The Futures Channel

M O V I E   G U I D E

MOVIE NUMBER **5001**

Water Supply

The Movie:

The water that comes out of your tap has traveled a long way to get there. Featured: Bernie Daley, Hydro Engineer, New York Department of Environmental Protection. *(Movie length = 3:20)*

Background:

Worldwide use of water has more than tripled since 1950; the demand is actually growing faster than the increase in population. Although the United States has a relatively large water supply, some parts of the country occasionally have too much water, while others have too little. Population growth, precipitation, pollution, and other factors are making it necessary to manage our water carefully. This requires a knowledge of available resources (precipitation, groundwater, savings from conservation), facilities to store water and move it where it is needed, and the ability to predict water needs.

Wherever it comes from, wherever it goes, and however it's used, water is a precious commodity. And the tens of thousands of people who work in fields related to water engineering are an equally precious resource.

Curriculum Connections:

Ratios — 1

Precipitation in the form of snow takes up much more space than the same amount of water in liquid form. It takes an average of 10 inches of snow to equal 1 inch of rain. Using this ratio, determine how many acre-feet of liquid water might be contained in the amount of snow that covers 1,000 acres to a depth of 2 feet. (1 acre-foot = the amount of water required to cover an area of 1 acre to a depth of 1 foot.)

Fractions, Measurement (volume) — 2

Suppose that a new type of toilet uses only 1/2 gallon of water per flush instead of 2 gallons. If each of the 35 million people in California flushes the toilet 4 times a day, how many gallons of water would the new toilet save each day? How many acre-feet is this per day? How many acre-feet each year?

Measurement (rate) — 3

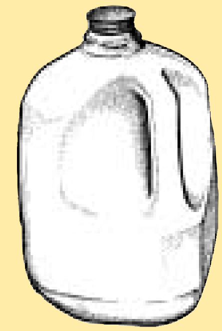
If 1.5 billion gallons of water flow through the 17 valves of the Van Cortland valve chamber each day, what is the flow rate through one valve, in gallons per minute?

Measurement (volume), Geometry (solids) 4

What if your classroom were filled with water? How many gallons of water would it hold? (picture of gallon container)

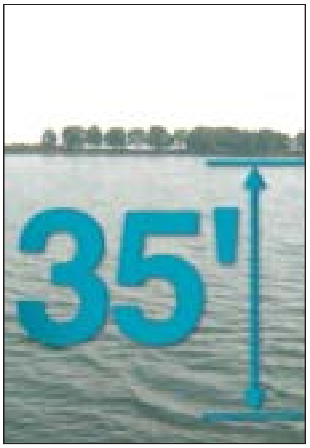
Look at a gallon container. Then estimate how many gallons it would take to fill your classroom.

Measure the size of your classroom, in feet, and determine the volume of the room, in cubic feet. If one cubic foot is the same volume as 7.5 gallons, how many gallons would fill your classroom?



Problem Solving 5

Imagine you are an engineer who builds reservoirs for your city. You have been asked to build a new reservoir which can provide water to the people of the city in case of an emergency. What information would you need to decide how big to make your reservoir?



Measurement (volume, rate) 6

Water can be wasted in the home if it is allowed to run without being used. Place a one-gallon container under your kitchen faucet. Turn the faucet on about half-way and allow water to run into the container for 15 seconds. About how much of the gallon is filled? How much water (in gallons) would come out of the faucet in one minute?

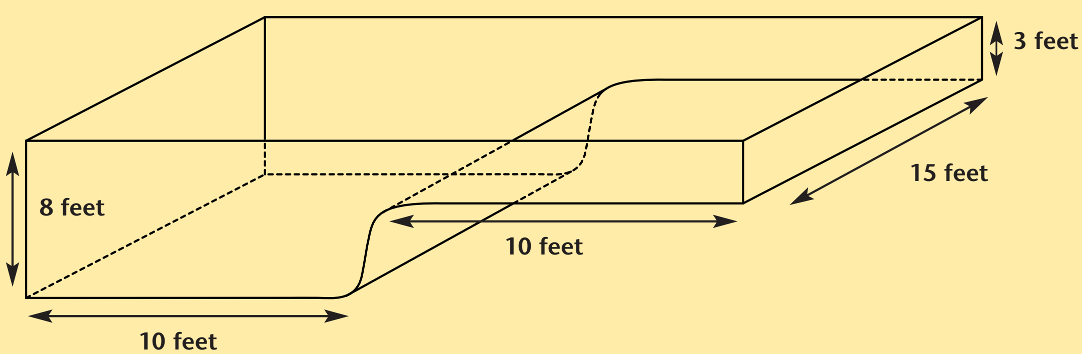
If the faucet were left running for 2 minutes every day in a house, how many gallons would be wasted in a year? How many gallons would be wasted in 3 million such houses?

Measurement (volume, rate) 7

Mr. Smith had a new pool dug in his back yard. The design drawing is shown below.

Mr. Smith plans to fill the pool using a garden hose on a tap in his back yard. He finds that it takes about 1 minute to fill a five-gallon bucket from the hose.

About how long will it take him to fill the pool? More than 12 hours? More than 1 day? More than 2 days?

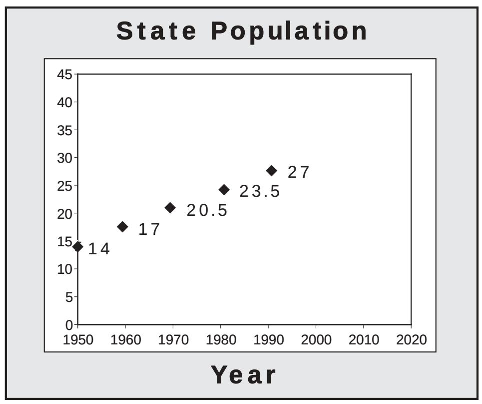


Department of Water Resources

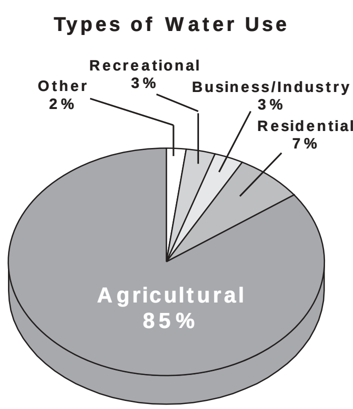
From: Director, Department of Water Resources
To: Water Resource Specialists
Subject: Predicting water use

We have been buying water from a nearby state, but have learned that officials in that state have decided that they need to keep more water for their own use. Faced with this situation, it has become critical to estimate how much water our state will require.

First, we need a prediction of how many people will be needing water. Look at this graph of our state's population. What do you think the population of our state will be in the year 2010? 2020?



Next, we need to predict overall water use for the state by the years 2010 and 2020. What we know is that people use about 200 gallons of water per day on average for residential purposes, and that the breakdown of all water uses in the state looks like this:



Please work out (in acre-feet) how much water we can expect to be used in 2010 and 2020 for a) business and industry, b) agriculture, c) recreational water use, and d) other purposes.

Finally, we need to decide where to concentrate our efforts to conserve water. Let's see if a rough calculation will help. Suppose we have a choice between two water conservation programs. One would allow us to save 5% of the total amount of water used in agriculture. The other would allow us to save 50% of all the water used for residential purposes. Which program would allow the state to save the most water?

Thanks, Jo

Teaching Guidelines: Department of Water Resources Activity
Math Topics: Algebra, (coordinates), Percents

Procedure:

This project should be done by students in teams of two or three.

Distribute the handout and discuss it. You may wish to have students completely carry out the first part of the task (prediction of population), before discussing the second part (prediction of water needs).

Students may make their predictions simply on the basis of extending the trend of the graph, or by noticing that the population rose by 3 million from 1970 to 1980, and by 3.5 million from 1980 to 1990, and therefore it might be expected to rise by 4 million by 2000, by 4.5 million by the year 2010, and by 5 million by the year 2020.

Students with enough algebra background can take a third approach—working out the linear equation that most closely represents the given graph.

Answers should be in these ranges: year 2000: 30–31 million; year 2010: 33–35.5 million; year 2020: 36–40.5 million.

The second part of the assignment is a multistep problem. Students need to realize that first they need to determine the total amount of future residential water needs (based on the 200 gallon per day datum and the population they projected). The total water needs can be determined based on the fact that the residential amount (which they know) is 7% of the total. They can then use the pie graph percents to find out the projected needs in other areas.

For the third part of the task (evaluating conservation strategies), the best strategy is to work out an actual example, starting with the total amount of predicted water usage for, say, 2010.

If you enjoyed this Futures Channel Movie, you will probably also like these:

Tunnel Number 3, #5002	Go deep underground with an engineer as she works to ensure a continuous water supply for millions of people.
The New York City Subway, #5005	The New York City subway moves millions of people every day, thanks to the skills of a team of remarkable people.
Water Tanks, #5006	Almost every building in New York City is topped by a water tank.