

Making Decisions for Water Use

VIRGINIA SOL

- *Science* 6.5, 6.7, 6.9, LS.12
- *Social studies* CE.1, CE.7
- *Language arts* 6.1, 6.2, 6.5, 6.6, 7.1, 7.2, 7.6, 7.7, 7.8
- *Technology* C/T8.2

OBJECTIVES

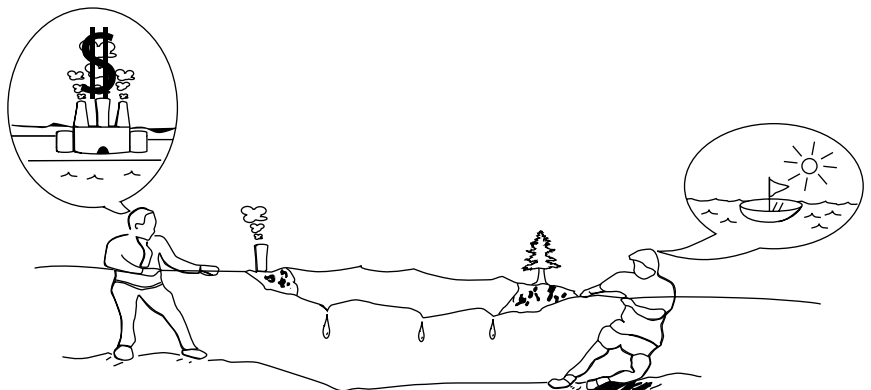
- Compare alternate water uses by different users
- Analyze how multiple users of water resources can affect water quality and quantity
- Analyze some water resource dilemmas
- Analyze tradeoffs and develop compromises for fair water use
- Discuss public policy issues affecting water quality and quantity in a community
- Prepare and communicate recommendations for fair sharing of water by different users

TIME NEEDED

One class period will be needed for discussing water resource dilemmas, and one class period for group presentations and discussions.

What compromises can be made to make sure there is enough clean water for different uses?

This lesson is written for seventh grade social studies and science. The lesson is designed for students to analyze water resource dilemmas, then role play scenarios to reach fair decisions for equitable water use by multiple users. The Social Studies SOL that are targeted are seventh grade CE.1 and CE.7, dealing respectively with skills for citizenship and knowledge of public policy at local, state, and national levels. For science, the lesson links with seventh grade LS.12, and also sixth grade SOL for science, 6.5, 6.7, and 6.9. The seventh grade SOL LS.12 deals with relationships between ecosystem dynamics and human activity. The revised sixth grade science SOL (Virginia Department of Education, 2003) emphasize an integrated focus on water in the environment, including the importance of water for agriculture, power generation, and public health (SOL 6.5), human interactions that affect watersheds systems (6.7), and public policy decisions (6.9). This lesson also relates to numerous English SOL. Sixth and seventh graders should participate in group activities and oral presentations



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(English SOL 6.1, 6.2, 7.1, and 7.2) and read informational and reference materials (6.5, 7.6, and 7.7), as well as carry out related writing (6.6 and 7.8).

Dependable water supplies are important for many reasons. For example, water is important for safe drinking water, agriculture, power generation, and many other different industries. Many people also use water resources for recreation and pleasure activities. As well as people, all other living things in an ecosystem depend on water. Some specific uses of water resources include the following.

- Water needed by wild animals and plants
- Safe drinking water for humans
- Water for farm and domestic animals
- Irrigation for agricultural crops
- Irrigation of yards, golf courses, and other non-agricultural land
- Water for steam production in power generating plants
- Hydropower from dams
- Water for manufacturing industries
- Transportation by barges and other cargo ships
- Swimming pools
- Boating
- Fishing
- Aesthetic beauty

When multiple water users compete for limited water resources, the quantity of our water supply as well as the quality of our water are affected. Often dilemmas arise where different claims on a limited water supply are all important in different ways to different people. In such cases, decisions must be made that can involve tradeoffs and compromises. These decisions should be fair and seek to ensure equitable water use. Public policy decisions should be based on careful assessment of a complex web of interrelated issues and priorities.

One example of a water resource dilemma was described in the Spring/Summer 2002 issue of Virginia Coastal Management, produced by Virginia Department of Environmental Quality (DEQ). Laura McKay, Virginia Coastal Program Manager at DEQ, described the “Shallow Water Use Conflict” dilemma. Virginia’s shallow waters provide critical ecological habitats for animals such as fish, shellfish, marine mammals, sea turtles, and birds. We humans also use shallow waters recreationally for such activities as swimming, boating, fishing, hunting, and wildlife watching. Commercially, we use shallow waters for marinas, fishing, and aquaculture. With an increasing coastal population, competing demands are growing. The Virginia Institute of Marine Science (VIMS) laid out a set of steps to be followed for developing an equitable use plan that could be applied to the shallow water use conflict or other similar dilemmas.

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1. Identify all of the potential uses.
2. Identify environmental conditions required for the uses.
3. Map where conditions are appropriate for particular uses.
4. Analyze the use conflict areas to determine if one use impacts or precludes the other.
5. In areas of potential use conflict, weigh the ecological, social, and economic value of each activity.
6. Identify the policy options to optimize use of an area.
7. Review existing legal and regulatory mechanisms.
8. Involve stakeholders in development of a use plan.

LESSON INTRODUCTION

Comparing alternate water uses by different users...

Begin this lesson by asking students to brainstorm different major water uses. Generate a list of water uses for the class that can be posted on the wall and seen by all students. Discuss with the students how competing water users can lead to negative impacts on water quantity and quality. Ask the students to work in groups to decide which water uses they think are most important and why. The students will probably think most or all of the different water uses are important. At this time, you can begin to talk to students about

the difficulties faced by policymakers and water managers who have responsibility for deciding how much access different users can have to shared water resources.

ACTIVITY PROCEDURES

Analyzing water resource dilemmas...

Have students work in small groups, with each group discussing and analyzing a different water resource dilemma. Ask each group to prepare recommendations for dealing with their dilemma situation, along with supporting reasons.

As groups of students analyze their dilemma and prepare recommendations they must analyze tradeoffs and develop compromises. Make sure students take account of ecological considerations as well as human considerations. They must take into account all types of families, including poor as well as rich and rural as well as urban. Have students work through the following steps, based on those developed by VIMS and described by McKay (2002).

1. Make a list of all the competing water uses.
2. Analyze the conflict area to determine exactly how each different water use impacts on the others.
3. Identify all the reasons in support of competing water uses. Consider ecological, social, and economic reasons.
4. Consider as many options as possible for optimizing use of the conflict area.

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5. Propose a means for involving and bringing together competing stakeholders to develop a water use plan.

Once students have formed some recommendations, give the groups directions for preparing class presentations. Let the students concentrate on working out their recommendations to their dilemma before giving them the directions for presenting a summary to the class. Then the students will give their full attention to working on the

problem, and not be distracted by thinking about how to make a presentation at the same time.

Help students to discuss some public policy issues affecting water quality and quantity. The federal Clean Water Act, originally passed in 1972, guides almost everything states do to protect and restore their waters (Killam & Ely, 2001). Ultimately, all provisions of the Clean Water Act relate back to the fundamental question, "Are water quality standards

SOME WATER RESOURCE DILEMMAS

While the locations in these scenarios are imaginary, the problems are very real, and are facing communities throughout Virginia and the Chesapeake Bay watershed.

A. Virginia's shallow waters provide critical ecological habitats for animals such as fish, shellfish, marine mammals, sea turtles, and birds. We humans also use shallow waters recreationally for such activities as swimming, boating, fishing, hunting, and wildlife watching. Commercially, we use shallow waters for marinas, fishing, and aquaculture. With an increasing coastal population, competing demands are growing.

B. Wetlands surrounding "Bay Town" were drained and filled with dirt several years ago. This has allowed for additional farming and business development on the drained land. Most people living in the area have noticed an increase in their standard of living. On the downside, native mammal and bird populations have declined, the number of tourist visitors has declined, and local fishing industries have started to report reduced catches. Local residents have been asked

to vote in favor of returning some of the drained lands to their original wetland condition.

C. A large tract of land (more than 400 acres) adjoining the Chesapeake Bay is for sale. A selection committee is charged with deciding who will be able to buy the land. A group of realtors would like to buy the land to divide into lots for expensive homes. A power company would like to buy the land to build a power plant. An entrepreneur would like to buy the land and develop the waterfront with a yacht marina along with several restaurants and shops. Lastly, a group of environmentalists hope to raise enough money to buy the land to establish a wildlife refuge.

D. Your river is currently designated for swimming and people do swim at the public beach. Just upstream from the beach, a church group wants to build a campground that will discharge partly treated sewage into the river. If the campground is permitted, then the public beach will be closed to swimming, although people could still put boats in the water there.

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being met?” Virginia’s water quality standards are available on the Internet at the Department of Environmental Quality web site (www.deq.state.va.us/wqs). Water quality standards include designated uses for water sites, water quality criteria to protect uses, and an antidegradation policy directed at keeping healthy waters healthy. The antide-

gradation policy was incorporated into the Clean Water Act to prevent or limit activities that will chip away existing water quality or improvements that have been achieved. The antidegradation policy begins with an absolute protection of existing uses. To learn more about the Clean Water Act, see the EPA’s summary at: www.epa.gov/region5/water/cwa.htm

Some Water Resource Dilemmas Continued...

- E. We build dams for several reasons, including controlling our water supply, to generate electrical power, and recreation. On the other hand, building dams causes rivers to flood the land upstream of the dam. This takes away people’s riverfront land and destroys habitat for plants and animals. A river’s ecosystem below the dam will also undergo many changes, and may not support the same plant and animal communities that are there before a dam is built. In your community a debate is underway as to whether to build a new dam upriver from town. The dam would supply electric power for years to come, provide new employment opportunities, and help control floods downstream. Opponents of the dam argue that much wildlife will be lost, along with some well-known historical Civil War sites. They also point out that whitewater rafting will no longer be possible upstream, and electric power will likely become more expensive to help pay for dam construction.
- F. Industrial development is increasing around the Chesapeake Bay. Industries include chemical manufacturers, chicken processing plants, and electric power plants. All these industries use large quantities of water either for cooling purposes or for plant processes. These new industries give new

jobs to the communities, but they also can pollute Bay waters with excess nutrients and warming of the water, as well as some toxic chemicals. These pollutants impact marine life, including migratory waterfowl and nesting bald eagles.

- G. More and more people are living in the Chesapeake Bay watershed. As more people buy and build homes in the area, water needs will rise exceeding available supplies and the amount of sewage produced will also increase. As the number of people living around the Bay continues to increase, the amount of polluted runoff will also increase. In order to protect the Bay, should state or local governments control or restrict the amount of urbanization in the watershed? Some people who own land oppose rules that won’t allow them to build on their land.
- H. Streams around “Bay Town” are drying up because too much water is being taken out from the streams and from the groundwater. Some of this water is for the town’s household water supply. Other water is being taken from streams by farmers and an increasing number of industrial operations. Although agriculture and industries are important for the town’s economy, recreational fishing is suffering, and canoeing and rafting are no longer possible in some areas.

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Preparing and communicating recommendations for fair sharing of water..

When each group has finished work, have each group present its recommendations and supporting reasons to the rest of the class. Encourage each group to be creative in their presentation. Also, allow time for questions and answers and for discussion following each presentation.

Assign students to write journal entries to summarize what they have learned. They can be prompted to write about different major water uses and how these can put user groups in competition with each other. They can also be prompted to summarize a water resource dilemma that they have studied, and reflections on how compromises can be sought to resolve the dilemma.

QUESTIONS

- What do you think are the most important uses of water resources?
- How do opinions of some other students compare with your opinions?
- Why do different people disagree about the most important uses of water resources?
- How did your group try to determine priorities when discussing your water resource dilemma?
- When decisions must be made, what are some ways to try to satisfy all individuals involved?

- Do you think your recommendations could be put into practice successfully in the real world? Why or why not?
- How can you find out more information about State regulations for water use?

ASSESSMENTS

- Observe students working in groups discussing and analyzing the water resource dilemmas.
- Group presentations.
- Students can write journals listing different major water uses, describing some water use dilemmas, and some compromises that can be reached for equitable water use.

EXTENSIONS

- Students could do research into how public policy relating to water resources is made at the local, state, and national levels.
- The class could make a project of investigating a locally important water resource dilemma in more detail. They could communicate recommendations to a wider audience, for example by producing information leaflets for distribution and/or by developing web pages containing information. Developing web pages supports Technology SOL C/T8.2.

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RESOURCES

For the teacher...

- Choices and Preferences, Water Index. *Project WET.*
- Common Water. *Project WET.*
- Common Water (Virginia Version). *Project WET.*
- Dilemma Derby. *Project WET.*
- Great Bay Land Grab. *Bay Link Lesson Plans.*
- Hot Water. *Project WET.*
- How Does the Clean Water Act Fit into My World? Killam, G., & Ely, E. (2001). *The Volunteer Monitor*, 13(1), 1–9.

The Spring 2001 issue of *The Volunteer Monitor* was a special issue on the Clean Water Act. Back issues of *The Volunteer Monitor* are available by calling 503-241-3506 or from volmon@rivernetnetwork.org or www.epa.gov/owow/volunteer/vm_index.html. See the Resources list at the end of this packet for additional information about *The Volunteer Monitor*.

- Just What Is Public Participation? Clifford, S. (2001). *The Volunteer Monitor*, 13(1), 14–15.
- Shallow Water Use Conflicts. McKay, L. (2002). *Virginia Coastal Management*, Spring/Summer 2002. www.deq.state.va.us/coastal
- Sum of the Parts. *Project WET.*
- Sum of the Parts: From the James River to the Chesapeake Bay. *Virginia Natural Resources Education Guide.*
- The Decision Makers. *An Ounce of Prevention.*
- To Dam or Not to Dam. *Aquatic Project Wild.*
- Water: To the Last Drop. [www.Discovery School.com](http://www.DiscoverySchool.com)

NOTES