Waterworks Around the World

(Grades 9-12, Suggested time: 20-40 minutes)

Identify freshwater projects implemented globally by the engineering company CH2M Hill (www.ch2m.com) by using geographic information to locate them on a world map. Learn more about CH2M HILL projects by using project descriptions included in this activity to classify the name and location of the project sites, the type of water source, and the type of project on a chart.

Materials

- Tabletop World Political MapMaker Kit (**http://tinyurl.com/natgeoedmap**) one for each small group of students (or any table-top size world map)
- Tape
- Markers
- CH2M HILL engineering project clues (one set for each small group of students)
- Answer key table and map

Instructions

- Divide the class into groups of three to four students each.
- Distribute one tabletop World Political MapMaker set to each group of students. Have students assemble the map using tape. Give a brief whole-class review of longitude/ latitude and other basic map skills as needed.
- Distribute a set of engineering project clues to each group of students. Have them use the geographic information (latitude, longitude, and country and city name) to identify the location of each project and mark it on the map with a colored marker.
- Assign one project to each small group of students and have them read the project description on the project clues sheet to themselves.
- Create a chart with four columns on the board. Label the columns Project Name, Location, Water Type, and Project Type.
- Have a student from each group volunteer to fill in the columns on the board with the details they learned about their assigned project. See example below:

Project Name	Location	Water Type	Project Type
Orkeeswa Secondary School	Lashaine, Tanzania	Rainwater	Rainwater Harvesting System

- Pick two or three projects (depending on class time) and have a class discussion about the location of these projects, their respective water sources and issues, and the reasons why the type of project that exists there was chosen for these particular circumstances.

CH2M HILL Engineering Project Clues

1. Wetlands Project

Geographic Clue: 37°N, 77°W (Bermuda Hundred, Virginia, USA)
Project Type: Wetland restoration
Description: In this project, industrial wastewater with high nitrogen and phosphorus (nutrients that can result in algal blooms which adversely affect aquatic life and pollute surface water sources loads) is treated using wetlands, which naturally filter water. Since 90 % of the natural wetlands in the area have been destroyed, a 15-hectare manmade wetland, bigger than 18 soccer fields, was developed. The wetland includes more than 150,000 plants of 15 different species and is now home to more than 85 varieties of animals that come and go with the seasons, including birds, foxes, turtles, deer, and more.

2. Los Palis Water Supply Project

Geographic Clue – 19°N, 71°W (Los Palis, Haiti)
Project Type– A solar pump, storage tank, water treatment unit, and new pipes
Description: During the dry season, residents have to walk 2 miles one way to the nearest river for water. In Los Palis, Haiti, a village of about 3,000 people, the existing water infrastructure was old, inadequate and contaminated. The villagers and an Engineers Without Borders team decided to upgrade the system by installing a new solar powered pump and disinfection system in the local schoolyard, as well as repairing the older pipes and storage cistern. Additionally**,** the community has agreed to a community water tax for future maintenance of the system and the local parish has agreed to match the amount raised by that tax by 100%.

3. Orkeeswa Secondary School

Geographic Clue – 3°S, 36°E (Lashaine Village, Monduli District, Arusha Region, Tanzania)
Project Type: Rainwater Harvesting System
Description: Due to the absence of permanent surface water, or groundwater aquifers, the people of Lashaine Village depend on seasonal watering holes (large depressions where water collects during the rainy season). The watering holes serve as the village's only water resources, shared by humans, livestock and wildlife. They often disappear (or evaporate) during the dry season. As a result, the villagers are left with only contaminated water stored in tanks, or they have to get water from neighboring villages. To combat this problem, the Indigenous Education Foundation of Tanzania (IEFT) hired the Engineers Without Borders-USA Portland Professional Chapter team to work with local contractors and villagers to create a rainwater harvesting system and solar energy system at Orkeeswa Secondary School. The water system includes two 60,000 liter tanks that collect rainwater from the school roof and a bio-sand filter to provide safe and reliable water.

4. London Tideway Tunnels

Geographic Clue: 51°N, 0°W (London, England, United Kingdom)
Project Type: Sewage System
Description: This program will modernize London's 150-year-old Victorian sewer system. The lack of capacity is currently causing weekly sewage discharges into the tidal area of the Thames River; the total amount of sewage discharged is enough to fill London's O2 Millennium Dome nearly 15 times. The construction of a new 32km tunnel under the City and a 10km tunnel under the River Lee will carry storm water and sanitary overflows to expanded and upgraded wastewater treatment plants. The tunnel diameters will be wider than three of London's buses placed side-by-side. The Lee Tunnel, the deepest tunnel in London, dives down to 98m below ground at its lowest point. This extreme depth enables the storm sewage to flow downwards to the wastewater treatment plant while also avoiding other tunnels, pipelines and cables that exist under London, particularly the Olympic Park cable tunnels.

5. Sharjah Desalination Plants

Geographic Clue: 25°N, 55°E (Sharjah, United Arab Emirates)
Project Type: Desalination Plant
Description: The environments and source waters of the three plant sites differ dramatically, each presenting unique design and engineering challenges. The Layyah Seawater Reverse Osmosis desalination plant lies on the Arabian Gulf, which has salinity levels among the highest in the world for seawater bodies. The Khor Fakkan and Kalba plants are located on the opposite side of the Oman Peninsula on the east coast of the UAE, facing the Arabian Sea. The engineering challenges have been addressed with an array of advanced desalination technologies. The Layyah and Khor Fakkan sites use filters for treatment of the raw seawater prior to reaching the high-pressure desalination system. Both plants use modern desalination technologies and energy recovery devices to minimize energy usage. The Layyah site incorporates an additional filtration system to better protect against accidental oil spills and seasonal algal blooms. Instead of conventional filters, the Kalba desalination plant will use ultrafiltration membranes that are specifically designed for Seawater Reverse Osmosis plants. All three plants incorporate the highest efficiency energy-recovery devices available.

6. Luggage Point Advanced Water Treatment Plant

Geographic Clue: 27°S, 153°E (Brisbane, Queensland, Australia)
Project Type: Water Treatment Plant
Description: By 2005, severe drought had caused the South East Queensland Reservoir levels to drop below 20% of total capacity. South East Queensland is one of the most heavily urbanized regions in all of Australia and continues to experience strong population growth (it is expected to grow from 2.8 million to 4.4 million by 2026). Representing a major component of the Western Corridor Recycled Water Project, the largest project of its kind in the Southern Hemisphere, Luggage Point uses a multi-step treatment process to recycle treated wastewater from the region's major wastewater treatment plants into potable quality water. The water reuse plant will provide a climate-independent water source for power stations, industry and agriculture, supplement drinking water supplies in regional dams and contribute to longer-term water management.

Waterworks Around the World – Answer Key

Project Name	Location	Water Type	Project Type
Wetlands Project	Bermuda Hundred, Virginia, USA	Industrial wastewater with lots of nitrogen and phosphorous	Wetland restoration
Los Palis Water Supply Project	Los Palis, Haiti	Groundwater from below the local schoolyard	A solar pump, storage tank, water treatment unit, and new pipes
Orkeeswa Secondary School	Lashaine, Tanzania	Rainwater	Rainwater harvesting system
London Tideway Tunnels	London, England	Wastewater from homes and businesses	Sewage system
Sharjah Desalination Plants	Sharjah, United Arab Emirates	Seawater from the Arabian Gulf	Desalination plant
Luggage Point Advanced Water Treatment Plant	Brisbane, Queensland, Australia	Wastewater from nearby wastewater treatment plants	Water-treatment plant