WATER WHIZ - A BOARD GAME

Objectives:
The student will be able to:

- play a board game with three to five other students;
- compute the price of water that will be on the monthly water bill;
- identify the different activities in the game that affect the price of water; and
- describe two ways that water usage is affected by each of the different aspects of community life.

Suggested Grade Level:
9-12

Subjects:
Science (Physical and Biology), Social Studies) Economics

Time:
Approximately 1-2 class periods

Materials:
- Water Whiz game board (included)
- game cards (included)
- 1 pair of dice per group
- student sheets (included)

BACKGROUND INFORMATION

Every one of us in our daily lives is involved in activities that directly or indirectly affect the quality and price of the water made available to us by our water utility. This game can be used as an introductory activity for a water quality unit to be taught in any course. Its objective is to make students aware that the activities they engage in affect the quality of the water they will have for bathing and drinking.

ADVANCE PREPARATION

A. Be certain that there are enough board games, game cards, blank water bills, game rules, game summaries, and dice for the students.

B. Suggestions:

1. Print the game board on card stock. Color each "card" space a different color and laminate the boards.
2. Print the cards for each category on colored paper to coordinate with the board. Laminate each sheet; then cut out the cards. (Hint: Cut bulletin board paper to 11"x17" and feed it into your copier!)
3. Print water bills with game summaries on back. Use half sheets.

C. Hand out copies of the rules to each group. See Rules Sheet.

D. Cut out the six different pages of station cards.

PROCEDURE

I. Setting the stage

A. After dividing the class into groups of four, tell the students to open up the game board and look at the community drawn on the board. The community reservoir provides roughly one-half of the community's drinking water; an artesian well and a river provide water for the other half. Have them study the

game board to observe what activities they see occurring in the community that might affect the quality and quantity of the water.

B. Tell the students to notice the six stations that are placed on the board. Each of these stations has a rectangular empty space next to it. Have the students place the shuffled and appropriately labeled cards upside down in these areas. The first station will have the agricultural cards, the second the business cards, and so on.

C. Have the students in each group select a person who will start the game, with the play moving clockwise, until all persons in the group have had a chance to represent some sector of the community and have changed their water bill one time.

D. Remind the students that they must listen to the activity on the card because they will participate later in a summary activity from the information gained from the game.

E. The first player will roll the die, pick up the top card, and read it aloud. He/she will then alter the price of water on the bill as the card so instructs.

F. Each player in the group will follow the same procedure until all the students have taken part in a round. As many rounds will be completed as time permits (approximately 10).

G. Remember that the winner of the game is the person who pays the lowest rate for each 1000 gallons of water used.

II. Activity

A. Students will participate in the game.

B. Summary activity - The students will write down two activities carried out by each sector of the community that affect the quantity and quality of water, one activity that increases and one that decreases the bill. The information for this written activity will come from what they remember from playing the game.

III. Follow-Up

A. Ask the students to discuss at home some ways their family can improve their community's water supply.

IV. Extensions

A. Ask students the following day to discuss, in their same groups, the reaction of their families. Have each group make a short report to the class.

R E S O U R C E S

The data for the amount of water lost in leaky faucets, garden watering with different size hoses, the shower, etc., came from a book entitled Water in Crisis by Peter H. Gleick, published by the Oxford University Press in 1993.

Arms, Karen, Environmental Science, Holt, Rinehart, and Winston, Inc., Austin, TX, 1996.

Chiras, Daniel D., Environmental Science, High School Edition, Addison-Wesley, Menlo Park, CA, 1989.

Nebel, Bernard J. and Richard T. Wright, Environmental Science: The Way The World Works, 4th Edition, Prentice-Hall, Englewood Cliffs, NJ, 1993.

Thank you to the Environmental Protection Agency *Water Sourcebook* for this activity!

http://water.epa.gov/learn/kids/drinkingwater/wsb_index.cfm

WATER WHIZ GAME

Rules of the Game

1. Each student will obtain a blank water bill and place $1.00 as the initial price for each 1000 gallons of water used by him/her during the month.

2. Predetermined by the roll of a die, the first player will roll a die and draw a card from the spot on the board as is indicated by the number on the die.

1 is the agricultural space.
2 is the business space.
3 is the development space.
4 is the industry space.
5 is the recreation space.
6 is the residential space.

3. Pick up the card from the appropriate stack. Read this card so that everyone in the group may hear what affects the water and its price.

4. Change the price of the water as you are instructed to do by the card. Then return the card to the bottom of the stack.

5. The winner is the student who pays the least for water.

Agriculture A sod farmer uses simazine as a herbicide on his land. A weather front with severe thundershowers blows in very rapidly and the simazine is washed into the streams. INCREASE: $.10/1000 GALLONS	**Agriculture** A farmer harvests his spring grain and then plows his soil to plant his corn. Harsh spring rains come and erode thousands of pounds of his topsoil into the streams and lakes. INCREASE: $.10/1000 GALLONS
Agriculture Farmers allow cattle to grave too close to the streams and their banks. Fecal material winds up in the water. There is an increase in bacterial and viral contamination. More testing and treatment are required of the public water supply. INCREASE: $.10/1000 GALLONS	**Agriculture** A farmer is extremely conscientious and gets support from the state to fence his cattle away from the stream and to build ponds to provide water for his livestock. The public water supply is free of microbial infection. DECREASE: $.10/1000 GALLONS
Agriculture A farmer carefully uses no-till farming practices as he plants his spring corn crops. Heavy rains come, and the Milo stalks on the ground from his previous crop cut down on erosion. DECREASE: $.10/1000 GALLONS	**Agriculture** A fisherman has been harvesting fish in lakes for 20 years to support his family. The insecticide chlordane is now building up in the sediment of the lake and he has been prohibited from selling his catfish to the restaurants. INCREASE: $.05/1000 GALLONS
Agriculture Straight row plowing practices have caused much topsoil to wash into the rivers and lakes. Deeper pool areas in the stream are filling. Recreational fishing and swimming have almost ceased. INCREASE: $.05/1000 GALLONS	**Agriculture** Sunlight penetration into the river is decreased because of the turbidity caused by topsoil runoff. The natural inhabitants are moving out because the habitat is changing. INCREASE: $.05/1000 GALLONS

Residential You neglect to fix a leaky faucet and lose 25 gallons of water each day. INCREASE: $.10/1000 GALLONS	**Residential** You decide to replace your toilets with the new 1.6 gallon models. You will save approximately 60 gallons of water/day. DECREASE: $.10/1000 GALLONS
Residential You change the size of the water hose you use in your yard from ¾ inch to a ½ inch diameter. You water your yard 5 hrs./wk. And save 1250 gallons in a week. DECREASE: $.05/1000 GALLONS	**Residential** In summer months, you water your grass 2 hours each day. You use 100,000 gallons in a month. INCREASE: $.10/1000 GALLONS
Residential Your cousins come to visit and an additional 120 gallons of water are used each day in your home. INCREASE: $.05/1000 GALLONS	**Residential** You change the oil in your car and take the old oil and pour it around your home's foundation to reduce pests. They hydrocarbons leach to the groundwater. It costs to clean it up. INCREASE: $.05/1000 GALLONS
Residential It is spring. You plant your garden and then spray your lawn and garden for weeds. It rains the same day and washes the pesticides into the stream and lakes. INCREASE: $.10/1000 GALLONS	**Residential** You change your shower head to a water-saving type and reduce the flow 50% DECREASE: $.05/1000 GALLONS

Development Your community is opening a new residential development next to the lake. They have graded new roads. This development created a turbidity problem in the lake. The fish are leaving the area because the food chain is being destroyed. INCREASE: $.10/1000 GALLONS	**Development** The stream flowing into the river has a sediment problem and the deeper fishing and swimming pools are filling with sediment. The value of the riverfront property has decreased. INCREASE: $.05/1000 GALLONS
Development New housing development around the lakes and streams has increased the number of septic tanks. More nitrates and phosphates are going into the streams and lakes decreasing the oxygen supply for fish. New sewage pipes must be laid. INCREASE: $.05/1000 GALLONS	**Development** You are maintaining your septic tank as your should. You have properly cleaned it of the sludge. DECREASE: $.05/1000 GALLONS
Development A new golf course has been built around the lake. The caretaker has used simazine on the turf. Rain and storm water discharge have carried the herbicide to the lake. INCREASE: $.05/1000 GALLONS	**Development** The coliform count has increased with the addition of new septic tanks. More chlorination is needed to prepare the municipal drinking water. INCREASE: $.05/1000 GALLONS
Development A request for permit to fill in a low-lying wetland bog to build more apartments has been denied. DECREASE: $.10/1000 GALLONS	**Development** The new highway being built is coming into the north side of town. All the proper erosion protection practices are being used. The lake is not experiencing a sediment problem. DECREASE: $.25/1000 GALLONS

Business The corner auto service has a leak in its gasoline storage tank. Hydrocarbons leach down to the groundwater. INCREASE: $.10/1000 GALLONS	**Business** Many old card batteries are taken to the old county landfill. There is no polyethylene or clay lining. Seepage of lead and acids occurs through the sandy soil. INCREASE: $.10/1000 GALLONS
Business The county commissioners have been told that the present landfill is no longer environmentally safe. New monies must be found to construct a new landfill to protect our groundwater. INCREASE: $.10/1000 GALLONS	**Business** Your dry cleaning business has permitted some of its chemicals to get into the ground and move toward the ground water. Your treatment plant must install granular activated carbon to remove them. INCREASE: $.10/1000 GALLONS
Business A furnace manufacturer improves its manufacturing process and now sells one of its recovered chemicals to claim a profit of over $1000/year. They used to pour this waste chemical down the drain. DECREASE: $.10/1000 GALLONS	**Business** The textile factory in town now has the technology to control its trichloraethylene release. DECREASE: $.10/1000 GALLONS
Business Toluene from a gasoline spill leaks into the groundwater. INCREASE: $.05/1000 GALLONS	**Business** A service station carefully recycles all its old oil drained out of cars and pays its “do it yourself” customers to bring in their oil. DECREASE: $.10/1000 GALLONS

Industry Bad tilling practices in the agricultural and developmental sections of the town have caused the river to fill with sediment. The depth is no longer sufficient for the coal barge to take its load to the power plant. It must be redredged. INCREASE: $.05/1000 GALLONS	**Industry** Detergent cleaning agents were not completely removed by the industrial wastewater treatment plant. These have been released into the river and are causing concern among homeowners along the water's shorelines. INCREASE: $.05/1000 GALLONS
Industry The industrial sector has built its own wastewater treatment plant, relieving the municipal plant of such a heavy load. DECREASE: $.05/1000 GALLONS	**Industry** Corrosive chemicals have been released into the surrounding watershed by older industry. These chemicals were not all removed by the treatment plant and have caused pipe corrosion in the city downstream. New pipes must be installed. INCREASE: $.05/1000 GALLONS
Industry The town must drill a new well tapping the groundwater because an old hazardous waste underground storage tank has been found located too close to the wellhead. The tank has begun leaking and has contaminated the surrounding soil. INCREASE: $.10/1000 GALLONS	**Industry** During the hot summer months, a coal-fired power plant is working at peak performance to provide electricity for air conditioning. SO_2 and NO_2 going into the air cause acid rain, and the pH of the lake is changing slightly. It must be adjusted. INCREASE: $.05/1000 GALLONS
Industry The pulp and paper mill has a wonderful environmental engineering department. The mill is odorless, the water is returned at ambient temperatures, and the pH and dissolved oxygen (DO) of the river is normal. DECREASE: $.10/1000 GALLONS	**Industry** In the hot summer months, the holding ponds of the mill do not cool the water as fast as in the winter months. Production is up, so the released water does not stay in the ponds long enough to cool down. It is causing fish kills in the river. INCREASE: $.10/1000 GALLONS

Recreation Nutrients from a farm have caused hydrilla to grow around the shore of the lake. This must be removed for recreational activities. INCREASE: $.05/1000 GALLONS	**Recreation** Boat fuel is spilled into the lake because of improperly managed fueling stations at the marina. The water must be cleaned up. INCREASE: $.10/1000 GALLONS
Recreation The marina installed a pump-out station to dispose of human waste from the self-contained larger boats. DECREASE: $.10/1000 GALLONS	**Recreation** Many boat owners will not take the time to return to the pump-out station at the marina and are emptying their holding tanks directly into the lake. INCREASE: $.10/1000 GALLONS
Recreation The drainage ditches in the community have been converted into artificial wetlands that adjoin the lake. The natural wetlands in the low areas around the lake have been preserved. This helps to clean the storm water running into the lake. DECREASE: $.10/1000 GALLONS	**Recreation** The creek and lake in town are filling up with sediment and the community must pay the charge of dredging the lake out to restore its beauty and recreational value. INCREASE: $.05/1000 GALLONS
Recreation Recreational fishing is at an all time high because the fisherman and volunteer lake quality monitors are preserving the natural habitats of the area. DECREASE: $.05/1000 GALLONS	**Recreation** The schools in this community are very progressive and are teaching the students to care for their lakes' quality during their recreation. Their drinking water supply will stay uncontaminated. DECREASE: $.10/1000 GALLONS

STUDENT SHEET

Name:_____

Initial Cost 1000 gallons = $1.00

Round 1 amount changed + or - _____
Altered Price $_____

Round 2 amount changed + or - _____
Altered Price $_____

Round 3 amount changed + or - _____
Altered Price $_____

Round 4 amount changed + or - _____
Altered Price $_____

Round 5 amount changed + or - _____
Altered Price $_____

Round 6 amount changed + or - _____
Altered Price $_____

Round 7 amount changed + or - _____
Altered Price $_____

Round 8 amount changed + or - _____
Altered Price $_____

Round 9 amount changed + or - _____
Altered Price $_____

Round 10 amount changed + or - _____
Altered Price $_____

STUDENT SHEET

GAME SUMMARY

List several of the things you have learned that will affect your water bill.

AGRICULTURAL

Increase _____

Decrease _____

BUSINESS

Increase _____

Decrease _____

DEVELOPMENT

Increase _____

Decrease _____

INDUSTRY

Increase _____

Decrease _____

RECREATION

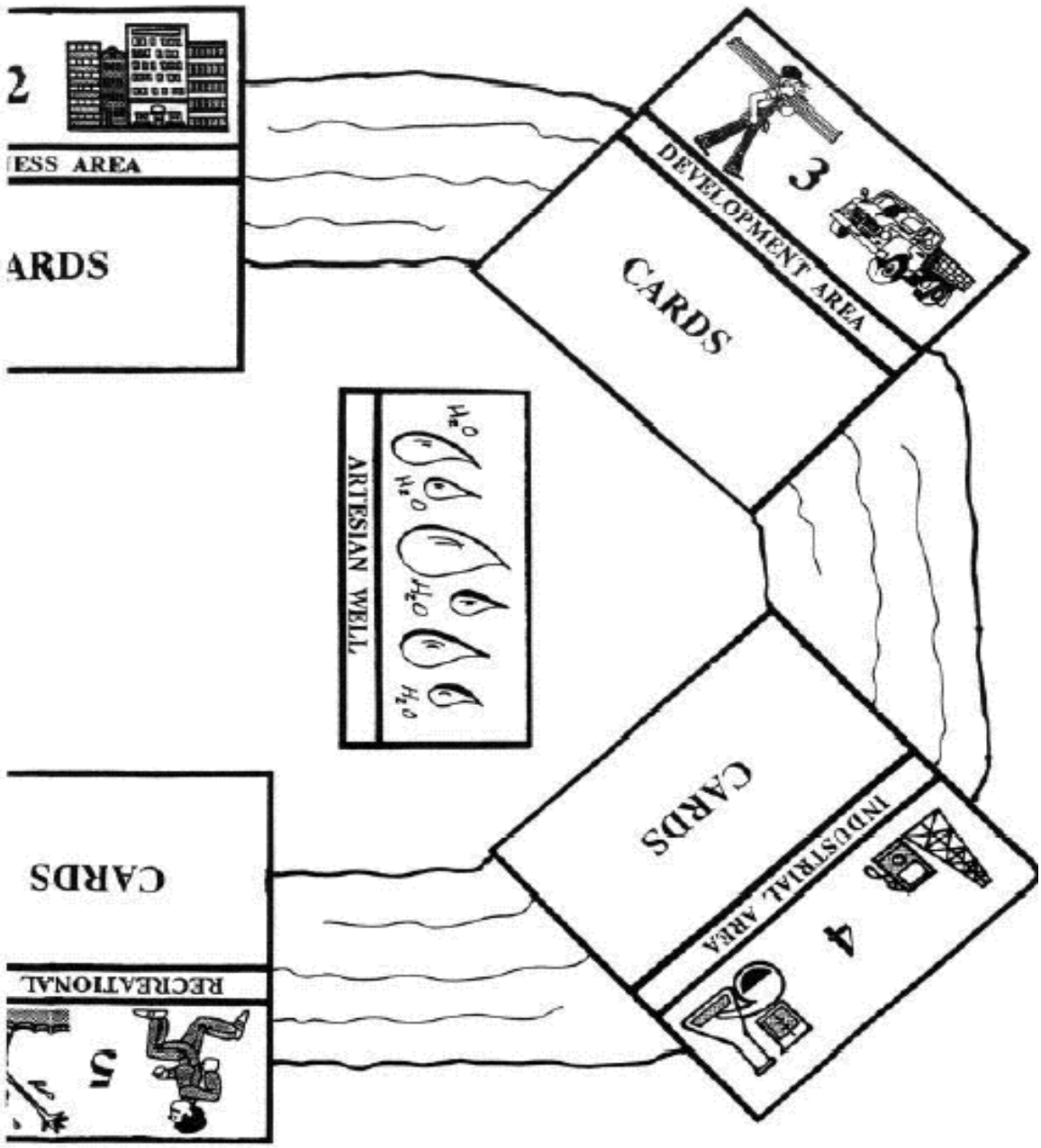
Increase _____

Decrease _____

RESIDENTIAL

Increase _____

Decrease _____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ESS AREA
ARDS
DEVELOPMENT AREA
3
CARDS
ARTESIAN WELL
CARDS
INDUSTRIAL AREA
4
CARDS
RECREATIONAL
5

ONAL AREA
:DS
RESIDENTIAL AREA
6
CARDS
WATER... WATER... WATER...WA
CITY RESERVOIR
CARDS
AGRICULTURAL AREA
1
CARD
BUSINESS A
2