

DROPS OF KNOWLEDGE FOR RIVERS OF CHANGE



GLOBAL TEACHING AND
LEARNING MATERIAL

A hands-on guide to teaching
and learning about
water, sanitation, hygiene,
and the environment

SWAROVSKI
WATERSCHOOL

BACKGROUND INFORMATION

Clean water is vital to every aspect of human life—we cannot survive without it. But dirty water is dangerous and can be deadly, especially for infants and young children. UN Water reported that, as of 2013, 2.5 billion people, including almost 1 billion children, did not have even basic sanitation. Every 20 seconds, a child dies as a result of poor sanitation, unsafe water, and lack of good hygiene—that equals 1.5 million deaths each year that could be prevented with access to sanitation, good hygiene, and safe water.⁸

Up to 80% of untreated sewage comes from human settlements. Another primary source of water pollution is related to waste from industrial and agricultural activities. Two million tons of sewage and other waste drain into the Earth's waters on a daily basis, without any treatment.⁹

All living beings—humans, animals, plants, and trees—need water to survive, and also release water in different forms. One of the ways that people release water from their bodies is by exhaling breath. (A simple exercise is to take a deep breath and exhale onto a mirror, then look at all the water that

comes out.) Perspiration is another way that the human body releases water. Transpiration is water being released as mist from the leaves of plants when they breathe. In the Earth's natural processes, evaporation is water being transformed to mist in the environment from the heat of the sun.

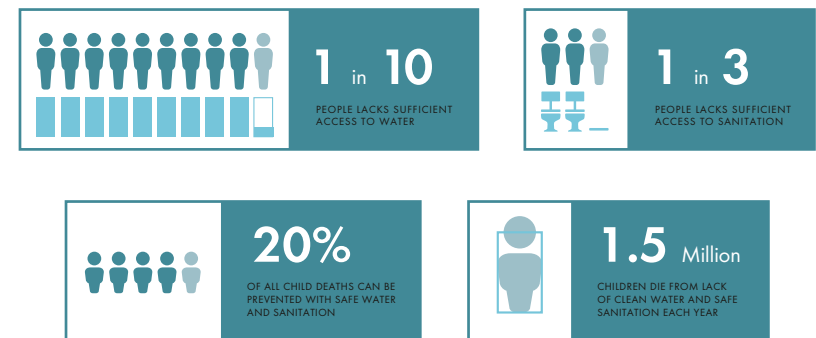
DID YOU KNOW? More than 700 million people lack access to improved sources of drinking water, and more than one-third of the global population—around 2.5 billion people—do not use an improved sanitation facility.¹

These deprivations cause illnesses that can be fatal, particularly for children. Nearly one out of every five deaths among children under age 5 is due to diarrhea—more than AIDS, malaria, and measles combined.²

SOURCE: (1) Joint Monitoring Programme for Water Supply and Sanitation, Progress on Drinking Water and Sanitation: Update 2014, Geneva and New York: World Health Organization and UNICEF, 2014, p. iv. Available at: www.wssinfo.org. (2) UNICEF and World Health Organization, Diarrhoea: Why Children Are Still Dying and What Can Be Done, 2009, p. 1. Available at: www.who.int/maternal_child_adolescent/documents/9789241598413/en

“An estimated 801,000 children younger than 5 years of age perish from diarrhea each year, mostly in developing countries. This amounts to 11% of the 7.6 million deaths of children under the age of five and means that about 2,200 children are dying every day as a result of diarrheal diseases.”

— CENTERS FOR DISEASE CONTROL
ADDITIONAL RESOURCES¹⁰



⁸ UN Water, “Factsheet: Sanitation,” 2013. Open PDF from: www.unwater.org/fileadmin/user_upload/watercooperation2013/doc/Factsheets/sanitation.pdf. ⁹ UN Water, “Water Quality,” web page and Factsheet, www.un.org/waterforlifedecade/quality.shtml. ¹⁰ Centers for Disease Control Additional Resources, https://www.cdc.gov/healthywater/global/wash_statistics.html

ACTIVITIES FOR WATER BASICS

THEMATIC CONCEPTS

Safe water – Safe water is water that will not harm you if you come in contact with it. To be safe, the water must have low concentrations of contaminants to avoid sickening the people who use it. The list of harmful contaminants includes bacteria, viruses, protozoans, pesticides, organic solvents, petroleum products, and other toxic substances.¹¹

Dehydration – Dehydration is the condition that results from excessive loss of body water. In severe acute malnutrition, dehydration is caused by untreated diarrheal disease that leads to the loss of water and electrolytes. Diarrheal disease is caused by poor cleanliness and contact with contaminated food or water. It is widespread in developing countries, where more than 700 million people do not have access to clean water and 2.5 billion people do not have access to basic sanitation.¹²

WASH – Water, sanitation, and hygiene are frequently mentioned together and referred to as “WASH.” Because poor water, sanitation, and hygiene have serious consequences for children’s lives around the world, many worldwide organizations have WASH programs. Without proper WASH, sustainable development will not become a reality.¹³

ACTIVITY 3.1: MAKING WATER SAFE TO DRINK

Depending on what we plan to use it for—drinking, cooking, personal hygiene, cleaning, or laundry—there are different types of treatments to make water safe. Home and school-based water purification makes good sense and “good cents” because they are simple, low-cost methods which help protect us from drinking or washing with unsafe water that can cause disease. For drinking water, treatments include disinfecting the water with heat (boiling), chemicals (chlorine), or sunlight. Another common treatment is to pass the water through a ceramic (clay) or sand filter.

Boiling is one of the most effective methods to make water safer to drink by killing disease-causing organisms, including viruses, bacteria, and parasites. If the water is cloudy or contains debris, it must be filtered first. Then the clear water must be brought to a rolling boil for three minutes and then cooled.

After an emergency, such as a flood, hurricane, or earthquake, drinking water may not be available or safe. As a result, residents often have to find a source of safe drinking water or know how to treat their water for drinking, cooking, washing hands, and brushing teeth. Even without disasters, many types of foreign materials and contamination make their way into our waterways. In developing countries, inadequate infrastructure for water treatment poses great danger to people’s health and to the ecosystem.

In this activity, the participants will add a variety of pollutants to the water and experience the ease or difficulty in removing them by using different kinds of filters. While the experiment is not intended to teach children how to filter water, it is designed to encourage curiosity and stimulate experimentation, developing students’

DID YOU KNOW? Water that has been boiled to purify it should be handled carefully, stored in a covered container, and used within 24 hours to prevent recontamination.

Sunlight can be used to disinfect small quantities of water, by filling clean bottles with pre-filtered, clear water and setting them out in the sun (usually on rooftops) for six hours.

SOURCE: UNICEF, Water, Sanitation and Hygiene for Schoolchildren in Emergencies: A Guidebook for Teachers, New York: United Nations Children’s Fund, November 2011, p. 21. Open PDF from: www.unicef.org/wash/files/WASH_in_Schools_in_Emergencies_Guidebook_for_teachers_.pdf.

¹¹ U.S. Geological Survey, “How Do You Define Safe Water?” www.usgs.gov/faq/categories/9814/2864. ¹² UN Water, “Facts and Figures,” www.unwater.org/water-cooperation-2013/water-cooperation/facts-and-figures/en. ¹³ See, for example: UN Water, Investing in Water and Sanitation: Increasing Access, Reducing Inequalities – Global Analysis and Assessment of Sanitation and Drinking-Water, Geneva: World Health Organization, 2014. Available at: www.who.int/water_sanitation_health/publications/glaas_report_2014/en.

problem-solving abilities related to methods for making water safe.

Time: 50 minutes / **Thematic Areas:** Health, Science / **Goal for Learning:** Introduce the concept of filtering water at school or at home, and encourage students to learn more about making water safe.

Materials: □ 2 large, wide-mouthed clear glass or plastic jars / □ Water (cool or room temperature) / □ Miscellaneous small items, such as gravel, seeds, leaves, paper clips, shredded paper, flower petals, seasoning, such as pepper, cinnamon or other organic or nonorganic material / □ Small objects made of iron and a magnet, if available / □ Liquid food coloring / □ Strainer (large enough to cover the top of the jars) / □ Basket-style coffee filter, light cloth or robust paper towel

Optional Extension: □ One-liter clean/recycled soda bottle(s) filled with dirty water / □ WADI device (a solar water disinfection device)

“I was selected to participate in Escola d'Agua (Swarovski Waterschool) because I like to show my friends and family how to use the clay water filters.”

— ODIRLE IA, AGE 12,
ESCOLA SÃO BENEDITO,
AMAZON RIVER.

SELF MADE CLAY WATER FILTER,
SWS BRAZIL



ACTIVITY STEPS:

- 1 Fill one jar more than halfway with water.
 - 2 Add the miscellaneous small items, iron objects, and food coloring.
 - 3 Let the mixture sit for a while, allowing the pollutants to settle. Ask students to notice the turbidity (cloudiness or haziness) of the water in the jar and to guess ways to make the water clean again.
 - 4 If using iron objects, wave the magnet around under the water and attempt to pull these objects out of the jar.
 - 5 Hold the strainer over the second jar and pour the contents from the first jar through the strainer. Notice and discuss what was filtered out and what is left in the water.
 - 6 Attach the coffee filter or paper towel to the top of the empty jar and pour the water through, filtering it one more time.
 - 7 Use other types of household materials, such as a cotton t-shirt or a kitchen colander to filter water. Also try the filtering process with sand or charcoal, as available.
- Optional Extension:**
- 8 Put one or more recycled plastic soda bottles filled with contaminated water into the sun. Place the WADI device next to the bottle(s). When the smiley face appears, the water is safe for drinking.



LOCALLY ADAPTED WATER FILTER
ACTIVITY, SWS CHINA

OBSERVATION AND DISCUSSION:

Talk about how easy or difficult it is to remove materials and contamination from the water. After it is filtered, does the water return to normal? Is it clear and colorless, or do some stubborn contaminants stay behind? Talk about what kinds of contaminants these might represent (chemicals, bacteria, etc.) How could you filter these types of contaminants?

Learn more and talk about the ways water is actually prepared for human use in your area. How is sewage treatment handled? If there is a water treatment plant nearby, consider making arrangements to visit. To find local water utilities, refer to the national environmental protection agency, ministry of environment, or rural development agency. Here are two examples: Uganda Ministry of Water and Environment, Rural Water Department, www.mwe.go.ug/index.php?option=com_content&view=category&layout=blog&id=19&Itemid=182, and U.S. Environmental Protection Agency, Local Drinking Water Information, <http://water.epa.gov/drink/local>.

Compare and contrast the means of sanitation in other areas of the world.

Learn more about water, sanitation, and hygiene (WASH) at the UNICEF websites: “Water, Sanitation and Hygiene” (www.unicef.org/wash) and “WASH in Schools” (www.unicef.org/wash/schools). To find out more about water and health, see: World Health Organization, “Health Topics: Water,” www.who.int/topics/water/en, which is available in Arabic, Chinese, English, French, Russian, and Spanish.

CELF, “Meet the Pathogens,” Chappaqua, New York: Children’s Environmental Literacy Foundation, 2014. Available at: <http://www.celfeducation.org/Websites/celf/images/Meet%20the%20Pathogens%20.pdf>

Prüss-Üstün, Annette, et al., *Safe Water, Better Health*, Geneva: World Health Organization, 2008.

Open PDF from: http://apps.who.int/iris/bitstream/10665/43840/1/9789241596435_eng.pdf

USAID Hygiene Improvement Project and Academy for Educational Development. “A Compendium of Resources: Integrating Water, Sanitation and Hygiene into Primary Schools and Teacher Training,” Washington, DC: United States Agency for International Development, June 2009.

Open PDF from: http://pdf.usaid.gov/pdf_docs/Pnadw496.pdf

Water Project, “Lesson Plan: Dirty Water ... So What?” Concord, New Hampshire,

<http://thewaterproject.org/resources/lesson-plans/dirty-water-so-what>

Water Supply and Sanitation Collaborative Council, “Global WASH Campaign,”

<http://wsscc.org/global-sanitation-fund/>

The WADI is a solar powered UV-measurement device that serves as an indicator for the process of solar water disinfection.

<https://www.helioz.org/index.php>

“Water and sanitation are among the most powerful preventive medicines available to governments to reduce infectious disease. Investment in this area is to killer diseases like diarrhoea what immunization is to measles—a life-saver.”

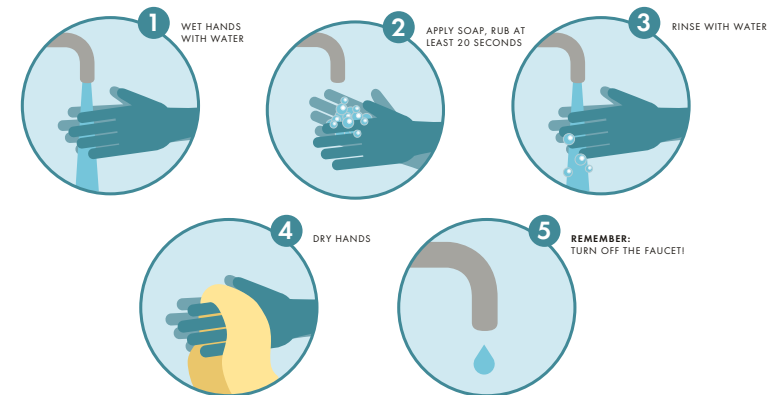
— UNDP HUMAN DEVELOPMENT REPORT 2006¹⁴

¹⁴ Watkins, Kevin, UNDP Human Development Report 2006: Beyond Scarcity: Power, Poverty and the Global Water Crisis, New York: United Nations Development Programme, 2006, p. 6. Available at: www.undp.org/content/undp/en/home/librarypage/hdr/human-development-report-2006.html.

ACTIVITY 3.2: GERM DETECTION AND HAND WASHING

Most of the germs that cause diarrhea, cholera, and other waterborne diseases come from exposure to human and animal feces. Many illnesses can be prevented by good hygiene and access to sanitation. Much of the health benefit of water supply and sanitation is realized through changes in our behavior. Hygiene education and promotion of good hand-washing practices, especially in primary schools, can save lives.

Do your students wash their hands after visiting latrines and before eating? Do they use soap? Each year, nearly 22 million school days are lost to the common cold alone. When children practice healthy habits, they miss fewer days of school. Thoroughly washing hands is the single most important thing students can do to keep from getting sick or infecting others. The typical person’s hands contain millions of microbes. Most are naturally occurring and are harmless, but some may be disease-causing germs. Vigorous hand washing—for at least 20 seconds and using soap—is the best way to lift off the microbes and rinse them away.




Source: <http://www.cdc.gov/features/handwashing>

¹⁵ Centers for Disease Control and Prevention, “Stopping the Spread of Germs at Home, Work & School,” Atlanta: United States Government, September 4, 2014, www.cdc.gov/flu/protect/stopgerms.htm.

The experiment in this activity vividly shows students the importance of hand washing. It can be conducted with an ultraviolet (UV) light, also called a “black” light, and powder or gel that simulates the presence of germs on students’ hands. Examples include products that are commercially available from Glo Germ (www.glogerm.com) or Germ Juice (www.germjuice.com).

Time: 50 minutes / **Thematic Areas:** Science, Health, Life Skills / **Goal for Learning:** Students learn that “clean” hands may not be so clean after all and discover the critical importance of washing their hands to prevent the spread of disease.

 **Materials:** Pens/crayons and paper / Gel that simulates the presence of germs on students’ hands / UV light / Place for washing hands with soap (sink, basin, or other) / Towels

ACTIVITY STEPS:

- 1 Ask students, “How do you think germs are spread? If one person has a cold, how can you catch it?”
- 2 Students will give many answers, such as “If you sit next to them”; “If you drink out of their cup”; and “If they sneeze on you.” Write these answers down
- 3 Next, ask students to develop a chart that will help them score how clean their hands are. Divide a large piece of paper into five sections. Trace the outline of a hand in each section. Now have students use pens or crayons to shade their idea of completely dirty, very dirty, dirty, and slightly dirty hand. Label the completely dirty hand as +++, the very dirty hand as ++, and so on. Use a minus sign (-) to represent the “completely clean” hand.
- 4 Spread some of the germ-simulating gel, paint, or powder evenly on both of a student’s hands, including the backs of the hands and the skin next to and under the fingernails. Allow the material to dry completely on the student’s hands (this should take a minute or two). Then place the student’s hands under the UV light.

- 5 Under the light, the “germs” will show up. Have other students use the chart to determine the cleanliness of the student’s hands that are covered in germs
- 6 Have the student wash her or his hands for 5 seconds. Stop and check the cleanliness of the hands under the light. Record this as “5 seconds.”
- 7 Have the student wash her or his hands for an additional 5 seconds. Stop and check under the light. Record this as “10 seconds.”
- 8 Repeat the procedure two more times, for 15 and 20 seconds. Each time, have students record the level of cleanliness. 9. Change roles and repeat the activity until everyone has had a turn being the hand washer.

Optional Extension:

- 9 If gels and UV lights are not available, you can substitute either a nontoxic, water-soluble children’s paint or a mixture of vegetable oil, baking flour, and food coloring. In this case, one student will smear the paint or mixture on her or his hands, then shake hands with the group, and all can check their hands to see how the “dirt” travels from one person to another.



GIRLS WASHING HANDS

**OBSERVATION AND DISCUSSION:**

Discuss with students what they have learned from the hand-washing experiment; that it is not easy to remove germs. It is necessary to use both soap and water, to wash hands for at least 20 seconds, and to rub vigorously.

Discuss with students how germs can be picked up or spread through inadequate hand washing. Cold viruses can be spread by touching people or objects. Many waterborne diseases such as diarrhea are spread through contact with contaminated water. Young children can put a toy in their mouth and then give it to another child, who picks up germs from the toy. Ask children to think about other examples. Hand washing protects you from illness, and also protects other people you may encounter.

Explain to students that because germs are living organisms, they require certain conditions to live. The “environment” is the surroundings and conditions external to the host that cause or allow the disease to be transmitted. Some diseases live best in dirty water. Others survive in human blood. Still others, such as E. coli, thrive in warm temperatures but are killed by high heat (such as boiling water).

Crawford, Elizabeth O., “Water and Sanitation for All: Bringing the Issue Home – An Early Childhood Unit (Pre-K to 2),” New York: TeachUNICEF, 2010. Open PDF from: http://teachunicef.org/sites/default/files/units/Water-and-Sanitation_PreKto2.pdf

Global Public-Private Partnership for Handwashing with Soap, “Global Handwashing Day,” 2015, <http://globalhandwashing.org/global-handwashing-day>

Khamal, S., et al., *Joyful Learning on Hygiene, Sanitation, Water, Health and the Environment: A Source Book for Lesson Plans*, Delft, The Netherlands: IRC International Water and Sanitation Centre, 2004. Available at: www.wsp.org/Hygiene-Sanitation-Water-Toolkit/Resources/ReadingsLifeSkills.html



ACTIVITY 3.3: WATER IN OUR BODIES AND DEHYDRATION
(Adapted from the Swarovski Waterschool programs in Austria, Brazil, and Uganda)

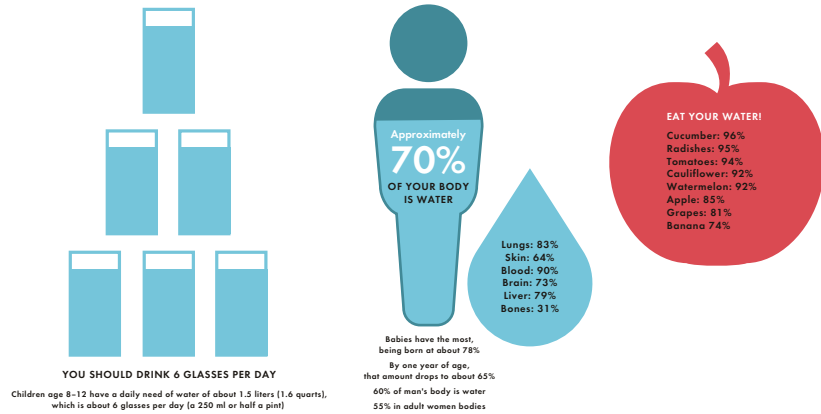
Without water, we would not exist and life on the Earth would not be possible. The water content of a child’s body is about 60%. If she or he weighs 25 kilograms (55 pounds), the water content is about 15 kilograms, or 15 bottles of water. Children ages 8–12 have a daily need of water of about 1.5 liters (1.6 quarts)—so they need to drink about 1 liter (1 quart) of water a day, gaining the rest of the water content they need from the food they eat. An apple, for example, has a water content of 85%.

All people lose water through respiration, perspiration, and excretions. Usually, this is a healthy process that removes waste from our bodies. Small decreases in water do not cause problems and, in most cases, they go completely unnoticed. But not drinking enough to keep up with the loss of fluid can sometimes make a person feel quite sick.



DRINKING ENOUGH WATER IS IMPORTANT


When someone gets dehydrated, it means the amount of water in her or his body has dropped below the level needed for normal bodily functions. One common cause of dehydration in children is gastrointestinal illness. This type of sickness causes our bodies to lose fluid through vomiting and diarrhea, which in many places is caused by contaminated water. You can also get dehydrated from playing sports or other extensive physical activities. If you do not replace fluids lost through heavy sweating, you can become dehydrated, especially on a hot day. Be sure to drink plenty of water to keep active!




Source: <http://water.usgs.gov/edu/propertyyou.html>

For a simple way to demonstrate dehydration over time, gather two flowers, the same kind and size. Place one in a glass of water on a sunny windowsill or ledge and set the other on the surface of the ledge. You and the students can observe and comment on what happens to the flowers as the days go by. After a few days, show and compare the fresh and withering flowers: one flower was able to “drink” the water through the capillaries in its stem, while the other was experiencing water stress and therefore withered.

Time: 50 minutes / **Thematic Areas:** Health, Science / **Goal for Learning:** Encourage awareness that humans and all living creatures are alive through water: drinking enough water is essential for healthy living, and fruits and vegetables are also important sources of water.

 **Materials:** □ 15 bottles of water (liters or quarts); ask students to bring in clean, recycled bottles and fill them with fresh water / □ Water drop fact sheet for each participant (a sample is provided in Annex B on page 156) / □ Pencils/pens and paper to write on / □ Scissors/ □ Cellophane tape

 **Optional Extension:** □ Solar food drier / □ Scale / □ Fruit (an apple is good, if available) / □ Mushroom, potato, or other vegetables

ACTIVITY STEPS:

- 1 To demonstrate the water content of a human body one student stands up and is surrounded by 15 bottles of water (the other students could help place the bottles around their classmate). Explain that these bottles equal the content of water inside the student’s body.
 - 2 After clearing away the bottles, ask students to make a list of how they think water functions in their bodies. Then pass out a copy of the water drop fact sheet to each student. (You might want to make two versions: one with empty water drops that the students can fill in with their ideas and one with the text included.) Discuss the different ways water helps you stay healthy, comparing the students’ ideas to the fact sheet.
 - 3 Ask students to cut out the water drops from their fact-sheet page(s). Then have them tape the water drops to their body in a place that is appropriate for the function described. For example, the drop that reads “water is important to my body because it helps me cool down when I am hot” can be placed anywhere on the skin to indicate sweat. The water drop about removing wastes can be placed on the kidneys (lower back), and so forth. (As an alternative to taping the drops on themselves, students could make a large drawing of a person on plain wrapping paper, then tape the drops on the drawing.)
 - 4 Once students have placed all the water drops, discuss each function and have students check how water works inside their bodies. This could include talking about perspiration, saliva, or excrement (urine and feces removing waste from the body). Questions could include: When do we sweat, and where does that water come from? Do you notice that your mouth feels dry when you are really thirsty after running? What are the ways that we can keep our bodies hydrated?
- Optional Extension:**
- 5 Obtain a food drier or build a solar food drier. Have students weigh a few food items such as an apple, a mushroom, and a potato, and write down the weight of each item.

- 6 Let students add these food items to the drier, then predict what the foods will look like when they are dry.
- 7 After drying is complete, weigh the dehydrated food and then compare that weight to the “before” weight. The difference equals the amount of water that has evaporated from the food into the air. How much water did the food contain?

OBSERVATION AND DISCUSSION:

Discuss the similarities and differences between the way water leaves our bodies—and how that can cause dehydration and the way water leaves the fruits and vegetables.

Talk about what happens to our bodies when we lose water through perspiration, and how the water can be replenished, for example, by drinking water and eating fruits and vegetables.

ADDITIONAL RESOURCES:

Science Buddies, “Staining Science: Capillary Action of Dyed Water in Plants,” *Scientific American*, August 16, 2012, www.scientificamerican.com/article/bring-science-home-capillary-action-plant

UNICEF and Alliance of Youth CEOs, “Sample Activity: How to Make a Solar Cooker,” *Climate Change: Take Action Now!*, pp. 70–72. Open PDF from: www.climatecentre.org/downloads/files/Youth%20docs/AYCEOs_climate-change_take-action-now_EN.pdf

USGS Water Science School, “The Water in You,” U.S. Geological Survey, March 19, 2014, <http://water.usgs.gov/edu/propertyyou.html>

SWS CHINA, CHILDREN AS WATER AMBASSADORS



“Not only has my son brought back water saving methods into our home, but he has also shared this with his uncles and aunts. Now they also use laundry water to flush toilets!”

– PARENT, SWAROVSKI WATERSCHOOL
CHINA

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