October 1972

WRRI Report No. 010
Part

WATER

A MEDIATED LEARNING PACKAGE FOR USE WITH ELEMENTARY SCHOOL CHILDREN

WATER

This mediated learning package is designed for use with elementary school children, particularly those at or above the third grade level. The material was developed under a grant from the New Mexico Water Resources Research Institute, and the package was produced at New Mexico State University.

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Upon completion of the work with the learning package, please return it within one week in its original condition in order to enable others to use the materials as scheduled.

Chris Buethe
Project Director

OBJECTIVES

1. To introduce children to the concept of the water cycle in order to develop some knowledge of the origin of the water that we use:

2. To introduce children to some of the major water problems, especially those of the dry Southwest regions:

3. To involve children in the consideration of solutions to our water problems:

4. To indicate the effects of possible solutions on future generations of water users.

CONTENTS OF THE PACKAGE

The program contains a series of 149 slide pictures and an accompanying tape recording of two cartoon characters, Bernard Beaver and Wendell Waterdrop. Through their adventures and discussions, these characters present material pertaining to the water problems of the Southwest. A copy of the tape script is included for use in previewing and in properly advancing the sequentially numbered slides.

The total length of the program is 22 minutes, but it can readily be divided into three segments. Using the program in segments is likely to produce the best results since it allows time for discussions and supplementary activities. Appropriate stopping points are noted on pages three and six of the accompanying script.

The three major divisions are:

1. An introduction which discusses the water cycle and develops the concept that our water is constantly being reused:

2. A section which (a) deals with the factors limiting our water supply and (b) discusses the major concepts of:

   (i) future water shortages;

   (ii) more efficient use of the water we have; and

   (iii) pollution of our water supplies by man.

3. A final section which discusses possible solutions to water problems. Children are asked to analyze the water problems of their own geographic area and to consider how solutions will affect the lives of everyone.

SUGGESTIONS FOR FOLLOW-UP ACTIVITIES

Section I - The Water Cycle

1) *INTRODUCTORY CLASS PROJECT:* Collect pictures of different ways in which water is used and display them on a bulletin board.

2) *CLASS DISCUSSION:* Based on Wendell's adventure, hypothesize about what a diagram of the water cycle would look like. (Keep in mind that a cycle has no set beginning or end.)

3) *TEACHER DEMONSTRATION:* Diagram and explain the water cycle in your area.

4) *CLASS PROJECT:* Make Wendell and Bernard puppets (see patterns attached). Dramatize a water cycle adventure in a familiar area.

5) *CREATIVE WRITING ACTIVITY:*

"Which people in past history would you wish to have used the water you are using today?"

Section II - Water Shortages

1) *CLASS PROJECT:* Arrange the pictures from the bulletin board to rank, from most important to least important, the water problems in your area.

2) *BLACKBOARD PROJECT:* List ways of conserving water that are applicable to your area.

3) *CLASS DISCUSSION:* What is the effect of extensive irrigation upon the water table?

4) *CLASS EXPERIMENT:* Hypothesize about which will be the better "drainage ditch" in the following experiment:

A paper towel is cut in half lengthwise. ONE half is lined with plastic wrap. Each half of the paper towel is folded to form a U-shaped ditch. (The U-shape is maintained by strips of scotch tape across the top of each "ditch.") The two "ditches" are placed parallel to each other on an incline. A cup or other receptacle is placed at the lower end of each "ditch." Equal amounts of water are measured and poured down each "ditch." The runoff water is then collected in the receptacle and measured.

Now perform the experiment and compare your results with your hypothesis.

Question: How can you make an even better ditch?

5) *CLASS PROJECT:* Have Wendell and Bernard Puppets talk with other children about things they can do to conserve water.

6) *CREATIVE THINKING ACTIVITY:* Assume that you are going on a three-month spaceship voyage. Analyze the things that you would absolutely HAVE to have in order to live.

(One group of children could write their opinions on what they consider "essentials" and another group could do library research in order to make a list of "essentials." A comparison of the lists of essentials can initiate lively debate.)

7) *CREATIVE THINKING-WRITING:*

"How would your life change in a water shortage?"
"If you could use only X gallons of water per day, how would you use them?"

Section III - Pollution

1) *CLASS PROJECT:* Collect pollution samples

Question: Where have you seen water in your community that is not useful because it is too polluted?

2) *INDIVIDUAL PROJECTS:* List things that you have done, or have seen done, that pollute a river, lake, or stream.

3) *CLASS PROJECT:* Collect samples of (a) tap water; (b) irrigation ditch water; (c) lake or stream water; and (d) distilled water.

Compare your samples for sediment.

Use a microscope for further comparisons.

4) *CLASS PROJECT:* Take a small sample of water and pollute it slowly with something that is NOT poisonous. (Use salt, soap, vinegar, etc.)

Decide when the water has become no longer useable for household use.

Question: Would you drink it?

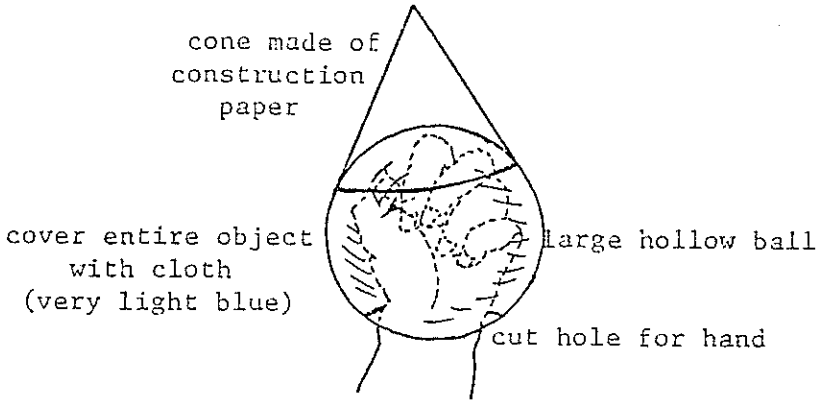
5) *CLASS PROJECT:* Experiment with guppies. Simulate a stream and pollute it by adding detergent, a little at a time. Watch for changes in the swimming patterns and positions of the guppies. When they show signs of distress, remove them from the polluted water and place them in fresh water.

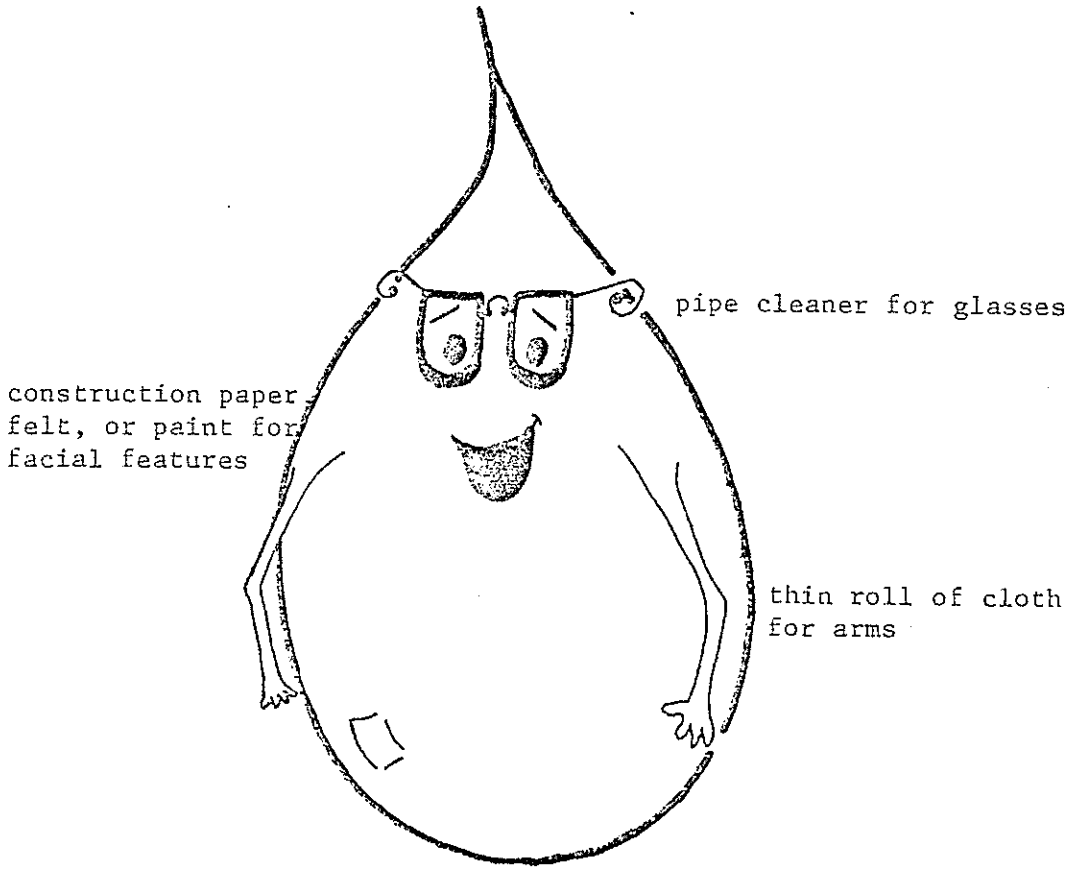
Question: If we keep polluting our water, how will we feel to be distressed "fish" swimming in our own pollution?

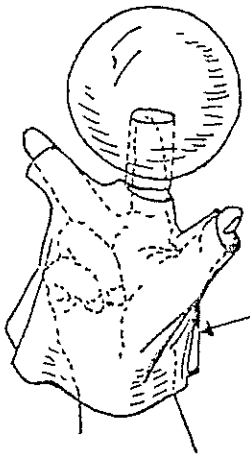
6) *CLASS PROJECT:* Put garbage, etc., into a sample of water. Later try to clean the water.

Questions: Can you do it?
How does your city clean its water?
Ask a water expert how water can be cleaned.

WENDELL WATERDROP



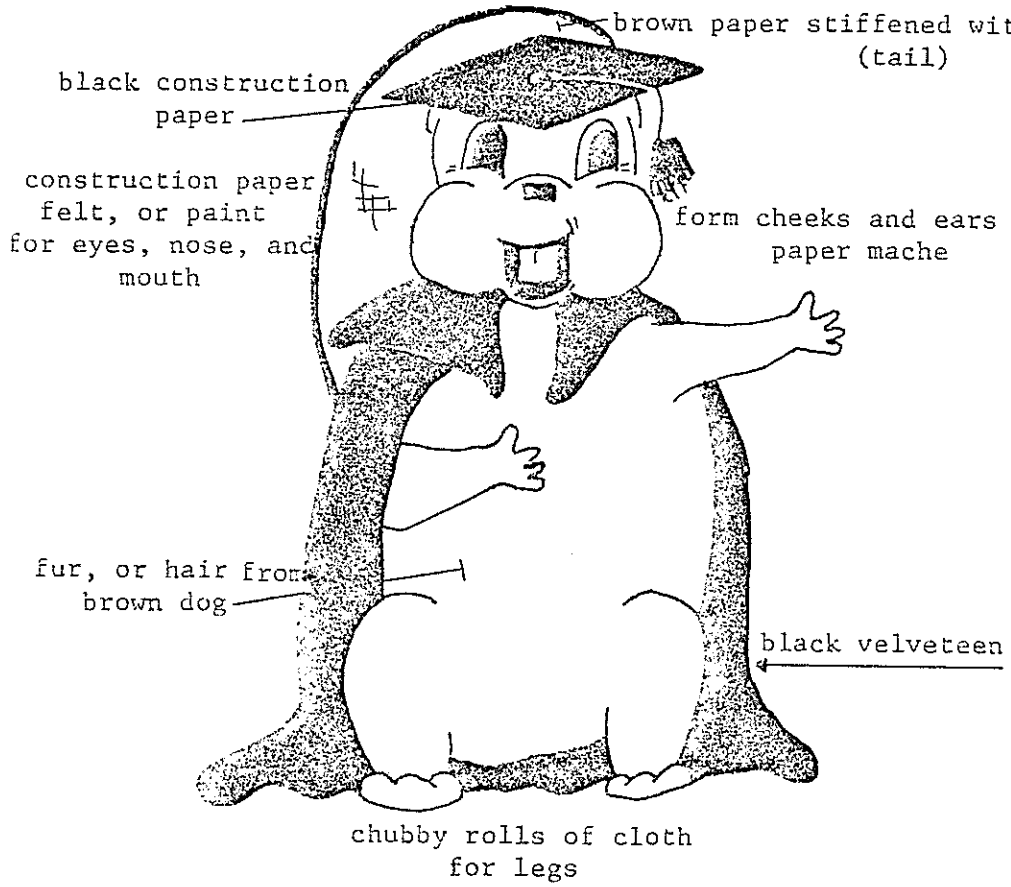




small hollow ball
for basic shape

old glove, mitten, or
two pieces of cloth
sewn together (brown)

(any kind of fuzzy material would be
excellent)



WATER

TAPE SCRIPT

(1)* This learning package was produced for elementary school (2) use through the New Mexico Water Resources Research Institute. (3) Funds were supplied in part through a grant from the U. S. Department of the Interior under PL 88-379. Project Director was Dr. Chris Buethe, Associate Professor of Education at New Mexico State University.

(12 second pause)

B.B.: (4) Hello. My name is Bernard Beaver. (5) This is my home! (6) This is my job. My friend Wendell Waterdrop and I are here to help you find out more about the water situation. (7) Wendell and I were chosen for this project because we are always in the "mist" of things, as they say in the trade.

To start with, the funny thing about water is that we keep using the same old water over and over again. Once I heard someone say, "Oh yeah? I swallowed some water today, and you ain't ever goin' to get that back." But, the truth is, eventually, water finds its way back into the water cycle, and is used over and over.

(8) Wendell knows more about the water cycle than most of us do since he has made the trip many, many times. Here he is to take you on several of his more exciting trips to help you see how water is recycled, or used over, in nature.

W.W.: Hi. I'm Wendell Waterdrop, and as Bernard said, I've taken this trip lots of times before. I've ended up in some pretty strange places and seen things that are wonderful (9) and frightening. I make this trip in different forms, so hang on and see if you can follow me. I'm in the form of a waterdrop now, so watch, and see where I land. (10)

B.B.: As you can see, Wendell lands in a water storage tank, where, travelling through pipes, he eventually ends up with millions of other drops (11) in a washing machine. (12)

He remains in a baby diaper and is hung on the railing today to dry. (13)

B.B.: The sun warms him and he turns into water vapor, evaporating up into the air as a gas. He is carried upward by warm rising air (which holds more water than cold air) until he reaches the cold upper layers of air. (14)

* *The numbers throughout the text indicate the point in the script at which the appropriate slide should be advanced into viewing position.*

B.B.: As the water vapor is cooled, it forms drops of moisture, then clouds. Each drop starts growing on a little speck of dust (15) or water. Right now Wendell is being cooled a lot, and, along with the other moisture drops, is becoming heavier. He is now in a thundercloud, ready (16) to fall as snow or rain, depending on the temperature. Remember, this is how we first found Wendell, so now one whole trip is completed. (17)

W.W.: Would anyone like to hear about some of my other adventures? Good! (18)

Once I was in a big rainstorm in the mountains. There were millions (19) of us. The grass caught us and I soaked into the ground. I was pulled downward and downward by gravity--through cracks and crevices in rocks--and between grains of sand in other formations below the surface of the earth--until I landed in a big underground pool. Bernard says that you (20) call this water inside the earth ground water. He also says to tell you that the top level of this ground water is called the water table--the level below the surface where you first find water filling all of the holes in the rocks and soil under ground. (B.B.: "Thank you.") Yes, Bernard! (21)

Now, what was I saying? Oh yes.... The water table, to use Bernard's term, lies under the surface of the ground. In places where the surface level of the ground dips way down, the water table can come over the ground surface to form lakes--or come out as a spring. So, there I was, floating along underground, when, all of a sudden, I felt the sun--and sure (22) enough, I was in a spring that ran into a big lake. Bernard (says) that I should tell you that the second I could be seen above ground, I became known as surface water. By the way, did you know that about half of our irrigation water in New Mexico comes from surface water and the other half from ground water? (23) Since I can see that you can't wait to hear about another adventure, here goes!

The first time this happened to me, I was pretty scared! I was in a little girl's water pail, and she poured me right into a flower bed full of (24) thirsty flowers. I was sucked up quickly by a great big orange flower and I travelled up the stem. I was beginning to wonder if I would ever see daylight again when, suddenly, I felt the warm sun shining on me and found myself (25) on the surface of a leaf. The next thing I knew--poof! I was in the air again, (26) all broken up into invisible water vapors!

Bernard can make things sound so ordinary. He says that this colossal adventure is "commonly" (Hmph!) known as transpiration, but I certainly would have thought of a more dramatic name for it! Actually, although it seems that I've been all over, in a typical

W.W.: trip a water drop rarely covers more than fifty miles in any underground part of its trip. (27)

Now that you know something about the water cycle and some of the most important terms used in explaining how water moves through its cycle, I'm going to tell you something that will amaze you.

You've probably been hearing about shortages of water. Actually, we have the same amount of water now as we always did. To see how this works, let's pretend that (28) the earth is a spaceship. Once a spaceship takes off, it has no way of getting new supplies out in space, does it? (29) It must use just the supplies it has on board for the whole trip. Well, our earth is just like a spaceship. (30) On its journeys around the sun these millions and millions of years, man has had just the supplies the earth has provided. (31) If our earth supplies run low, is there someplace we can get more? No! And while we have the same amount of water on our spaceship earth, (32) we have more people each day. And we like to use water for more things. And with more of us wanting more water, WOW! (33)

Our earth will always have the same amount of water. Yet, as our population grows (34) and we have more industries that use water, we are asking more and more from our water supply and using it less and less efficiently. (35) We waste water and (36) pollute it, and so, we cut down on the amount of "useful" water. We must learn to use water better and to use it over and over and over. (37)

Since we're all in the Southwest, let's look at the problems in our own area. What are we doing that is cutting down on our amount of "useful" water? How are we limiting our water supply? (38)

Does this look familiar? What do you think using lots of water for irrigation does to the water table (39) and ground water supply? The largest amounts of water in New Mexico are used by farmers. (40) This ditch may have brought the water to the field that you just saw.

If the irrigation water did flow through this ditch to reach the field, can you make a guess what happened to some of the water? Just for fun, you might want to try an experiment your teacher knows about that will give you an idea of how this works. (41) *(Appropriate stopping place.)*

Actually, in some areas of New Mexico, less than half the water meant for irrigation reaches the fields. A lot of water is

B.B.: lost by being (42) drunk by plants growing on the ditch banks. And thirsty ditch banks steal a lot of water before the water can ever reach the crops. (43)

W.W.: Boy! Let me tell you, that happens more than you think. Why, one time I was on my way to irrigate (44) some watermelon plants. I was really excited, too. I couldn't wait to see what it was like (45) inside one of those rich juicy red watermelons. It was hot out, too, and I knew it would be nice and cool inside. Anyway, wouldn't you know (46) it? The walls of the ditch were so thirsty that I never did get to the watermelons. As a matter of fact, (47) I was left up a tree that time. I'm sure that I'll be around long enough to make the trip again some day, but it sure was disappointing! (48)

B.B.: As I said before, although the water amount stays the same, it is the amount of useful water, or water that is available for our uses, that is (49) getting smaller. Wasting water, like we mentioned before, is one cause (50) of this, but pollution is another big cause. Did you know that one of our Great Lakes, Lake Erie, contains billions of gallons of water, but it has gotten so dirty that it is not useful for many of the needs man has (51) for water? Wendell was in Lake Erie once and he hated it. (52) The terrible thing is that he has also seen the same kind of pollution beginning in New Mexico. (53) This is my friend Oswald R. (for river) Otter. I promised him I'd tell you that he is a student of ecology and studies living things and the way they live in their (54) surroundings. He's worried that his pond is being polluted by man. (55) Please be careful! Wendell and I agree, for once, that pollution is so important that we're going to talk about it in more detail later. Believe me, pollution is a dangerous thing. (56)

When we get copper from the ground we add chemicals to some water. When we wash our clothes we add chemical detergents to water. (57) In our fields we add chemicals to make plants grow. Water runs through our soil and washes chemicals out of it. And where does that water go with its load (58) of chemicals? Much of it finds its way to our rivers, where downstream, farmers want to use that same water to grow crops, (59) and further on, city people want that water to drink. Is the water still as "good" as it was when (60) it fell as clean, clear rain from a cloud? How much more use could we have made of the water if care had been taken of it from the beginning? (61) All of these things are beginning to limit water available for industrial and recreational needs. What will this mean to the future growth of New Mexico? (62)

Remember Wendell told you that he had seen some pretty terrible things in his millions and millions of recycling trips? Let's go with Wendell on one experience in the New Mexico desert. (63)

W.W.: Boy, is this exciting. (64) I'm caught in this thunderstorm above New Mexico with a terrific lightning storm going on (65) around my head. I hope I get cool enough and heavy enough to fall pretty soon. Ah, I can feel myself getting bigger (66) and bigger. I'm a raindrop and I'm on my way! Boy, what a rainstorm! There are so many of us falling it looks like I won't have a chance to soak into the ground and become part of the ground water system. Yikes!! Here I go! (67) I'm in a flood heading down an arroyo. This is the fastest water I've ever been in. Wonder where (68) I'll stop! There's mud and silt going down with me--that wouldn't (69) have happened if there had been lots of grass and trees on the mountain to hold the soil in place.

Wow--I'm in a whirlpool. I must have landed; (70) it seems like the water's slowing down. I must be in a river. I wonder if it's the Rio Grande? I understand the rainstorm was close to Las Cruces. If it is the Rio Grande, I'll be meeting lots of water that came from melted snow in Colorado and got polluted along the way. Well, I'll just flow down this river a while and enjoy life. Enjoy life! (71) Ha! I just got hit in the head by a pop bottle! And the soapsuds are coming toward me. I've got to stop talking or I'll choke! Here I go....(72)

B.B.: Let's leave Wendell. Cross your fingers and hope we'll meet him later--all in one piece.

Wendell was meeting water pollution for the first time. Water pollution is becoming one of our biggest problems on Earth. Let's look at some other water pollution problems in our area. (73)

Silt or mud is one of our greatest water polluters. It is washed down from (74) the mountains or mesas above because the land is bare and has no grass to hold the water. (75) This silt and mud kills fish by clogging their gills or covering the beds where they lay their (76) eggs. It also fills lakes and reservoirs, turning them into worthless mud flats. (77)

Another bad water pollution problem is where industries or cities dump their sewage and waste water into streams and lakes. This is done in many places in the United States because it is cheaper to dump wastes and waste water into a river than to treat or fix up the wastes. Sewage breaks down when it is put into the water in a stream or lake, and as it breaks down it uses up the oxygen that the fish need to stay alive. So the fish die, (78) and what used to be a clear lake or stream turns into a scummy pond. There are some industries that do not pollute the water. (79) But this one does pollute something else. Can you see what? (80)

B.B.: Of course, things aren't as bleak as they may seem here. There are things you and your friends can do to help our Earth improve on its water situation.

But before we give you our ideas, you might want to see what you can come up with as solutions to our water problems. *(Appropriate stopping place, and change carousel.)*

(81) Most crops need at least 20 inches of water per year in order to grow. Since we get less than this in (82) New Mexico, farmers must irrigate to raise crops. What can you think of that would help us keep from losing so much (83) water through faulty irrigation methods? What would be the best types of crops to grow in New Mexico? (84)

W.W.: What can you do to make sure that there will be water available in New Mexico (85) for you and your children (86) to swim in, fish in, and (87) have fun with?

B.B.: (88) Salinity, or salt in water, is a big problem in New Mexico. Do research to find out what industrial plants are doing about salinity. This is a drawing that shows how one type of desalting plant works. (89)

W.W.: Why is it a bad idea to play or to swim in irrigation ditches? (90)

B.B.: How can we be sure that when industries want to come to New Mexico and help New Mexico grow, there will be water available for these industries to use? (91)

W.W.: Pollution--I happen to know that Cub Scouts and Boy Scouts are working on this problem. Check with them before you go further. You'll probably be able to come up with some really good ideas because you're (92) not in the thick of the water problem like I am.

B.B.: (93) Now we'll show you our solutions, but we're sure that you came up with some better solutions. If you did, why don't you write your solutions to:

(94) Professor of Science Education
NMSU
Box 3AC
Las Cruces, New Mexico, Zip Code 88003

Now for our solutions to irrigation problems (95):

B.B.: Small, old irrigation ditches need to be put (96) together into larger, better-designed systems of ditches to deliver enough irrigation water to the crop land. Ditches could also be lined with concrete or plastic to keep the thirsty ditches from drinking the water that is supposed to go to the crops. The government will even help farmers pay the cost of having the ditches lined so they won't leak. (97)

W.W.: In many parts of the state, (98) water is wasted through over-irrigating. In some places, (99) farmers use sprinklers or irrigate with (100) pipes under the ground. They will grow better crops and waste less water.

B.B.: (101) And most of our water problems can be solved, as I'm sure you've discovered, by planning for our future needs of water and then having laws (102) that will limit our uses of water. To start with, we need to know how much water is available in the ground in New Mexico. We don't know these facts yet, but we do know the amount of ground water (103) in New Mexico is going down and that the quality of our ground water is becoming poorer.

Think--let's imagine (104) that in your town there were some people who wanted to close down the public swimming pool in order to provide water for the Kreamy Kola bottling plant. (105) The bottling plant would provide jobs for many people in your town and would bring more tax money into your town to pay for schools and parks. Another factory would also like to move into your town--a factory that needs water to use in recycling aluminum cans so that they can be used (106) again and again for making mini-bike frames. How would you decide who has the right to the water? (107) If you or your class had to present the case for keeping the swimming pool open, what would you say to the city council?

Keep in mind, that in your own future, you may be called on to make decisions exactly like this!

W.W.: (108) In the meantime, what can you yourself do to help solve our water problems? First, think about water and how much you use each day. Ask yourself (109) these questions:

How many quarts of water do I drink in a (110) day?
How many gallons do I use in bathing each (111) day?
How else do I use water?
How much water does my (112) mother use to:
    Fix my meals? (113)
    Wash my clothes? (114)
    Clean the house I live in?
How much water does my father use in:
    (115) Shaving?
    Washing our car?
    Showering? (116)

W.W.: Keeping our lawn and garden green?
Cooling our house?

B.B.: (117) In addition to the water you use in your home, water is being used in your community, (118) and industry, and in activities for your safety, health, and enjoyment.

Experts guess that each person in New Mexico uses about 150 gallons of (119) water per day just around his home. Think of that! 150 gallons! (120) That's about seven bathtubs full! (121) If you add the water used in industry, (122) farming, and recreation, (123) and other purposes, the total leaps to at least 1,500 to 2,000 gallons per person per day.

Let's (124) look at some pictures of water (125) being wasted. See if you can think (126) of ways to help save some of the wasted water. (127), (128), (129)

B.B.: (130) Can you think of any more ideas before we give you some of ours? We've included some things you may not have thought of.

W.W.: (131) As it turns out, one of the best things that you can do in your (132) own home is to fix the leaky faucets. (133)

B.B.: Begin organic gardening. In this way, harmful chemicals in soils are avoided, and some organic garbage can (134) become useful rather than a waste product.

W.W.: Don't use a dishwasher or a washing machine unless there is a full load. (135)

B.B.: Use your energy and biodegradable cleansers in cleaning dishes, pots, and sinks, rather than using a lot of running water. (136)

W.W.: Keep cold drinking water in the refrigerator instead of letting faucets "run" to get cold water. (137)

B.B.: Use biodegradable, phosphate-free cleaning agents and bubble bath. Phosphates and some other chemicals added to the water can throw off the balance of life and cause harmful water plants to increase. (138)

W.W.: Cut down on letting the water run while you're brushing your teeth, or combing your hair, or washing--and tell Dad to when he's shaving. Then take quick showers. (139)

B.B.: Water lawns early during the day (140) or after the sun goes down. Water only when necessary, and don't over-water lawns or gardens. (141)

W.W.: Don't flush filter cigarettes down toilets. They can cause problems at sewage treatment plants. Never flush away anything that you can put in the garbage. (142)

B.B.: Don't use pesticides, herbicides, (143) or insecticides unless you have expert advice or you may harm or kill the wrong things. (144)

W.W.: Producing electric power pollutes the air and water and uses up our precious fuels: so use less electricity.

B.B.: As a class you might:

W.W.: (145) Work with Boy Scouts or other organizations to fight water pollution in your area (146)

B.B.: Have your class write letters to such conservation groups as:

Environmental Improvement Agency
PERA Building
Santa Fe, New Mexico Zip Code 87501

or

The National Parks and Conservation Association
1701 18th Street, N.W.
Washington, D.C. Zip Code 20009

See what they say you can do to conserve our water resources and put our limited supply to best use. (147)

W.W.: Make group collages, bulletin boards, and posters to show people our polluted environment and what we must do to correct it. (148)

B.B.: We have as much water as we'll ever have. We all need to learn to use it more wisely and to use it over and over. (149)

W.W.: We can do it if we all work together, can't we?