons for doing so. They should be listening for an explanation supported by evidence that is in the photograph. Remind them that they can ask questions if they do not understand something or do not agree with the presenting group. Point out that these comments and questions are to be made politely.

At the end of the presentations and discussions, give students time to revise their conclusions and their posters.

#### META NOTES

When students listen to their classmates giving a presentation on something they are familiar with, they may learn what to say or how to say something and refine their own presentations.

#### [icon] Assess

During each presentation, listen for students to make connections between land uses, sources of pollution, and water quality indicators. Students should be able to describe all three for their particular photograph and justify their choices.

The table below summarizes problems, tests, and possible causes that students might identify in their assigned land use photos. Refer to the table as each group presents. If a group is unable to think of more than one item for their photograph, use the table as a resource to suggest an indicator the students might have overlooked.

**NOTE: See the back of the book for the answer table.**

After each land use has been presented, give the audience a few minutes to ask questions and make observations. Make sure the student asking the question directs the question to the group presenting and not to you.

Assess students' ability to construct and pick out claims, evidence, and science knowledge and construct explanations.

Give groups time to edit their posters. Collect posters for future use in the unit.

#### Update the Project Board

10 min.

#### [icon] Guide

Let students know that after their discussions, they will be ready to answer the question: *How does water quality affect the ecology of a community?* The answer to this question will come from information that they have entered in columns 3 and 4 of their *Project Board*. Let students know that after they have answered this question, they will be ready to write a draft of part of their recommendations for the Wamego Town Council.

Transition students to recommendations by letting them know that their explanations go into the fifth column of the *Project Board*. Their recommendations will be about how to address the challenge. Their recommendations will be based on the evidence they have entered in columns 3 and 4.

#### [icon] Get Going

Have students work in groups to compose their best group recommendation. Remind them to review their explanations to make sure it reads logically.

### **[icon]Guide**

At this point, you should lead students to a class discussion. Ask one group to share their recommendation and allow other groups to comment on the recommendation. Display each statement where the class can edit it before it is transferred to the *Project Board*. Write the recommendations the class makes in column 5. Let students know that when the final letter to Wamego Town Council is put together, it will contain all the recommendations.

### **Teacher Reflection Questions**

- What difficulties did students have in integrating information from *Learning Sets 1* and *2*? How successful were they in making justifications for their use of particular water quality indicators and what can be done to improve their comfort in doing so in future presentations requiring justification of choices?
- How comfortable were students in using the photographs as a basis for their decisions? Do the photos contain sufficient information for students to base conclusions? How many groups also referred to their investigations with their land use models?
- During the *Idea Briefing*, did everyone participate in the presentations? What can be done to improve participation by everyone in each group?