Watershed Mania!

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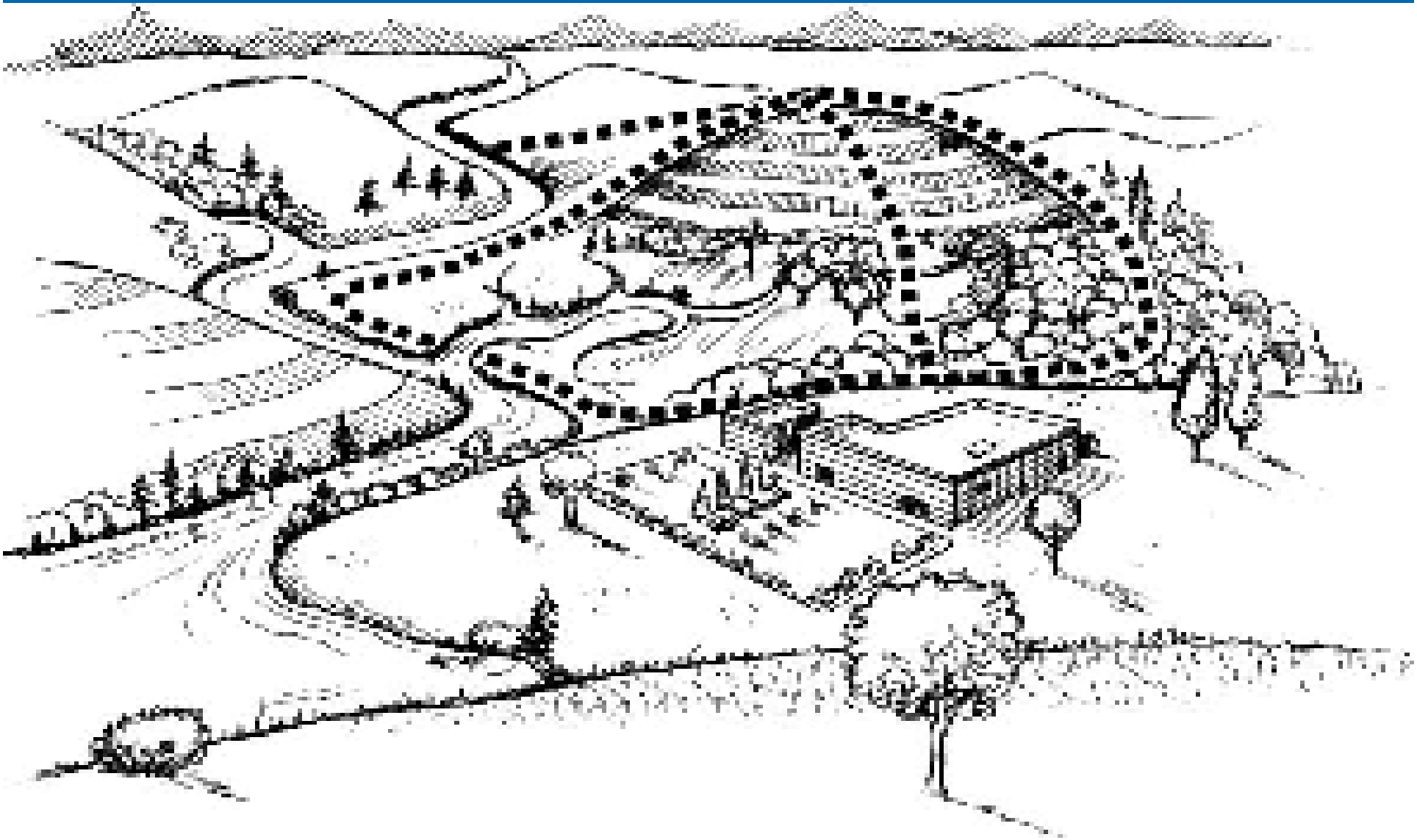
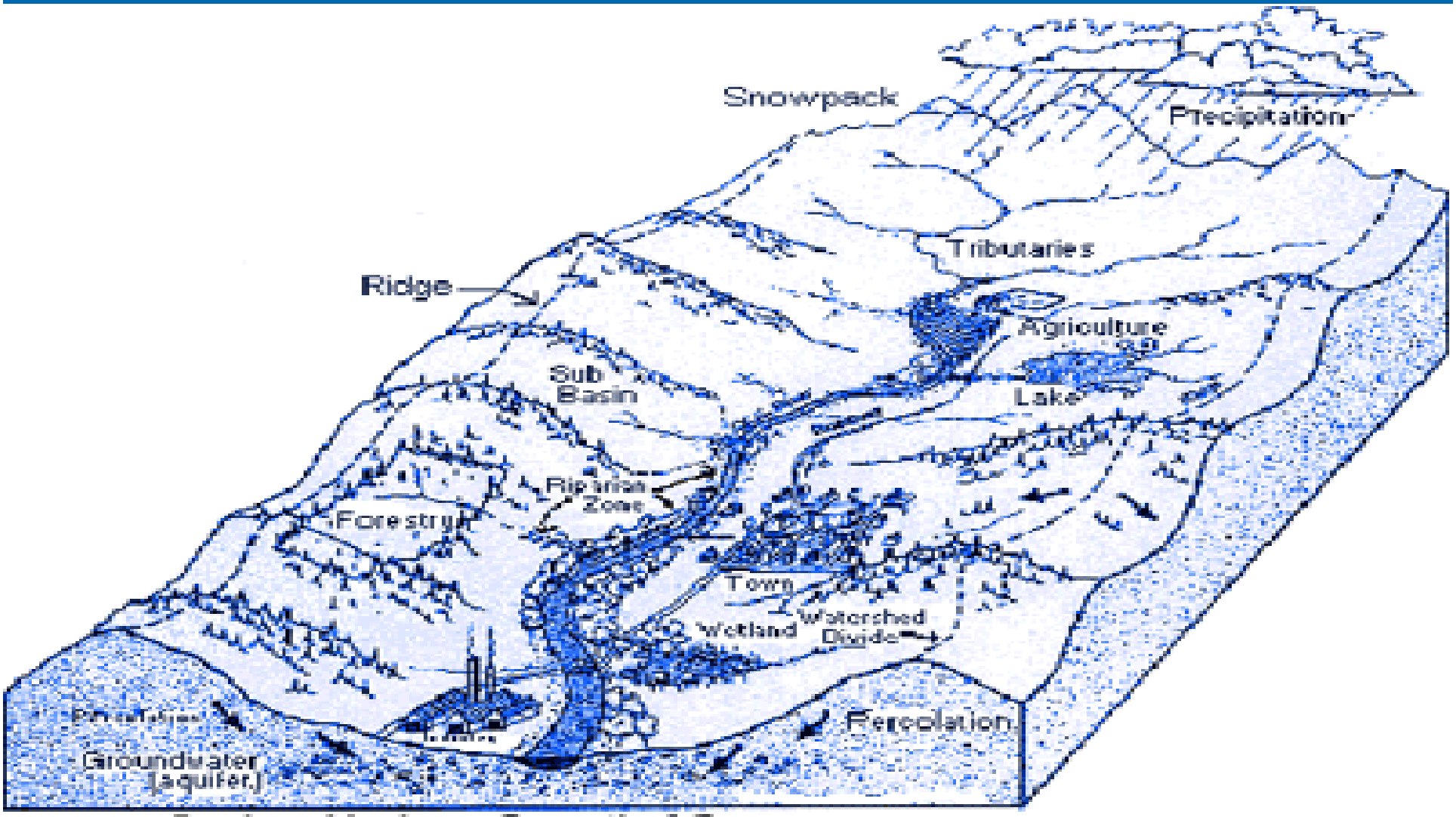
What Is a Watershed?



Another view of a Watershed



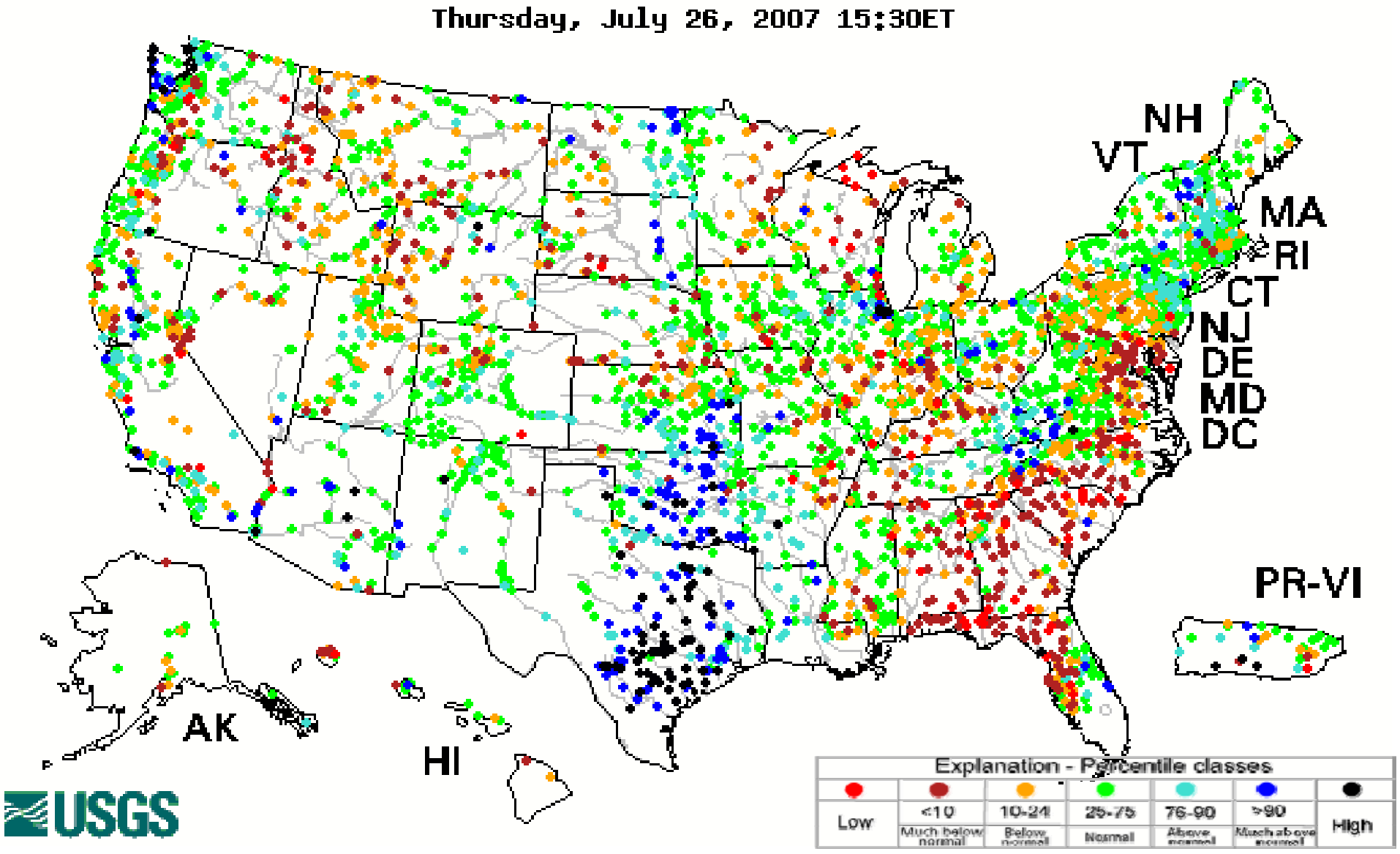
A Watershed Approach

- Is hydrologically defined
  - geographically focused
  - includes all stressors (air and water)
- Involves all stakeholders
  - includes public (federal, state, local) and private sector
  - is community based
  - includes a coordinating framework
- Strategically addresses priority water resource goals (e.g. water quality, habitat)
  - integrates multiple programs (regulatory and voluntary)
  - based on sound science
  - aided by strategic watershed plans
  - uses adaptive management

Beaver Water District

Water Watch –

Real-time US Streamflow compared to historical streamflow for the day/year

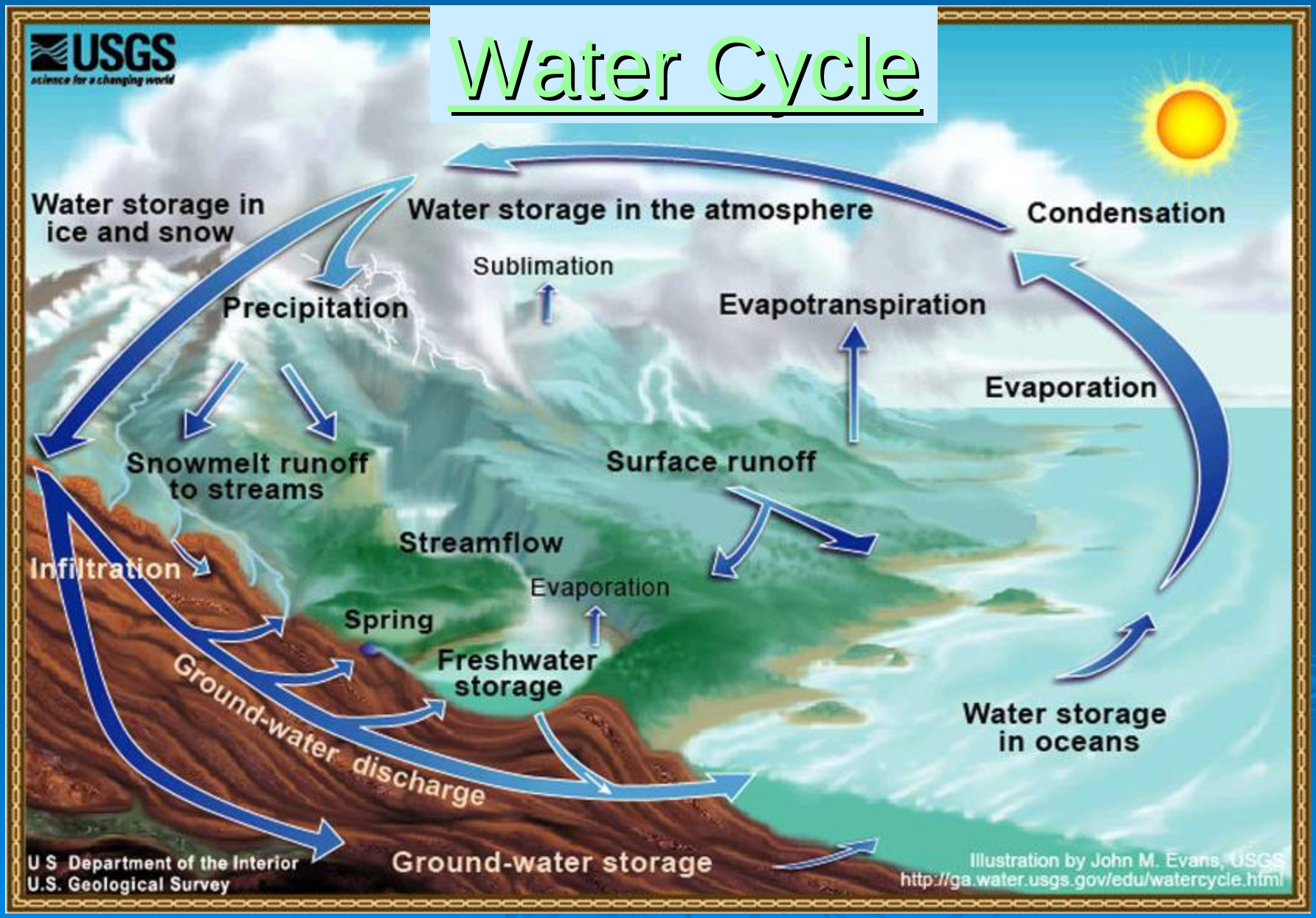


Locate Your Watershed

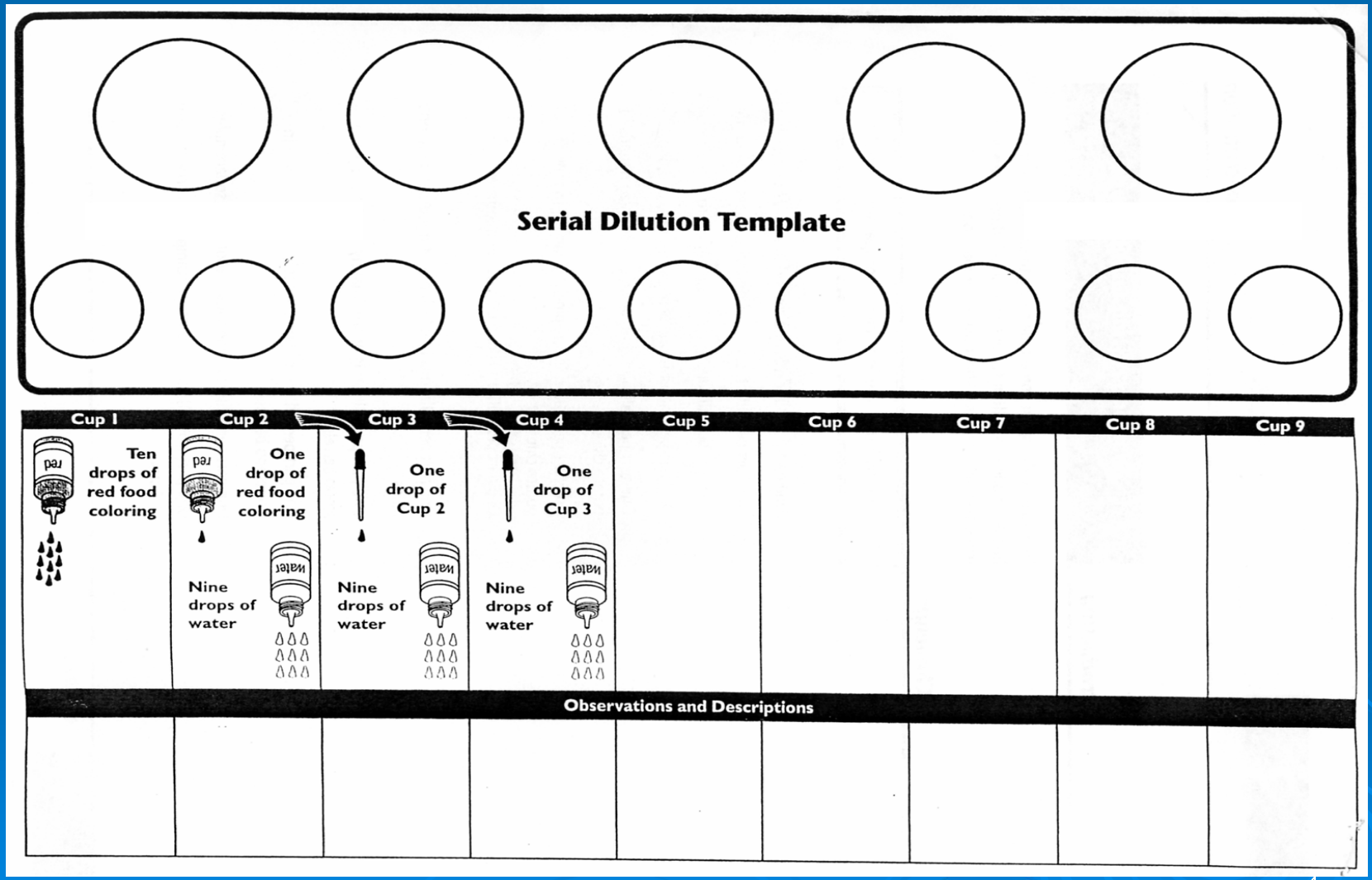
Water Cycle

- Activities and Resources
  - ppm (SEPUP) Serial Dilution and Dilution of Copper Chloride
  - Water Cycle
    - NOAA - The Water Cycle Game
    - Incredible Journey (Project WET)
  - Water Distribution Demonstration
  - Watershed Models and Lessons
  - Water and Watershed websites

Water Cycle


USGS
science for a changing world
Water storage in ice and snow
Water storage in the atmosphere
Condensation
Sublimation
Precipitation
Evapotranspiration
Evaporation
Snowmelt runoff to streams
Surface runoff
Streamflow
Infiltration
Evaporation
Spring
Freshwater storage
Ground-water discharge
Water storage in oceans
Ground-water storage
U S Department of the Interior
U.S. Geological Survey
Illustration by John M. Evans, USGS
http://ga.water.usgs.gov/edu/watercycle.html

SEPUP Serial Dilution



Example of Serial Dilution

Activity 2

3 CLASS SESSIONS

Dilution of Copper Chloride

Activity Overview

Students explore dilution as a disposal method for solutions that contain metals. They perform a serial dilution of 100,000 ppm copper chloride to develop an understanding of the concept of parts per million (ppm) as a way of expressing the concentration of a solution. They then test a copper chloride solution with ammonia to demonstrate how chemical tests can reveal concentrations lower than those visible to the human eye. The tests are used to determine the concentration of the used copper chloride from Activity 1.

CONCEPTS, PROCESSES, AND ISSUES

(NSES 5–8 Content Standards)

1. Toxic waste is harmful to living organisms and must be disposed of according to strict guidelines. *(Inquiry: 1; Perspectives: 1, 4)*
2. Dilution is one approach to disposing of liquid toxic waste. Although the solution still contains toxic elements, dilution can lower the concentration of a solution to levels that are generally considered safe for living organisms. *(Inquiry: 1; Perspectives: 1, 4)*
3. The amount of a contaminating substance in air or water is often expressed in parts per million or even parts per billion. *(Inquiry: 1; Perspectives: 1, 4)*

TEACHING SUMMARY

Step 1.
Discuss what is meant when concentration is expressed in parts per million.

Step 2.
Perform a serial dilution of copper chloride and use ammonia to test copper concentrations.

Step 3.
Calculate solution concentrations.

Step 4.
Clarify the concept of parts per million. (optional)

Step 5.
Discuss the limitations of dilution as a disposal procedure.

MATERIALS

For the teacher

- 1 Transparency 2.1, "Use of Dropper Bottles"
- 1 Transparency 2.2, "Diluting and Testing Copper Chloride"
- 1 Transparency 2.3, "Determining Concentration"
- 1 Transparency 2.4, "Serial Dilution and Concentration "
- 1 Transparency 2.5, "Some Interesting Comparisons"
- 1 transparency of Student Sheet 2.1, "Concentration of Copper in Solution"
- * 1 overhead projector
- 2 plastic cups
- 1 bottle of red food coloring
- * access to water
- 1 pair of disposable latex gloves
- * 1 pair of safety goggles
- * 1 large glass or plastic container (to collect waste copper chloride)
- * 1 bucket (containing initial rinse water)
- * 1 funnel
- * 1 2-liter bottle (optional)

SEPUP (2003) *Waste Disposal: Computers and the Environment*. Ronkonkoma, NY: Lab-Aids©, Inc.
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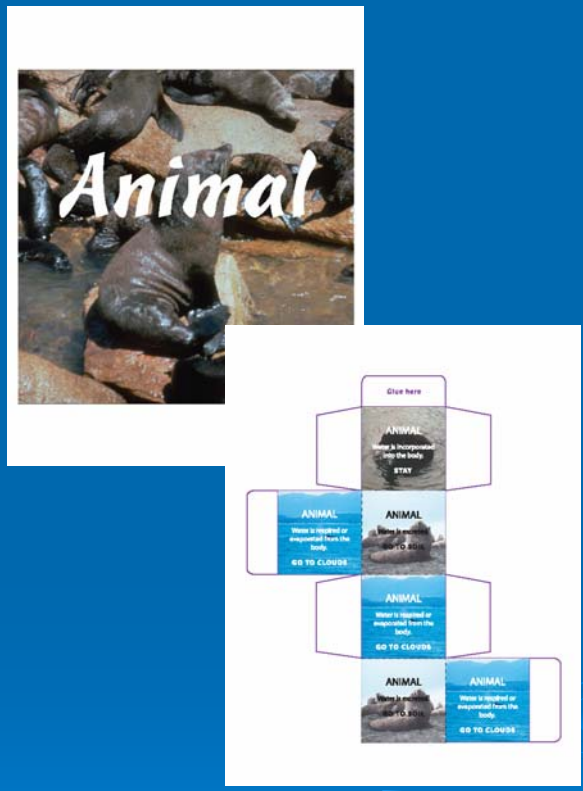
The Water Cycle

Where did the water you drank today come from?

Summary
With a roll of the dice, you can simulate the movement of water within the water cycle.

Objectives
Students will learn the complex movement of water through the water cycle through role playing, and, they will identify the states of water and changes in state as it moves through the water cycle.



The Incredible Journey

Grade Level:
Upper Elementary, Middle School

Subject Areas:
Earth Science

Duration:
Preparation time: 50 minutes

Activity time: two 50-minute periods

Setting:
A large room or playing field

Skills:
Organizing (mapping); Analyzing (identifying components and relationships); Interpreting (describing)

Charting the Course
Other water cycle activities include "Water Models" and "Imagine!" In-depth investigations of how water moves can supplement this activity: condensing and evaporating ("Water Models"), filtering through soil ("Get the Ground Water Picture"), traveling over Earth's surface ("Branching Out!"), and moving through the atmosphere ("Piece It Together").

Vocabulary
condensation, evaporation, electromagnetic forces

Where will the water you drink this morning be tomorrow?

Summary
With a roll of the die, students simulate the movement of water within the water cycle.

Objectives

Students will:

- describe the movement of water within the water cycle.
- identify the states of water as it moves through the water cycle.

Materials

- *9 large pieces of paper*
- *Copies of* ***Water Cycle Table*** (optional)
- *Marking pens*
- *9 boxes, about 6 inches (15 cm) on a side*
  Boxes are used to make dice for the game. Gift boxes used for coffee mugs are a good size or inquire at your local mailing outlet. There will be one die [or box] per station of the water cycle. [To increase the pace of the game, use more boxes at each station, especially at the clouds and ocean stations.] The labels for the sides of the die are located in the *Water Cycle Table*. These labels represent the options for pathways that water can follow. Explanations for the labels are provided. For younger students, use pictures. Another option is to use a spinner—see the activity "A Drop in the Bucket" for spinner design. It is necessary to design a spinner for each station.
- *A bell, whistle, buzzer, or some sound maker*

Making Connections

When children think of the water cycle, they often imagine a circle of water, flowing from a stream to an ocean, evaporating to the clouds, raining down on a mountaintop, and flowing back into a stream. Role-playing a water molecule helps students to conceptualize the water cycle as more than a predictable two-dimensional path.

Background

While water does circulate from one point or state to another in the water cycle, the paths it can take are variable.

Heat energy directly influences the rate of motion of water molecules (refer to the activity "Molecules in Motion"). When the motion of the molecule increases because of an increase in heat energy, water will change from solid to liquid to gas. With each change in state, physical movement from one location to another usually follows. Glaciers melt to pools which overflow to streams, where water may evaporate into the atmosphere.

Gravity further influences the ability of water to travel over, under, and above Earth's surface. Water as a solid, liquid, or gas has mass and is subject to gravitational force. Snow on mountaintops melts and descends through watersheds to the oceans of the world.

One of the most visible states in which water moves is the liquid form. Water is seen flowing in streams and rivers and tumbling in ocean waves. Water travels slowly underground, seeping and filtering through particles of soil and pores within rocks.

Although unseen, water's most dramatic movements take place during its gaseous phase. Water is constantly evaporating, changing from a liquid to a gas. As a vapor, it can travel through the atmosphere over Earth's surface. In fact, water vapor surrounds us all the time. Where it condenses and returns to Earth depends upon loss of heat energy, gravity, and the structure of Earth's surface.

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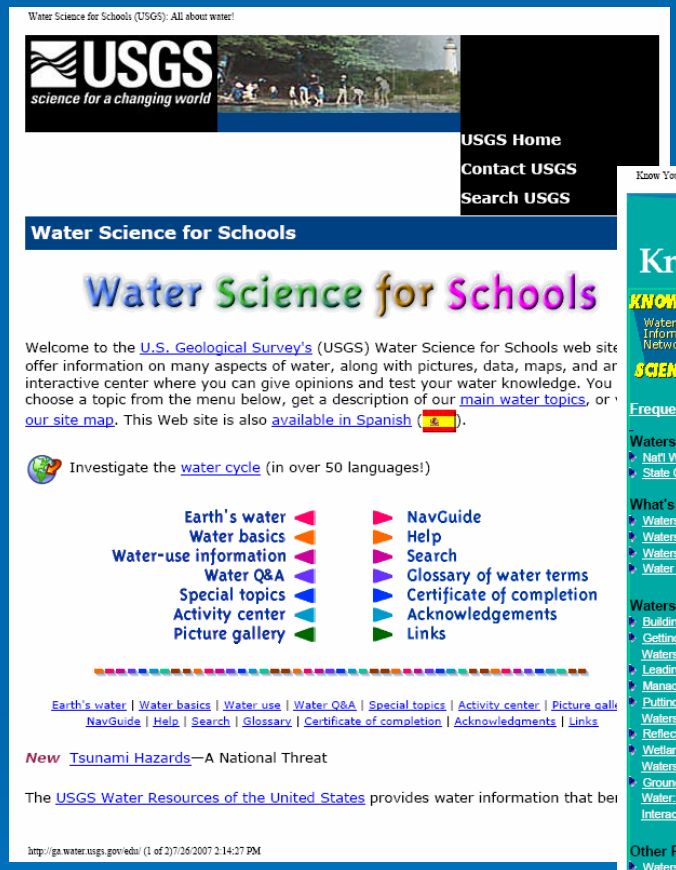
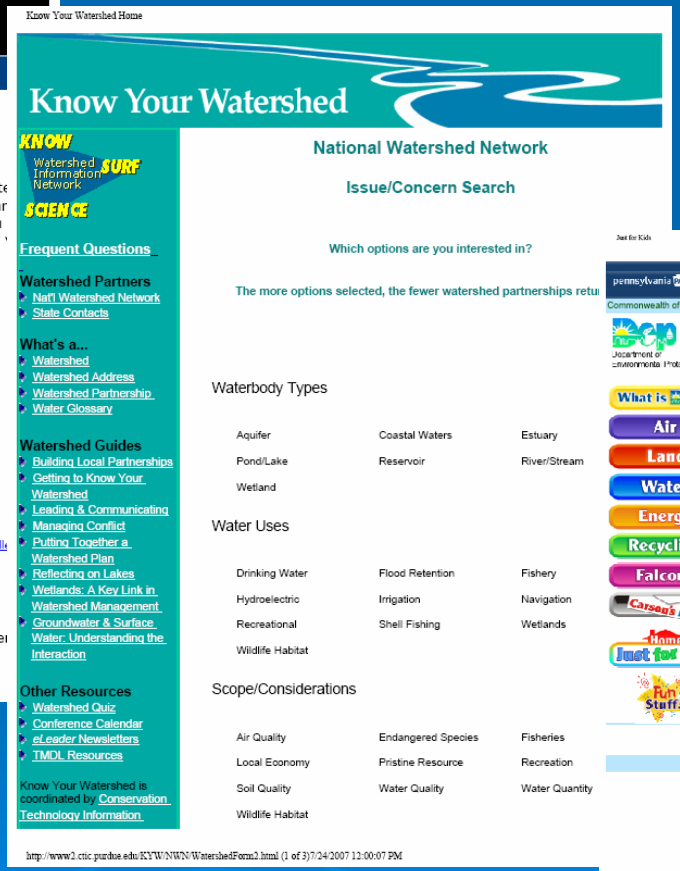
Some suggested websites





Water Distribution

WATER DISTRIBUTION DEMONSTRATION

INTRODUCTION

Humans must have freshwater to live. But about ninety-seven percent of the Earth's water is too salty to use. The remaining 3 percent is freshwater, but most of it is in polar icecaps, remote glaciers, and icebergs and is not easily accessible. Accessible freshwater, therefore, comes from streams, lakes, and underground sources. These sources represent less than one-half of one percent of all water on Earth. If all the water on Earth equals 100 percent, then the following table shows the breakdown representing each type.

Earth's Total Water Supply		Earth's Total Freshwater Supply	
97.2%	Oceans (saltwater	2.38 %	Icecaps, glaciers
2.8%	Freshwater	0.397%	Ground water
100.0%	Total Water on Earth	0.022%	Surface water
		0.001%	Air and soil
		2.8 %	Total Freshwater on Earth

OBJECTIVES

After the demonstration, students will:

1. Know the distribution of Earth's water.
2. Be able to name the sources of freshwater on Earth (icecaps and glaciers, ground water, surface water, atmospheric water vapor, and soil moisture).

MATERIALS

Two 1,000-milliliter (mL) graduated cylinders, four 100-mL graduated cylinders, one medicine dropper, food coloring.

TEACHER PREPARATION

If two 1,000-mL graduated cylinders are not available, other clear containers can be used. If you have access to laboratory glassware, fifteen 100-mL graduated cylinders will work. Ten cylinders will hold 972 mL of saltwater, while the remaining five graduated cylinders will hold freshwater. A clear plastic jug holding one liter (soft drink container) of colored water can be used. Other clear glasses or jars can hold the smaller divisions. The following table shows the distribution of water for this demonstration.

Earth's Total Water Supply		Earth's Total Freshwater Supply	
972 mL	Ocean (saltwater)	23 mL	Icecaps and Glaciers
28 mL	Freshwater	4 mL	Ground water
1,000 mL	Total Water on Earth	2*	Drops Surface water
		1*	Drop Water in air and soil
		28 mL	Total Freshwater on Earth

1 liter = 1,000 mL
*3 drops = 1 mL

97.2% 972 ml salt water	2.8% 28 ml fresh water
2.3% 23 ml icecaps, glaciers	.397% 4 ml ground water
.022% drops ice water	.001% 1 drop atmosphere and soil moisture

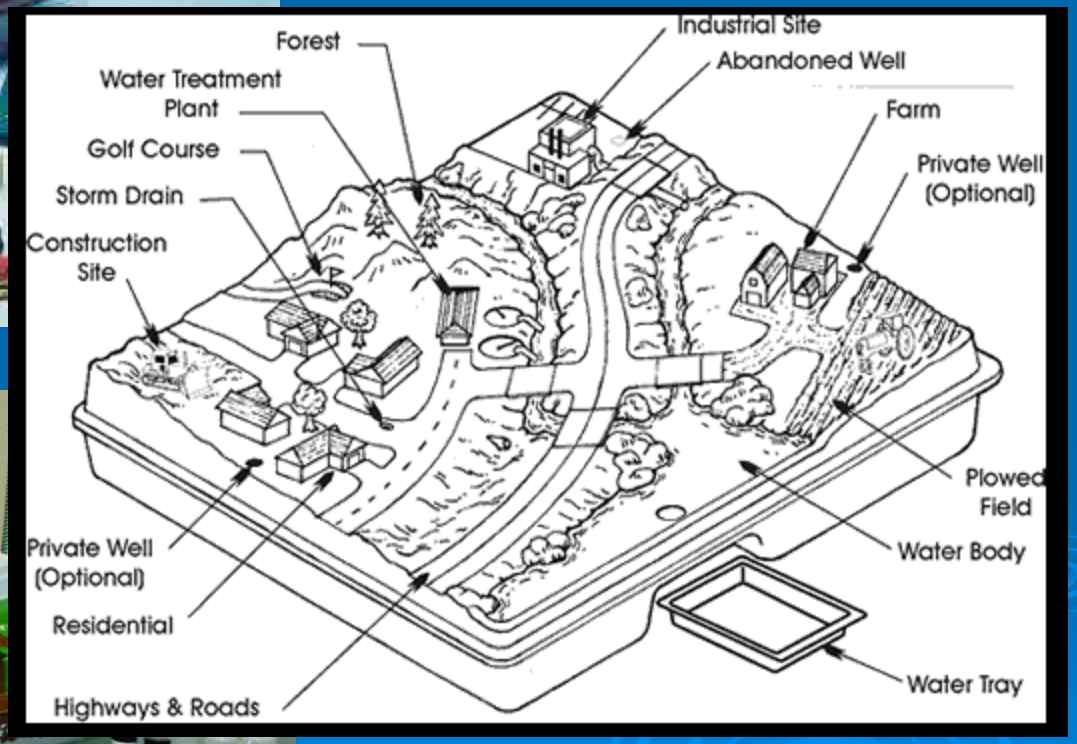
Water Distribution Script for use with graduated cylinders

I am **all** the water on Earth. I am 100% of all the water on Earth. Show the 1000ml cylinder. This much water also fills ten 100ml cylinders.

I am all the water in the **oceans** on Earth. I am 97.2 % of all the water on Earth. Because I am salty, I am not useful for drinking water. Measure 972ml into the 100 ml graduated cylinders.

I am all the fresh water on the Earth. Animals and plants depend on me for life. I am 2.8% of all the water on Earth. Measure 28ml in into the 100 ml graduated cylinders.

EnviroScape



Planning and Creating:
From rough sketch to model

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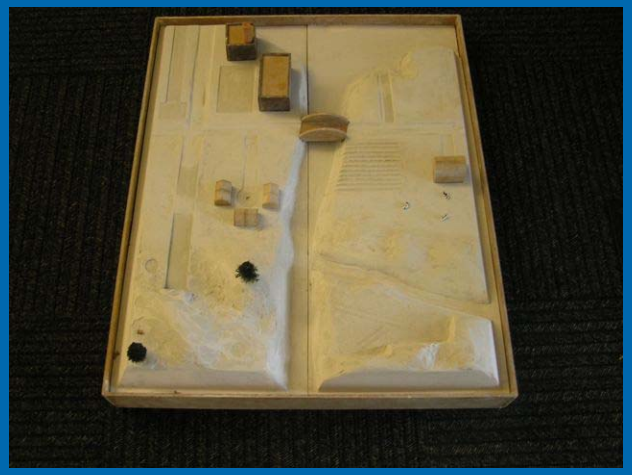
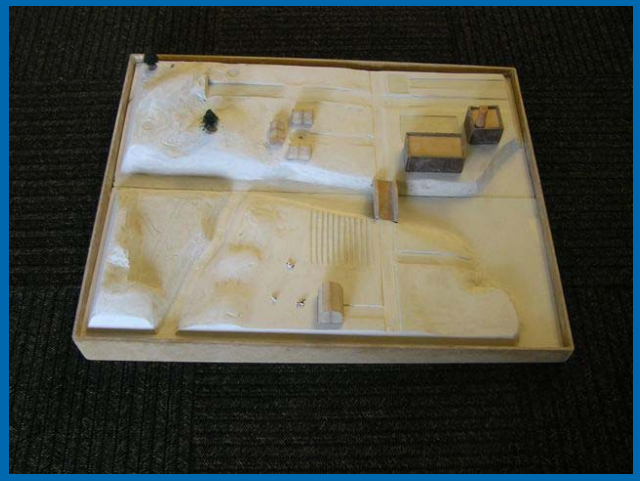
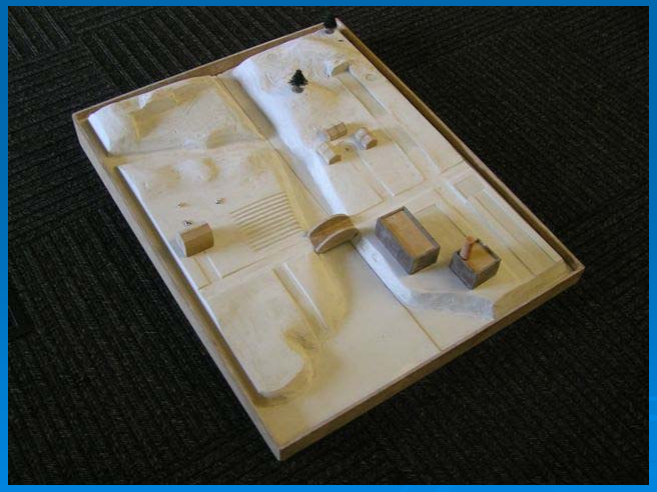


Planning and Creating:

From rough sketch to model





Watershed in a Box

1st Grade Unit

Beaver Watershed Project
1st Grade Interdisciplinary Unit

Engage

History of Beaver Watershed and BWD.

What is it? Why does it exist?
Use a book and/or storytelling with a beaver puppet to engage the students' interest in learning about the Beaver Water District
(TCC.1.2. Explain how individuals, events and ideas influence the history of one's self, family, community, state and nation and TCC.2.1 Discuss and record changes in one's self, community, state and nation.)

Use the beaver puppet and the beaver puppet script to introduce the students to the Beaver water district. Complete a KWL chart to assess what students know about the importance of water. Discuss how NW Arkansas would be different without the work of the Beaver Water District now and in the past.

Exploration #1

Where in the world is Beaver Water District?

Use world map, U.S. map, Arkansas map, area maps, city maps and the model to show the location of BWD.
(SSPS.1.3. Interpret information from visual aids, such as graphs and maps.
SSPS 2.1. Define and apply key features on maps and globes.)

Play a game of Surf and Sand Ball Toss. Discuss how important water is to the Earth. Have students find the United States on the globe ball. Show students a map of the U.S., Arkansas and the Beaver Water District. Have the students color Arkansas on the U.S. map and the Beaver water district on the Arkansas map. Have them find their city on the Beaver Water District map.
D iscuss again why the Beaver Water District is important to those who live in Northwest Arkansas.

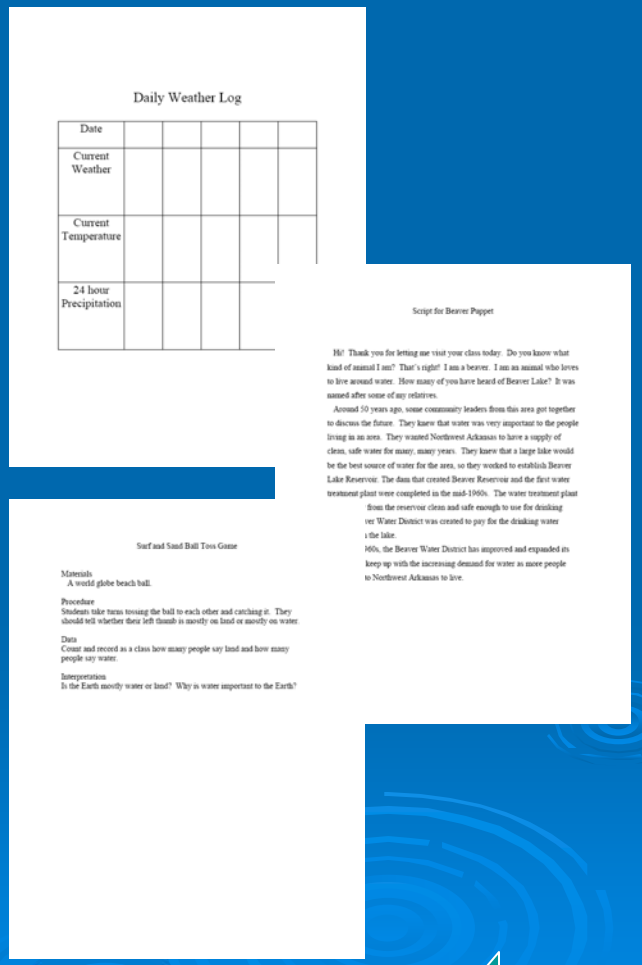
Exploration #2

Properties of Water

Explore

Students will observe and investigate the properties of solids and liquids and how they interact. (PS.5.1.2. Identify characteristics of solids and liquids.)

Do activities to investigate solids and liquids such as "Liquid Classification Game," "Pouring Over Matter" and "Melt an Ice Cube."



Daily Weather Log

Date					
Current Weather					
Current Temperature					
24 hour Precipitation					

Script for Beaver Puppet

Hi! Thank you for letting me visit your class today. Do you know what kind of animal I am? That's right! I am a beaver. I am an animal who loves to live around water. How many of you have heard of Beaver Lake? It was named after some of my relatives.

Around 50 years ago, some community leaders from this area got together to discuss the future. They knew that water was very important to the people living in an area. They wanted Northwest Arkansas to have a supply of clean, safe water for many, many years. They knew that a large lake would be the best source of water for the area, so they worked to establish Beaver Lake Reservoir. The dam that created Beaver Reservoir and the first water treatment plant were completed in the mid-1960s. The water treatment plant

from the reservoir clean and safe enough to use for drinking

ver Water District was created to pay for the drinking water

the lake.

960s, the Beaver Water District has improved and expanded its keep up with the increasing demand for water as more people to Northwest Arkansas to live.

Surf and Sand Ball Toss Game

Materials
A world globe beach ball.

Procedure
Students take turns tossing the ball to each other and catching it. They should tell whether their left thumb is mostly on land or mostly on water.

Data
Count and record as a class how many people say land and how many people say water.

Interpretation
Is the Earth mostly water or land? Why is water important to the Earth?