

# Planning Our Restoration Site: Planning and Testing a Solution

## *Science Instructional Materials Lesson Upgrade*

### Introduction

This lesson upgrade was developed as part of an Office of Superintendent of Public Instruction (OSPI) and Washington State Leadership and Assistance for Science Education Reform (LASER) project funded through an EPA Region 10 grant. The purpose of the lesson upgrades is to incorporate environmental and sustainability concepts into high use science instructional materials and also address the cultural relevancy of the lessons by incorporating Native American stories.

This lesson is designed to be taught with Lesson 7 of the STC®/*Land and Water* unit.

This and other upgraded lessons can be downloaded at: [http://www.wastatelaser.org/\\_support/ESEL/land\\_and\\_water/index.asp](http://www.wastatelaser.org/_support/ESEL/land_and_water/index.asp)



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## *Science Instructional Materials Lesson Upgrade*

### **Post Assessment**

After Lesson 15/16 of the *Science Instructional Materials Upgrade*, you will administer a post assessment to determine student growth.

### **Standards**

#### **A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas**

ESS2.C: *By the end of Grade 5.* Water is found...and running water on land...The downhill movement of water as it flows to the ocean shapes the appearance of the land....

#### **Common Core State Standards in English Language Arts**

##### *Writing (4th and 5th grade)*

W.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

W.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

W.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

##### *Speaking and Listening (4th and 5th grade)*

SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade level topics and texts, building on others' ideas and expressing their own clearly.

SL.4 Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

##### *Language (4th and 5th grade)*

L.4.6. Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being and that are basic to a particular topic.

## LESSON 15/16

# Planning Our Restoration Site: Planning and Testing a Solution

### Overview and Objectives

In this lesson, which serves as an embedded assessment, students apply what they have learned by planning an improvement or restoration to a local site such as a school yard. After identifying a possible location, students think about how the class can improve to restore their site in order to decrease erosion or flooding, increase habitat for native plants and animals, or reduce pollution. Students plan, model, and test their ideas using their stream table.

- ◆ Students will plan and test an improvement or restoration of local site.
- ◆ Students will build a model of their site and suggested improvement/restoration.
- ◆ Students will predict the impact of their design.

### Background

This background information comes from *Washington K-12 Integrated Environmental and Sustainability Education Learning Standards* (2009).

*In 1990, the State Board of Education created a rule defining environmental education as part of Basic Education and mandating its instruction in public school at all grade levels in all subject matters. WAC 392-410-115, Subsection (6) reads, "Pursuant to RCW 28A.230.020, instruction about conservation, natural resources, and the environment shall be provided at all grade levels in an interdisciplinary manner through science, the social studies, the humanities, and other appropriate areas with an emphasis on solving the problems of human adaptation to the environment."*

*In response to this legislation, the Office of Superintendent of Public Instruction created "Environmental Education Guidelines for Washington Schools" (EE Guidelines), with the most recent update to the EE Guidelines occurring in 2000.*

*Because of its real-world, project-based application, Environmental and Sustainability Education offers excellent opportunities for authentic assessment. It is not intended for there to be a separate assessment of student learning in Environmental and Sustainability Education. Rather, these standards can be a tool to demonstrate student learning within core content areas. Environmental and Sustainability Education is required in Washington State to be taught across all grade levels in an interdisciplinary manner, therefore, the assessment of how well students meet these standards should be integrated into core content assessments, where appropriate. Educators can determine whether their present curricula and assessments are already aligned with these standards. For example, Environmental and Sustainability Education offers excellent content and context for Classroom-Based Assessments in social studies and the arts.*

*The standards indicate what students should know and be able to do in three areas of Environmental and Sustainability Education. Although each Integrated Environmental and Sustainability Education Learning Standard is distinct unto itself, they are interrelated and ideally would inform teaching and learning concurrently. The Integrated Environmental and Sustainability Education Learning Standards address the following areas:*

***Standard 1: Ecological, Social, and Economic Systems***

*Students develop knowledge of the interconnections and interdependency of ecological, social, and economic systems. They demonstrate understanding of how the health of these systems determines the sustainability of natural and human communities at local, regional, national, and global levels.*

***Standard 2: The Natural and Built Environment***

*Students engage in inquiry and systems thinking and use information gained through learning experiences in, about, and for the environment to understand the structure, components, and processes of natural and human-built environments.*

***Standard 3: Sustainability and Civic Responsibility***

*Students develop and apply the knowledge, perspective, vision, skills, and habits of mind necessary to make personal and collective decisions and take actions that promote sustainability.*

As students plan and test their improvement or restoration, they are engaging in the Environmental and Sustainability standards within the context of their science unit.

**Materials***For each student*

- 1 science notebook
- 1 clipboard (optional)

*For each group of four*

- 1 copy of **Record Sheet 15/16-A: Planning and Testing a Solution**
- Stream table materials (as listed in the Materials Management in Section 3 of the STC® *Land and Water* teacher's guide)
- Crayons
- 1 paper towel
- Centimeter cubes

*For the class*

- Gravel
- Sand
- Clay
- Humus
- 1 sprinkler head
- 1 2-liter soda bottle, containing 2 liters of water
- Rocks
- Sticks, branches, leaves, grasses from site
- Craft sticks, 11 cm (4 1/2 in)
- Toothpicks
- Jumbo straws
- Scissors
- Masking tape
- Assorted color markers
- 2 rinse buckets, 3.8 liters (1 gal)
- 1 large absorbent pad, 58.4 x 91.4 cm (23 x 36 in)
- Paper towels
- Clean up supplies

## Preparation

1. Teacher needs to identify a location that can be the site of a restoration or improvement. Suggestions can include:
  - ◆ Playground site where erosion is significant
  - ◆ School yard location like a parking lot that has water run off that flows into a creek or stream
  - ◆ Location that floods
  - ◆ Area located near a stream, creek, or other body of water particularly if the site has been modified previously
2. Take photographs of the area if possible.
3. This lesson can be done in multiple sessions. Decide what works best for your situation.
4. Make one copy of **Record Sheet 15/16-A: Planning and Testing a Solution** for each student.
5. Set up the distribution center as shown in Figure 15-1 on page 165 of the STC® *Land and Water* teacher's guide. Because students are selecting (or collecting) materials based on their plans, you will need to label each item with its name. Add the note "Take as needed for your plan."
6. Set up a rinse station for hand washing. Set out paper towels.

## Procedure

1. Take the students to the location and define the boundary of the site for the purpose of the project
2. Ask students to record in their notebooks evidence of erosion, deposition, run off, pollution, etc.
3. Have them create a list of at least 5 ideas on how they could improve the site to prevent the problematic activity or event.
4. Students then share with a partner their ideas.
5. Return to the classroom and collect students' ideas on a class chart or notebook.
6. Describe the objective of the lesson: How can we improve or restore our site using the knowledge we have gained from the Land and Water unit?
7. Reiterate the boundary of the site and the evidence of the problematic activity identified by students. It may be necessary to draw their attention to the problematic activity that best lends itself to correction with the available resources.



**Final Activities**

1. Students now answer the following questions in their notebook
  - a. Did your modification improve the problem caused by the input of rain?
  - b. Did your modification make the problem worse?
  - c. Would you recommend that your modification be used at the site to improve it? Why or why not?
2. Have students clean up.
3. Administer the Land and Water post assessment.

**Extension**

1. Students can research the cost of actually making their suggested improvements and fill in the third column. In addition they could present their findings to the school board or principal.

**Assessment**

This lesson provides several opportunities to assess students' understanding of the concepts covered in the STC® *Land and Water* unit in addition to assessing their knowledge of the *Washington K-12 Environmental and Sustainability* standards.

- ◆ Can students identify at least one subsystem of the larger site system? (WA 4-5 SYSA)
- ◆ Can students describe the effect on the site system if the amount of the input of rain is changed? (WA 4-5 SYSC)
- ◆ Can students create a model to represent the site system and use the model to learn about the site system? (WA 4-5 INQF)
- ◆ Can students communicate the solution to the problem and their modification using oral, written, and/or pictorial representations of the process and product? (WA 4-5 APPF)
- ◆ Can students describe methods people use to reduce soil erosion? (WA 4-5 ES2F)

Additionally, there is a *Washington State Science Measure of Student Progress* type item developed with the use of the *Plan and Test* item template provided by the *Washington State Office of Superintendent of Public Instruction*.

## Record Sheet 15/16 - A

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Planning and Testing a Solution**

1. **Examine the Problem:** Describe the problem at your site. What are some causes of the problem?

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2. **Planning to Solve the Problem:** How would you solve the problem? List your ideas.

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3. **Summarizing Your Plan:** After you have selected one of your ideas, write a summary of the plan, including a scientific reason for choosing this solution.

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4. **Test Your Solution:** Describe the process to measure or observe how well your solution may solve the problem.

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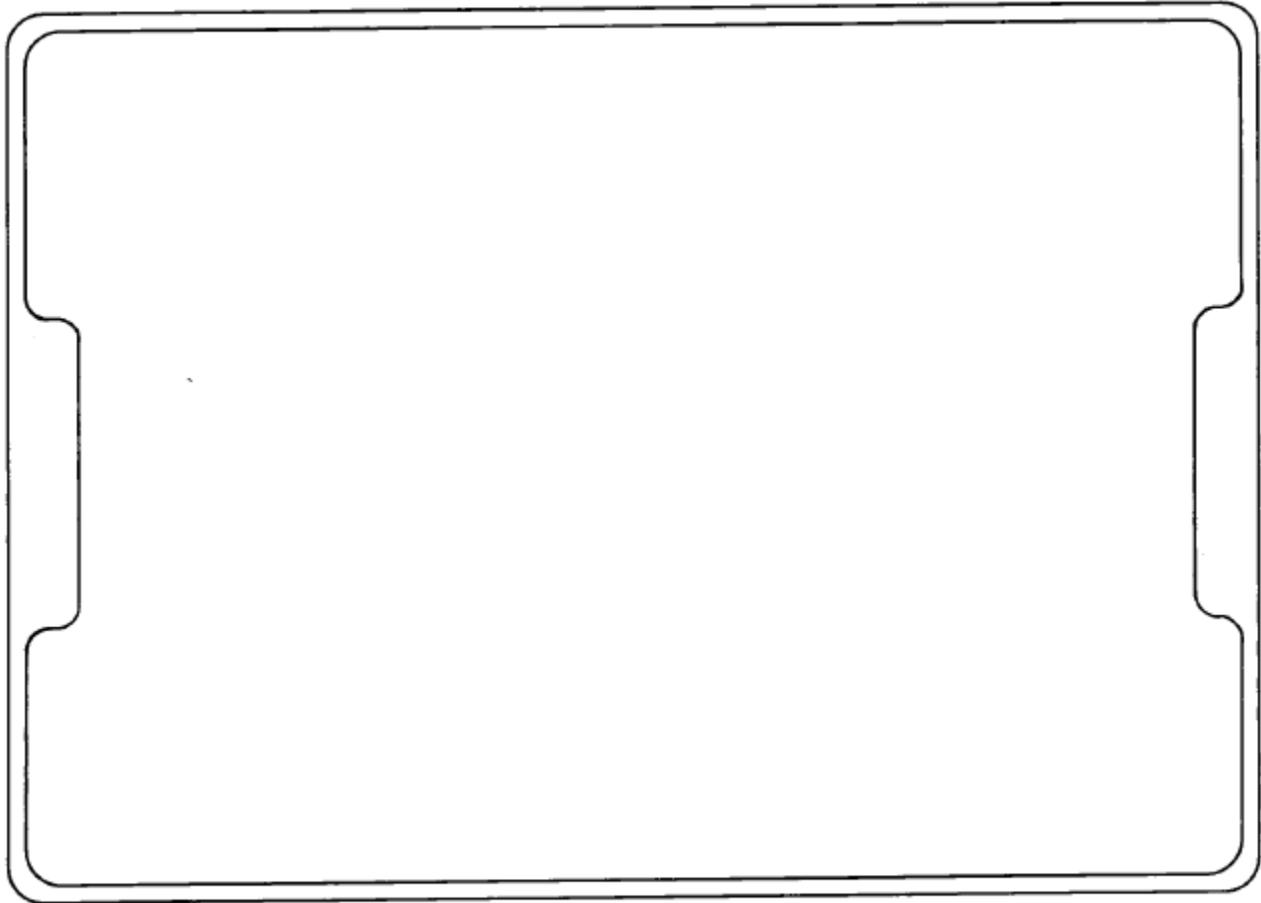
**Record Sheet 15/16 - A**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Planning and Testing a Solution, *continued***

Use this space to draw your ideas for your site system solution. Predict what you think will happen.



**Prediction and Reason:**

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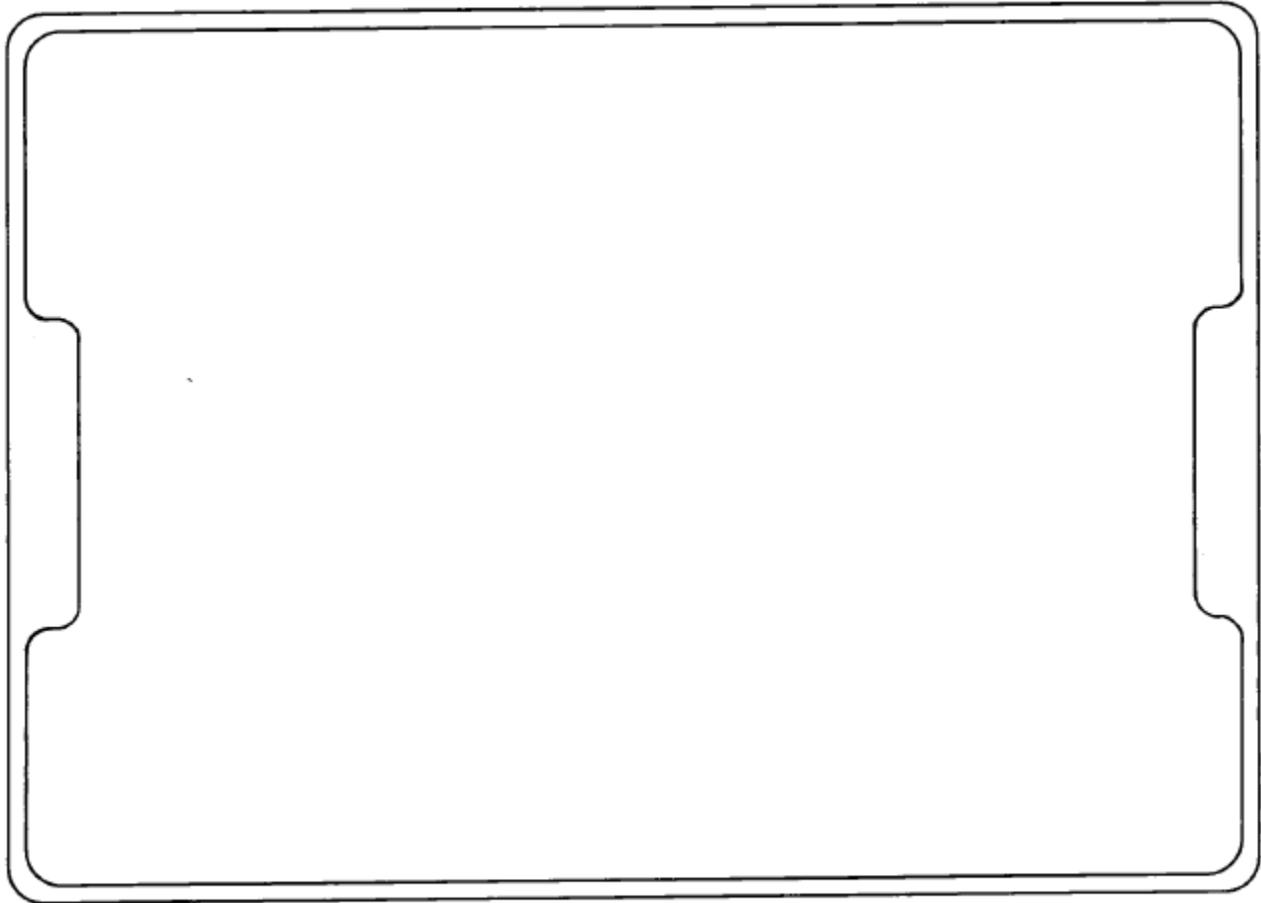
**Record Sheet 15/16 - A**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Planning and Testing a Solution, *continued***

Use this space to draw and describe what happened when you tested your solution to the problem.



**What happened:**

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Name: \_\_\_\_\_

Date: \_\_\_\_\_

**Swing Set Sadness**

Manuel and Sara noticed that every time it rains, the ground under the swing set on the playground floods. Because of the water, students cannot use the swings until the water under them is gone. Describe how to design and test a way of solving the swing set flooding problem.

Be sure to describe these stages in your design process:

- **Plan Summary:** Write a summary of the plan, including a scientific reason for choosing this solution.
- **Test Solution:** Describe the process to measure or observe how well this solution may solve the problem.

<b>Problem: Describe how to design and test a way of solving the swing set flooding problem.</b>
<b>Plan Summary:</b>
<b>Test Solution:</b>

Scoring Rubric for: Plan & Test		
Performance Description		Attributes
A <b>2-point response</b> demonstrates the student understands the Content Standard APPE: Possible solutions should be tested to see if they solve the problem. Building a model or prototype is one way to test a possible solution. Item Specification 1: Write a summary of a scientific solution and/or describe a scientific test of the solution given a description of a problem that can be solved using a technological design process.		3-4
A <b>1-point response</b> demonstrates the student partially understands the Content Standard.		2
A <b>0-point response</b> demonstrates the student has almost no understanding of the Content Standard.		0-1
Attributes of a Scientific Design Process		
Design Process Stage	Description	Attributes
<b>Plan Summary</b>	A simple plan summary is given which could solve the problem (e.g., <i>build a drain under the swings, fill the area with gravel, move the swings to a hill</i> ).	1
<b>Summary Scientific Reason</b>	A scientific reason is given for the plan or for selecting one of the materials (e.g., <i>the gravel allows water to drain through quickly, the drain would cause the water to move from the area by giving it a path, water flows down hill so building up high will cause the water to flow away from the location</i> ).  Stage Notes: The given problem cannot be credited as a reason.	1
<b>Test Solution</b>	The test describes at least one measurement or observation that relates to the effectiveness of the solution (e.g., <i>amount of water</i> ).  Stage Notes: This attribute may not be credited when the test gives or implies artificial data (e.g., <i>my solution worked</i> ).	1
<b>Scientifically Test Solution</b>	The test includes measuring the before-after or input-output of all pertinent variables (e.g., <i>measure the amount of water before the solution and after the solution</i> ) OR the test includes regularly measuring all pertinent variables in a consistent manner (e.g., <i>measure the amount of water every time it rains for one month</i> ).  Stage Note: This attribute may be credited even if a test gives or implies artificial data.	1
<b>Total Possible Attributes</b>		<b>4</b>

<p><b>General Notes:</b></p> <p><b>Copying the Scenario:</b> Responses that copy the whole scenario cannot be credited for any attributes. However, responses that appropriately copy a stage from the scenario may be credited.</p>
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