

TEACHER GUIDE

Trash in the River

What will students do?

In this project, students will calculate approximately how much trash could be collected from a river that runs through a town in a 5-day period and decide if and how the amount of trash in the river could be reduced by:

- using math and the given data to calculate how much of different kinds of trash could be collected in a 5-day period,
- analyzing the data to decide if the amount of trash in the river could be reduced,
- thinking about options for reducing the amount of trash in the river,
- recommending ways that trash in the river could be reduced, and
- justifying their suggestions with reasons.

California CCSS Standards: 4.SMP.1, 4.SMP.2, 4.SMP.3, 4.SMP.4, 4.SMP.6, 4.NBT.5

California ELD Standard: 4.1.A.1

Driver of Investigation: 3

California Environmental Principles and Concepts: Principle 1, Concept C

What should I do?

1. Read this Teacher Guide and Student Handout, and gather materials listed below.
2. Print the Student Handout for students and enough rubrics to grade each project.
3. If you plan to do the project digitally, you will need to print pages 1–2 ONLY. If you’d like to complete the project on paper, you’ll need to print the entire student handout.
4. Review the rubric with students.
5. Assign the digital portion of the project.

|                |                                                                                                      |
|----------------|------------------------------------------------------------------------------------------------------|
| <b>Time:</b>   | Choose to spend 45 minutes in one setting or spread over multiple small-group sessions in the module |
| <b>Format:</b> | Choose from printed only or print/digital                                                            |

See **Module Projects** in the Implementation Guide for more guidance in using the project with students.

**Materials:** project rubric

TEACHING STRATEGY

UDL Support: Engagement

Ask students if they would rather go swimming or on a boat ride on a river full of trash or on a river with no trash in it. Facilitate a discussion using questions to result in students agreeing that a river with no trash would be much more pleasant than a river with trash in it for either activity.

#### TEACHING STRATEGY

### **Multilingual Learners**

Emerging multilingual students may not be familiar with the word *recycle*. Explain to them that materials like paper, plastic, metal, and glass can often be reused to make new things. We call this process recycling.

See the **Language Development Resource Guide** for additional support and suggestions.

# Module 3 Project Rubric

Group: \_\_\_\_\_

## Using the Rubric

Complete the rubric for each student or group (however you assigned the project). Circle the heading that describes the quality of the work. See the last section of this document for an example response.

|                     | Excellent<br>(20 – 25 points)                                                                                                                                                                                                          | Meets Expectations<br>(10 – 20 points)                                                                                                                                                                                            | Needs Revision<br>(5 – 10 points)                                                                            | Unfinished<br>(0 – 5 points)                                                                       |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| <b>Math</b>         | <ul style="list-style-type: none"> <li>No errors.</li> </ul>                                                                                                                                                                           | <ul style="list-style-type: none"> <li>No more than one mistake made in “Analyze the Situation.”</li> </ul>                                                                                                                       | <ul style="list-style-type: none"> <li>There are two or more mistakes in “Analyze the Situation.”</li> </ul> | <ul style="list-style-type: none"> <li>Response is incomplete or shows minimal attempt.</li> </ul> |
| <b>Reason</b>       | <ul style="list-style-type: none"> <li>All parts of Meets Expectations are included.</li> <li>All answers and conclusions are supported by evidence from the situation and mathematical evidence and are well communicated.</li> </ul> | <ul style="list-style-type: none"> <li>Some of the answers and conclusions are supported by sound mathematical evidence.</li> <li>Answers and conclusions are supported by evidence from the situation and mathematics</li> </ul> | <ul style="list-style-type: none"> <li>Explanations are not clear.</li> </ul>                                | <ul style="list-style-type: none"> <li>Response is incomplete or shows minimal attempt.</li> </ul> |
| <b>Completeness</b> | <ul style="list-style-type: none"> <li>Answers to all questions are thoroughly explained and address the criteria and constraints of the situation</li> </ul>                                                                          | <ul style="list-style-type: none"> <li>All questions are answered minimally.</li> </ul>                                                                                                                                           | <ul style="list-style-type: none"> <li>Not all questions have answers.</li> </ul>                            | <ul style="list-style-type: none"> <li>Response is incomplete or shows minimal attempt.</li> </ul> |

# Example Response (25-point response)

## Analyze the Situation

Students doing the project independently should turn in their own work.

Students working in pairs or in groups should discuss and answer the questions together and should agree on the answers. The group recorder should record the answers and turn them in for the group.

1. What are the five different kinds of trash found in the river? [paper, plastic, metal, glass, non-recyclable trash]
2. Write an equation you could use to find the expected amount of paper that could be collected in five days. [ $119 \times 5 =$  ]
3. Write an equation you could use to find the expected amount of plastic that could be collected in five days. [ $107 \times 5 =$  ]
4. Write an equation you could use to find the expected amount of metal that could be collected in five days. [ $68 \times 5 =$  ]
5. Write an equation you could use to find the expected amount of glass that could be collected in five days. [ $37 \times 5 =$  ]
6. Write an equation you could use to find the expected amount of non-recyclable trash that could be collected in five days. [ $89 \times 5 =$  ]

## The Questions

As with the questions in **Analyze the Situation**, students working in groups should discuss and answer the questions together. Remind students to use the rubric to check whether their answers give the required information.

- A. Make Conjecture:** Can the amount of trash in the river be reduced? How? [Possible answer: Yes. Placing more trash and recycling containers near the river, along with signs indicating what trash belongs in each container, would make it easy for people to clean up after themselves, and most people would be more likely to take care of their trash with the containers placed in convenient locations. Establishing recycling centers, if there aren't any, and posting notices throughout the community about the centers would educate people and encourage more recycling. A presentation showing photographs of trash in the river and its effects on the wildlife could be made available on the community website and for community groups to talk about the issue and solutions.]
- B.** About how many pounds of paper can be collected in 5 days? Make an area model to solve the equation you wrote for #2 above. Show your work.

$$119 \times 5 = \underline{\quad}$$

|     |    |   |
|-----|----|---|
| 100 | 10 | 9 |
|     |    |   |

$500 + 50 + 45 = 595$   
595 pounds

- C. About how many pounds of plastic can be collected in 5 days? Make an area model to solve the equation you wrote for #3 above. Show your work.

$$107 \times 5 = \underline{\quad}$$

535 pounds

- D. About how many pounds of metal can be collected in 5 days? Make an area model to solve the equation you wrote for #4 above. Show your work.

$$68 \times 5 = \underline{\quad}$$

340 pounds

- E. About how many pounds of glass can be collected in 5 days? Make an area model to solve the equation you wrote for #5 above. Show your work.

$$37 \times 5 = \underline{\quad}$$

185 pounds

- F. About how many pounds of non-recyclable trash can be collected in 5 days? Make an area model to solve the equation you wrote for #6 above. Show your work.

$$89 \times 5 = \underline{\quad}$$

445 pounds

**G.** Choose one of the types of trash and explain how you used the area model and the Distributive Property to find the amount that could be collected in 5 days. [Possible answer: The average number of pounds of paper collected in one day is 119. The number of pounds of paper that can be collected in five days is  $119 \times 5$ . To solve this equation, my area model shows a rectangle that is 119 units by 5 units. Since 119 is equal to  $100 + 10 + 9$ , I divided the large rectangle into 3 rectangles of 100, 10, and 9 units to show multiplying  $5 \times 100$ ,  $5 \times 10$ , and  $5 \times 9$ . I can multiply to find the area of each of the small rectangles and then find the sum of those areas to get the area of the larger rectangle. This is the number of pounds of paper that can be collected in five days.]

**H. Justify Your Reasoning:** Why do you think it is reasonable to try to reduce the amount of trash in the river? What methods do you think will work and why? [Possible answer: Each day, 420 pounds of trash ends up in the river. In 5 days, that would add up to 2,100 pounds of trash. We need to increase awareness of the trash problem and the recycling methods that are available to help reduce the trash. These methods are reasonable because people can participate in the solutions.

- Placing recycling and trash containers beside the river, along with signs near the river showing the locations of these containers, would make it easy for people to find the appropriate places for their trash.
- Establishing recycling centers and educating the community about recycling would help because a lot of the trash that ends up in the river is recyclable. With 595 pounds of paper, 535 pounds of plastic, 340 pounds of metal, and 185 pounds of glass going into the river every five days, 1,655 pounds of the 2,100 pounds of total trash every five days is recyclable.
- A presentation showing photographs of trash in the river and its effects on the wildlife could help people understand the benefits of keeping trash out of the river and using the recycling and trash containers]

**I.** What are the pros and cons for the town of reducing the amount of trash in the river? [Possible answer: Pros: Reducing the amount of trash in the river provides a cleaner environment that includes healthier water for wildlife and people. The visual appeal of the river would improve. The community might feel a renewed sense of pride. Cons: The cost of cleanup might be expensive. The time and effort required for ongoing maintenance of the river and empowering community members to change their habits to prevent littering may also be discouraging.]

**J.** How would reducing the amount of trash in the river impact the health of the ecosystem? [Possible answer: Reducing the amount of trash in the river would positively impact the health of the river ecosystem. The improved conditions would produce a cleaner and safer environment for aquatic life so that the river could support the growth and survival of fish, plants, and other organisms. Creating a more balanced and thriving ecosystem would also reduce pollutants that can harm wildlife and disrupt natural processes. Overall, a cleaner river enhances biodiversity, promotes healthier habitats, and ensures the sustainability of the ecosystem for future generations.]