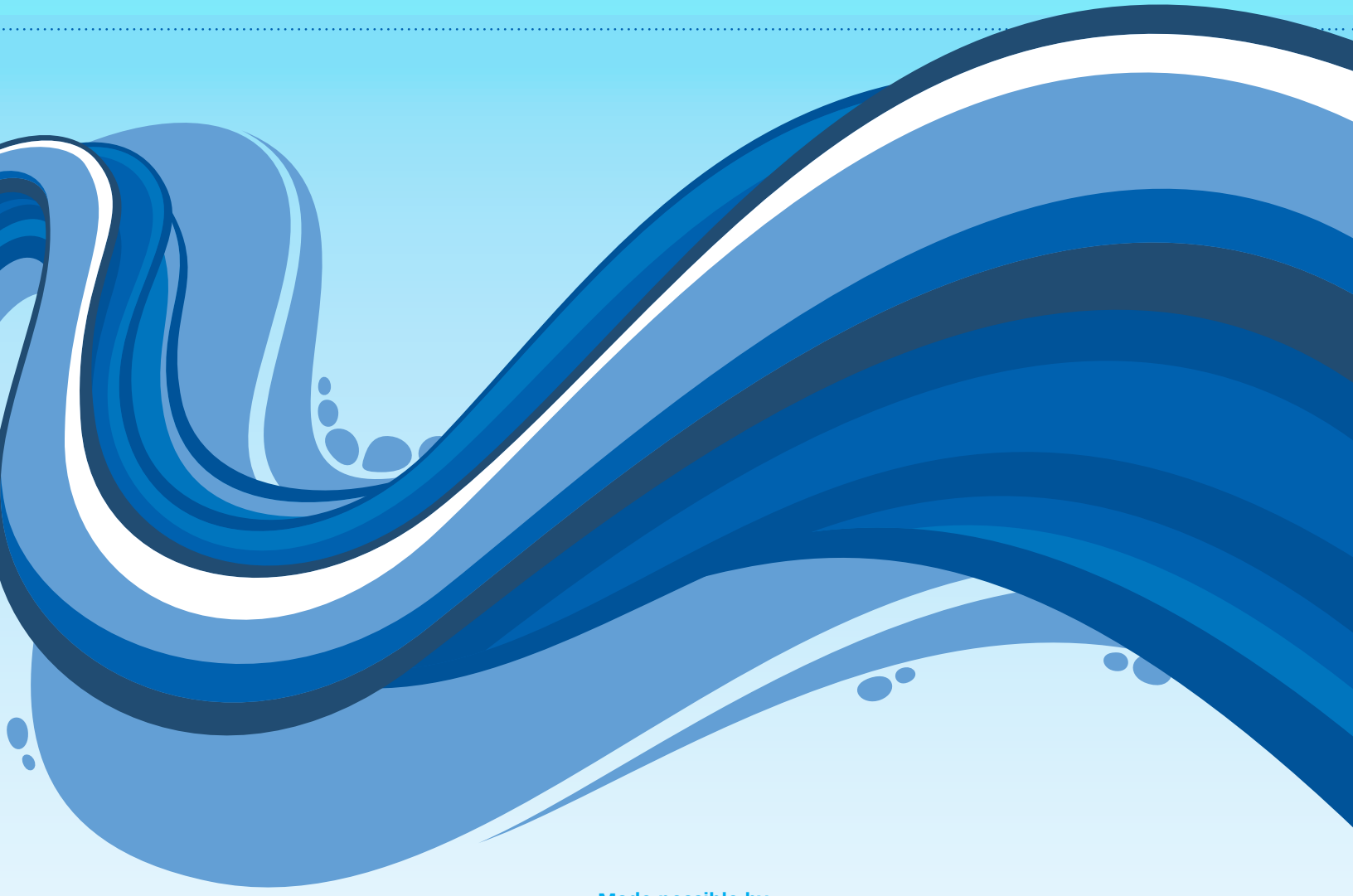
GLOBAL WATER SUPPLY HIGH SCHOOL CURRICULUM



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WATER.ORG'S CURRICULUM ALIGNMENT: U.S. EDUCATION STANDARDS MASTER LIST

:: **Middle and High School**
:: http://www.education-world.com/national/standards

English/Language Arts

NL-ENG.K-12.1
Reading for Perspective: Students read a wide range of print and non-print documents to build an understanding of texts, of themselves, and of the cultures of the United States and the world.

NL-ENG.K-12.3
Evaluation Strategies: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.

NL-ENG.K-12.4
Communication Skills: Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

NL-ENG.K-12.5
Communication Strategies: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

NL-ENG.K-12.6
Applying Knowledge: Students apply knowledge of language structure, language conventions, media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

NL-ENG.K-12.7
Evaluating Data: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

NL-ENG.K-12.8
Developing Research Skills: Students use a variety of technological and information resources to gather and synthesize information and to create and communicate knowledge.

NL-ENG.K-12.11
Participating in Society

NL-ENG.K-12.12
Applying Language Skills: Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

WATER.ORG'S CURRICULUM ALIGNMENT: U.S. EDUCATION STANDARDS MASTER LIST

Science

NS.9-12.1
Science as Inquiry: Abilities necessary to do scientific inquiry/ Understanding about scientific inquiry

NS.9-12.3
Life Science: Populations and ecosystems/ Diversity and adaptations of organisms/ Interdependence of organisms

NS.9-12.5
Science and Technology: Abilities of technological design/ Understandings about science and technology

NS.9-12.6
Science in Personal and Social Perspectives: Personal health/Populations, resources, and environments/Risks and benefits

Social Sciences

Geography

NSS-G.K-12.1
The World in Spatial Terms: Understand how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

NSS-G.K-12.2
Places and Regions: Understand the physical and human characteristics of places/ Understand that people create regions to interpret Earth's complexity/ Understand how culture and experience influence people's perceptions of places and regions.

NSS-G.K-12.3
Physical Systems: Understand the physical processes that shape the patterns of Earth's surface/ Understand the characteristics and spatial distribution of ecosystems on Earth's surface.

NSS-G.K-12.4
Human Systems: Understand the characteristics, distribution, and migration of human populations on Earth's surface/ Understand the characteristics, distribution, and complexity of Earth's cultural mosaics/ Understand the patterns and networks of economic interdependence on Earth's surface/ Understand the processes, patterns, and functions of human settlement/ Understand how the forces of cooperation and conflict among people influence the division and control of Earth's surface.

NSS-G.K-12.5
Environment and Society: Understand how human actions modify the physical environment/ Understand how physical systems affect human systems/ Understand the changes that occur in the meaning, use, distribution, and importance of resources.

NSS-G.K-12.6
Uses of Geography: Understand how to apply geography to interpret the present and plan for the future.

Civics

NSS-C.9-12.1
Civic Life, Politics, and Government: What is government? Why are government and politics necessary? What purposes should government serve?

NSS-C.9-12.4
Other Nations and World Affairs: What is the Relationship of the United States to Other Nations and to World Affairs?/ How is the world organized politically?/ How has the United States influenced other nations and how have other nations influenced American politics and society?

NSS-C.9-12.5
Roles of the Citizen: What are the responsibilities of citizens?/ How can citizens take part in civic life?

NSS-WH.5-12.1
Era 1: The Beginnings of Human Society

NSS-WH.5-12.2
Era 2: Early Civilizations and the Emergence of Pastoral People

Technology

NT.K-12.1
Basic Technology Operations and Concepts: Students demonstrate a sound understanding of the nature and operation of technology systems/ Students are proficient in the use of technology.

NT.K-12.2
Social, Ethical, and Human Issues: Students understand the ethical, cultural, and societal issues related to technology/ Students practice responsible use of technology systems, information, and software/Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

NT.K-12.3
Technology Productivity Tools: Students use technology tools to enhance learning, increase productivity, and promote creativity/ Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

NT.K-12.4
Technology Communications Tools: Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences/ Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

NT.K-12.5
Technology Research Tools: Students use technology to locate, evaluate and collect information from a variety of sources/ Students use technology tools to process data and report results/ Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

Economics

NSS-EC.9-12.1
Productive Resources: Scarcity

NSS-EC.9-12.3
Allocating Goods and Services: Comparing the benefits and costs of different allocation methods in order to choose the method that is most appropriate for some specific problem can result in more effective allocations and a more effective overall allocation system.

NSS-EC.9-12.4
Positive and Negative Incentives: Acting as consumers, producers, workers, savers, investors, and citizens, people respond to incentives in order to allocate their scarce resources in ways that provide the highest possible returns to them. Responses to incentives are predictable because people usually pursue their self-interest/ Changes in incentives cause people to change their behavior in predictable ways/ Incentives can be monetary or non-monetary.

NSS-EC.9-12.6
Gain from Trade: A nation pays for its imports with is exports/When imports are restricted by public policies, consumers pay higher prices and job opportunities and profits in exporting firms decrease.

12.0 (MIDDLE AND HIGH SCHOOL) WATER-AWARE PORTFOLIO INSTRUCTIONS

WATER-AWARENESS PORTFOLIO INSTRUCTIONS

A portfolio is a record demonstrating what students learn over an extended period of time for a specific unit such as a "global water crisis" unit or "water-awareness" unit. The introduction of a water portfolio is an effective technique teachers can use to interface water curriculum with ongoing assignments and activities in any subject including economics, geography, biology, language arts, social studies, and environmental science.

- The participation and completion of a global water crisis or water-awareness portfolio will give students access to knowledge and awareness of current water conditions in developing nations, an increased awareness of the need for conservation practices and the value of water as a shared global resource.
- Students who are involved in creating the portfolio gain valuable experience in setting their own goals and standards of excellence. The process of creating many entries over time gives students a sense of ownership and control over their own learning.
- Portfolios that have depth, duration, and complexity will challenge students and motivate them towards construction of knowledge. They will acquire problem-solving, planning, and self- evaluation skills. Students will process and generalize information to make predictions about, and generate solutions for, the global water crisis. The written components of a portfolio also strengthen reading comprehension and writing skills that benefit students in standardized testing conditions.

Materials needed:
A three-ring notebook or a folder with pockets
Instructor prompts (see sample portfolio entry prompts below)

A portfolio may include a variety of written assignments: journal entries, poetic responses to a piece of art or journalism, letters, essays, reports, stories, timelines, creative writing, book summaries, article summaries and/or WebQuests.

Non-written entries may include: drawings, original artwork, photos, brochures, maps, charts, computer-generated graphics, maps and/or illustrations, etc. Students should demonstrate correct grammar, punctuation, spelling, and vocabulary usage in all entries.

Sample prompts for a water-awareness portfolio:
Students will visit a broad collection of websites to raise water awareness. Students will create a chart and briefly describe water crisis information found of each of the following websites:

National Geographic: (http://www.nationalgeographic.com)

Environmental Protection Agency: (http://www.epa.gov)

American Museum of Natural History: (http://www.amnh.org)

Discovery Education: (http://www.discoveryeducation.com)

- Students will create a proposal to convince the U.S. Congress to take a more active role in assisting developing nations with water and sanitation infrastructures.
- Students will write a letter to inspire and challenge family members to conserve water. Students will read the letter to their family and discuss family reactions the next day in class.
- Students will visit (http://www.water.org) and create a Venn Diagram comparing water and sanitation conditions in two of the five following countries: Bangladesh, Ethiopia, Honduras, India, Kenya.
- Students will read the article "Dangerous Waters" by Sharon P. Nappier, Robert S. Lawrence, and Kellogg J. Schwab. Students will identify and describe five infectious pathogens posing serious threats to freshwater sources around the world. Students may research images of infectious pathogens and create visual representations of pathogens such as Norovirus, Plasmodium, Giardia, E. coli, and Cryptosporidium parvum.
- Students will create a timeline that demonstrates the evolution of significant water and sanitation inventions and discoveries since the time of Roman aquifers through the present.
- Students will read the document "Early History of Water Sanitation Technology" and create an invention to assist with the collection, distribution, sanitation or any other aspect of the global water crisis.
- Students will analyze a variety of economic plans to assist water-deprived third-world nations. Students will visit (http://www.water.org) to research micro-finance example: WaterCredit and other sources to research oil-for-water programs.

13.0 (HIGH SCHOOL) "MOCK MUCK" MINI-UNIT

National Curriculum Alignment:
(The following National Curriculum Standards are addressed by completing all of the activities associated with the Global Water Crisis mini-unit. See http://www.educationworld.com/standards/national for a corresponding key to standards)

NL-ENG.K-12.1
Reading for Perspective: Students read a wide range of print and non-print documents to build an understanding of texts, of themselves, and of the cultures of the United States and the world.

NL-ENG.K-12.3
Evaluation Strategies: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.

NL-ENG.K-12.4
Communication Skills: Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

NL-ENG.K-12.5
Communication Strategies: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

NL-ENG.K-12.6
Applying Knowledge: Students apply knowledge of language structure, language conventions, media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

NL-ENG.K-12.7
Evaluating Data: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

NS.9-12.6
Science in Personal and Social Perspectives: Personal health/Populations, resources, and environments/Risks and benefits

NSS-G.K-12.2
Places and Regions: Understand the physical and human characteristics of places/ Understand that people create regions to interpret Earth's complexity/ Understand how culture and experience influence people's perceptions of places and regions.

NSS-G.K-12.3
Physical Systems: Understand the physical processes that shape the patterns of Earth's surface/ Understand the characteristics and spatial distribution of ecosystems on Earth's surface.

NSS-G.K-12.4
Human Systems: Understand the characteristics, distribution, and migration of human populations on Earth's surface/ Understand the characteristics, distribution, and complexity of Earth's cultural mosaics/ Understand the patterns and networks of economic interdependence on

Earth's surface/ Understand the processes, patterns, and functions of human settlement/ Understand how the forces of cooperation and conflict among people influence the division and control of Earth's surface.

NSS-G.K-12.5
Environment and Society: Understand how human actions modify the physical environment/ Understand how physical systems affect human systems/ Understand the changes that occur in the meaning, use, distribution, and importance of resources.

NT.K-12.1
Basic Technology Operations and Concepts: Students demonstrate a sound understanding of the nature and operation of technology systems/ Students are proficient in the use of technology.

NT.K-12.2
Social, Ethical, and Human Issues: Students understand the ethical, cultural, and societal issues related to technology/ Students practice responsible use of technology systems, information, and software/Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

NT.K-12.4
Technology Communications Tools: Students use telecommunications to collaborate, publish, and

interact with peers, experts, and other audiences/ Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

NT.K-12.5
Technology Research Tools: Students use technology to locate, evaluate and collect information from a variety of sources/ Students use technology tools to process data and report results/ Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

:: **Middle School**
:: **Global Water Crisis**
:: **Level of difficulty and duration:**

Objective:
Students will research water crisis conditions for one of the following five countries: Bangladesh, Ethiopia, Honduras, India, or Kenya and record findings on the Global Water Crisis International Comparison Group Activity graphic organizer. Students will then report their findings to the class, who will then record the remaining information for the other four countries on their activity charts.

Lesson:
Students will be assigned to research one of the following nations that have received aid from WaterPartners International: Bangladesh, Ethiopia, Honduras, India, or Kenya. Students will individually visit (http://water.org). [Website instructions: From the main page click on world water crisis, then scroll down to the bottom of the page and click on Water Crisis in the Countries [we help], next under the left hand column heading "Where We Work" select the icon for the country you have been assigned to research.] Students will individually complete the activity chart for the country they have been assigned. Students will then work in groups of four or five to organize and present information on the country assigned to their group.

Materials:
Internet access, Global Water Crisis International Comparison Group Activity graphic organizer, pencils or pens, and presentation materials such as index cards, PowerPoint, or overhead transparencies.

Optional Activity:
Students may work in groups to discuss the major water, health and sanitation issues of their assigned country and make 2-3 recommendations for improvement of water and sanitation conditions.

Water-Awareness Portfolio Entry:
Which one of the four countries that the class reported on would you most like to live in? Which of the countries would you least like to live in? Why?

Possible discussion question:
Why does more than one-third of the world's population not have access to clean water?

BANGLADESH

Country Facts

Capital: Dhaka
Median age: 22.5 years
Population: 150,448,339
Infant mortality: 59.12 deaths/1,000 live births

Access to improved water source: 74%
Below poverty line: 45%
Access to improved sanitation: 39%
Adult literacy: 43.1%

Bangladesh is located in South Asia on the Bay of Bengal between India and Myanmar. It is mostly flat alluvial plain with hills in the southeast. Bangladesh became an independent nation in 1971 when it seceded from West Pakistan.

Each year during the summer monsoon season about one third of Bangladesh floods. These floods often force people from their homes, and hinder the economic development of the country. Preventable diseases, largely the results of poverty and overcrowding, remain highly prevalent and are the main killer of the 72 children out of 1,000 who die before their fifth birthday.

Water Crisis in Bangladesh

Bangladesh has made commendable progress in supply of safe water to its people. However, gross disparity in coverage exists across the country. Latrine usage is very poor across the country, averaging only 16% in the rural areas. Diarrheal diseases constitute a major health problem in Bangladesh, killing over 100,000 children each year. Thousands of episodes of diarrhea occur in children and adults each day. Diarrheal diseases have close biological and socio-economic links to the problems of malnutrition, poor maternal health, high fertility, and child survival.

In the late 1970s, approximately four million wells were drilled to replace the traditional contaminated surface water sources. The projects made significant headway and mortality due to water-related diseases had declined. However, in 1993, high arsenic concentrations were discovered in the groundwater of several wells in western Bangladesh. Long-term intake of high concentrations of arsenic from drinking water gives rise to a number of health problems, particularly skin disorders. Internal cancers have also been linked with arsenic in drinking water.

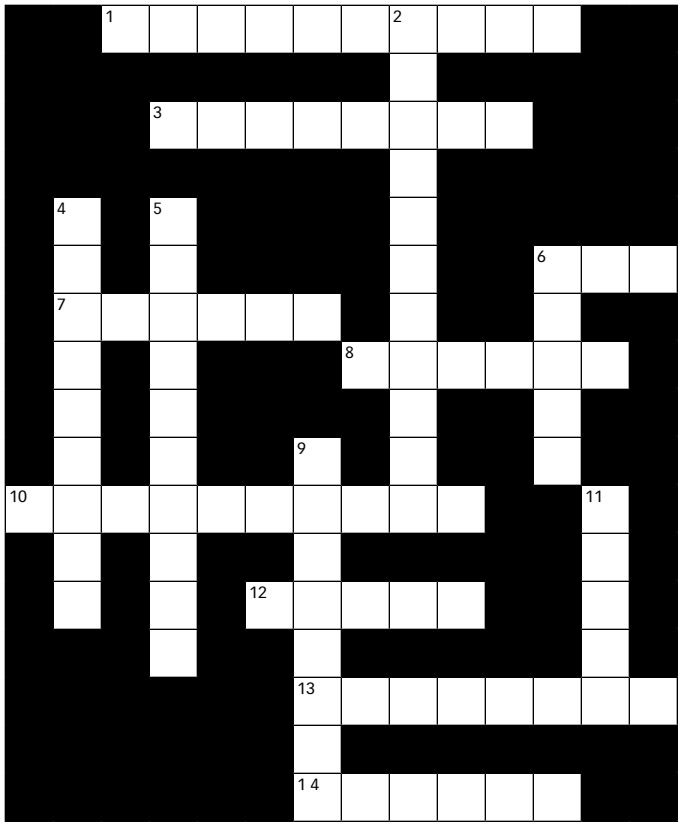
Although the arsenic crisis on an individual level is concerning, the more acute impacts are seen on the community as a whole. In Bangladesh, many wells containing arsenic were closed without considering the possible immediate adverse affects of such interventions, particularly the increase in diarrheal illnesses. Once a well is painted red, signifying the water contains arsenic concentrations above the national standard, community members are no longer supposed to use it. However, when a well is closed, the community must seek other sources for drinking water, usually returning to the traditional unprotected water sources such as ponds or ditches, or walking to distant wells that do not contain arsenic. While reducing the effects of chronic arsenic exposure, such practices dramatically increase the risk of acute bacteriological contamination, leading to greater outbreaks of water-related diseases. These diseases especially affect children who are much more vulnerable to diarrheal diseases. The resulting impact of this dilemma has been a spike in child mortality.

Urban Crisis

The size of the urban population is increasing at alarming rates. The poor people from the rural areas continue to migrate to the urban areas in with the hope of being able to earn larger wages to support their families. Many of these people find shelter in the Dhaka's slum communities. These squatter communities are the most densely populated areas in the country. The enormous quantity of people living in such close quarters causes people living in these slums to have some of the worst health in the country. Most people in these slums live on less than US $2 a day, and many live on less than US $1 a day. Acute poverty, over-

WATER-AWARE FACT PUZZLE

Read the Water-Aware Fact Sheet to help you solve this puzzle,



Across

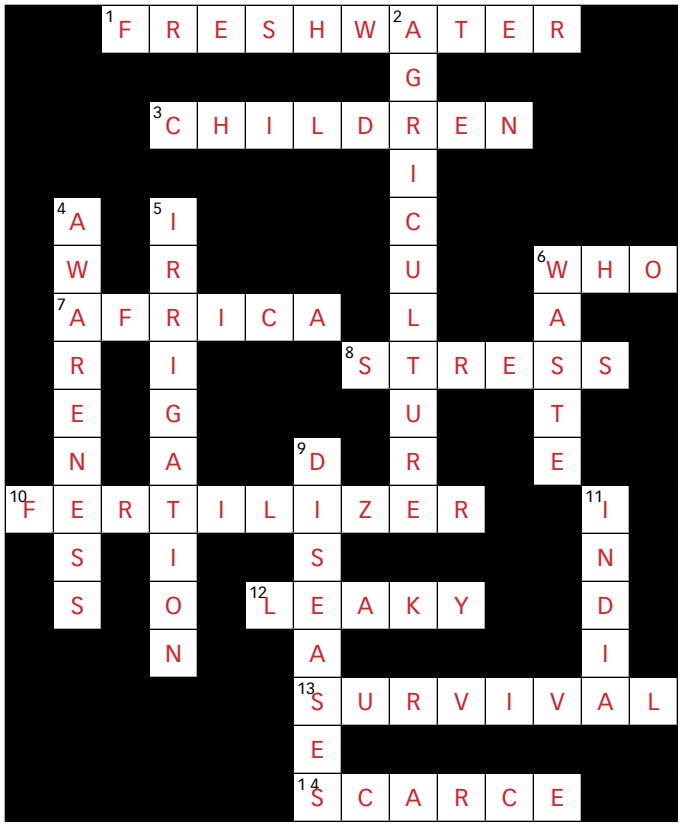
1 used faster than it can be replaced
3 15 million die a year from water related illness
6 World Health Organization (acronym)
7 continent with minimal percentage of water treatment
8 one-third of world population suffers from water _____
10 farming containment along with pesticide
12 Large cities waste water because of these type of systems
13 more than 1 gallon a day is the bare minimum for _____
14 "value groundwater like any other _____ resource"

Down

2 responsable for 80% of world water consumption
4 increase public and government _____
5 60% of this water is wasted
6 two million tons a day are disposed in freshwater resources
9 diarrhea, typhoid, cholera
11 home to the Ganges River

WATER-AWARE FACT PUZZLE

Read the Water-Aware Fact Sheet to help you solve this puzzle,



Across

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9 diarrhea, typhoid, cholera
11 home to the Ganges River

14.0 (HIGH SCHOOL) "HYDRO-TECHNOLOGY" MINI-UNIT

crowding, poor housing, and unhealthy disposal of waste all play major roles in the water and sanitation crisis in the urban areas of Bangladesh.

ETHIOPIA

Ethiopia is a landlocked country in the eastern Horn of Africa. It is slightly less than twice the size of Texas. The average temperature throughout much of the country is about 60° Fahrenheit. However, the northern part of the country along the Sudanese border can be much hotter. There are nearly 80 languages spoken in Ethiopia, but the most common are Amharic, Tigrinya, and Oromigna.

The need for water and sanitation in Ethiopia is severe. Only 22% of the population has access to an improved water supply, and only 13% of the population has access to adequate sanitation services. In rural areas, these numbers drop even further.

Water Crisis in Ethiopia
In rural areas, women and children walk up to six hours to collect water. Most people collect water from shallow, unprotected ponds which they share with animals. Other people collect water from shallow wells. Both these sources are subject to contamination as rain water washes waste from surrounding areas into the source. They then carry the large clay jugs of water back to their villages. These jugs can weigh up to 40 pounds! Often, young children are left home by themselves or with a slightly older sibling while their mother and older siblings collect water and their father works tends to animals or tries to earn money at a job outside the house.

Drought
In the last 20 years, Ethiopia has experienced recurring droughts followed by food shortages and famines. Poverty is accentuated during the droughts. Staple foods, like cabbage, experience sharp increases in prices, while families find that they must sell their cattle for half what they would get in a non-drought year. Along with limited food supply, during times of drought, water-related diseases are rampant. Surface water sources such as springs and ponds dry up. What limited water sources remain become are heavily contaminated by environmental waste, such as human and animal excreta which is washed in when the limited rains do come. The stagnant water serves as a breeding place for mosquitoes.
In addition to being at risk for contracting diseases through drinking water, there is another risk. In times of drought, it is common for there not to be enough water available to bathe regularly. As a result, community members, especially children, suffer from scabies and eye infections. During these times, in an effort to conserve water, hand washing after defecation or before eating is rarely practiced.
Poverty continues to affect the child mortality rate in Ethiopia. There are many factors that contribute to the high child mortality rate. Diarrheal and water-related diseases are among the principle causes of death in young children. Pneumonia, vaccine-preventable diseases (especially measles), malaria, tuberculosis, and malnutrition are also among the top killers of this age group.

INDIA

Country Facts

Capital: New Dehli	Population: 1,129,866,154
Median age: 24.8 years	Infant mortality: 34.61 deaths/1,000 live births
Access to improved water source: 86%	Access to improved sanitation: 33%
Below poverty line: 25%	Adult literacy: 61%

India boasts the world's second largest population with more than 1 billion people. Its population is more

than 3.5 times the size of that of the United States. However, India is only one-third of the physical size of the US.

The population is incredibly diverse. Hindi is the national language, but there are 14 other official languages. India's schools teach 58 languages and its national newspapers are published in 87 languages. The predominant religion is Hindu (81.3%), but 12% of the population is Muslim, and other religions such as Sikhism, Christianity, Buddhism, Jainism, and Zoroastrianism are also practiced. Much of India's art reflects the country's religious ties and includes colorful masks, intricate sculpture, and lively dance.
Poverty is a chief concern in India. Although overall poverty in India has decreased in the last 50 years, more than 25% of India's population still lives on less than two dollars a day. There is an ever-widening gap between poor people and those who are better off. Health has also improved in India, however, 34% of India's children under age five are malnourished, and maternal deaths account for nearly 25% of the world's childbirth-related deaths.

Water Crisis in India
India's huge and growing population is putting a severe strain on all of the country's natural resources. Most water sources are contaminated by sewage and agricultural runoff. India has made progress in the supply of safe water to its people, but gross disparity in coverage exists across the country. Although access to drinking water has improved, the World Bank estimates that 21% of communicable diseases in India are related to unsafe water. In India, diarrhea alone causes more than 1,600 deaths daily—the same as if eight 200-person jumbo-jets crashed to the ground each day. Hygiene practices also continue to be a problem in India. Latrine usage is extremely poor in rural areas of the country; only 14% of the rural population has access to a latrine. Hand washing is also very low, increasing the spread of disease. In order to decrease the amount of disease spread through drinking-water, latrine usage and hygiene must be improved simultaneously.

KENYA

Country Facts

- Capital: Nairobi
- Median age: 18.6 years
- Access to improved water source: 61%
- Below poverty line: 50%
- Population: 36,913,721
- Infant mortality: 57.44 deaths/1,000 live births
- Access to improved sanitation: 43%
- Adult literacy: 85.1%

Kenya is located in East Africa. It borders the Indian Ocean and Somalia on the east, Ethiopia and Sudan on the north, Uganda and Lake Victoria on the west, and Tanzania to the south. Kenya's eastern low plains rise to central highlands bisected by the Great Rift Valley in the west.

Over 50 percent of Kenyans are living below the poverty line. The HIV/AIDS pandemic has compounded the deteriorating health standards and resulted in growing destitution, and unprecedented levels of poverty.

Water Crisis in Kenya
The water crisis in Kenya is disrupting social and economic activities throughout the country. Unfortunately, the current wave of droughts and water shortages in Kenya and the rest of East Africa is only expected to continue.

The water crisis is due not only to the wave of droughts, but also to poor management of the water supply, under-investment, unfair allocation of water, rampant deforestation, pollution of water supplies by untreated sewage, and a huge population explosion (thirty-fold increase since 1900).

Kenya is limited by an annual renewable fresh water supply of only 647 cubic meters per capita, and is classified as a water scarce country. Only 61percent of the rural population has access to an improved drinking water source, and the time-intensive pursuit of water collection often prevents women from taking up income generating activities, or in the case of girls, prevents them from attending school.

Nyanza Province
Much of Nyanza Province, where WaterPartners is working, is semi-arid and is subject to severe drought. Most people obtain their drinking water from Lake Victoria, seasonal rivers and streams, and hand-dug wells, all of which are contaminated sources. Women and children walk up to six kilometers each day to haul water, a task that takes up to three hours. Water is not only contaminated at its source but also from the way it is transported and stored. Few households boil their water.

HONDURAS

Country Facts

Capital: Tegucigalpa
Median age: 19.7 years
Access to improved water source:87%
Below poverty line: 53%
Population: 7,483,763
Infant mortality: 25.21 deaths/1,000 live births
Access to improved sanitation: 69%
Adult literacy: 80%

Honduras is the knee of Central America, bordered to the south by Nicaragua and El Salvador and to the west by Guatemala. In the rural regions, nearly 63% of the population is considered extremely poor, living on less than a dollar a day.

Families often work as subsistence farmers—growing only what they can use to feed their own families, and leaving very little money for other purchases.

Water Crisis in Honduras

In 1998 Honduras was devastated by Hurricane Mitch. The tiny country was the hardest hit by Mitch's rampage. Mitch was followed by three days of rain that caused landslides and floods, burying towns and killing thousands of people. Many of the rural communities were devastated. The hurricane caused $58 million in damages and left 75% of the country without safe drinking water.

Reconstruction efforts are continuing. However, until they are complete, in these areas families are forced to rely on contaminated water supplies, and the prevalence of waterborne diseases like cholera is increasing. Mosquitoes that carry malaria and dengue fever are also a problem.

Beyond the issues of health, poor access to water supplies causes overall development to stagnate. Many women and children in the rural areas of Honduras spend up to six hours each day simply fetching water and carrying it home on their heads.

Level of Implementation

	5 Excellent	4 Great	3 Good	2 Average	1 Poor
Expense: How likely are developing nations to adopt the new technology considering the price to design, construct and implement on a large scale?					
Range of application: (can this new technology be applied to a variety of climates/countries or is it very limited in its scope to offer a solution to a water-deprived region)					
Feasibility: Do the products necessary to build the technology exist? How readily available are materials? How long could the technology be expected to produce results? How many would be served by the design?					
Effectiveness: How likely is the new technology to positively impact global water conditions?					

SURVEY-GROUP ACTIVITY CHART

Information	India	Ethiopia	Kenya	Bangladesh	Honduras
Description of physical location/ geography					
Description of water crisis					
Relevant statistical information					
Problems specific to the country/ region					
Recommendations					

GLOBAL WATER CRISIS "WATER COMMONS" LAB

Most of the world's valuable resources, water included, are treated as "commons" where individuals, corporations and governments have the right to freely consume them and return their wastes. A "tragedy of the water commons" occurs when one person's/institution's wastes affects another person's/institution's access to safe, clean drinking water.

Pre-Activity Questions:

1:: Where does the tap water in your home come from?

2:: Where does your family's used water go?

3:: What possible pollutants may enter the water "commons" from your home?

Materials:

- One aluminum pie pan per group
- Regular M&M's
- Peanut M&M's
- One spoon for each person
- One plastic/paper cup for each person

Procedure:

1. Your group will start at the first station in the river (upstream). Put 100 regular M&M's in the pie pan. These represent the clean water from the river.

2. All group members must close their eyes or wear blindfolds. The teacher will carefully time the collection of "water" within a 30-second time frame.

3. Using the spoon as your pail, collect as many M&M's as you can, keeping your eyes closed (no cheaters!), and place them in the cup.

4. After the 30 seconds is up, count how many M&M's are left in the pan. Once this number is counted, subtract it from 100, and put that number of peanut M&Ms in the pan. The peanut M&M's will represent the polluted water. Record the information in the chart.

5. Repeat steps 2-4 for each station in the river, or until no "water" is left.

Station	Clean Water	Polluted Water
1		
2		
3		
4		
5		
6		

Questions:

1:: How many stations did your group make it through before the resource ran out?

_____

2:: How does the pollution from the stations upstream affect stations located downstream?

_____

_____

3:: What was the ratio of clean water to polluted water for each station? (Ratio = number of regular M&M's to number of peanut M&M's)

_____

4:: What is meant by the phrase, "We all live downstream"?

_____

5:: Research existing protections for freshwater sources at the local, national and international level. Report findings to your class.

GLOBAL WATER CRISIS BASIC FACTS SHEET

- Less than 1% of the world's fresh water (or about 0.007% of all water on earth) is readily accessible for direct human use.
- A person can live weeks without food, but only about three days without water.
- The interventions with the greatest impact on national development and public health are the provision of safe drinking water and the proper disposal of human waste.
- Water-related diseases are one of the leading causes of disease and death in the world. At any given time, half of the world's hospital beds are occupied by patients suffering from a water-related disease.
- Close to half of all people in developing countries suffer from a health problem caused by

water and sanitation deficits.

- 2.6 billion people in the world lack access to proper sanitation resources.
- A person needs 4 to 5 gallons of water per day to survive.
- The average American individual uses 100 to 176 gallons of water each day.
- The average African family uses about 5 gallons of water each day.
- Millions of women and children spend several hours a day collecting water from distant, often polluted sources.
- Water systems fail at a rate of 50% or higher.
- Every $1 spent on water and sanitation creates on average another $8 in costs averted and productivity gained.
- Almost two in three people lacking access to clean water live on less $2 a day.
- Poor people who are likely to live in slum areas often pay 5-10 times more for per liter of water than wealthy people living in the same city.
- Every 15 seconds, a child dies from a water-related disease.
- At any given time, half of the world's hospital beds are occupied by patients suffering from a water-related disease.
- 1.8 million children die each year from diarrhea – 4,900 deaths each day.
- Human health improvements are influenced not only by the use of clean water, but also by personal hygiene habits and the use of sanitation facilities.

Reading for Comprehension Questions

1:: Approximately how many people on the planet lack access to a safe supply of drinking water?

2:: At about what percentage rate do water system projects fail?

3:: What crisis claims more lives than any war?

4:: How much water does a person need each day to survive?

5:: What is the average amount of gallons of water used per day by an American individual?

6:: What is the average amount of gallons of water used per day by an African family?

7:: Worldwide, how many children die from water-related diseases each day?

8:: Which interventions have the greatest overall impact on national development and public health?

9:: What percent of the world's fresh water is readily accessible for direct human use?

10:: How much more are poor people living in slum areas likely to pay for water than wealthy people living in the same city.

Answers:

1:: 2.6 billion

2:: 50%

3:: Water-related diseases

4:: 4 to 5 gallons

5:: 100 to 176 gallons

6:: 5 gallons

7:: 4,900

8:: providing safe drinking water and properly disposing of human waste

9:: less than 1%

10:: 5-10 times more

WATER-AWARENESS PORTFOLIO INSTRUCTIONS

A portfolio is a record demonstrating what students learn over an extended period of time for a specific unit such as a "global water crisis" unit or "water-awareness" unit. The introduction of a water portfolio is an effective technique teachers can use to interface water curriculum with ongoing assignments and activities in any subject including economics, geography, biology, language arts, social studies, and environmental science.

- The participation and completion of a global water crisis or water-awareness portfolio will give students access to knowledge and awareness of current water conditions in developing nations, an increased awareness of the need for conservation practices and the value of water as a shared global resource.
- Students who are involved in creating the portfolio gain valuable experience in setting their own goals and standards of excellence. The process of creating many entries over time gives students a sense of ownership and control over their own learning.
- Portfolios that have depth, duration, and complexity will challenge students and motivate them towards construction of knowledge. They will acquire problem-solving, planning, and self- evaluation skills. Students will process and generalize information to make predictions about, and generate solutions for, the global water crisis. The written components of a portfolio also strengthen reading comprehension and writing skills that benefit students in standardized testing conditions.

Materials needed:
A three-ring notebook or a folder with pockets
Instructor prompts (see sample portfolio entry prompts below)

A portfolio may include a variety of written assignments: journal entries, poetic responses to a piece of art or journalism, letters, essays, reports, stories, timelines, creative writing, book summaries, article summaries and/or WebQuests.

Non-written entries may include: drawings, original artwork, photos, brochures, maps, charts, computer-generated graphics, maps and/or illustrations, etc. Students should demonstrate correct grammar, punctuation, spelling, and vocabulary usage in all entries.

Sample prompts for a water-awareness portfolio:
Students will visit a broad collection of websites to raise water awareness. Students will create a chart and briefly describe water crisis information found of each of the following websites:

National Geographic: (http://www.nationalgeographic.com)

Environmental Protection Agency: (http://www.epa.gov)

American Museum of Natural History: (http://www.amnh.org)

Discovery Education: (http://www.discoveryeducation.com)

- Students will create a proposal to convince the U.S. Congress to take a more active role in assisting developing nations with water and sanitation infrastructures.
- Students will write a letter to inspire and challenge family members to conserve water. Students will read the letter to their family and discuss family reactions the next day in class.
- Students will visit (http://www.water.org) and create a Venn Diagram comparing water and sanitation conditions in two of the five following countries: Bangladesh, Ethiopia, Honduras, India, Kenya.
- Students will read the article "Dangerous Waters" by Sharon P. Nappier, Robert S. Lawrence, and Kellogg J. Schwab. Students will identify and describe five infectious pathogens posing serious threats to

freshwater sources around the world. Students may research images of infectious pathogens and create visual representations of pathogens such as Norovirus, Plasmodium, Giardia, E. coli, and Cryptosporidium parvum.

- Students will create a timeline that demonstrates the evolution of significant water and sanitation inventions and discoveries since the time of Roman aquifers through the present.
- Students will read the document "Early History of Water Sanitation Technology" and create an invention to assist with the collection, distribution, sanitation or any other aspect of the global water crisis.
- Students will analyze a variety of economic plans to assist water-deprived third-world nations. Students will visit (http://www.water.org) to research micro-finance example: WaterCredit and other sources to research oil-for-water programs.

National Curriculum Alignment:

(The following National Curriculum Standards are addressed by completing all of the activities associated with the Walking for Water mini-unit. See http://www.educationworld.com/standards/national for a corresponding key to standards.)

English Grades 6-12

NL-ENG.K-12.1
Reading for Perspective: Students read a wide range of print and non-print documents to build an understanding of texts, of themselves, and of the cultures of the United States and the world.

NL-ENG.K-12.3
Evaluation Strategies: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.

NL-ENG.K-12.4
Communication Skills: Students adjust their use of spoken, written, and visual language to communicate effectively with a variety of audiences and for different purposes.

NL-ENG.K-12.5
Communication Strategies: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

Science Grades 6 - 12

NS.9-12.3
Life Science: Populations and ecosystems/ Diversity and adaptations of organisms/ Interdependence of organisms

NS.9-12.6
Science in Personal and Social Perspectives: Personal health/Populations, resources, and environments/Risks and benefits

Social Sciences Grades 6-12

Geography Grades K - 12

NSS-G.K-12.2
Places and Regions: Understand the physical and human characteristics of places/ Understand that people create regions to interpret Earth's complexity/ Understand how culture and experi-

ence influence people's perceptions of places and regions.

NSS-G.K-12.3
Physical Systems: Understand the physical processes that shape the patterns of Earth's surface/ Understand the characteristics and spatial distribution of ecosystems on Earth's surface.

NSS-G.K-12.4
Human Systems: Understand the characteristics, distribution, and migration of human populations on Earth's surface/ Understand the characteristics, distribution, and complexity of Earth's cultural mosaics/ Understand the patterns and networks of economic interdependence on Earth's surface/ Understand the processes, patterns, and functions of human settlement/ Understand how the forces of cooperation and conflict among people influence the division and control of Earth's surface.

NSS-G.K-12.5
Environment and Society: Understand how human actions modify the physical environment/ Understand how physical systems affect human systems/ Understand the changes that occur in the meaning, use, distribution, and importance of resources.

:: **Middle School**:
:: **"Walking for Water"**
:: **Level of difficulty and duration**:

Pre-activities:
Distribute materials on "Women Bear the Weight of Water" and/or Kenya, Honduras and Ethiopia materials. Students will answer "Women Bear the Weight of Water" Reading for Comprehension Questions. Students will discuss facts relating to the difficulty and sociological implications of the unavailability of water in each

of the above regions. Review statistical information regarding average distances travelled for water. Form a hypothesis about the difficulty level of performing the task of carrying a gallon of water ½ mile.
Objective: Students will compare their own experiences with the availability of water to those in third world countries.

Lesson:
Students will be asked to fill gallon containers with water and walk the distance of ½- mile.
Materials: Students will bring in clean, empty plastic gallon jugs from home. The instructor will pre-determine a route of ½ mile around the school campus and should inform the administration about the activity in advance.

Post Activities:
Students will discuss their experiences as a group. Are students better able to empathize with third world conditions after the activity? Why or why not? Were student's earlier predictions about difficulty level accurate? Review statistics regarding gallons needed and miles carried by people living in Africa and South America as documented in "Bearing the Weight of Water" and/or Kenya, Honduras and Ethiopia materials.
Optional Post-Activities: Have students try to lift a two or three gallons of water at a time. (Be careful, be-

cause water weighs a lot!) Explain to students that many people in other parts of the world do not have access to running tap water or to wells. People (most often women) in other parts of the world carry as much as twelve gallons of water on their heads very long distances to meet the needs of their families.

Water Portfolio Entry:
Women in many areas of the world must carry large amounts of water long distances to provide the basic needs of their families. What other tasks might these women be doing if they did not have to spend so many hours (sometimes as much as 20 hours per week) carrying water? What could you do with 20 extra hours per week?

WATER-AWARE FACT SHEET

In many regions of the world, fresh water, both groundwater and surface water, **is being used faster than it can be replaced.** Already about one-third of the world's population lives in countries suffering from moderate-to-high water stress, according to the most recent Global Environment Outlook (GEO-3) report. Water stress is defined as areas where water consumption is more than 10% of renewable freshwater resources. The GEO-3 scientists project that **more than half the people in the world could be living in severely water-stressed areas by 2032.**

A lack of safe drinking water brings an added burden of illness to families already living in poverty. Infectious **waterborne diseases such as diarrhea, typhoid, and cholera are responsible for 80% of illnesses and deaths in the developing world,** many of them children. Worldwide, approximately 15 million children a year die from a waterborne disease or related illness.

The amount of water a person needs can vary; obviously, a person doing manual labor in the tropics will need more water than someone sitting at a computer in a temperate zone. **The World Health Organization (WHO) suggests 0.5 to 1 gallon a day for drinking, and another 1 gallon for cooking and food preparation as the bare minimum for survival.** However, the minimum quantity of water recommended by **the U.S. Agency for International Development for household and urban use is close to 26.4 gallons per person per day.**

Some two million tons of waste per day are disposed of in open freshwater sources, including industrial wastes, agricultural wastes, human waste and chemicals. World Watch Institute, for example, estimates that **every minute, 300,000 gallons of raw sewage are dumped into the Ganges River, the primary source of water for many Indians.**

In all of Asia, only about 35 percent of the wastewater is treated, and about 14 percent is treated in Latin America. **A minimal percentage of treatment has been reported to be treated in Africa.** Even in industrialized countries, sewage is not universally treated, according to UNEP (United Nations Environment Program).

Freshwater resources are being further squandered due to pollution and the way in which we use water. **Agriculture accounts for an unbelievable 80% of world water consumption**, and an **estimated 60% of the water used for irrigation is wasted**, lost to leaky canals, evaporation, and mismanagement. Fertilizer and pesticide residues from farming also contribute to contamination of fresh water resources. Large cities waste their share of water too due to leaky systems.

Conserving and managing freshwater resources is politically and socially difficult; many rivers, lakes, and underground aquifers cross national boundaries and are often be shared by several countries, all with differing laws and beliefs about rights to use and ownership.

"This crisis is one of water governance, essentially caused by the ways in which we mismanage water," conclude the authors of the UN's World Water Development Report issued in March of 2007. According to Brian Morris, principal hydro-geologist at the British Geological Survey, "What is needed is pragmatic management such as **increasing public and government awareness**, properly resourcing the agencies that manage groundwater, supporting community management, and encouraging the use of incentives and disincentives particularly in poorer countries and rural areas. **It is vital we give groundwater value like any other scarce resource".**

Source: UN Highlights World Water Crisis (2007): (http://news.nationalgeographic.com)

"Water-Aware Fact Sheet"
Reading for Comprehension Questions

1:: According to the most recent Global Environment Outlook report what percent of the world's population lives in countries suffering from moderate-to-high water stress?

15.0 (HIGH SCHOOL) "RISING TENSIONS OVER THE NILE RIVER BASIN" MINI-UNIT

National Curriculum Alignment:
The following National Curriculum Standards are addressed by completing all of the activities associated with the Rising Tensions over the Nile River Basin mini-unit

NL-ENG.K-12.1
Reading for Perspective: Students read a wide range of print and non-print documents to build an understanding of texts, of themselves, and of the cultures of the United States and the world.

NL-ENG.K-12.3
Evaluation Strategies: Students apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.

NL-ENG.K-12.5
Communication Strategies: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

NL-ENG.K-12.6
Applying Knowledge: Students apply knowledge of language structure, language conventions, media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts.

NL-ENG.K-12.7
Evaluating Data: Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources to communicate their discoveries in ways that suit their purpose and audience.

Science Grades 6 - 12

NS.9-12.6
Science in Personal and Social Perspectives: Personal health/Populations, resources, and environments/Risks and benefits

Social Sciences Grades 6-12

Geography Grades K - 12

NSS-G.K-12.1
The World in Spatial Terms: Understand how to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.

NSS-G.K-12.2
Places and Regions: Understand the physical and human characteristics of places/ Understand that people create regions to interpret Earth's complexity/ Understand how culture and experience influence people's perceptions of places and regions.

NSS-G.K-12.3
Physical Systems: Understand the physical processes that shape the patterns of Earth's surface/ Understand the characteristics and spatial distribution of ecosystems on Earth's surface.

NSS-G.K-12.4
Human Systems: Understand the characteristics, distribution, and migration of human populations on Earth's surface/ Understand the characteristics, distribution, and complexity of Earth's cultural mosaics/ Understand the patterns and networks of economic interdependence on Earth's surface/ Understand the processes, patterns, and functions of human settlement/ Understand how the forces of cooperation and conflict among people influence the division and control of Earth's surface.

NSS-G.K-12.5
Environment and Society: Understand how human actions modify the physical environment/ Understand how physical systems affect human systems/ Understand the changes that occur in the meaning, use, distribution, and importance of resources.

NSS-G.K-12.6
Uses of Geography: Understand how to apply geography to interpret the present and plan for the future.

Civics Grades 9-12

NSS-C.9-12.1
Civic Life, Politics, and Government: What is government? Why are government and politics necessary? What purposes should government serve?

NSS-C.9-12.4
Other Nations and World Affairs: What is the Relationship of the United States to Other Nations and to World Affairs?/ How is the world organized politically?/ How has the United States influenced other nations and how have other nations influenced American politics and society?

NSS-C.9-12.5
Roles of the Citizen: What are the responsibilities of citizens?/ How can citizens take part in civic life?

NSS-WH.5-12.1
Era 1: The Beginnings of Human Society

NSS-WH.5-12.2
Era 2: Early Civilizations and the Emergence of Pastoral People

Economics Grades 6-12

NSS-EC.9-12.1
Productive Resources: Scarcity

NSS-EC.9-12.3
Allocating Goods and Services: Comparing the benefits and costs of different allocation methods in order to choose the method that is most appropriate for some specific problem can result in more effective allocations and a more effective overall allocation system.

NSS-EC.9-12.4
Positive and Negative Incentives: Acting as consumers, producers, workers, savers, investors, and citizens, people respond to incentives in order to allocate their scarce resources in ways that provide the highest possible returns to them. Responses to incentives are predictable because people usually pursue their self-interest/ Changes in incentives cause people to change their behavior in predictable ways/ Incentives can be monetary or non-monetary.

NSS-EC.9-12.6
Gain from Trade: A nation pays for its imports with is exports/When imports are restricted by public policies, consumers pay higher prices and job opportunities and profits in exporting firms decrease.

:: **High School**
:: **Rising Tensions over the Nile River Basin: A Global Commons Case Study**
:: **Level of difficulty and duration: ****

Objective
Students will analyze the concept of a global commons dilemma through an evaluation of a primary source document.

Lesson
Students will read The Middle East Media Research Institute Inquiry and Analysis Series –No. 165 February 27, 2004: Rising Tensions over the Nile River Basin by Dr. Nimrod Raphaeli and respond in writing to the Reading for Comprehension questions that follow.

Materials
The Middle East Media Research Institute article

Post Activities
Reading for Comprehension questions and "Tragedy of the Water Commons" Lesson Plan

The article "Rising Tensions over the Nile River Basin" illustrates a global commons dilemma specifically as it relates to water. The article communicates why several African nations are in conflict regarding the use of the Nile River as a water source. Read the article carefully and complete the Reading for Comprehension questions.

"RISING TENSIONS OVER THE NILE RIVER BASIN"

Source: The Middle East Media Research Institute
Inquiry and Analysis Series - No. 165 February 27, 2004

Introduction
The Nile River is the longest river in the world. From its major source, Lake Victoria in east central Africa, the White Nile flows generally north through Uganda and into Sudan where it meets the Blue Nile in Khartoum, which rises in the Ethiopian highlands. The Nile traverses almost 6,700 kilometers (4,169 miles) from its farthest sources of the headwaters of the Kagera River in Burundi and Rwanda to its delta in Egypt on the Mediterranean Sea. [1]

The Nile is shared by ten countries – Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania and Uganda –- with a combined population of about 300 million, about 160 million of whom live within the boundaries of the Nile Basin. The ten countries that share the Nile waters include some of the world's poorest, with annual per capital income of less than $250. [2]

In recent months, tensions have been rising over the waters of the Nile. In preparation for the African summit meeting of African heads of state to be held in Libya next week, the ministers of water representing the riparian countries have decided to put the subject of the 1929 Nile Water Agreement on the summit's agenda.

President Hosni Mubarak chaired a cabinet meeting in Cairo to discuss the issues. The communiqué issued after the meeting did not say what Egypt would do in the face of a persistent demand for reallocating the Nile waters, and whether Mubarak himself would attend the summit meeting. It vaguely referred to Egypt's readiness to provide training, technical assistance, "and help in procuring funding for projects that benefit all the countries of the Basin," in the framework of respecting the shares established by the existing agreement. [3] A couple of days earlier, the Egyptian government daily Al-Gomhouriya wrote that the demands by some of the Nile Basin countries for reallocating water shares is a matter of concern to Egypt which requires quick intervention to kill any initiative that would reduce the water supply to Egypt. [4]

The following is an overview of tensions regarding the Nile River:

The Nile Water Agreement of 1929
The Nile Waters Agreement (NWA) over the allocation of its waters between Egypt and Great Britain (which represented Uganda, Kenya, Tanganyika [now Tanzania] and the Sudan) was concluded on November 7, 1929 in Cairo by an exchange of letters between the Egyptian Prime Minister and the British High Commissioner in Egypt. The agreement allocated 48 billion cubic meters per year to Egypt as its acquired right and 4 billion cubic meters per year to the Sudan. These allocations were later increased to 55.5 billion cu. meters and 18 billion cu., respectively, under a 1959 bilateral agreement between these two countries that allowed for the construction of the Aswan Dam. Apart from Ethiopia, which had a government in place, the NWA was made before the other Nile Basin countries gained their independence.

The agreement stated that no works would be undertaken on the Nile, its tributaries, and the Lake Basin that would reduce the volume of the water reaching Egypt. It also gave Egypt the right to "inspect and investigate" the whole length of the Nile to the remote sources of its tributaries in the Basin.

This right "to inspect and investigate," which was tantamount to a veto power over any water or power project, has in recent years become moot, as all the former colonies on the Nile Basin have become independent nations and are not likely to readily agree to such encroachment on their sovereignty by Egypt. Indeed, some of them have begun to nibble on the NWA by initiating water projects that threaten to reduce the volume of water available to Egypt. Egypt considers any change in the agreement as a strategic threat and has repeatedly threatened to use all means at its disposal to prevent the violations of the agreement. The other Nile Basin African countries consider the agreement as a relic of a colonial era which no longer reflects their needs and aspirations and hence it should be annulled. Countering this argument, Sherif Al-Mousa, head of the Middle East Program at the American University in Cairo, argues that the Nile water agreement should be treated the same way as the boundaries of most Nile Basin countries which were established by colonial powers, and are recognized under international law. [5]

The Pressures for Change

Population pressures, frequent draughts, and increasing soil salinity have intensified the demands by the Nile Basin countries to renegotiate the 1929 agreement. Not deterred by Egyptian reluctance to negotiate the 1929 agreement, or even Egyptian threats, and constrained by financial hardships, some Nile Basin countries are determined to implement projects that would tap into the sources of the Nile.

The 1959 agreement between Egypt and Sudan, which increased the water allocations to themselves while completely ignoring the interests of the other riparian countries such as Tanzania, Kenya and Ethiopia has, in retrospect, weakened the Egyptian argument about inviolability of the NWA.

The Nile Basin Initiative

To reduce the potential for conflict, and with the help of the World Bank, the Nile Basin Initiative was launched in 1999 as a transitional arrangement until a permanent framework is in place. It is guided by a shared vision "to achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources."

The Nile Basin Initiative notwithstanding, member countries are forging ahead with their own projects and challenges. Droughts are difficult to forecast, even in the beginning of the crop season. Building dams to store water is not unlike a bank savings account, to be used at a time of need. While Egypt has secured its agriculture with the building of the Aswan Dam, it has been reluctant, if not belligerent, when other countries on the Nile Basin sought similar solutions.

Ethiopia Asserts Rights to the Blue Nile

The **Ethiopian Minister of Water Resources** announced his country's intentions to develop close to 200,000 hectares (ha.) of land though irrigation projects and construction of two dams in the Blue Nile Sub-basin. He further stated that these projects would be the first phase of forty-six projects which Ethiopia proposed to execute along with ten joint projects which Egypt and Sudan proposed. The Egyptian Ambassador to Ethiopia confirmed.

Egypt's commitment is to the utilization of the Nile waters for the benefit of all riparian countries. However, the Egyptian commitment was conditional. All projects must benefit both upstream and downstream countries, provided these projects do not lead to a reduction of the waters reaching Egypt.

The Ethiopian Minister of Water Resources retorted that the agreement to participate in the Nile Basin Initiative reserves Ethiopia's right to implement any project in the Blue Nile Sub-basin unilaterally, at any given time. He charged that the 1959 agreement between Egypt and Sudan impedes sustainable development in the basin and called for its nullification. [6]

From the Egyptian perspective, any change in the volume of its water could have devastating effects on Egypt. The vast majority of Egyptians live in a valley which is about 4 percent of the Egyptian territory, and 95 percent of Egypt's water resources are derived from the Nile.

Tanzania Challenges Egypt
In early February 2004, Tanzania launched a project to draw water from Lake Victoria to supply the Shinyanga region. The project calls for the construction of about a 100 mile long inland pipeline at an initial cost of $27.6 million, to be constructed by a Chinese engineering company. To mitigate the anticipated Egyptian reaction, Tanzania announced that the pipleline was designed to provide drinking water to its thirsty population rather than irrigate agricultural land. Tanzania's population of 35 million has suffered from frequent droughts, desertification, and soil erosion. In fact, Tanzania was the first riparian country which, upon its independence in 1961, declared the 1929 agreement invalid. [7]

Nevertheless, Egypt expressed its irritation with the Tanzanian project, arguing that under the 1929 agreement it has the right to veto any project - agricultural, industrial, or power - that could threaten its vital interests in guaranteeing its annual share of the river waters. While Egypt is handling the issue diplomatically, Egyptian officials stressed that "the diplomatic dialogue does not mean that Cairo does not consider any number of other options, if necessary." [8] In diplomatic parlance, "other options" do not exclude the use of force. Tanzania has not budged. The Deputy Permanent Secretary in the Tanzanian Ministry of Water and Livestock Development, Dr. C. Nyamurunda, said that Tanzania's sentiments about the legality of the water agreement are well known. He emphasized that "other countries also believe that the treaties [NWA] were illegal but they are to cooperate in negotiations, although they are not restricted from using the waters of the Nile." [9]

Another Challenge from Kenya
Similarly, in response to a threat from Kenya that it was considering withdrawing from the 1929 agreement, the **Egyptian Minister of Irrigation and Water Resources Mahmoud Abu Zeid** said: "Egypt considers the withdrawal of Kenya from this agreement as tantamount to official declaration of war [emphasis added] and a threat to its vital interests and national security." A Kenyan weekly quoted the Egyptian minister declaring in Addis Ababa that Kenya could be subject to sanctions by Egypt and the other eight members of the Nile River Basin Agreement. He said Kenya's position violates international law and customs "and we will not agree to it." [10]

The **Kenyan deputy foreign minister M. Watangola** repeated his country's demand for a revision of this historic agreement because Kenya was not consulted prior to its being signed. He said eight Kenyan rivers flow into Lake Victoria, which is the main source of the Nile waters. [11]

Water for Oil
A senior Kenyan parliamentarian suggested that the Nile water should be sold to Egypt and Sudan for oil. He said that the time has come to replace the Nile agreement with a new agreement to allow the members to benefit from the Nile's waters. He added: "We have presented our natural resources to Egypt and Sudan free without them doing anything in return. We need to sell to them as they sell to us." The Egyptian treated the idea as "stupid" because the two countries have vested rights, rather than customers who would buy the water. [12]

Egypt Accuses Hidden Fingers
In addition to Tanzania and Kenya, Ethiopia and Uganda are also demanding the abrogation of the 1929 agreement and a bigger share of the Nile waters. Egypt accuses "hidden fingers known to the Egyptian side [which] are openly inciting the traditional allies of Egypt in the Nile Basin to annul the agreement, arguing that it is incompatible with the population and political developments that have transpired in the last 75 years." [13] The anonymous senior Egyptian official who has made the allegation about the "hidden fingers"

stressed that any change in the agreement was inconceivable and warned that "any infringement of the agreement would suggest that the African countries do not respect regional obligations." [14]

Egypt's Alternatives

To deal with the threat to its vital oil supply Egypt has four alternatives. Some are not mutually exclusive:

- Reduce waste through improved irrigation system.
- Price water at market rates.
- Maintain the status quo as long as feasible.
- Resort to the use of force.

Reduce Waste Through Improved Irrigation System

According to a study by the World Bank, 96.44 per cent of the economically active population in Egypt is engaged in agriculture. It is the highest percentage in the Middle East, with Morocco in second place with 92.61 percent of active population in agriculture. By contrast, the corresponding ratios for Tunisia and Lebanon are 60.87 and 10.35 percent, respectively. As a result, much of the water is used in agriculture, which contributes proportionately a small percentage to GDP. In Egypt, 88% of the water is consumed in agriculture which, as a sector, contributes only 14 percent to GDP, while 8 percent of water used in industry contributes 34 per cent of GDP. The report suggests that "from a narrow macroeconomic perspective, rationale of justifying the allocation of water to agriculture over industrial and other sectors is weak." [15]

Price Water at Market Rates

While the region remains one of the most water-scarce regions in the world, the cost of water for irrigation is set at below cost recovery levels. Egyptian agriculture is entirely dependent on irrigated land. The government provides irrigation water free, except of cost recovery of on-farm investment projects. Annual irrigation subsidies are estimated at $5 billion. In Egypt, irrigation subsidies are often rationalized as a means of offsetting low farm prices controlled to keep down urban food prices. [16] Water pricing and subsidies are such that they lead to waste in agriculture and provide little incentive for conservation techniques.

Maintain the Status Quo

Egypt's third option is to seek a status quo while tolerating some changes on the margin. To do so, Egypt must continue to maintain a pro-American and pro-Western orientation to discourage them and organizations controlled by them, such as the World Bank, from financing costly water projects such as dams or power projects in any of the riparian countries, which they themselves cannot finance through internally-generated resources.

Resort to the Use of Force

The last and least likely alternative is to resort to the use of force to uphold Egypt's right to exercise the veto power on activities that it deems dangerous to its national interests. Egypt's saber rattling cannot be taken too seriously, certainly not by the African countries themselves. Indeed, as one Egypt daily pointed out, "the harsh language adopted by Abou Zeid … might not be working…" [17] Not only does Egypt lack the military capacity to strike at countries two thousand miles outside its borders, but it will be hard pressed to justify a military action to enforce the provision of a 75-year old agreement concluded to satisfy colonialist considerations and priorities but dissatisfy the needs of the countries upstream. A Kenyan father of two, who owns eight ponds for fish farming, was quoted as saying: "If the Egyptians try to invade Kenya for the sake of its water we are ready to die for our rights. Kenya must forget the Nile agreement and return to the commercial consumption of the Lake Victoria Lake." [18]

Reading for Comprehension Questions:

1:: Which ten African nations share access to the Nile River?

2:: What issue, regarding the Nile, was put on the African Summit agenda in February of 2004?

3:: In what ways did the Nile Water Agreement of 1929 give Egypt an advantage over other African nations?

4:: What pressures intensified the demand for the Nile Basin countries to re-negotiate the 1929 agreement?

5:: Identify and explain the four suggested alternatives for Egypt.

6:: Why would Egypt been considering or threatening the use of force against other African nations? Why was Egypt's use of force unlikely?

7:: Ethiopia and Tanzania announced plans to construct dams and pipelines. According to the article, the Egyptian perspective at that time was, "any change in the volume of its water could have devastating effects on Egypt". Describe the position of the leaders of Ethiopia and Tanzania.

8:: If you were an Ethiopian Minister of Water how would you have responded to threats from Egypt designed to prevent you from accessing Nile water?

Answers:

1:: Burundi, Democratic Republic of Congo, Egypt, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda

2:: The Nile Water Agreement of 1929

3:: Other countries could not build structures that would reduce the amount of water flowing into Egypt. Also, the agreement gave Egypt the right to "inspect and investigate" the entire river.

4:: Population, frequent droughts and increasing soil salinity

5:: (see article for descriptions/descriptions may vary)
1. **Reduce waste through an improved irrigation system**
2. **Begin charging market rates for water**
3. **Maintain the status quo**
4. **Resort to the use of force**

6:: Egypt wanted to maintain the dominant access to the Nile provided by The Nile Water Agreement of 1929. Egypt was unlikely to use force because it did not have the military capability to take on such a large effort and ultimately would not be able to justify the validity of the 1929 agreement.

7:: The Ethiopian Minister of Water Resources stated that Ethiopia has the right to implement any project in the Blue Nile Sub-basin at any time. The Deputy Permanent Secretary in the Tanzanian Ministry of Water and Livestock Development questioned the legality of the water agreement and stated that Tanzania is not restricted from using Nile waters.

8:: Answers will vary.

:: **High School**
:: **"Tragedy of the Water Commons"**
:: **Difficulty and duration: *****

Objective
Introduce students to the concept of The Tragedy of the Commons and apply the concept to address the global water crisis. Student will gain insight into the global water crisis and interpret information illustrating the lack of access to freshwater in many developing nations.

Lesson
At tables of four, students will review materials that will help them better understand the global water crisis.

Background
In 1968, environmentalists coined a term or concept called the Tragedy of the Commons. The tragedy being the notion that any resource that is open to everyone – such as the air, rivers and lakes, or the ocean – will eventually be destroyed because everyone can use the resource but no one is responsible or fully accountable for preserving it. When people are not compelled to preserve resources for the welfare for future generations, the Tragedy of the Commons occurs.

Materials
Before the activity begins you must set-up the room so that four students can each sit around a table. In the middle of the table, for each group, the teacher will place a dish (this represents the lake) containing varying numbers of orange goldfish crackers. Eighteen crackers are suggested for one of the groups. Sixteen crackers are suggested for two or three of the groups. Ten crackers are suggested for one of the groups. Eight crackers are suggested for one of the groups. Place four sets of chopsticks (they represent the fishing apparatus) at the table.

1:: Read the following to students: Each one of you represents the head of a family that is starving. In order for your family to survive, you must catch enough fish for them to eat. The only food source is a small local lake which can hold up to 16 fish. Each group will be given a predetermined, differing number of fish to represent access to, or the lack of access, to water as a resource.

Once a "year" you will get a chance to fish and each time you fish you may take 0, 1, 2, 3, or 4 fish from the lake. It is your choice how many fish you take, however, if you only take one fish, your family will starve. If you take more than 2 fish, you can sell them for a profit. The fish in your lake will reproduce once a year. Keep the fish that you "catch" in front of you. (You will be able to eat them later.)

2:: At the end of each year, the teacher will visit each table and add more fish to the lake when they reproduce. They simply double each year. If any family has starved then they obviously cannot fish the next year.

3:: Instruct students not to communicate while fishing

4:: Have the student fish for 5 "years" and make sure that they fill in the Data Table for 1st game after each round. You should control each and every round telling them when to start and stop.

5:: After the first game have students answer questions 1 and 2 in the discussion questions.

6:: The students have still been unable to talk to each other during fishing so now you begin game #2. Remind students not to communicate with each other.

7:: Once the game is complete, have students answer the discussion questions.

8:: Facilitate a class discussion focusing on the questions provided. Extend this to have students look at how the U.S and other countries use water as a global common.

FISH DATA TABLE
1st game

NAME OF LAKE: _____ BEGINNING # OF FISH: _____

	Number of fish in the lake [after reproduction]	Number of fish caught per person	Number of fish caught per year [by everyone]
YEAR ONE			
YEAR TWO			
YEAR THREE			
YEAR FOUR			
YEAR FIVE			
TOTAL			

FISH DATA TABLE
2nd game

NAME OF LAKE: _____ BEGINNING # OF FISH: _____

	Number of fish in the lake [after reproduction]	Number of fish caught per person	Number of fish caught per year [by everyone]
YEAR ONE			
YEAR TWO			
YEAR THREE			
YEAR FOUR			
YEAR FIVE			
TOTAL			

Tragedy of the Water Commons" Discussion Questions

1:: Did anyone in your group take too many fish? How did that make you feel? Did everyone try to take as many as possible? Why or Why not? Does society reward those with the "most" or greatest access to resources?

2:: Did your group start out at a disadvantage with fewer fish or with an advantage of more fish than other groups? How did the number of fish your group started with affect the team's strategy?

3:: How might a lack of access to safe, clean drinking water place individuals and communities at a disadvantage in their daily lives?

4:: Is it possible to maximize the number of fish caught/person AND the number of fish remaining in the pond at the same time? Why or Why not?

5:: The game is structured to illustrate why many people/corporations/farms/governments, etc. have abused their privilege of access to common natural resources such as freshwater. Does the game successfully demonstrate this principle? Why or why not?

6:: In Game two how did your strategy change, if at all? Does it make a difference to know what the rewards are?

7:: What can people do to create access to safe, clean drinking water for countries or regions who "begin the game with fewer fish" or are at an apparent disadvantage to other more developed regions?

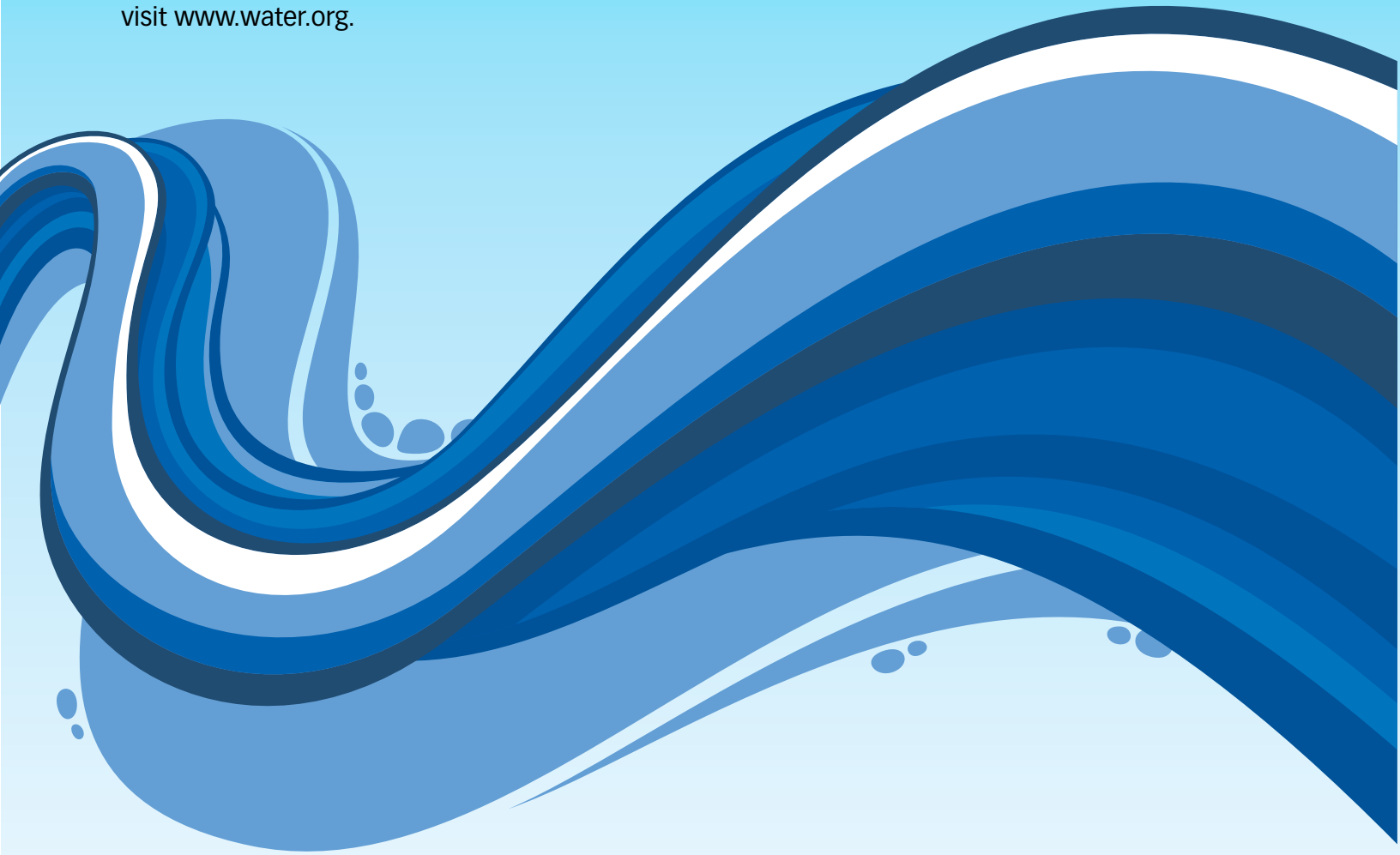
8:: Did anyone sacrifice the # of fish, for the good of the community? Why or why not? Does society ever reward that type of person?

9:: What infrastructures are in place to protect water as a global common?

10:: How might nations reward one another for protecting water as a valuable global commons resource?

ABOUT WATER.ORG

Water.org is a non-profit organization whose founders have transformed hundreds of communities in Africa, South Asia and Latin America by providing access to safe water and sanitation. Founded by Matt Damon and Gary White, Water.org works with local partners to deliver innovative solutions for long-term success. Its microfinance-based WaterCredit Initiative is pioneering sustainable giving in the sector. Water.org's life-saving work is made possible by the support of its donors, including the Open Square Foundation, the Pepsico Foundation, OnexOne and the Michael & Susan Dell Foundation. To learn more visit www.water.org.



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