Background:
Nature has given the earth enough water to sustain the people, agriculture and animal lives on this planet if it is used wisely, distributed equally, and overseen with care. Currently this is not the case and over 1 billion people are without access to clean drinking water. Some 2.6 billion people, 42% of the world's population, are without hygienic toilets. The lack of access of these basic services is the number one killer of children under age five and the leading cause of illness in the world.

Objectives:
Students will:
- Understand the cycle of water
- Identify the usages of water in their own country
- Understand the issues of water in developing countries
- Understand how diseases are spread through water, lack of sanitation, and poor hygiene practices
- Examine the many effects water access has on women and girls
- Understand the relatedness of life in their country with life in a developing country
- Discuss ideas to promote global water equity

Materials:
- Visual of the water lifecycle
- Water Usage Survey – handout
- Water Quotes and Facts Sheet
- 5 Gallon (or many 1 gallon) container(s)
- Ethiopia DVD
- Article describing life of a typical woman
- Discussion sheet on Women and Girls
- Youth Advocacy sheet for taking action

Key Issues/Concepts:
- Water scarcity
- Gender Equity
- Leadership responsibilities
- Sustainable Solutions

Subject Areas:
- Social Studies
- Environmental Science
- Math
- Geography
- Language Arts

Vocabulary:
- Inequity
- Sustainability
- Conservation
- Hygiene
- Sanitation

water 1st INTERNATIONAL Teacher Presentation

1. Have overhead of **water life cycle** or draw with help of students the life cycle on the white board in their classroom. Supplement discussion with regional information about water treatment process in their local community (i.e Cedar River and Tolt Watersheds in Seattle area). Visit *www.drinktap.org* and click on the "Find Your Water Utility" link for information about your local drinking water.
2. Once they have gained an understanding of the water life cycle, pass out **water usage survey** for students to get a realistic understanding of the amount of water they use on a daily basis. This can be done as a pre-lesson activity, done on an individual basis during class time, or as a group activity.
3. Now to segue into how water is viewed in a more global manner. Pass out **"water facts and quotes"** (printed and cut strips to be passed out – one to each student in class). Each student will stand and read their fact.
4. Discuss facts read to broaden their understanding about the impact the lack of clean water has on people around the world.
5. Show Ethiopia film to illustrate the life of people without access to clean water. (View on our website, or email us at info@water1st.org to get a free DVD copy)
6. Have follow-up discussion on the film about:
    a. Who did they see carrying the water?
    b. What does the water look like?
    c. Where do animals get water?
    d. What are the results of unclean water?
7. Have a discussion about **water and gender** inequity, the impact of water collection on women and girls.
8. Now make the discussion closer to home. Where would your students go to get water if they did not have access to clean water?
    a. Review the fact that 1.1 billion people are without access to clean drinking water, (1 out of 6 people), and 2.6 billion (1 out of 3 people) are without access to sanitation.
    b. Use a 5 gallon container or several 1 gallon containers to illustrate the difficulty entailed in carrying water for many miles.

    Where would students go to the bathroom if they had no toilet?

    a. What does this do to the water supply?
    b. How does this affect the health of their community?
    c. What is given up in their lives by time spent getting water?
9. Have students do follow-on activity.
    a. **Writing assignment** – grades 5-12
    b. **Art activity** – grades k-12
    c. **Science activity** – grades 4-12
10. Have students come up with a plan on how they can help make a difference on this issue through **Youth Advocacy and Involvement**.

Water Life Cycle

The recycling trend has been around for millions of years when it comes to water. Nature does not create any new water, but simply recycles the water that has been on the earth for billions of years. As water moves through the earth and its atmosphere, it goes through three phases: solid, liquid, gas.

The water cycle is just that – a cycle, no beginning or ending. Let's pick one area to start with – the ocean where 97% of the water exists as sea-water.

The sun heats up the ocean and water is evaporated as vapor into the air.

Water is also transpired from plants and the soil - these vapors also rise into the air.

Both of these, evaporation and transpiration, condense into clouds.

Air currents move clouds around the globe. These clouds grow and collide and eventually rain or snow occurs causing precipitation to fall back to the earth.

- Some precipitation falls as snow and can accumulate as ice caps and glaciers and can be frozen for thousands of years.
- Most precipitation falls back into the oceans or onto land.

Snowpacks eventually melt and flow into streams moving toward the ocean.

Not all runoff flows into rivers, much of it soaks into the ground and replenishes aquifers. The aquifers store huge amounts of water for long periods of time.

At any given time 0.005 percent of the worlds total water supply is moving through this water life cycle.

A drop of water will usually spend 9 days in the cycle, then can spend up to 40,000 year in the ocean before going through the cycle again.

You can download a flash video of the water cycle from the EPA at:
http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

Why does all this matter?

Water is more precious than gold!

If 97% of our water is seawater (undrinkable),
And 2% of our water is locked in ice caps and glaciers (unreachable),
And 1% lies too far underground to retrieve (irretrievable),
Then less than one percent (0.37% to be exact) of that water is drinkable.

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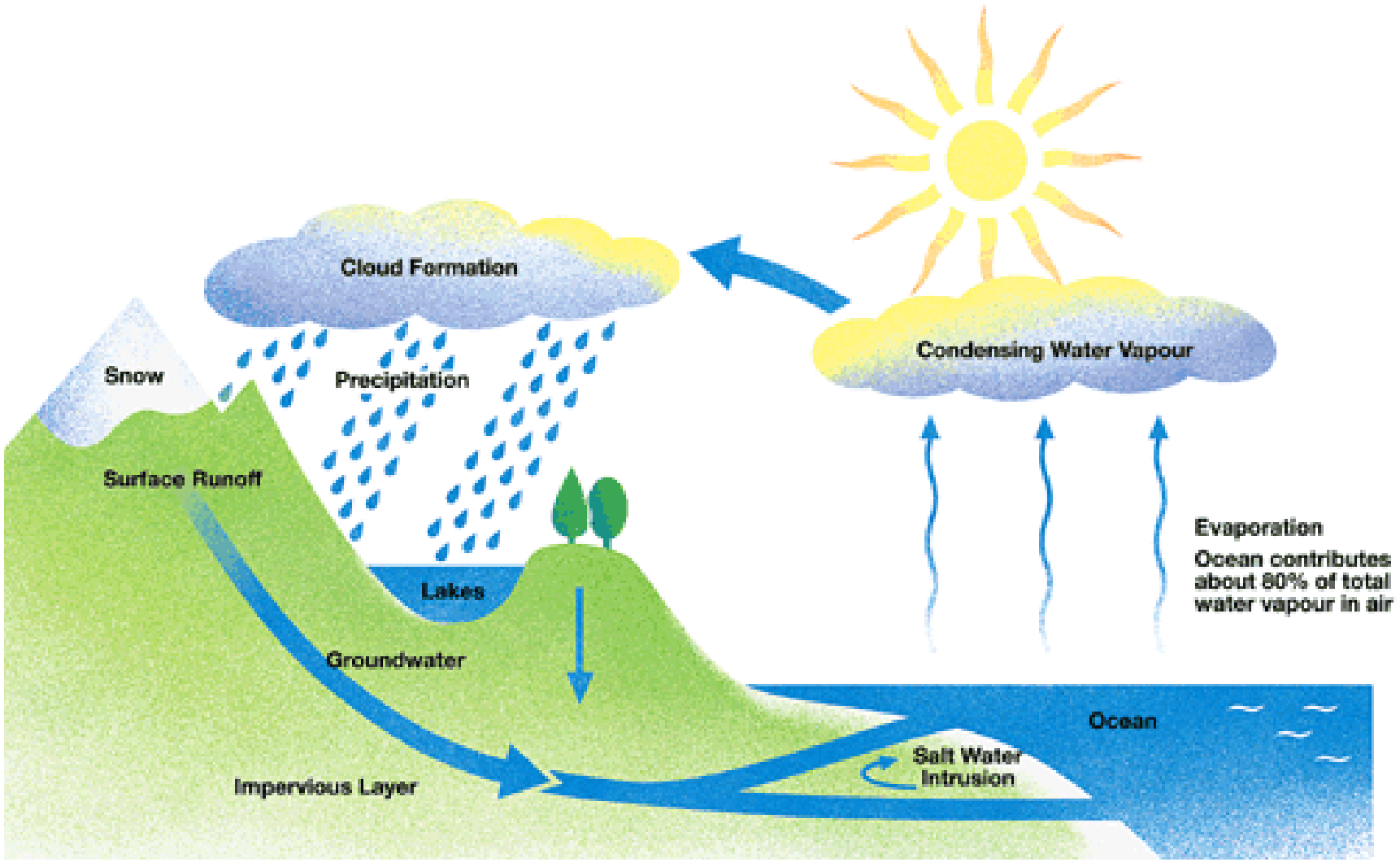
Water Life Cycle



WATER 1ST INTERNATIONAL / 1904 3rd Avenue Suite 1012 / Seattle, WA 98101 / 206.297.3024 / water1st.org

water 1st INTERNATIONAL Student Water Usage Survey

Estimate your water use for entire day!

Activity	Number of times a day	Average amount used	Your Total
Washed hands		0.1 gallons	
Showered		30 gallons (low flow 15 gallons)	
Bathed		20 gallons	
Brushed Teeth		.2 gallons	
Flushed Toilet		2 gallons, low-flow toilet 5 gallons, older toilets	
Drank a large water bottle full of water (20 ounces)		0.15 gallons	
Boiled water for cooking (i.e.: pasta, hot dogs, corn on the cob, hardboiled eggs)		0.25 gallons	
Washed dishes by hand		20 gallons	
Ran the dishwasher		10 gallons (divide by the number of people in your family to estimate your water use)	
Washed a load of laundry		40 gallons total (so estimate how much of that was for your laundry)	
Washed a car		15 gallons (divide by the number of people in your family to estimate your water use)	
Watered the lawn		5 gallons per minute (divide by the number of people in your family to estimate your water use)	
Other uses you can think of?			
		Add it all together:	I use _____ gallons of water in one day

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World Water Use Fact Sheet

	Home Water Use (gallons/day/person)	Industrial Use (gallons/day/person)	Agricultural Use (gallons/day/person)	Total (gallons/day/person)
Middle East and North Africa				
Afghanistan	10	0	568	578
Egypt	45	35	503	583
Iraq	106	228	1199	1533
Israel	70	12	113	194
Kuwait	95	4	117	217
Morocco	28	8	245	282
Saudi Arabia	59	20	574	653
Sub-Saharan Africa				
Congo, Democratic Republic (formerly Zaire)	2	1	1	4
Ethiopia	3	0	44	47
Kenya	8	2	38	48
Rwanda	3	1	7	11
South Africa	56	11	113	179
Uganda	3	1	3	6
Europe				
Denmark	28	23	37	88
Germany	41	227	66	335
Russian Federation	74	251	70	395
Spain	80	110	404	594
United Kingdom	30	104	4	137
North & Central America				
Canada	188	661	113	963
Cuba	101	65	364	530
Guatemala	7	14	81	101
Honduras	7	10	65	82
United States	140	506	453	1099
South America				
Argentina	88	49	385	522
Brazil	60	38	117	215
Bolivia	14	7	84	105
Colombia	84	6	77	167
Paraguay	11	4	39	54
Venezuela	13	15	99	126
Asia (excluding Middle East)				
Armenia	198	29	435	662
Bangladesh	18	4	161	183
China	38	72	192	302
India	33	10	410	454
Korea Democratic People's Republic	54	68	150	272
Malaysia	39	49	145	234
Philippines	45	58	507	610
Viet Nam	45	140	395	580

Source: Pacific Institute (2011). *The World's Water*. Island Press.

1.1 billion (or one in every six) people do not have access to safe drinking water. 2.6 billion people (about 1/3 of the world's population) do not have access to a toilet.

The lack of access to safe drinking water and sanitary latrines is the top public health problem in the world. Water related diseases, such as diarrhea, are the number-one cause of child death in the world. *World Health Organization*

Approximately 4,000 children worldwide die every day of diarrhea. Diarrhea, largely caused by water-related diseases, then leads to dehydration, which can eventually lead to death.

Hand-washing with soap could prevent up to 1.4 million deaths per year in developing countries.

Much of the world gets by on 2.5 gallons of water per day. The average American uses 400 gallons per day, 30% of which is for outdoor uses (and half of this just for watering lawns- totaling 7 billion gallons per day). *(EPA)*

In Ethiopia women carry 5-gallon containers of water, weighing approximately 40 pounds, several hours a day.

Only 4% of the rural population of Ethiopia has a toilet.

If no action is taken to address unmet human needs for water, as many as 135 million people will die from water-related diseases by 2020. *Peter Gleick, Author, co-founder and President of the Pacific Institute for Studies in Development, Environment, and Security.*

The World Health Organization estimates that 80% of the world's illnesses are water-related.

Women make up a higher percentage of the world's poor and powerless, with much less access to opportunities than men, making it even more difficult for them to escape from poverty. Ending poverty has to be about gender equality, and in no aspect of life is this truer than for water, as women bear the burden of meeting the family's basic needs.

Lack of access to clean water has a devastating effect on women and girls who are traditionally responsible for water collection. Collecting water is a difficult and time-intensive task, leaving women with little or no time to manage their households or participate in income-generating work. Illnesses in children and adults add to women's workloads, as they are often the caregivers for the sick.

Young girls often help their mothers collect water, making them unable to attend schools. The resulting lack of education means that very few women in developing countries are leaders and decision-makers. The countries with the least educated people are the poorest.

By 2020, water will have replaced petroleum as a main cause of strategic tension.
High Noon 20/20

In response to this crisis, international organizations have recommended taking action to address water and sanitation among the top development priorities. The United Nations Millennium Goals (United Nations, 2000) specifically target water and sanitation measures, and the United Nations General Assembly proclaimed the years 2005 to 2015 as the International Decade for Action on 'Water for Life'.

At current government funding levels, under-funding for sanitation means the sanitation goal is 90 years off target and will not be met until 2105. The cost of missing this goal: 133 million lives.

The Global Water Partnership estimated that to meet the Millenium Goals, annual spending on water and sanitation needs to double from $14 billion to $30 billion.

In 2006, Americans spent $15 billion on bottled water.

In a poll carried out by the British Medical Journal in January 2007, sanitation was voted the most important medical milestone since 1840, ranking higher than antibiotics and vaccines.

water 1st INTERNATIONAL Quotes About Water

"When the well is dry, we learn the worth of water"
Benjamin Franklin

"A river is more than an amenity, it is a treasure."
Justice Oliver Wendell Holmes

The wars of the twenty-first century will be fought over water.
Ismail Serageldin, World Bank Vice President for Environmental Affairs

"Water is life's mater and matrix, mother and medium. There is no life without water."
Albert Szent-Gyorgyi, Hungarian biochemist and Nobel Prize Winner for Medicine.

"Thousands have lived without love, not one without water."
W.H. Auden, Poet

“The difference between what we do and what we are capable of doing would suffice to solve most of the world’s problems.”
Mahatma Gandhi

“… success in combating environmental degradation is dependent on the full participation of all actors in society, an aware and educated population, respect for ethical and spiritual values and cultural diversity, and protection of indigenous knowledge.”
Ministers of the Environment, First Global Ministerial Environment Forum,
Malmö, Sweden, May 2000

Water and Gender

Why Water Is Important…

Water is needed for drinking, food preparation, personal and family hygiene, washing, cleaning and caring for the sick.

Why Women and Girls Matter….

Women are most affected by lack of sanitation and safe water.

Almost half of the nearly 2 million deaths from diarrhea each year could be prevented through an understanding of basic hygiene.

Women are the ones who bear the burden of carrying water for up to 5 hours a day; women and girls are the "water haulers" of the world.

Hauling water over long distances can lead to physical damage to the back and neck (8lbs per gallon in weight).

According to the World Health Organization, 40 billion working hours are spent carrying water each year in Africa.

Fetching water takes time, time that is not spent in productive efforts that could raise money for the family.

Globally, more than 1 in 5 girls of primary school age are not in school. Also, girls that have reached menstrual age are less inclined to attend a school without proper sanitation facilities. In one school sanitation project the availability of separate facilities for boys and girls increased school attendance of girls by 11%.

With access to clean water and sanitation, there is significant improvement in gender equality, improvement in women's livelihoods, the education and life chances of girls, and overall improvement in the health of a family.

How Water 1st is Addressing Gender and Why…

Although women have the main responsibility for water provisions, they are often overlooked in the planning and implementation of infrastructure development and water projects. Water 1st takes a different approach and only works with communities that have shown the willingness to allow women to be part of the entire process.

Women's presence is critical to the sustainability of water and sanitation initiatives, particularly in management and technical roles, to ensure they contribute to decision-making processes. Building women into a project assures more sustainable outcomes.

Using the video seen, create your own story:

Describe your walk to the water source:

- What do you see on the way?
- What do you talk about as you walk?
- How long does your walk take?
- Describe the scene at the water hole.
- How do you collect the water?
- How do you feel on your walk back to your village?

Five Minutes of writing exercise (choose one scenario):

- Describe a day in your life before access to clean water
- Describe a day in your life after access to clean water.
- What is your hope for the future?
- What would say to people in the US?
- What would you tell us about where you live?
- What does water mean to you?

After reading “A Heartbreaking Need for Clean Water”, describe how each of the people in the story’s life would be different with access to clean water:

- Dilium, the mother
- Kidame, the seven year old girl
- Medin, the infant son
- The other women of Echele

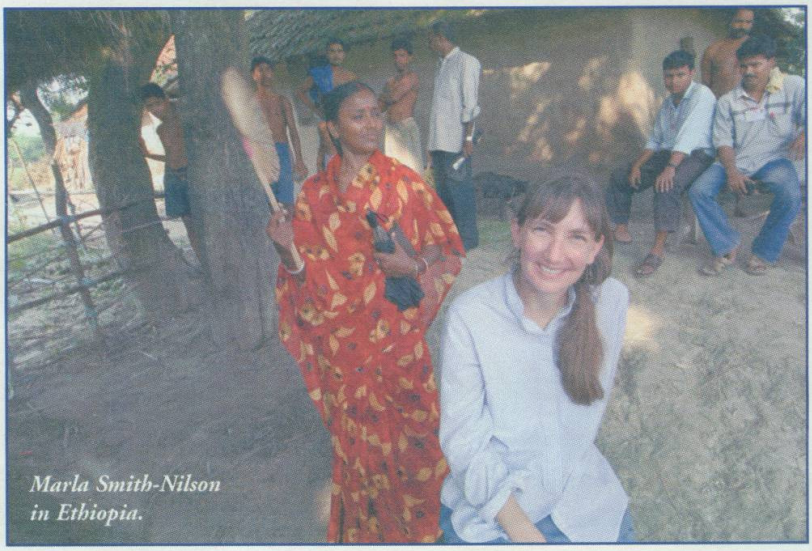
Also see Water 1st Art Activities curriculum for writing activities with art and photography.

A heartbreaking need for clean water

By Marla Smith-Nilson, Executive Director, Water 1st International

THE WORK THAT I do is often described by statistics: More than 1 billion people worldwide do not have access to safe water. Five million people die each year because of water-related disease. But I think the problem is best described by the real people behind the numbers.

One of them is Dilium Araya. Born and raised in Echele, a village in northern Ethiopia, 30-year-old Dilium was already the mother of six children when I met her in 2004.



Marla Smith-Nilson in Ethiopia.

At 5 a.m., Dilium awakens to nurse her infant son, Medin, and make a breakfast of injera bread and chick-pea soup for her family.

Around 6 a.m. Dilium and her 11-year-old daughter, Asmaraha, strap empty 5-gallon plastic containers on their backs and begin the walk to collect water. It's a 14-mile journey that takes them six hours to complete.

Dilium leaves Medin at home under the watch of her 7-year-old daughter, Kidame. While Dilium is gone, Medin misses two feedings. Dilium once told me that some days she doesn't have enough breast milk for Medin, and I thought of the calories she was burning simply collecting water.

When we reach the water source, the sight breaks my heart. It's a hole in the middle of a dry riverbed with women lined up waiting their turn to scoop out, cup by cup, their daily water. Goats and other animals meander nearby. Feces cover the ground. This is not just a water hole for humans, and it is clearly not drinkable water, but there is no other option for this village of 500 people.

After filling her water container, Asmaraha bends over deeply to get the 40-pound vessel up on her back, the ropes visibly pulling her little shoulders tightly together.

For the rest of the day, Dilium prepares food, makes coffee and takes care of the family's chickens and goats. She skips lunch herself so that the rest of the family can have more food. In the evening, if there is time, she will make a second trip to the water hole.

> *"I don't know how such women and men maintain their families and their spirits and still literally say a prayer of thanks every day for what they have been blessed with."*

Dilium has lost one child so far to diarrhea, caused by drinking unsafe water. Every woman I met in Echele had lost at least one child. When I asked Dilium what she does when her children are sick, Dilium said that she carries them to the nearest health clinic, which is 18 miles one way on foot.

I am humbled by women like Dilium. I don't know how such women and men maintain their families and their spirits and still literally say a prayer of thanks every day for what they have been blessed with. I am a mother too. My son Calvin is a 6-year-old kindergartner, and Melina is 4. One of Calvin's favorite ways of protesting my requests is to deem them "not fair." Calvin has learned from experience that this doesn't go over well with me, especially when I have just returned from Ethiopia or somewhere else. I say, "What was that, Calvin?" and he rolls his eyes and says, "I know, Mom. I know. At least I have water."

Truthfully, this is something that I really struggle with. Every day, my job is about trying to help people who have really been dealt an unfair hand in life — they don't even have water or a simple toilet. I struggle with my own decisions about the kind of life I lead as I try to comprehend "What is my fair share?"

I'll probably never know the answer to that question, but I do feel that as a person who by the sheer luck of my birth has access to wealth and opportunity, I must show compassion. Real compassion. Not just emotion or good feelings, but compassion that commits. Compassion that acts.

I believe that the work of Water 1st represents that kind of real compassion. Through the safe water and sanitation projects we support around the world, I see communities transformed from places where children routinely die of preventable diseases to places where children live healthy lives. From places where women and girls spend their days carrying water to places where girls have time to go to school. There are also benefits we can't measure but we know are greatly valued by the people we serve, such as privacy and dignity and a life free from the drudgery of carrying water.

Every single individual on earth has both the potential and the right to live a decent life. It's my belief that the water projects we support are the first large step on that path. ▣

Water 1st International is a ParentMap *Giving Together partner. For more information, visit* www.water1st.org.

Water Challenge (4th-6th)

As part of a water education day, challenge your students to try to make it through the day using only one gallon of water. Have each student bring to school a recycled plastic jug (one gallon jug or two half gallon jugs) as well as a cup or water bottle. Students must use this water for drinking, washing hands and any other water uses at school (except for flushing the toilet). Give a demonstration of how you might wash your hands with this water or anything else. Then have a discussion about whether or not this was difficult. What if you had to use that one gallon to also brush your teeth, clean your clothes, clean yourself by shower or bath? What if you had to walk and carry enough water for your whole family each day?

Measuring rainfall (5th-6th)

Measure rainfall in your area and compare it to other places around the world

Materials:

- Rain vial to measure rainfall

Set up a rain vile outside your classroom to measure rainfall. Over a time period of one month, measure the amount of rainfall once a week (alter time depending on the amount of time your class has). Then compare the rainfall at your school with other national or international cities. Then have students calculate whether rainfall could be enough to support water needs.

Student rain log

Rainfall	Week 1	Week 2	Week 3	Week 4
Amount (inches)				

Link to Global rainfall patterns
http://www.teachersdomain.org/resource/ess05.sci.ess.watcyc.rainfall/

Taking it further

Continue your exploration of rain by setting up a classroom rain barrel and using the rain water to water your school garden.

Materials:

- Rain barrel- Call your local public utilities company and ask where to buy a rain barrel or get one donated.

As a classroom, set up a rain barrel to collect water over time somewhere about a 10 minute walk away. Then after significant rainfall, as a classroom, choose a day to water your entire garden with water from your rain barrel. Create that day into an experience of what it might be like to walk and get your own water. Have each student bring their own water container (milk jug, water bottle, Tupperware). Then together as a class, walk to the water source as many times as needed for the day in order to have enough water to water their student garden. Then have a follow up discussion in which the students respond to the difficulty of the challenge and whether they felt protective of this precious resource. Continue to discuss what would happen if you lived in a region where water was scarce and you had to use that water to support your family for drinking as well as by growing your own food?

Water Uses (4th +)
Using your Water1st Water Survey, compare your water use with the Global Water Use Fact Sheet.

How much drinkable water is left for the whole world to share?
Materials:

- Two colors of paper
- White paper
- World map
- 1000 ml beaker
- 100 ml graduated cylinder
- small dish
- salt
- eye dropper
- bucket of ice

What percentage of the earth is covered with water? What percentage of that water is drinkable?
Have students work in pairs to make their estimation. Have each pair draw a circle on a white sheet of paper, representing the world. Then identify one color as drinkable (potable) water and one as non-potable. Have them tear the two colors of paper into a total of 100 pieces to fill the globe, with the amount of each color representing the amount of water of that water they think is present in the world. Have them record their estimations.

Activity: Demonstration
1. Show the class a liter (1000 ml) of water and tell them it represents all the water on the earth
2. Ask where most of the water on earth is located (refer to a world map). Pour 30 ml of the water into a 100 ml graduated cylinder. This represents the earth's fresh water, about 3% of the total. Put salt in the remaining 970ml to represent ocean water, not drinkable by humans.
3. Ask students what is at the Earth's poles. Almost 80 percent of the earth's fresh water is frozen in ice caps and glaciers. Pour 6ml of fresh water into a small dish or cylinder and place the rest in an ice bucket. The 6ml represents the non-frozen fresh water (about .6% of the total). Only about 1.5 ml of this water is surface water, the rest is underground.
4. Use an eyedropper or to remove a single drop of of water (0.003 ml). Release this one into a small metal bucket, making sure that the students hear the drop. This represents clean, fresh water that is not polluted or otherwise unavailable for use, about 0.003 % of the total water in the world.
5. Continue with a discussion of why we must care for our water and how we can care for it.

Quantity to be divided among people on Earth	**Amount available Liters/person**	**% of total water**
All the water on Earth	233.3 billion	100%
Only the fresh water (calculate 3% of the amount available)		3%
Only the non-frozen water (calculate 20% of the remaining amount available)		0.6%
Available fresh water that is not polluted, trapped in soil, too far below ground, etc. (calculate 0.5% of the remaining amount available)		.003%

Source: The Watercourse and Council for Environmental Education 1995, Project Wet, Curriculum and Activity Guide

Transmission of a Water-Borne Disease (Grade Level: 6th-12th)

Objectives
Students will be able to:
Understand essential concepts about maintaining and promoting personal health
Know essential concepts about the prevention and control of disease
Define infectious disease
Describe symptoms, mode of transmission, and causes of the disease cholera
Explain the destruction cholera had on the people living in and traveling through the West in the 1800's
Compare the cholera outbreaks of the 1800's to the 1990's
Examine the symptoms of, modes of transmission, and causes of several (selected) infectious diseases

Materials
- Background on Infectious Disease
- Highlights in the History of Microbiology
- Cholera Fact Sheet
- John Snow and the Broad Street Pump – a story of the London cholera epidemic of the mid-1800s
- The West Episode 3: My Share of the Rocks – a story of the U.S. cholera outbreak during the gold rush in the mid 1850s
- Water-related Diseases Homework Assignment

Activities
1. After reviewing the background reading on infectious disease, write the following journal prompt on the board or overhead; "Using a paragraph format, how would you describe the term infectious disease?"
2. Pair students: have them discuss their responses and come up with a definition of
3. infectious disease to share with the class.
4. Write each definition of infectious disease on the board or overhead.
5. Answer: An infectious disease is a clinically evident disease that damages or injures the host that results from the presence of one or more pathogenic microbial agents, including viruses, bacteria, fungi, protozoa, multi-cellular parasites, and aberrant proteins known as prions. These pathogens can cause diseases in both animals and plants. Transmission of an infectious disease may occur through several pathways; including through contact with infected individuals, by water, food, airborne inhalation, or through vector-borne spread. *From McGraw-Hill Encyclopedia of Science and Technology. The McGraw-Hill Companies, Inc., 2005*

6. Read "John Snow and the Broad Street Pump" or "The West"
7. Hold a class discussion on cholera. Ask students the following information about cholera (that they might have picked up from reading the John Snow or The West pieces). Write their responses on the board:

- Is cholera an infectious disease? How do you know?
- What are some symptoms of cholera?
- Is cholera a potentially fatal disease? Always?
- What conditions from the life during that time might lead to getting this disease?

8. Hand out the Cholera resource sheet and repeat the questions, this time using the information sheet with the questions: add any new information on the board next to their previous answers. They should have a bit more data using the information from the resource sheet.

9. Students will research a water-related disease and report their findings back to the class. A list of water-related diseases is attached.

Younger students:
What are some infectious diseases they/people they know have had? What were some of the symptoms that they had with that illness? How did they treat it? What can be done to limit the outbreak of a particular infectious disease?

Students could create a disease prevention poster. This poster should include a "tip" on how to avoid getting or spreading an infectious disease. For example, a person washing their hands with soap & warm water or someone covering their mouth as they sneeze. They could post their work in the school as reminders to other students and staff or create a class book.

Older Students:
Using the web, investigate epidemics from the past and present. Compare the past epidemics to current ones. Do any similarities exist? Are there any obvious differences. Create a class timeline of epidemics throughout history. Do any patterns emerge? How can collecting and organizing data like this help people?

Background on Infectious Disease

Bacteria existed long before humans evolved, and bacterial diseases probably co-evolved with each species. Many bacterial diseases that we see today have been around for as long as we have, others may have developed later. In either case, for the longest time we were not aware of the cause of infectious diseases. With the beginning of microbiology, bacterial pathogens became apparent.

Ancient man recognized many of the factors involved in disease. Early civilizations on Crete, India, Pakistan and Scotland invented toilets and sewers. Restrooms, dating around 2800 BC, have been found on the Orkney islands and in homes in Pakistan about the same time. One archaeologist has stated, "The high quality of the sanitary arrangements [in about 2500 BC] could well be envied in many parts of the world today". In Rome, 315 AD, the public lavatories were places where people routinely socialized and conducted business. Ten to twenty people could be seated around a room, with their wastes being washed away by flowing water. The Chinese used toilet paper as early as AD 589. In Europe moss, hay and straw were used for the same purpose.

The first cities to use water pipes (of clay) were in the Indus Valley of Pakistan around 2700 BC. Metal water pipes were used in Egypt (2450 BC) and the palace of Knossos on Crete around 2000 BC had clay pipes. Rome built elaborate aqueducts and public fountains throughout its empire to insure a clean supply of water for its citizens. Rome had a "water commissioner" who was responsible for seeing that the water supply was kept adequate and clean; the punishment for pollution of the water supply was death. Lead was commonly used for Roman pipes and the subsequent fall of the Roman empire has been related by some to the effects of lead on the Roman brain.

Most ancient peoples recognized that some diseases were communicable and isolated individuals thought to carry "infections." An example of this is the universal shunning of lepers, which occurs even today. When the Black Death struck Europe, entire villages were abandoned as people fled in an effort to escape the highly infectious plague. Similarly, in the Middle Ages the rich of Europe fled to their country homes when small pox struck in an effort to escape its terrible consequences. The fact that people who recovered from a particular disease were immune to that disease was probably recognized many different times in many places. Often these survivors were expected to nurse the ill. Greek and Roman physicians routinely prescribed diet and exercise as a treatment for ills.

Ancient people had certainly seen masses of microbes, such as mold and bacterial colonies, on spoiled food, but it is doubtful if anyone considered that they were viewing living organisms.

The first person to report seeing microbes under the microscope was an Englishman, Robert Hooke. Working with a crude compound mi-

croscope he saw the cellular structure of plants around 1665. He also saw fungi which he drew. However, because his lens were of poor quality he was apparently unable to "see" bacteria.

Anton van Leeuwenhoek was a man born before his time. Although not the first to discover the microscope or to use magnifying lens, he was the first to see and describe bacteria. We know that he was a "cloth merchant" living in Delft Holland and that he used magnifying lens to view the quality of the weave of the merchandise he purchased. He traveled to England in 1668 to view English cloth and there he saw drawings of magnifications of cloth much greater than any of the current lens available in Holland would do.

He returned to Holland and took up lens grinding. Being meticulous, he developed his lens grinding to an art and in the process tested them by seeing how much detail he could observe with a given lens. One can guess that he chanced to look at a sample of pond water or other source rich in microbes and was amazed to see distinct, uniquely shaped organisms going, apparently purposefully, about their lives in a tiny microcosm. He made numerous microscopes from silver and gold and viewed everything he could including the scum on his teeth and his semen.

His best lens could magnify ~300-500 fold which allowed him to see microscopic algae and protozoa and larger bacteria. He clearly had excellent eyesight because he accurately drew pictures of microbes that were at the limit of the magnification of his lens. He used only single lens and not the compound lens of the true microscopes we employ today; which makes his observations all the more amazing. He wrote of his observations to the Royal Society of London in 1676 and included numerous drawings. He astonished everyone by claiming that many of the tiny things he saw with his lens were alive because he saw them swimming purposefully about. His discovery was the equivalent of our finding life on Mars today.

SOURCE: Washington State University, Microbiology 101/102 Internet Text.
http://www.slic2.wsu.edu:82/hurlbert/micro101/pages/Chap1.html Date site accessed: 9/19/07

water 1st INTERNATIONAL Cholera Fact Sheet

Cholera outbreaks can occur sporadically in any part of the world where water supplies, sanitation, food safety and hygiene practices are inadequate. Overcrowded communities with poor sanitation and unsafe drinking-water supplies are most frequently affected.

The disease and how it affects people
Cholera is an acute infection of the intestine, which begins suddenly with painless watery diarrhoea, nausea and vomiting. Most people who become infected have very mild diarrhoea or symptom-free infection. Malnourished people in particular experience more severe symptoms. Severe cholera cases present with profuse diarrhoea and vomiting. Severe, untreated cholera can lead to rapid dehydration and death. If untreated, 50% of people with severe cholera will die, but prompt and adequate treatment reduces this to less than 1% of cases.

The cause
Cholera is caused by the bacterium Vibrio cholerae. People become infected after eating food or drinking water that has been contaminated by the faeces of infected persons. Raw or undercooked seafood may be a source of infection in areas where cholera is prevalent and sanitation is poor. Vegetables and fruit that have been washed with water contaminated by sewage may also transmit the infection if V. cholerae is present.

Distribution
Cholera cases and deaths were officially reported to WHO, in the year 2000, from 27 countries in Africa, 9 countries in Latin America, 13 countries in Asia, 2 countries in Europe, and 4 countries in Oceania.

Scope of the Problem
Control of cholera is a major problem in several Asian countries as well as in Africa. In the year 2000, some 140,000 cases resulting in approximately 5000 deaths were officially notified to WHO. Africa accounted for 87% of these cases. After almost a century of no reported cases of the disease, cholera reached Latin America in 1991; however, the number of cases reported has been steadily declining since 1995.

Interventions
To prevent the spread of cholera, the following four interventions are essential:

- Provision of adequate safe drinking-water
- Proper personal hygiene
- Proper food hygiene
- Hygienic disposal of human excreta.

Treatment of cholera consists mainly in replacement of lost fluids and salts. The use of oral rehydration salts (ORS) is the quickest and most efficient way of doing this. Most people recover in 3 to 6 days. If the infected person becomes severely dehydrated, intravenous fluids can be given. Antibiotics are not necessary to successfully treat a cholera patient.

SOURCE: World Health Organization Cholera Fact Sheet
http://www.who.int/water_sanitation_health/diseases/cholera/en/ Date site accessed: 9/19/07

A History of Cholera Epidemics

Cholera was originally endemic to the Indian subcontinent, with the Ganges River likely serving as a contamination reservoir. It spread by trade routes (land and sea) to Russia, then to Western Europe, and from Europe to North America. Today in the United States and other wealthy countries, because of advanced water and sanitation systems, cholera is not a major threat.

- 1816-1826 - First Cholera pandemic: Previously restricted, the pandemic began in Bengal, then spread across India by 1820. It extended as far as China and the Caspian Sea before receding.
- 1829-1851 - Second Cholera pandemic reached Europe, London and Paris in 1832. In London, it claimed 6,536 victims[1]; in Paris, 20,000 succumbed (out of a population of 650,000) with about 100,000 deaths in all of France.[2] It reached Russia (Cholera Riots), Quebec, Ontario and New York in the same year and the Pacific coast of North America by 1834.
- 1849 - Second major outbreak in Paris. In London, it was the worst outbreak in the city's history, claiming 14,137 lives, ten times as many as the 1832 outbreak. In 1849 cholera claimed 5,308 lives in the port city of Liverpool, England, and 1,834 in Hull, England.[3] An outbreak in North America took the life of former U.S. President James K. Polk. Cholera spread throughout the Mississippi river system killing over 4,500 in St. Louis[4] and over 3,000 in New Orleans[5] as well as thousands in New York.[6] In 1849 cholera was spread along the California and Oregon trail as hundreds died on their way to the California Gold Rush, Utah and Oregon.[7]
- 1852-1860 - Third Cholera pandemic mainly affected Russia, with over a million deaths. In 1853-4, London's epidemic claimed 10,738 lives.
- 1854 - Outbreak of cholera in Chicago took the lives of 5.5 per cent of the population (about 3,500 people).[8] Soho outbreak in London stopped by removing the handle of the Broad Street pump by a committee instigated to action by John Snow.[9]
- 1863-1875 - Fourth Cholera pandemic spread mostly in Europe and Africa.
- 1866 - Outbreak in North America. In London, a localized epidemic in the East End claimed 5,596 lives just as London was completing its major sewage and water treatment systems--the East End was not quite complete. William Farr, using the work of John Snow et al. as to contaminated drinking water being the likely source of the disease, was able to relatively quickly identify the East London Water Company as the source of the contaminated water. Quick action prevented further deaths.[10]

- 1881-1896 - Fifth Cholera pandemic; The 1892 outbreak in Hamburg, Germany was the only major European outbreak; about 8,600 people died in Hamburg, causing a major political upheaval in Germany, as control over the City was removed from a City Council which had not updated Hamburg's water supplies. This was the last serious European cholera outbreak.
- 1899-1923 - Sixth Cholera pandemic had little effect in Europe because of advances in public health, but Russia was badly affected again.
- 1961-1970s - Seventh Cholera pandemic began in Indonesia, called El Tor after the strain, and reached Bangladesh in 1963, India in 1964, and the USSR in 1966. From North Africa it spread into Italy by 1973. In the late 1970s there were small outbreaks in Japan and in the South Pacific. There were also many reports of a cholera outbreak near Baku in 1972, but information about it was suppressed in the USSR.
- January 1991 to September 1994 - Outbreak in South America, apparently initiated when a ship discharged ballast water. Beginning in Peru there were 1.04 million identified cases and almost 10,000 deaths. The causative agent was an O1, El Tor strain, with small differences from the seventh pandemic strain. In 1992 a new strain appeared in Asia, a non-O1, nonagglutinable vibrio (NAG) named O139 Bengal. It was first identified in Tamil Nadu, India and for a while displaced El Tor in southern Asia before decreasing in prevalence from 1995 to around 10% of all cases. It is considered to be an intermediate between El Tor and the classic strain and occurs in a new serogroup. There is evidence of the emergence of wide-spectrum resistance to drugs such as trimethoprim, sulfamethoxazole and streptomycin.
- 2007 - The U.N. reported a Cholera outbreak in Iraq.[11]
- 2010-2012 - The WHO reported Cholera outbreaks in Haiti, the Democratic Republic of Congo, and Sierra Leone [12]

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[1] Wikipedia. http://en.wikipedia.org/wiki/Cholera_outbreaks_and_pandemics#Second Date site accessed: 10/10/12

[2] *Rabbani GH (1996). "Mechanism and treatment of diarrhoea due to Vibrio cholerae and Escherichia coli: roles of drugs* and prostaglandins". Danish medical bulletin 43 (2): 173-85.

[3] IBMS Institute of Biological Science

[4] *Bhattacharya SK, National Institute of Cholera and Enteric Diseases (2003). "An evaluation of current cholera treatment".* Expert Opin Pharmacother 4 (2): 141-6.

[5] *Parsi VK (2001). "Cholera". Prim. Care Update Ob Gyns 8 (3): 106-109.*

[6] The Cholera Years: The United States in 1832, 1849, and 1866 by Charles E. Rosenberg

[7] Trails of Hope: California, Oregon and Mormon Trails

[8] Saha D, et al. (2006). "Single dose azithromycin for the treatment of cholera in adults". New Engl J Med 354 (23): 2452–62.

[9] On the Mode of Communication of Cholera (1855) by John Snow, M.D. (1813-1858) [http://eee.uci.edu/clients/bjbecker/PlaguesandPeople/week8a.html

[10] "The Ghost Map" by Steven Johnson, pg. 209

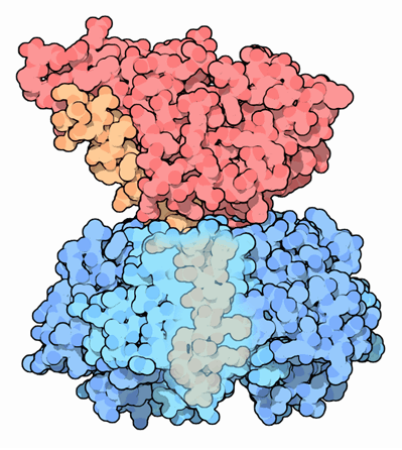
[11] "U.N. reports cholera outbreak in northern Iraq" (http://www.cnn.com/2007/WORLD/meast/08/29/iraq.cholera/index.html), CNN. Date site accessed: 8/30/07

[12] Cholera http://www.who.int/csr/don/archive/disease/cholera/en/ Date site accessed: 10/10/12

Water-related Diseases Homework

Select an infectious disease from the list and research the nature of the disease and your understanding of pathogens using web-based and book resources.

Remember to record your bibliographic details as you go.



Cholera. Illustration by David S. Goodsell of The Scripps Research Institute

Using one of the following formats present your written report as a:

- Essay - as a survivor, a doctor, a sufferer, a relative of a sufferer, or a pathogen
- Pamphlet
- Cartoon
- Poster
- PowerPoint

Areas to be researched are :

1. Type of pathogen
- What organism causes the disease?
- What does the organism look like?
- How big is it? Is it microscopic?

2. Transmission
- How do you catch the disease?
- Is it passed by air, touch, or other means?

3. Is it easy to catch?
- Does it spread quickly or slowly?
- What conditions cause it to spread

4. Course of the disease
- What are the symptoms of the disease?
- Does it go through definite stages? If so, what are they?
- How long does it last?
- Does it have any long lasting effects?
- How serious is the disease?

5. Treatment
- Are there any drugs used?
- Is there a quarantine period? If so, what is its duration?
- Is it necessary to isolate the patient?
- Is the disease easy / difficult to treat?

6. Control
- Is it possible to vaccinate against the disease?
- What is the vaccine?
- What practices can prevent the disease from spreading?

7. Special features

- Are there any unusual features of this disease?
- What is the history of the disease?
- Are there any recorded epidemics?
- Are there any advances in the treatment of the disease?

List of water and sanitation related diseases to research:

Anaemia
Ascariasis
Campylobacteriosis
Cholera
Cyanobacterial Toxins
Dengue and Dengue Haemorrhagic Fever
Diarrhoea
Guinea-Worm Disease (Dracunculiasis)
Hepatitis
Japanese Encephalitis
Leptospirosis
Malaria
Onchocerciasis (River Blindness)
Ringworm (Tinea)
Scabies
Schistosomiasis
Trachoma
Typhoid and Paratyphoid Enteric Fevers

JOHN SNOW AND THE BROAD STREET PUMP
ON THE TRAIL OF AN EPIDEMIC

By Kathleen Tuthill, Illustrated by Rupert Van Wyk

British doctor John Snow couldn't convince other doctors and scientists that cholera, a deadly disease, was spread when people drank contaminated water until a mother washed her baby's diaper in a town well in 1854 and touched off an epidemic that killed 616 people.

Dr. Snow, an obstetrician with an interest in many aspects of medical science, had long believed that water contaminated by sewage was the cause of cholera. Cholera is an intestinal disease than can cause death within hours after the first symptoms of vomiting or diarrhea. Snow published an article in 1849 outlining his theory, but doctors and scientists thought he was on the wrong track and stuck with the popular belief of the time that cholera was caused by breathing vapors or a "miasma in the atmosphere".

The first cases of cholera in England were reported in1831, about the time Dr. Snow as finishing up his medical studies at the age of eighteen. Between 1831 and 1854, tens of thousands of people in England died of cholera. Although Dr. Snow was deeply involved in experiments using a new technique, known as anesthesia, to deliver babies, he was also fascinated with researching his theory on how cholera spread.

In the middle 1800s, people didn't have running water or modern toilets in their homes. They used town wells and communal pumps to get the water they used for drinking, cooking and washing. Septic systems were primitive and most homes and businesses dumped untreated sewage and animal waste directly into the Thames River or into open pits called "cesspools". Water companies often bottled water from the Thames and delivered it to pubs, breweries and other businesses.

Dr. Snow believed sewage dumped into the river or into cesspools near town wells could contaminate the water supply, leading to a rapid spread of disease.

In August of 1854 Soho, a suburb of London, was hit hard by a terrible outbreak of cholera. Dr. Snows himself lived near Soho, and immediately went to work to prove his theory that contaminated water was the cause of the outbreak.

"Within 250 yards of the spot where Cambridge Street joins Broad Street there were upwards of 500 fatal attacks of cholera in 10 days," Dr. Snow wrote "As soon as I became acquainted with the situation and extent of this irruption (sic) of cholera, I suspected some contamination of the water of the much-frequented street-pump in Broad Street."

Dr. Snow worked around the clock to track down information from hospital and public records on when the outbreak began and whether the victims drank water from the Broad Street pump. Snow suspected that those who lived or worked near the pump were the most likely to use the pump and thus, contract cholera. His pioneering medical research paid off. By using a geographical grid to chart deaths from the outbreak and investigating each case to determine access to the pump water, Snow developed what he considered positive proof the pump was the source of the epidemic.

Besides those who lived near the pump, Snow tracked hundreds of cases of cholera to nearby schools, restaurants, businesses and pubs.

According to Snow's records, the keeper of one coffee shop in the neighborhood who served glasses of water from the Broad Street pump along with meals said she knew of nine of her customers who had contracted cholera.

A popular bubbly drink of the time was called "sherbet", which was a spoonful of powder that fizzed when mixed with water. In the Broad Street area of Soho, that water usually came from the Broad Street pump and was, Snow believed, the source for many cases.

Snow also investigated groups of people who did not get cholera and tracked down whether they drank pump water. That information was important because it helped Snow rule out other possible sources of the epidemic besides pump water.

He found several important examples. A workhouse, or prison, near Soho had 535 inmates but almost no cases of cholera. Snow discovered the workhouse had its own well and bought water from the Grand Junction Water Works.

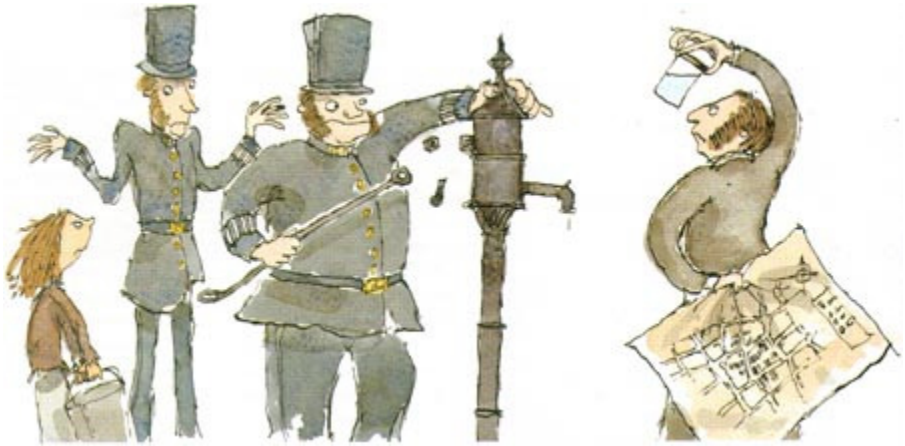
The men who worked in a brewery on Broad Street which made malt liquor also escaped getting cholera. The proprietor of the brewery, Mr. Huggins, told Snow that the men drank the liquor they made or water from the brewery's own well and not water from the Broad Street pump. None of the men

contracted cholera. A factory near the pump, at 37 Broad Street, wasn't so lucky. The factory kept two tubs of water from the pump on hand for employees to drink and 16 of the workers died from cholera.

The cases of two women, a niece and her aunt, who died of cholera puzzled Snow. The aunt lived some distance from Soho, as did her niece, and Snow could make no connection to the pump. The mystery was cleared up when he talked to the woman's son. He told Snow that his mother had lived in the Broad Street area at one time and liked the taste of the water from the pump so much that she had bottles of it brought to her regularly. Water drawn from the pump on 31 August, the day of the outbreak, was delivered to her. As was her custom, she and her visiting niece took a glass of the pump water for refreshment, and according to Snow's records, both died of cholera the following day.

Snow was able to prove that the cholera was not a problem in Soho except among people who were in the habit of drinking water from the Broad Street pump. He also studied samples of water from the pump and found white flecks floating in it, which he believed were the source of contamination.

On 7 September 1854, Snow took his research to the town officials and convinced them to

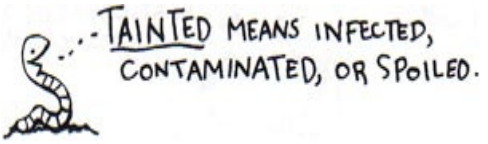


take the handle off the pump, making it impossible to draw water. The officials were reluctant to believe him, but took the handle off as a trial only to find the outbreak of cholera almost immediately trickled to a stop. Little by little, people who had left their homes and businesses in the Broad Street area out of fear of getting cholera began to return.

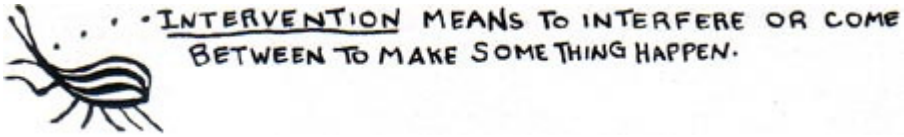
Despite the success of Snow's theory in stemming the cholera epidemic in Soho, public officials still thought his hypothesis was nonsense. They refused to do anything to clean up the cesspools and sewers. The Board of Health issued a report that said, "we see no reason to adopt this belief" and shrugged off Snow's evidence as mere "suggestions."

For months afterward Snow continued to track every case of cholera from the 1854 Soho outbreak and traced almost all of them back to the pump, including a cabinetmaker who was passing through the area and children who lived closer to other pumps but walked by the Broad Street pump on their way to school. What he couldn't prove was where the contamination came from in the first place.

Officials contended there was no way sewage from town pipes leaked into the pump and Snow himself said he couldn't figure out whether the sewage came from open sewers, drains underneath houses or businesses, public pipes or cesspools.



The mystery might never have been solved except that a minister, Reverend Henry Whitehead, took on the task of proving Snow wrong. The minister contended that the outbreak was caused not by tainted water, but by God's divine intervention. He did not find any such proof and in fact, his published report confirms Snow's findings. Best of all, it gave Snow the probable solution to the cause of the pump's contamination.



Reverend Whitehead interviewed a woman, who lived at 40 Broad Street, whose child who had contracted cholera from some other source. The child's mother washed the baby's diapers in water which she then dumped into a leaky cesspool just three feet from the Broad Street pump, touching off what Snow called "the most terrible outbreak of cholera which ever occurred in this kingdom."

A year later a magazine called *The Builder* published Reverend Whitehead's findings along with a challenge to Soho officials to close the cesspool and repair the sewers and drains because "in spite of the late numerous deaths, we have all the materials for a fresh epidemic." It took many years before public officials made those improvements.

In 1883 a German physician, Robert Koch, took the search for the cause of cholera a step further when he isolated the bacterium *Vibrio cholerae*, the "poison" Snow contended caused cholera. Dr. Koch determined that cholera is not contagious from person to person, but is spread only through unsanitary water or food supply sources, a major victory for Snow's theory. The cholera epidemics in Europe and the United States in the 19th century ended after cities finally improved water supply sanitation.

The World Health Organization estimates 78 percent of the people in Third World countries are still without clean water supplies today, and up to 85 percent of those people don't live in areas with adequate sewage treatment, making cholera outbreaks an ongoing concern in some parts of the world.

Today, scientists consider Snow to be the pioneer of public health research in a field known as epidemiology. Much of the current epidemiological research done at the U.S. Centers for Disease Control, which still uses theories such as Snows' to track the sources and causes of many diseases.

THE WEST is an eight-part documentary series which premiered on PBS stations in September 1996. Episode 3 covered the years 1848 to 1856. The Gold Rush brings the whole world to the West, as 49ers from Asia, South America and the eastern states scramble for "a share of the rocks," littering the hills with mining towns and creating the West's first metropolis. This segment follows William Swain and his travels from New York to California. Along the journey, he documents the cholera outbreak he encountered along the water trail.

My Share of the Rocks

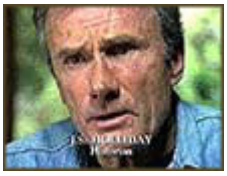
By the beginning of 1849, over 50,000 American gold seekers had decided to head for California. The only question was how to get there. Since it was impossible to go overland until spring thawed the prairies and mountain passes, the most impatient prospectors started off by sea -- 14,355 nautical miles -- all the way around the tip of South America. But most of the Americans decided to wait and go by wagon train.

April 11, 1849
All my things being ready last night, I rose early and commenced packing in my trunk, preparatory to leaving home on my long journey, leaving for the first time my home and my dear friends with the prospect of absence from them for many months and perhaps for years.
William Swain

William Swain was a twenty-seven year old farmer's son from Youngstown, New York, utterly convinced he would find riches in California. His wife, Sabrina, was against his going West. She did not know if she and their infant daughter, Eliza, could bear to be apart from him. William's older brother George was for it. If pickings were as easy as the newspapers said, he would go West, too, the following spring.

Swain's plan was to take the overland route to California, make a quick $10,000 in the gold fields, and return home. He carried with him a guidebook to the Overland Trail, a Bible -- and his diary.

I had fortified my mind by previous reflection to suppress my emotions, as is my custom in all cases where emotion is expected. But this morning I learned by experience that I am not master of my feelings in all cases. I parted from my family completely unable to restrain my emotions and left them all bathed in tears, even my brother, whose energy of mind I never saw fail before.
William Swain



He is a farmer. He lives a simple life. He's pretty well educated. He's read Shakespeare, he's read Wordsworth. His wife is a teacher. They have a very comfortable life. They don't have anything to complain about in eighteen forty-nine. This is a key point. They did not have anything that would cause them distress. His expectations were perfectly comfortable expectations of an average family, a farming family in America. The Gold Rush changed that. Suddenly he wanted more. Suddenly he wasn't satisfied.
J. S. Holliday

April 12th, 1849
At half past two o'clock we took passage for Detroit on the steamer Arrow. The lake is very smooth, and the boat shoots along like an arrow, and as she leaves, far in the distance, objects familiar to me

and bears me on to those that are strange, I feel that she bears me and my destiny.
William Swain

April 15, 1849
Dear, dear William,
I feel as though I was alone in the world. The night you left home I did not, nor could not, close my eyes to sleep.... William, if I had known that I could not be more reconciled to your absence than I am, I never could have consented to your going. However, I will try to reconcile myself as well as I can, believing God will order all things for the best.
Sabrina

May 6, 1849
Independence, Missouri
We came up from St. Louis with a company... from Marshall, Michigan. They are got up on the joint stock principle and are going with ox teams. They proposed that we should join them by paying $100 each into the fund, furnishing a wagon and thus becoming members of their company... which we have done.
William Swain

The members of Swain's company printed "Wolverine Rangers" on their wagons with axle grease. Other companies had their own nicknames: "Wild Yankee," "Rough and Ready," "Live Hoosier," and "Never Say Die." But in honor of the momentous year they believed would change their lives, they all proudly called themselves "'49ers."

Thirty thousand people -- that's not an exaggeration -- in the spring of 1849, take off from Independence and St. Joseph, Missouri, and travel along the Great Platte. Hundreds of miles of wagons. You can look to the west and as far as you can see on a dusty day, there are wagon trains, way off into the distance. And you turn around to look back, and they're stretched all the way back as far as you can see.

The men who traveled to California in the Gold Rush years had a conscious sense of the need to organize. There are rules. For instance, no swearing -- literally! They have constitutions, they have these rules and orders: No swearing. No drinking. We will observe the Sabbath. Many a company broke up over the argument of whether or not to observe the Sabbath. 'How can we observe the Sabbath? Here it is the middle of June, we're already behind. These people are passing us on Sunday, they're rolling. How can we sit here?' So they have arguments about it, and companies split up over the moral question of whether to observe the Sabbath or not.
J. S. Holliday

For thirty days, the Forty-niners crossed rolling prairie in what is now Kansas and Nebraska. It was Indian Territory, where tribes from the East had been relocated a decade earlier. Fears of Indian raids proved mostly groundless: men were more likely to die by drowning at a river crossing, or by an accident with their own guns, than they were at the hands of Indians. The Sac and the Fox, the Pawnees and Kickapoos, charged tolls at bridges and fords. The Potawatomis sold the emigrants bacon, beef and vegetables, and charged from one to five dollars to ferry emigrants across the Kansas River.

The real danger on the plains was cholera -- with its soaring fevers, chronic dysentery and ghastly death from dehydration. Cholera was rampant all across the United States in 1849, and quickly spread through the wagon trains. Some 1,500 of the gold seekers who set out for California that spring died from it on the trail.

Youngstown, New York
Dear Brother William,
We... were in a perfect fever of anxiety about you.... We know the cholera will be with you in crossing

the plains.... Do write as soon as you get there.
George Swain

Sabbath, May 27, 1849
In violation of our principle, we travel today on account of the sickness on the route.

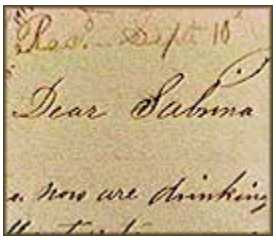
May 31, 1849
I was attacked at noon by dysentery very badly. I... got Reverend Hobart to make me a composition tea.

June 1, 1849
Still taking medicine, opium and astringent powders... Today I have thought much of home and of my little girl, who is today one year old.

June 7, 1849
I am... on the gain, but very weak.... My appetite is good but I cannot eat hearty for fear of the consequences.
William Swain

On June 13th, William Swain and his companions passed Fort Kearny on the Platte River. By early July, they reached Fort Laramie, in what is now Wyoming. They had gone nearly 700 miles from Missouri. But they still had more than 250 to go before they reached South Pass, which would take them through the Rocky Mountains. And nearly 1,000 more before they actually reached the gold fields.

July 4th, Independence Day
Dear Sabrina,
I have just left the celebration dinner table, where the company now are drinking toasts to everything and everybody and cheering at no small rate. I enjoy myself better in conversing with you through the medium of the pen....


Dear Sabrina

I am hearty and well, far more so than when I left home.... I am also more fleshy. Notwithstanding these facts, I would advise no man to come this way to California.

Kiss my little girl for me, give my love to George and Mother, and tell them I am determined to have my share of the rocks. Your affectionate husband until death,
William Swain

Below are suggestions for art and writing projects that can be done at the end of a Water 1st presentation or as a follow-up activity.

Simple Printmaking (Grade level: Appropriate for all grades)

Materials needed:

- brayers
- water-based printing ink
- styrofoam sheets for etching design (available in art supply stores)
- paper plates (or ideally pieces of cut plexiglas for printing)

Lesson Plan:

1. Following the Water 1st presentation and discussion, hand out pieces of scratch paper. Have the students fold them into fourths. (Two folds)
2. Have them label one half of the paper (two squares). Pictures of what the village was like before the Water 1st project. Talk about the fact that it doesn't have to be a whole scene but just one image that they remember. Talk about examples. (Before: along path, lots of people in the river, big jugs for carrying the water…..)
3. Have them do the same process for the second two squares of images that they remember from after the Water 1st project came to the village. (After: a water spigot, babies being washed, toilets…..)
4. Have them choose their favorite before and after image.
5. Hand out pieces of the scratch foam and wooden utensils.
6. Have the students draw a line down the middle with a pencil and ruler.
7. IMPORTANT: Because everything will be reversed when you print, students need to put the image for the before on the RIGHT side of the paper and the one for the after on the LEFT side. Remember all letters or numbers must be written backwards (mirror-image) as well.
8. Students can lightly sketch with pencil, then go over their lines with the wooden stick to etch deeper.
9. When they are finished, they are ready to print
10. Make sure all surfaces covered with newspaper!
11. Pour the printing ink either onto a paper plate or onto piece of plexiglass
12. Roll brayer until uniformly coated with ink.
13. Roll over scratch foam until evenly coated.
14. Lie paper down on top of foam and smooth out with your hands carefully so the paper does not move.
15. Peel off carefully and allow to dry.

Accordion Book (Grade level: 2nd through upper grades)

Ever since people began to communicate with each other, they've recorded events and thoughts in some way. In ancient times, people made drawings on cave walls and other natural surfaces. Around 3500 B.C., the Sumerians, who lived in Mesopotamia, developed a writing system on clay tablets. At about the same time, the Egyptians were working on Hieroglyphics, a writing method in which pictures were carved in stone or painted on papyrus. Other civilizations developed their own recording systems and materials, and in 868 A.D., the Chinese made the first known book.

The creation of handmade books is called book arts. As an introduction to this ancient craft, we'll learn how to make a simple accordion book in which you can write, draw, or display a collection of small items.

Materials:

- Mat board scraps
- Scraps of plain and decorative paper 24" to 36" long and 3" to 5" wide
- Pencil
- Ruler
- Scissors
- Glue stick

Lesson Plan:

1. After the Water 1st presentation have students brainstorm a list of things that they remember about the lives of the people before getting their new water system and a list of things they remember from after.
2. Depending on the grade level, have them write a short story (this can range from 4 –5 sentences for both the before and after to any length the student desires). After creating an accordion book, students will write and illustrate their stories with the before story going up one side of the accordion and the after going down the backside.
3. Students can illustrate the stories as well and choose a favorite illustration for the cover design.
4. The pages of this two-sided book actually are composed of one long piece of paper folded back and forth "accordion style". You'll need paper which is at least 24" to 36" long and 3" to 5" wide. Your local printing company or quick print shop are good places to obtain long scraps of preconsumer waste paper for this project.

5. To begin, fold the paper in half. Unfold, and then fold one side over so that the end touches this center crease, as shown. Repeat for the other side. Unfold and notice all the fold lines. Fold the left side over to the first crease or fold, and repeat this step for the right side, folding it over to the first fold on the right. Now unfold the paper, and fold the whole sheet back and forth in an accordion fold.

6. To make the book covers, cut two pieces of mat board the same size as the surface of the folded paper. For example, after folding a paper which measures 24" long and 5" wide, the surface will measure 3"x5". Have an adult cut the cardboard on a paper cutter or use a utility knife in combination with a triangle, T-square, or ruler to keep the corners square.

A Look at my World (Grade level: 2nd through upper grades)
Art, Photography and Writing – 2-session project

After the Water 1st presentation, have students brainstorm what the most powerful image was for them in the presentation. It could be something from before the community had access to clean water or after.

1. Have them do a rough draft of writing (or dictating to someone) about that image or place.
2. Then have them sketch the place on a piece of 9x12" watercolor paper… Have them place the paper vertically on their desk before beginning to draw.
3. When they are done with the sketch, have them use pens, pastels or crayons to color.
4. Meanwhile, take turns taking black and white digital shots of the students from the back from the shoulders up.
5. Print the photos in a 5x7" format and hand out to class.
6. Have the students carefully cut their figure out.
7. Glue in center at bottom of drawing.
8. Finish their writing. This only needs to be a couple sentences. What is the place they described and how do they feel looking in at that scene they have chosen?

Diary Entry (Grade level: 3rd through upper grades)
Art and Writing

After the Water 1st presentation, have students create a diary entry for an entire day of a young person their age in the village or community they viewed. They can choose to have it be a day before access to clean and accessible water or after.

Be sure to have a discussion about the gender issues that affect young girls especially when living in a family that does not have access to a ready supply of clean water.

These diary entries could be illustrated as well and compiled into a class book.

Hi. My name is Asmaraha, and I am 11 years old. In Echele, Ethiopia, where I live, there isn't very much water. The water that we do have is brown and dirty. Every morning my mother and I go to get water at 6:00 in the morning from the waterhole. There is always a long line, so we wait for a long time. When it is our turn in line, I am grateful for the water, yet at the same time I dread the six hour walk back home. Although I want to, I do not complain. My back still hurts from the walk to the waterhole, but I have to put the water jug back on. Inside I cry, but outside I stay strong.

My little brother died last year because my mom couldn't feed him enough. My brain tells me everyday that I am so very luck to be alive and able to help my mother, but every once in a while my heart asks me, 'how lucky am I really?'

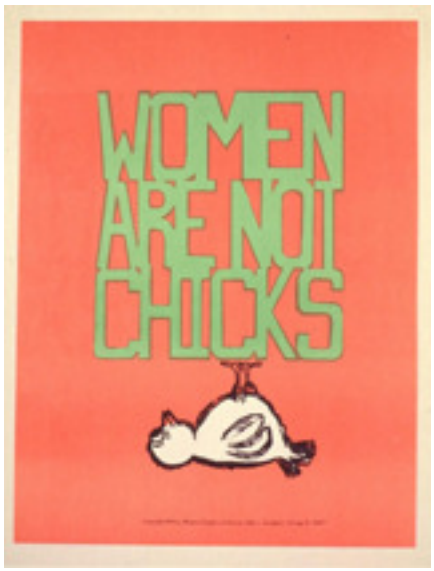
Kamilah, 7th grade
Lake Washington Girls School, Seattle

Poetry (Grade level: 5th grade through upper grades):
Poetry can be a powerful means of letting young people respond to an issue such as water access.

Place and Moment Poems: Have students put themselves into the lives of one of the young people they saw in the presentation at one moment that they remember. Have them describe that moment and why it is special to that person. Ask them to describe the place where that moment takes place. Let each line show something new about that place. Have them describe what it smells like, looks like, and sounds like. Have them describe what is going on at the moment they are remembering that place.

What would clean water look like?
How will it taste?
I imagine that someday, water will be sweet.
Clear, and translucent.
I bend down to scoop up another cup of water from the watering hole,
and gaze out over the line of women waiting their turn.
Everyday, I walk 3 hours for a taste of filthy water.
Everyday, I imagine a better future, only to be stifled by reality.
I bend down again for more of the brown liquid.
Slowly, I turn towards home,
and with nothing to strive for I walk away.

Jamie, 7th grade
Lake Washington Girls School, Seattle



Poster Project (Grade level: 5th grade through upper grades)
Art and Writing, tied to Advocacy Projects
This project could take anything from one period to an entire unit!

After the Water 1st presentation, have students create a water advocacy poster. (Also see, Water 1st curriculum on *Youth Advocacy: Raising Public Awareness* for more ideas)

Background information: If appropriate spend time exploring the history of protest posters. See some examples (at right) and visit the websites below as resources for this exercise:

http://www3.iath.virginia.edu/sixties/HTML_docs/Exhibits/Track16.html
http://www.upress.umn.edu/artofprotest/onlinechintro1.html

Discuss what makes an effective poster….the importance of images…who is the audience…..how will they affect change?

Turning commitment into action…

FUNDRAISING IDEAS

TREASURES for TREASURES – Sell your favorite treasures you no longer use to provide a life long treasure to a person in another community – water for life.

1. Recycle – sell your old clothes, books, games, toys, etc. Friends and neighbors can buy something "new" from you and you can feel good about passing along great finds.
2. The money you raise can then be used to provide clean drinking water to one person, a family, or an entire village!

A LIFETIME OF LEARNING – Sell your well loved books so that children in other parts of the world will be able to also have the opportunity to attend school.

1. Get your entire classroom/school to bring in used books, CDs, DVDs and host a community book sale to raise money for a well in a community.
2. The money you raise will allow children, particularly girls, to have the ability to go to school instead of walking for water.

WALK FOR WATER –Organize a walk to raise money so that children do not have to continue this strenuous existence.

1. You and your classmates can organize a water walk around a park, lake, or neighborhood. You determine how you will get pledges to raise money – by distance walked? Amount carried? Length of time carrying water?
2. With greater appreciation than you had ever previously known, you can give the gift of water for a lifetime to someone in Ethiopia, Bangladesh, Honduras or India.

RIDE FOR WATER – Exert your energy for a day so a girl your age will be able to walk to a well not a dirty water source miles away.

1. Pick a site (in Seattle – Discovery Park, Green lake, Seward Park are a few ideas), and organize a ride and get donations for the amount of laps you are able to accomplish.
2. The money you and your friends raise can help all the girls in a village be able to attend school instead of spending their days walking to get water.

MOVIE NIGHT – Host a movie night, complete with popcorn and pajamas, to raise money to train women of a village how to maintain their new water system.

1. Pick a location (school gym, library, community center) and show a movie. Cost of admission includes popcorn, juice and movie.
2. A night of leisurely fun can raise enough money to allow moms in other communities to be able to spend more time with their own children.

WATER SPORTS DAY – Organize a day of water games to fund a water point in a Water 1st site.

1. Use your creativity and come up with a field full of stations with a different water game at each (water bucket relay, water balloon baseball, water balloon toss, pin-the-bucket on the well,)
2. A fun water day to raise money for every-day water for families in Ethiopia.

WISHING WELL – Make wishes come true by providing a real well for a community

1. Make a paper mache water urn and set it out in your school so kids can toss the change they bring in. You'll be surprised how every little bit helps!
2. Wishes can come true, all contributions lead to an eventual water source for the many people in the world without access to clean drinking water.

COLORED WATER FOR CLEAR WATER - Help people in other parts of the world enjoy fresh water.

1. Sell Otter Pops at a booth after school or at a school sports event.
2. You'll be amazed at how much money you raise and how this money can be used to help people in other parts of the world enjoy the wonderful taste of clean water.

Amount	What we buy…..	What it could buy…..
$20	20 downloads from iTunes	Safe water for a child for a lifetime (Bangladesh)
$75	A pair of Chuck Taylors	One woman access to safe water, leaving time to earn money. (Ethiopia)
$150	A new outfit at GAP	Two girls access to safe water and more time to attend school. (Ethiopia)
$500	A new iPhone	Safe water, a toilet and hygiene education for 4 children for life. (Honduras)
$1,500	A two week sleep-away camp	Drilling of a deep well and the installation of a hand pump for 400 people, clean water for life. (Bangladesh)
$ 2,500	A family vacation	2500 feet of PVC pipe to carry safe water from the storage tank to the household taps, ending the long walk for water for women and girls. (Honduras)

Making Your Voice Heard

Take-home assignments
Using the handouts you've received, and your own research and ideas,
Discuss the following questions with an adult (or adults) you know well:
How much water does our family use in a day?
How much our water cost per gallon?
How could our family be more water conscious?
How many people today do not have access to clean drinking water?
Which regions have the biggest lack of clean drinking water?
Why is water such an important issue?
Which gender is primarily impacted by lack of water? Why?
What other problems happen when there is inadequate or unsafe water?
Why is water predicted to be what wars will be fought over instead of oil in the next 20 years?
What can be done about it?

Raising public awareness
Suggested audiences:

Students/school community
- Letters to a student publication
- Article in a student publication
- Make and display posters (see the Water 1st curriculum *Art Activity—Poster Project* for ideas and resources)
- Announcement or presentation during school assembly
- Organize an information booth or a fundraiser (during lunch period, at a school event, a local fair, a sports game, science fair, etc)
- Ask for small donations from other students at school, and for each donation pour a cup of water into an empty container. See whose class can can create an overflow of water.

Extracurricular/sports teams
- Talk to teammates about water issues and encourage them to join you in making a difference at home or in the world!
- Make and display posters
- Organize an information booth or a fundraiser, possibly during a game or performance
- If the team has a sponsor, ask them if they would be willing to sponsor an information booth or match donations
  At a sports event, ask the concession operators if you can wrap each bottle with a piece of paper with a water-related statistic on it ("water wraps"), or turn it into a fundraiser by selling your own wrapped water

Citizens
- Write letters to the editor (individually or as a class)
- Write letters to a columnist, to persuade him/her to write an article on the issue
- Talk to family members, neighbors, and friends about water issues
- Organize a information booth or fundraiser in a public place (YMCA, boys/girls club, park, voting station, mall, farmers' market, school play, Westlake Center)
  Host a Water 1st Event/fundraiser, with speakers, student presentations, community discussions, and/or showings of the Water 1st Ethiopia or Bangladesh DVD.

Politicians
- Letter writing

Supplies for an Information booth:
- Literature (by both Water 1st and students)
- Posters and decorations by students
- Statistics about water around the world
- Visual aids, such as a 5 gallon container full of water that visitors can try to lift, a container of water that represents how much people in other countries live off every day, or even a performance by students, a hands-on demonstration of the amount of fresh water available in the world.
- Plenty of eager student volunteers!

Letter writing tips:
- The potential audiences for letters are unlimited! Try school newspapers, community newsletters, church publications, local papers, online forums. In general, smaller publications are more likely to print letters.
- For younger children, try writing letters as a class. Students can suggest points and arguments to include, which the teacher then compiles.
- Discussing in small groups sometimes helps students to focus their letters.
- Keep the letter short and direct. This is especially important for letters to the editor, where it is best to focus on a single point.
- For letters to the editor, speak in reference to a specific article from a previous issue, if applicable.
- Before writing letters to a publication, it is sometimes helpful to have the class read letters from it, so they can get a feel of the appropriate tone, pace, and length for their letters.
- Make sure to confirm all facts and statistics before putting them in a letter.
- Include your contact information.
- Remind students to keep their letters courteous and polite, but firm. Their voices are important, and their well-informed opinions are valuable.

Suggestion for letter format:

Introduce yourself and the issue that you want to talk about.
(Briefly state your name, grade, school, and your reason for writing the letter)

Demonstrate that you are well informed on the topic.
(Show what you know using science, current events, statistics, etc.)

Give your opinion, and what you think should be done.
(Support your opinions and conclusions with evidence)

* Remember to have someone proofread before you sign and send the letter