

OVERVIEW

At the beginning of the Water Quality Detectives Program, students are invited to be detectives in search of the mystery of where and how water is polluted. As part of their first assignment, students hone their observation skills in preparation of the “site investigation.” The site investigation has students observing their facility/school grounds – mapping where water comes from, where it goes, any pollution left on the ground, and more. Based on their observations, discussions, and their review of a one-page information sheet focused on water quality, students develop ideas about what might be happening on their site. Next, students use maps to determine where the nearest body of water is to the study site while learning about watersheds and the impact of pollution.



While collecting data, students continue to build content knowledge and context before reflecting on what they have learned and share their thoughts through the choice of a PowerPoint presentation, poster, news article, or other idea.

In the final step of the Water Quality Detectives Program students use their reflections to make informed choices and develop a service project to help their community. Students use their workbooks to guide them through project development and follow through.

Feel free to adapt the activities as needed and develop plans that match yours and your students’ needs.

ADVANCE PREPARATION

WATER QUALITY INFORMATION

Gather information that will help you and your students’ understanding of local issues of water quality. Consult the California Water Boards at www.swrcb.ca.gov, the California Environmental Protection Agency at www.epa.gov/water or www.epa.gov/surf, your local regional water board (listings are available at www.swrcb.ca.gov), or other environmental groups.

STUDENT WORKBOOKS

Pages for the Water Quality Detectives Workbook are provided. Create a workbook for each student by photocopying pages and inserting them into a notebook, placing them in a folder, or stapling them together with a tagboard or construction paper cover. These workbooks will be used by the students through each step of the program.

FACILITY/SCHOOL MAP

For the Site Investigation activity (Part 2), photocopy an outside map of your facility. Enlarge it as much as possible, and divide it into different areas. Schools usually have a map of their campus that can be used, but be sure to white out or cover any unnecessary information before photocopying. A simple, hand drawn map can be used as well. The map should indicate major buildings, walkways, driveways, eating areas, etc.

AREA MAPS

For the What is a Watershed? activity (Part 4), gather maps of the area that show where rivers and other bodies of water are located. Maps that show the route water takes to either the ocean or another large body of water are ideal. Local street maps and Thomas Guides are good choices. Photocopy, if necessary, to give each student group their own maps to investigate.

FIELD TRIP

If possible, plan a field trip to enhance the program. Identify a site where polluted runoff enters the closest body of water or a part of the waterway that demonstrates human impact. This will help students make the connection between what they are learning and the water quality in the community.

Be sure the site is easily accessible and safe for students. Contact a resource professional familiar with water quality issues in your area to help or provide a guide to answer questions.

You may find sites within walking distance from your facility/school. If not, seek the help of staff responsible for local areas. Most communities have city and county park districts, as well as various governmental agencies that can assist you.

WATER QUALITY DETECTIVES

PART I – 60 minutes

OVERVIEW

Students are introduced to the program as they receive their Water Quality Detectives Workbook and go over the “case” they are to solve. They will learn water quality code words and make predictions about what they think they will find, discover, and solve. An observation game teaches them the need for good observation skills to be a water quality detective.

PROCEDURE

1. Congratulate students for taking on this mission, and becoming water quality detectives. Explain that as part of this program they will learn how to observe, investigate, analyze, and come up with solutions to a potential problem in their community.
2. Ask students what the term “water quality” means. After getting responses, confirm that it refers to whether water is suitable or not if used for drinking, swimming, farming, fish production, or industrial processes. Specific levels of pollutants that make water harmful for these uses, determine poor water quality.
3. Explain that a Water Quality Detective is someone who is in search of clues about what may contribute to poor water quality in their community. Every time water quality detectives get together they will receive a new assignment that will lead them to solve the case.
4. Pass out a Water Quality Detectives Workbook to each student. Go through the first page that explains the “mission.”

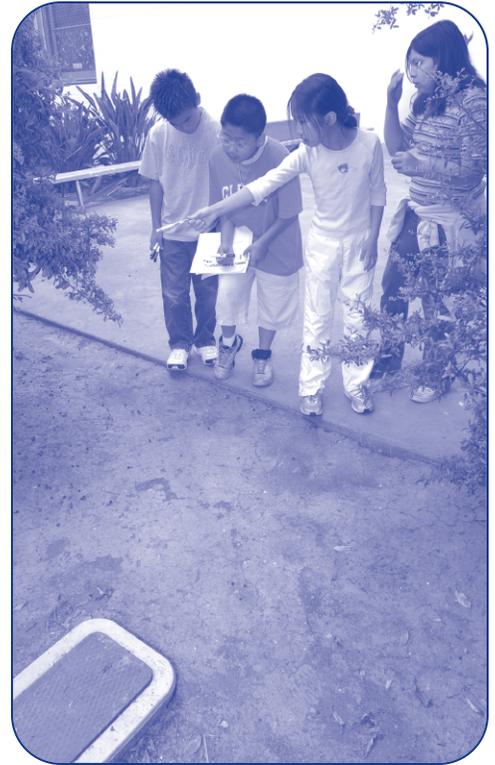


MATERIALS

- Water Quality Detectives Workbook – 1 per student
- Pen/pencil – 1 per student
- 12 – 15 easily recognizable objects such as pen, book, keys, shoe, pine cone, feather, rock, leaf, etc.
- Cloth large enough to cover objects
- Blindfold/bandanna – 1 per student pair

PART I: WATER QUALITY DETECTIVES

5. Go through the water quality code words and discuss the definitions. These are words they will learn and use that will help them accomplish their mission.
6. In their workbook, ask students to predict what they think they will discover the quality of water in their community.
7. Explain to students that in order to be good detectives they will need to have good observation skills. Discuss what being observant means: to pay attention; to notice things and be alert; even to take notes about a particular thing that they are investigating.
8. Invite the students to try out their observation skills. Explain to them that you have several objects under the cloth on the table. You are going to lift the cloth and give them one minute to look at what is there. You will then cover the objects again and they are to write in their workbook all the items they can remember.
9. After one round of the game, share the number of items under the cloth. Did they get them all?
10. Tell the students they will have another chance, but this time they get to use all their senses (touch, smell, and sound) except sight. Arrange students in pairs. One of the partners will be blindfolded (or have eyes closed) while the other hands their partner the different objects. Allow the partner to touch, smell, and listen to the object. Have the partners switch roles after all the items have been rotated around the class.
11. Place the objects under the cloth. Again, have students write down all the items they can remember. Compare their list to the prior list.



WRAP-UP

1. Discuss with students their observations and ask the following guided questions:
 - a. Did you remember more items the second time? Why?
 - b. How do you think the use of all your senses helps you to be more observant?
2. In their workbook, have students reflect on what they learned about observation.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next time, you will receive your first assignment, and use your observation skills to look for clues!”

SITE INVESTIGATION

PART 2 – 60 minutes

OVERVIEW

Student teams are given maps of the site they are to investigate. Students follow the guidelines in their Water Quality Detectives Workbooks to make water related observations and indicate their findings on the map and in their workbooks.

HELPFUL HINTS

- Plan ahead for proper adult supervision for each group of students “mapping” around the area.
- Outline a walking route around the area to help point out key items pertaining to the questions on the Site Investigation (rain gutters, drains, etc.), and any safety hazards.
- If necessary, take time to orient students on how to read a map of the area from a “birds eye view.” It is essential that students are able to read their map.
- Depending on the students and the site, you may choose to facilitate the activity as one group – going from location to location – rather than in separate student groups.

MATERIALS

- Water Quality Detectives Workbook
- Map of site to be investigated – photocopy a map of the outside area where students will be conducting the investigation. Enlarge the map as much as possible, and divide it into different areas.
- Green, blue, purple, black, and red markers or colored pencils – 1 set per group

ASSIGNMENT

1. Pass out the students’ Water Quality Detectives Workbooks. Go over Assignment #1 with students.
2. Explain to the students that their first assignment is to do detective work to investigate different areas of their facility/school to find out where water can get in the ground, sources of water, where it travels, where there is trash and other harmful items on the ground, and finally, where water is wasted.
3. Go through the water quality code words and discuss the definitions. Explain that they will be using these words today.

PART 2: SITE INVESTIGATION

4. Pass out markers/colored pencils and maps of the site. Explain to students that they will use their maps to mark what they find.
5. Have students find Assignment #1 (Site Investigation) in their workbook. Go through the worksheet and demonstrate what the student groups will be looking for and how to mark their map.
6. Help student groups read their map and familiarize themselves with their designated area.
7. As a group, walk to one area to point out examples of what they will be looking for and how they should mark these items on their map, including drains, rain gutters, and anything else that may not be familiar.
8. Give groups a deadline before sending them to their different locations.

WRAP - UP

1. When students return to the meeting area, discuss their detective work and go over what was found using the following guided questions:
 - a. In what places can water get into the ground?
 - b. What sources of water did you find?
 - c. In what places does water travel?
 - d. What kind of trash or other harmful items did you find?
 - e. In what areas is water wasted?
2. In their workbook, have students reflect on what they observed and how it might relate to water quality.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next time, we will analyze the clues and go deeper into solving “how” water is being polluted.”

WHAT IS THE QUALITY OF YOUR WATER?

PART 3 – 60 minutes

OVERVIEW

Students put their individual maps together to create one large map of the site to review the sources of water, where water gets into the land, where it flows, where it is wasted, and where trash and other harmful items can be found.

HELPFUL HINTS

- When reading News Flash!, have students use a marker to highlight or underline key points or information they think is important.
- After reading News Flash!, set up a demonstration with water, trash, and a concrete surface to show students how water carries trash.



MATERIALS

- Water Quality Detectives Workbook
- Investigation maps of site
- Tape
- Markers

ASSIGNMENT

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #2 and code words for the day.
2. Remind students what they did in their last assignment. Explain that their next assignment is to analyze what they learned about the investigated area.
3. Take each of the map sections and tape them together to make one complete map of the investigation area. Affix to a wall or white board.
4. Discuss their detective work and go over what was found, pointing out that:
 - a. Water comes from many sources, including rain.
 - b. Water travels over concrete surfaces and into gutters, drains, and the street.
 - c. Water that travels into dirt, grass, and garden areas is usually able to seep into the ground.
 - d. Water can be wasted when it floods or when used to hose down concrete.
 - e. Trash and other harmful items can be found on the ground.

PART 3: WHAT IS THE QUALITY OF YOUR WATER?

5. Have each student read the first News Flash! in their workbook.
6. Have student groups discuss what they read and the ways in which it relates to what they observed about the investigated area. Each group can report their main points to the class as part of a group discussion.

WRAP - UP

1. Re-look at the site map and discuss with students the clues they found. As you go through the following questions, circle the areas on the map that may need further investigating.
 - a. Did we find trash at our site?
 - b. Where did it come from?
 - c. Where will it go?
 - d. If it isn't in a trash can what is going to happen to it?
 - e. How does wasted water flowing over hard surfaces impact the plants, fish, and animals living in local rivers and streams?
 - f. Is the trash we found harmful to our water and the environment?
2. In their workbook, have students reflect on what they think may be the greatest problem to water quality at their site.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next week’s assignment will use maps to get us closer to solving the case.”

WHAT IS A WATERSHED?

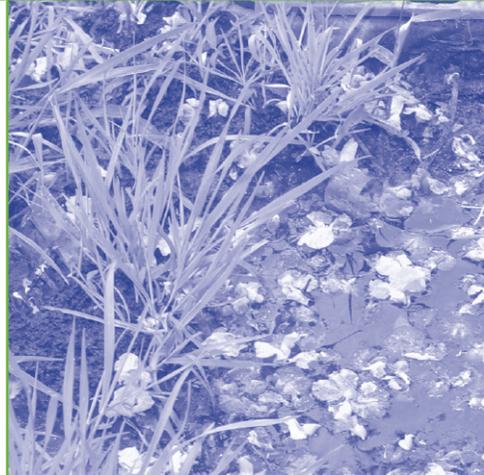
PART 4 – 60 minutes

OVERVIEW

Students read the one-page information sheet in their workbook about watersheds. Using local maps, students locate the closest body of water to their site, and based on what they learn, students think about the route water takes from their site to the nearest body of water and how it may be impacted.

HELPFUL HINTS

- When reading News Flash!, have students use a marker to highlight or underline key points or information they think is important.



MATERIALS

- Water Quality Detectives Workbook
- Local maps – 1 per student group
- Pencils/Markers

ASSIGNMENT

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #3 and the code words for the day.
2. Remind students what they did in their last assignment. Explain that their next assignment is to investigate what waterway may be affected by what they found at their site.
3. Have each student read the second News Flash! in their workbook.
4. Have student groups discuss what they read and the ways in which it relates to what they observed in the investigated area. Each group can report their main points to the class as part of a group discussion. Discuss:
 - a. The living and non-living components of a watershed.
 - b. How water travels from higher areas to lower areas.
 - c. In what ways is clean water essential to the health of the living components of a watershed?

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PART 4: WHAT IS A WATERSHED?

- d. Water that travels over hard surfaces carries everything with it into the nearest body of water.
 - e. How does land pollution affect the non-living components of a watershed?
 - f. How does this affect the living components of a watershed?
 - g. Where is the water going that travels from our site?
5. Pass out city maps of the area, specifically those that include the location of the facility/school, and the closest body of water to the site.
 6. Ask the student groups what they can find on a map – streets, cities, etc. Explain that maps can also show rivers, creeks, and other waterways.
 7. Have students investigate the maps and locate the waterway closest to their facility/school and, if possible, trace its path from origin to end.
 8. Have students investigate how they think water travels from their site to the body of water.
 - a. Underground stormdrains?
 - b. Street gutters?
 - c. Any other way?



WRAP-UP

1. Discuss with students their detective work and go over what they found using the following guided questions:
 - a. How do you think what we found during the site investigation affects the waterway closest to this site?
 - b. What are some questions you have, or what more would you like to find out? Examples:
 - i. Are there any groups in the area involved with water quality?
 - ii. Does the trash we found at our site make its way to the waterway?
 - iii. Where does the trash come from and can we eliminate it from its source?
2. In their workbook, have students reflect on whether or not they think their site has an impact on the closest body of water and any questions they have.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next week’s assignment will be to go deeper into solving some of these questions.”

INVESTIGATE FURTHER

PART 5 – 60 minutes

OVERVIEW

Depending on the resources of the facility/school, and information about local water issues, students find out more about what is happening in their community – either through Internet access, local experts, local articles, etc. A planned field trip is ideal.

ASSIGNMENT

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #4.
2. Remind students what they did in their last assignment. Explain that their next assignment is to investigate further to find out more about water quality issues in their community.
3. Provide students with a variety of options to do their detective work:
 - a. Computers
 - b. Local articles or studies
 - c. Guest speaker from local government, such as a stormwater manager, someone from the department of public works, or someone from an environmental or other non-profit group
4. Have students keep a record of their findings in their workbooks.

MATERIALS

- Water Quality Detectives Workbook
- Local information, Web sites, etc. that would help students find out about local water quality issues existing in their community.

WRAP-UP

1. Discuss with students their detective work and go over their mission to see if they solved the mystery:
 - a. What clues about water quality did we find at our site?
 - b. How does water become polluted?
 - c. Where does water come from in our community?
 - d. Where does water go in our community?
 - e. How did our site discoveries contribute to water quality in our community?

2. In their workbook, have students reflect on what they can do at their site or in their community to improve water quality.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next week we’ll get creative and share what we have learned with others.”

REFLECTION

PART 6 – 60 minutes

OVERVIEW

Students choose a way to share what they have learned about water quality issues. They connect their investigations to their own activities at the facility/school and the community. Reflections can be in the form of a PowerPoint presentation, poster, poem, news article, etc.

HELPFUL HINTS

- The goal is for students to reflect on what they have observed and learned, and share their thoughts about it. Reflection is an important part of the service learning process.
- Help students to formulate ideas and include the results of their investigations, how the results link to water quality, and one thing that they can do to improve water quality at their facility/school or in their community.

MATERIALS

- Water Quality Detectives Workbook
- Supplies as needed: poster paper, computer.

PROCEDURE

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #5.
2. As a class, have students reflect on what they have learned using the following guided questions.
 - a. What did you learn from your experience?
 - b. How did your conclusions differ from your prediction?
 - c. How can your knowledge about water help you make good choices about water quality?
 - d. Why is clean water important?
 - e. How can you improve water quality at your school or in your community?

PART 6: REFLECTION

3. Have students decide on a way to present their thoughts on water quality and solutions. Give guidelines to include information on how their investigations and the evidence they collected influenced their ideas about water quality. Ideas include:
 - a. PowerPoint presentation
 - b. Poster
 - c. Poem
 - d. News article for local paper or newsletter
 - e. Information booklet



WRAP-UP

1. Invite students to present their reflections to the class and share their ideas to improve water quality.

ANTICIPATION

1. Use the following phrase to help your students anticipate the next lesson:
“Next week we’ll use our ideas to improve water quality and come up with a project we can do together.”

SETTING UP A SERVICE LEARNING PROJECT

PART 7 – Two to three 45-minute planning sessions **Project length determined by project**

OVERVIEW

Following the instructions in their Water Quality Detectives Workbooks, students work together to plan and carry out a water quality community service project.

HELPFUL HINTS

- Student voice is an important component of service learning. However, to save time, you may want to determine what projects might work best for your class to help guide student discussions. A list of project ideas is provided.
- Invite the school principal or facilities manager to hear the students' ideas and to show support.

MATERIALS

- Water Quality Detectives Workbook
- Chart paper
- Mural paper
- Markers

PROCEDURE

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #6.
2. Explain to students that the last part of their mission was to "take action." Use the students' reflection pieces to begin a discussion that leads to planning a service learning project, and how these efforts may help resolve a water quality problem at their facility/school or in their community.
3. Using the worksheets in their workbooks, have student groups follow the guidelines to list the problems they found and ideas that might resolve the problems. Have groups share their findings as you list them on the board/chart paper. As one group, pick the top three ideas.
4. Have students fill out one Look Closer worksheet for each of the top three ideas. Have them share their findings and decide which one seems most practical and most exciting to them. Using the worksheet, have students develop possible names for their project. As one group, decide or vote on a final name.
5. Have student groups use the worksheets to brainstorm the tasks necessary to implement their project.

PART 7: SETTING UP A SERVICE LEARNING PROJECT

6. Help students organize the tasks. Use a large sheet of mural paper and organize the tasks using a technique called webbing:
 - a. Place the name of the project in the center and circle it.
 - b. Write each suggested task, circle it, then connect it to the center.
 - c. Tasks associated with these main tasks should be circled and connected to the task.
7. As a class, use the worksheet to assign tasks.
8. Have students use the Get Support For Your Project worksheet to brainstorm who might be able to support the project or provide helpful ideas or resources.
9. Help students follow the task list to implement their project.

CELEBRATE AND EVALUATE

PART 8 – 60 minutes

OVERVIEW

The program wraps up with a letter to the California Water Boards describing what the students learned, the project they accomplished, and how they evaluated their project. Finally, students celebrate their detective work and receive a certificate for accomplishing their mission.

HELPFUL HINTS

- Have students display all of their work in an open house format for others to see.
- Invite parents and community members to the celebration.



MATERIALS

- Water Quality Detectives Workbook
- Letter writing materials
- Signed student certificate – 1 per student
- Supplies for celebrating

PROCEDURE

1. Pass out the students' Water Quality Detectives Workbooks. Go over Assignment #7.
2. As one group or individually, have students write to the California Water Boards about their project and its success. Address letters to:

Public Affairs Office
California Water Boards
1001 I Street
P.O. Box 100
Sacramento, CA, 95812
info@waterboards.ca.gov

3. Pass out certificates of accomplishment to each student.
4. Celebrate! Work with the students to come up with celebration ideas, such as a pizza party, picnic, or ice cream social. Or, make t-shirts with a catchy motivational slogan on the back (e.g. "We made a difference!") for everyone who participated.

WRAP UP

1. Have students evaluate their project by answering the following questions in their workbook:
 - a. What were the most successful parts of the project?
 - b. What was the least successful part?
 - c. What did you learn from your experience?
 - d. What would you do differently next time and why?
 - e. Who or what was influenced by your action?
 - f. Would you like to get involved in another environmental service project? If yes, what would it be? If no, why not?



**MISSION
ACCOMPLISHED!**

Congratulations!

Name of student

**is an official
WATER QUALITY DETECTIVE**

Signed

Date

