

# EWB Water for the World

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## Water Filter Activity

### Objectives

1. To introduce students to the global issue of access to clean drinking water
2. To make students enthusiastic about technology and its role in human development

Subjects: Science,  
Geography, Social  
Sciences

Time: 30-45 minutes

### Materials

The following is a list of materials you need for this activity:

- 1 500-mL plastic bottle per group
- ¼ cup of fine sand per group
- ¼ cup of coarse sand per group
- ¼ cup of fine gravel per group
- ¼ cup of coarse gravel per group
- 1 cotton ball per group
- 1 transparent plastic cup per group
- 1 small piece (about 10 cm<sup>2</sup>) of cheese cloth per group
- 1 rubber band per group
- Monopoly money
- Photocopies of country profiles and instruction handouts
- Scissors to cut the bottom of the plastic bottles

Here are some suggestions of where you can find the materials you need:

Material	Where to find it
500-mL plastic bottles	Recycling bins on recycling day
Buckets or plastic bins	Hardware store
Cheese cloth	Kitchen or car cleaning section of Canadian Tire
Cotton balls	Drug store or dollar store
Gravel (Coarse)	Hardware store in the garden section (e.g. Home Depot)
Gravel (Fine)	Hardware store in the construction section (beside cement)
Plastic cups	Grocery store
Rubber bands	Office supply store
Sand (Coarse)	Hardware store in the construction section (beside cement)
Sand (Fine)	Hardware store in the garden section

## Advance Preparation

1. Prepare the materials.
  - Cut the bottoms off the 500 mL bottles so they are ready for making filters
  - Find and cut an extra plastic bottle to prepare the “dirty water
  - ”Prepare “dirty water”; add approximately 2 tablespoons of soil or mud to 500mL of water.
2. Assemble country packages.
  - Each group will receive a handout that includes a country profile, instructions on how to make the water filter, and an amount of Monopoly money based on the table below:

Country	Monopoly Money	Distribution
Canada	\$500	5 x \$100
Canadian First Nations	\$500	5 x \$100
Kuwait	\$400	4 x \$100
South Africa	\$65	6 x \$10 & 1 x \$5
Ghana	\$40	8 x \$5
Kenya	\$30	6 x \$5
Malawi	\$50	10 x \$5

\*\* Allow countries with the least amount of money to buy supplies first (to have enough change at the store)

\*\* The amount of money distributed & quality of instructions are based off of the country's access to improved water sources

## Procedure

1. Put the filter materials in an easily accessible area at the front of the class (the “store”)
2. Divide the students into working groups (4-5 students per group). Distribute a country package to each group.
3. Explain to the students that they are to make a water filter as outlined on their instructions sheet. They may purchase the materials they need from the “store” using the Monopoly money that they have been given.
4. After about 20 minutes, have a representative from each group come up to the front of the room and demonstrate their water sample OR have the groups put their filters up at the front and go through the debrief while the filters are running.
5. Follow-up the activity with a discussion on how the activity relates to the real world. Follow the slide and script provided.

### Sources:

CIA The World

# Canada



## General

Area: 9,984,670 km <sup>2</sup>	Population: 35,881,659
Languages: English (Official), French (Official)	Urban: 81.4% Rural: 18.6% Population Growth Rate: 0.72%

## Drinking Water Resources

Improved Drinking Water:  Urban: 100% of population Rural: 99% of population Total: 99.8% of population	Unimproved Drinking Water:  Urban: 0% of population Rural: 1% of population Total: 0.2% of population
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This entry provides information about access to improved or unimproved drinking water sources available to segments of the population of a country. *Improved* drinking water - use of any of the following sources: piped water into dwelling, yard, or plot; public tap or standpipe; tubewell or borehole; protected dug well; protected spring; or rainwater collection. *Unimproved* drinking water - use of any of the following sources: unprotected dug well; unprotected spring; cart with small tank or drum; tanker truck; surface water, which includes rivers, dams, lakes, ponds, streams, canals or irrigation channels; or bottled water.

## Health

Life expectancy: 82 years
Infant Mortality Rate: 4.5 infant deaths / 1,000 live births

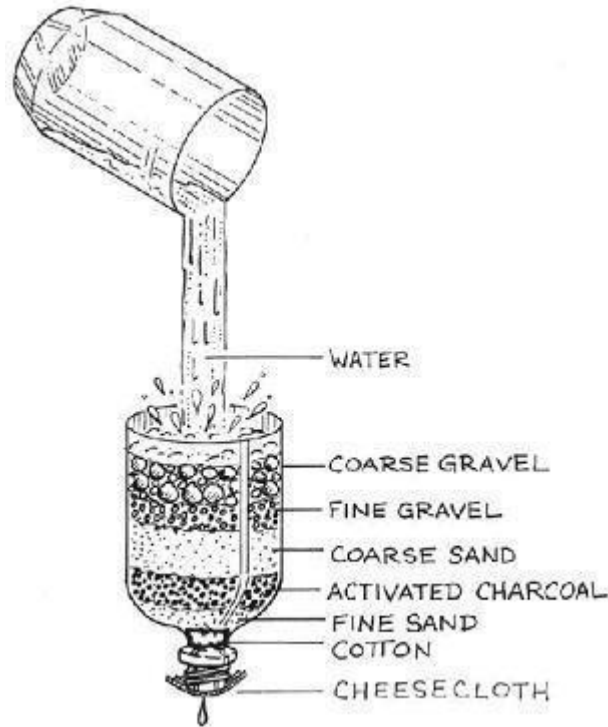
## Economy

GDP per capita (PPP US\$): \$48,400
Median Income (CAD\$): \$27,097

## Instructions

Instructions- Canada

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by 1-cm of coarse sand, fine gravel, and coarse gravel.
3. Clean the filter by slowly and carefully pouring through 1-litre of clean water (over a bucket).
4. Place the filter over a plastic cup. Now, test your water filter by pouring half of the dirty water through the filter.



Cost of Materials:

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		

# Canadian First Nations



## General

Area: 9,984,670 km<sup>2</sup> (Canada)

Population: 977,235

Languages: English, French, Cree, Inuktitut, Ojibwe, Innu, Dene, Mi'kmaq, Sioux, Atikamekw, and many others

Number of First Nations bands (First Nations governments): 617

## Drinking Water Resources

Federal funding allocated to First Nations water issues: \$2 billion

Communities with long-term boil water advisories: 33

Communities using well water: 20%

Bands at risk of water contamination: 73%

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## Health

Life expectancy: 72.5 years

Infant Mortality Rate: 9.6 infant deaths / 1,000 live births

## Economy

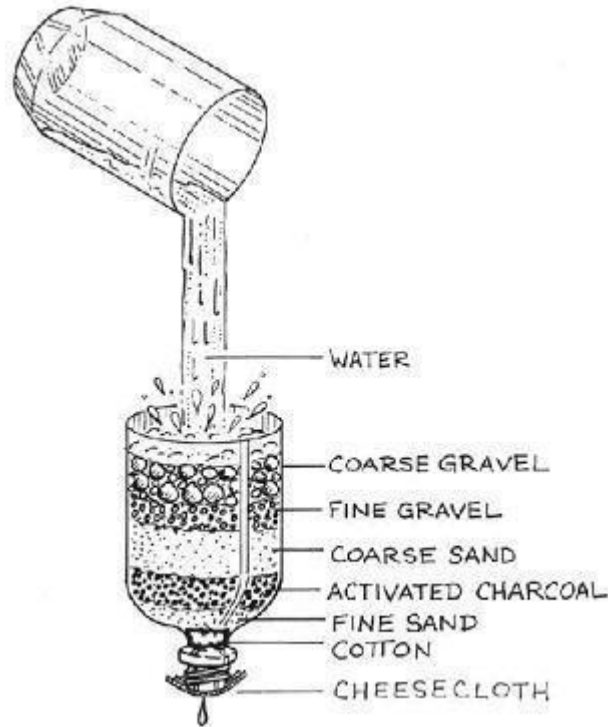
Indigenous and Northern Affairs Canada funding: \$8 billion

Median Income (CAD\$): \$18,962

## Instructions

Instructions- Canada

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by 1-cm of coarse sand, fine gravel, and coarse gravel.
3. Clean the filter by slowly and carefully pouring through 1-litre of clean water (over a bucket).
4. Place the filter over a plastic cup. Now, test your water filter by pouring half of the dirty water through the filter.



Cost of Materials:

Cheesecloth	\$20/square	Rubber Band	\$20 each
Cotton	\$20/ball	Sand, Coarse	\$80/portion
Gravel, Coarse	\$40/portion	Sand, Fine	\$80/portion
Gravel, Fine	\$40/portion		

# Kuwait



## General

Area: 17, 818 km <sup>2</sup>	Population: 4, 437, 590
Languages: Arabic (Official), English widely spoken	Urban: 100%
	Population Growth Rate: 1.38%

## Drinking Water Resources

Improved Drinking Water: Total: 99% of population	Unimproved Drinking Water: Total: 1% of population
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## Health

Life expectancy: 78.3 years
Infant Mortality Rate: 6.8 infant deaths / 1,000 live births

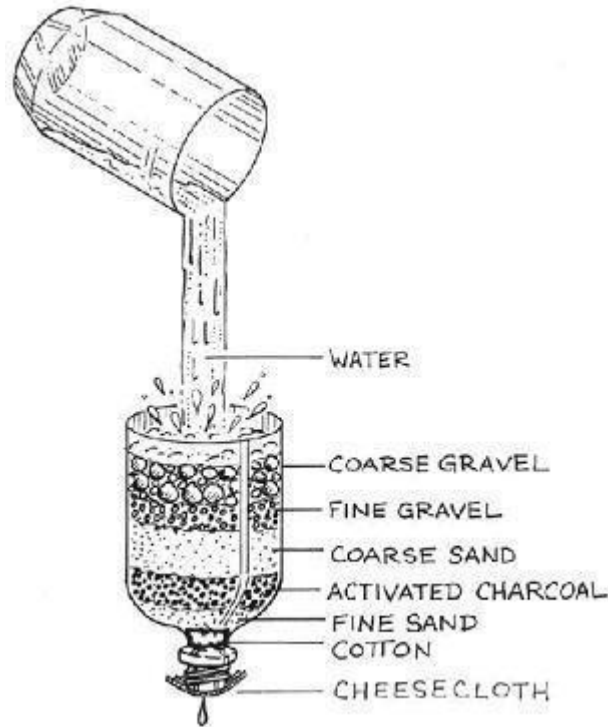
## Literacy

Adult Literacy: 95.7 % of the population age 15 and above
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## Economy

GDP per capita (PPP US\$): \$65,800
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1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by 1-cm of coarse sand, fine gravel, and coarse gravel.
3. Clean the filter by slowly and carefully pouring through 1-litre of clean water (over a bucket).
4. Place the filter over a plastic cup. Now, test your water filter by pouring half of the dirty water through the filter.



Cost of Materials:

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		

# South Africa



## General

Area: 1,219,090 km <sup>2</sup>	Population: 55,380,210
Languages spoken most often at home:  isiZulu (24.7%), isiXhosa (15.6%), Afrikaans (12.1%), Sepedi (9.8%), Setswana (8.9%), English (8.4%) Sesotho (8%), Xitsonga (4%) siSwati (2.6%), others 5.9%	Urban: 66.4% Rural: 33.6% Population Growth Rate: 0.97%

## Drinking Water Resources

Improved Drinking Water:  Urban: 99.6% of population Rural: 81.4% of population Total: 93.2% of population	Unimproved Drinking Water:  Urban: 0.4% of population Rural: 18.6% of population Total: 6.8% of population
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## Health

Life expectancy: 64.1 years
Infant Mortality Rate: 29.9 infant deaths / 1,000 live births

## Literacy

Adult Literacy: 94.4% of the population 15 years and above
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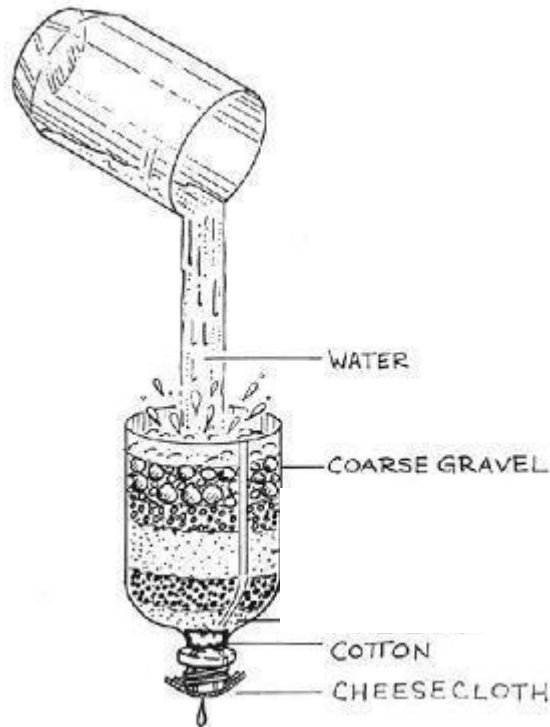
## Economy

GDP per capita (PPP US\$): \$13,600
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Instructions- South Africa

## Instructions

1. Loosely put a cotton ball in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of fine sand over the cotton plug, followed by 1-cm coarse sand, fine sand, and gravel.
3. Clean the filter by slowly and carefully pouring through 1-litre of tap water (over a bucket).
4. Place the filter over a plastic cup. Now, test your homemade filter. Pour half of the dirty water through the filter.



Cost of Materials:

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		



Instructions- South Africa

# Kenya

## General

Area: 580,367 km <sup>2</sup>	Population: 48,397,527
Languages: English (official), Kiswahili (official), Kiswahili numerous indigenous languages	Urban: 27% Rural: 73% Population Growth Rate: 1.57%

## Drinking Water Resources

Improved Drinking Water:  Urban: 81.6 % of population Rural: 56.8% of population Total: 63.2% of population	Unimproved Drinking Water:  Urban: 18.4% of population Rural: 43.2% of population Total: 36.8% of population
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## Health

Life expectancy: 64.6 years
Infant Mortality Rate: 36.1 infant deaths/ 1,000 live births

## Literacy

Adult Literacy: 78% of the population age 15 years and above

### Economy

GDP per capita (PPP US\$): \$3,500

Instructions- Kenya

## Instructions

1. Take a piece of cheesecloth and put a cotton plug in the neck of the cut plastic bottle, then secure the neck of the bottle with a rubber band of cheese cloth secured with a rubber band.
2. Add a 1-cm layer of coarse sand over the cotton plug, followed by 1-cm of fine sand, and a 1-cm layer of gravel.
3. Test the filter by carefully pouring clean water (from a bucket).
4. Place the filter over a plastic cup. Now, test your water filter by pouring some of the dirty water through the filter.

### Cost of Materials:

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		

# Ghana



## General

Area: 238,533 km <sup>2</sup>	Population: 28,102,471
Languages: English (Official), Asante (16%) Ewe (14%), Fante (11.6%) Boron/Brong (4.9%), Dagomba (4.4%), others (49.1%)	Urban: 56.1% Rural: 43.9% Population Growth Rate: 2.16%

## Drinking Water Resources

Improved Drinking Water:  Urban: 92.6% of population Rural: 84% of population Total: 88.7% of population	Unimproved Drinking Water:  Urban: 7.4% of population Rural: 16% of population Total: 11.3% of population
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## Health

Life expectancy: 67.4 years

Infant Mortality Rate: 34.1 infant deaths/ 1,000 live births

## Literacy

Adult Literacy: 76.6% of the population age 15 years and above

## Economy

GDP per capita (PPP US\$): \$ 4,700

Instructions- Ghana

## Instructions

1. Cut a piece of cotton cloth to fit around the neck of the cut plastic bottle, then

wrap the neck of the plastic bottle with a piece of cheese cloth with a rubber band.

2. Pour a 1-cm layer of fine sand over the plastic plug, followed by 1-cm of fine gravel, and coarse gravel.

3. Clean the filter and carefully wash it with

water (over a bucket).

4. Hang the filter over a plastic cup. To test the water filter by pouring some of the dirty water through the filter.

## Cost of Materials

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		

# Malawi



## General

Area: 118,484 km <sup>2</sup>	Population: 19,842,560
Languages: English (Official), Chichewa (Common), Chinyanja, Chiyao, Chitumbuka, Chilomwe, Chinkhonde, Chingoni, Chisena, Chitonga, Chinyakyusa, Chilambya	Urban: 16.9% Rural: 83.1% Population Growth Rate: 3.31%

## Drinking Water Resources

Improved Drinking Water: Urban: 95.7% of population Rural: 89.1% of population Total: 90.2% of population	Unimproved Drinking Water: Urban: 4.3% of population Rural: 10.9% of population Total: 9.8% of population
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collection. *Unimproved* drinking water - use of any of the following sources: unprotected dug well; unprotected spring; cart with small tank or drum; tanker truck; surface water, which includes rivers, dams, lakes, ponds, streams, canals or irrigation channels; or bottled water.

### Health

Life expectancy: 62.2 years

Infant Mortality Rate: 42.1 infants deaths / 1,000 live births

### Literacy

Adult Literacy: 62.1 % of the population age 15 and above

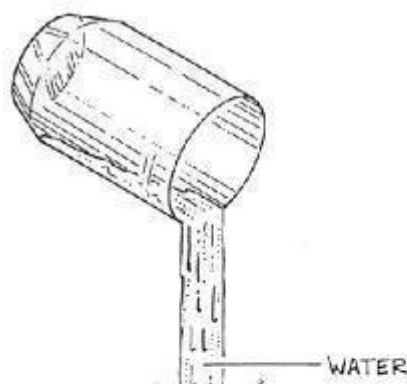
### Economy

GDP per capita (PPP US\$): \$1,200

Instructions- Malawi

## Instructions

1. Loosely put a cotton plug in the neck of the cut bottle, then cover the neck of the bottle with a piece of cheese cloth secured with a rubber band.
2. Pour a 1-cm layer of mud over the cotton plug, followed by 1-cm sand, fine charcoal, and gravel.
3. Clean the filter by slowly and carefully pouring through 1-litre of clean water (over a bucket).
4. Place the filter over a plastic cup. Now, test your charcoal filter by pouring half of the dirty water through the filter.



## Cost of Materials

Cheesecloth	\$5/square	Rubber Band	\$5 each
Cotton	\$5/ball	Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion	Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion		

Instructions- Malawi

## Store Master Price List

Rubber Band	\$5 each
Cheesecloth	\$5/square
Cotton	\$5/ball
Sand, Coarse	\$20/portion
Gravel, Coarse	\$10/portion
Sand, Fine	\$20/portion
Gravel, Fine	\$10/portion

**\*\*Note:** Portion refers to an about an inch in cup. Country must bring transportation vessel when purchasing (plastic bottle)

**\*\*\*Note:** Prices for Canadian First Nations are multiplied by four (4). E.g. Rubber Bands are \$20 each, Fine Sand is \$80/portion, etc.

### **Further Information on Canadian First Nations**

- Prices are inflated as equipment and materials must be transported long distances to remote First Nations lands and reserves.
- The costs of providing and maintaining adequate water treatment infrastructure for all First Nations still exceed what is provided by the Federal government.

### **Further Information on Malawi**

- Malawi has a significantly low GDP
- In fact, according to the CIA World Fact Book, Malawi is ranked 223 out of 228 countries, when comparing GDP on a purchasing power parity basis divided by population
- Engineers without Borders successfully launched a Water and Sanitation program in Malawi
- EWB is focused on systemic need and innovations that allow the government to improve management systems, identifying ways to ensure wells are monitored and maintained, and ensuring that sanitation efforts lead to learning and usage.

### **Key achievements of Engineers Without Borders In Malawi**

- EWB ran a program to generate low-cost creative approaches to strengthen local government's ability to support water, sanitation and hygiene service delivery in Malawi. Fifty percent of the districts in Malawi were inducted over this period. This unique program asked district governments to design new approaches within existing budget constraints, and provided embedded support to pilot, implement and scale them without extra funding.
- EWB created an effective space for motivated leaders to learn from each other, and EWB has seen districts adopt promising ideas from their peers. EWB also observed that districts are taking a more active role in pressing for change in the way they deliver rural water services, towards sustainable programs that can continue without the need for outside support.
- EWB successfully facilitated a two-year transition strategy for WaterAid Malawi out of one of its longstanding projects in Salima district. EWB developed and executed a process that examined the post-project context of the district, and worked directly to build the management skills and behaviors needed to sustain service delivery.
- At the closing workshop in March 2017, local government participants stated that because of this work they now have a better understanding of how their particular job can prevent loss of services after projects leave. At the end of the two-year period, EWB produced recommendations to WaterAid Malawi on how to conduct effective transition phases and to design future projects in ways which strengthen institutional sustainability.