

Introduce and Plan for Audit (1-2 meetings)

1. **Review** this audit guide and contact DOE with any questions.
2. **Introduce and discuss water use and conservation.** We encourage you to cover as many of the following topics as possible:
 - Conduct the **Drop in the Bucket** demonstration.
 - Fill your empty, clean milk jug to the top with water. Explain to the Club that this water represents *all* of the water in the world.
 - Tell students that you want them to guess how much of this water is available for everyday use. Have them suggest percentages.
 - Start dumping water out of the milk jug into the bucket. Tell students that you are now dumping out all of the salt water (which we can't drink, use to grow crops, use for bathing, etc.). Dump out all but ½ cup of the water. **97% of the world's water is salt water.**
 - Explain that what remains in the milk jug is fresh water, but not all of it is accessible. **About 80% of our fresh water is frozen in glaciers.** Dump this amount into the bucket. (All that should remain in the bucket is about 2 tablespoons of water).
 - Explain that not even all of the remaining water in the milk jug is available for human use. Some of that fresh water is in groundwater, mixed in with soil, or so badly polluted that it cannot be used. Dump a bit more water into the bucket.
 - What remains in the jug (1 ½ tablespoons of water) represents all of the world's fresh water that is fit for consumption and use – less than 0.5% of the world's water.
 - Of all the water that left in the jug, a large part of it is stored in the great lakes. **20% of the world's fresh water is found in the Great Lakes!**
 - Using the information from the Water Workshop's PowerPoint **presentation** and/or the **Putting the Pieces Together** activity starting on this page, explain where Chicago's water comes from and where it goes after it is used.
 - Have students **brainstorm some of their uses for water**, and some of the school's uses.

Putting the Pieces Together

Chicago has a very unique system of water management in comparison to other parts of the country. This activity clarifies the flow of the water that we use from its source in Lake Michigan, to filtration and treatment, to transport, to use, and then to treatment of wastewater.

Before the meeting:

1. **Cut out the puzzle pieces** for this activity (only the 17 *numbered* pieces from both pages).
 - They can be found in the Appendix of this guide on p.13-14, or on your Club's Water Resource CD.
2. **Place sets (17 pieces total) in envelopes.** The number of sets is up to you; the activity can be done individually, in pairs, in groups, or with the entire Club.
3. **Copy the Statement Sheet** (p. 3) for your students.
4. **Download the following two YouTube videos** onto a computer that your students can view.
 - Go to www.YouTube.com
 - In the Search field, enter "Illinois Drinking Water." With your students, view the first two hits, produced by ISAWWA:
 - **Part 1** (6 minutes, 47 seconds)
 - **Part 2** (4 minutes, 22 seconds)

During the meeting:

5. **Watch the video clips** as a group.
6. Pass out the puzzle pieces and Statement Sheet.
7. Explain that there are 17 puzzle pieces in the envelope, but that only **13 of them are correct.**
8. Each piece has a number that corresponds to a statement on the list. **If the statement is true, they should use the piece to complete the puzzle.** If the statement is false, they should return the piece to the envelope.





Putting the Pieces Together Statement Sheet

Chicago Conservation Corps (C3) Student Clubs
City of Chicago Department of Environment (DOE)



Answer the true/false statements below. *Hint: Only 4 are false!* The 13 that are true correspond to the 13 puzzle pieces you should use to complete the Water Flow puzzle. The wrong pieces will fit into the puzzle, but will not have correct information about the municipal water cycle – there might be incorrect captions or arrows. Make sure that you check your final puzzle against the answer key.

#	T/F?	Statement
1		After water goes down a drain in Chicago, it returns to Lake Michigan.
2		7.1% of electrical energy produced in the U.S. comes from hydroelectric power plants, while over 70% is generated using fossil fuels.
3		There is always new water available, so we needn't worry about conservation.
4		The Chicago region uses over 2 billion gallons of water per day.
5		Less than 1% of all the water on Earth is fresh, non-frozen, potable water.
6		Water that is taken out of Lake Michigan must be treated before it can be used by people.
7		The average Chicagoan uses 200 gallons of water per day.
8		Because energy is required to treat, heat, and transport water, about 1.65 pounds of carbon are emitted by power plants for every gallon of water a person uses.
9		Using one recreational watercraft for an hour can produce the same amount of emissions as using 348 cars for the same amount of time.
10		About 40% of all freshwater withdrawals in the United States goes towards producing energy from fossil fuels and nuclear power.
11		American water supply and treatment facilities consume about 56 billion kilowatt-hours per year, enough to power more than 5 million homes for one year.
12		One-tenth of the world's fresh water is found in the Great Lakes.
13		Allowing a faucet to run for five minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours.
14		Global warming would have no effect on water supply and water quality in lakes, rivers, and aquifers.
15		About 3% of the national energy consumption is used for the transportation and treatment of drinking water and wastewater services, which equates to adding approximately 45 million tons of greenhouse gas to the atmosphere.
16		On average, 55% of precipitation in urban areas will be runoff into sewer systems and will not infiltrate the ground to nourish plants.
17		If one out of every 100 American homes installed water-efficient fixtures, about 100 million kilowatt hours of electricity would be saved per year, preventing 80,000 tons of greenhouse gas emissions. This is equal to removing 15,000 automobiles from the road for one year.



Putting the Pieces Together
Teacher Answer Key: Statement Sheet
Chicago Conservation Corps (C3) Student Clubs
 City of Chicago Department of Environment (DOE)



#	T/F?	Statement
1	F	After water goes down a drain in Chicago, it returns to Lake Michigan. <i>(YouTube clips) Answer: Water goes to the Chicago River, which empties into the Mississippi River.</i>
2	T	7.1% of electrical energy produced in the U.S. comes from hydroelectric power plants, while over 70% is generated using fossil fuels. <i>(USGS, http://ga.water.usgs.gov/edu/wuhy.html)</i>
3	F	There is always new water available, so we needn't worry about conservation. <i>(YouTube clips) Answer: Water is a limited resource. Only a small amount is available and accessible for human use.</i>
4	T	The Chicago region uses over 2 billion gallons of water per day. <i>(You Tube clips, Chicago Department of Water Management)</i>
5	T	Less than 1% of all the water on Earth is fresh, non-frozen water that could be used for drinking. <i>(YouTube clips)</i>
6	T	Water that is taken out of Lake Michigan must be treated before it can be used by people. <i>(YouTube clips)</i>
7	T	The average Chicagoan uses 200 gallons of water per day. <i>(Chicago Department of Water Management)</i>
8	T	Because energy is required to treat, heat, and transport water, about 1.65 pounds of carbon are emitted by power plants for every gallon of water a person uses. <i>(Chicago Department of Water Management)</i>
9	T	Using one recreational watercraft for an hour can produce the same amount of emissions as using 348 cars for the same amount of time. <i>(US EPA 2007)</i>
10	T	About 40% of all freshwater withdrawals in the United States goes towards producing energy from fossil fuels and nuclear power. <i>(USGS, http://pubs.usgs.gov/circ/2004/circ1268/)</i>
11	T	American water supply and treatment facilities consume about 56 billion kilowatt-hours per year, enough to power more than 5 million homes for one year. <i>(EPA, www.epa.gov/owm/water-efficiency/water/save/env_benefits.htm)</i>
12	F	One-tenth of the world's fresh water is found in the Great Lakes. <i>(YouTube clips, EPA): Answer: One-FIFTH. 20%, not 10%.</i>
13	T	Allowing a faucet to run for five minutes uses about as much energy as letting a 60-watt light bulb run for 14 hours. <i>(EPA, www.epa.gov/owm/water-efficiency/water/save/env_benefits.htm)</i>
14	F	Global warming would have no effect on water supply and water quality in lakes, rivers, and aquifers. <i>(EPA, www.epa.gov/climatechange/effects/water/northamerica.html) Answer: Global warming would negatively impact water quality by causing the water level of the Great Lakes to drop.</i>
15	T	About 3% of the national energy consumption is used for the transportation and treatment of drinking water and wastewater services, which equates to adding approximately 45 million tons of greenhouse gas to the atmosphere. <i>(EPA, www.epa.gov/waterinfrastructure/bettermanagement_energy.html)</i>
16	T	On average, 55% of precipitation in urban areas will be runoff into sewer systems and will not infiltrate the ground to nourish plants. <i>(www.lcrep.org/fieldguide/importance.htm, original source: Nonpoint Education for Municipal Officials (NEMO) publication)</i>
17	T	If one out of every 100 American homes installed water-efficient fixtures, about 100 million kilowatt hours of electricity would be saved per year, preventing 80,000 tons of greenhouse gas emissions. This is equal to removing 15,000 automobiles from the road for one year. <i>(EPA www.epa.gov/owm/water-efficiency/water/benefits.htm)</i>



Putting the Pieces Together

Discussion:

1. After all Club members have assembled their puzzle pieces, check them as a group. **Piece numbers 1, 3, 12, and 14** should NOT be in the completed puzzle.

2. **Discuss** the completed activity as a Club. Consider the following questions:

- What did you think about the **video**?
- Which steps of the **process** had you not previously considered?
- Water management in other parts of the country and world is **very different** from water management in Chicago. What are some of the aspects of Chicago's water use that might be different from other areas'? For example, how would it compare to:
 - **Phoenix, AZ**, a city in a dry climate?
 - **Detroit, MI**, another Great Lakes city that sends its wastewater directly back into the Great Lakes?
 - **Port-au-Prince, Haiti**, a city with very few public services (like water treatment)?
- How is water use connected to **climate change**?
- Why does this information matter when considering water **conservation**?
- Were any of the **true/false** statements surprising?
- Does knowing more about where our water comes from and where it goes **change how you look at your own water use**?

3. **Discuss the audit, explaining the goals of the activity.**

- Pass out copies of the **Personal Water Audit Guide and Data Sheet / Calculations Worksheet (p. 7-8)**; explain that Club members will be tracking their water use for one day.
- Explain the **“Leaky Faucets” Audit Guide and Data Sheet (p.9-10)**.
- Explain that Club members will make estimates of water *use* and *waste* based on their findings.

4. **Plan for the Personal Water Audit.**

- Determine a final date by which each Club member must have completed his or her personal audit. Alternatively, choose one day when everyone will complete their audit.

5. **Plan for the “Leaky Faucets” Audit.**

- **Brainstorm** with the Club to come up with a list of all the areas where water is used in the school (some examples might be include classrooms, science labs, kitchen, lunchroom, administrative offices, hallways, maintenance areas, sports fields, landscaped grounds, the gym and locker rooms).
- **Select** the water-use areas in the school that will be audited.
- **Assign** a Club member or group of Club members to each selected water-use area.
- **Choose the date** for the audit.
- **Notify** appropriate administration, maintenance staff and other teachers that students will be visiting different areas of the school where water is used. Find out the extent to which students will need to be supervised as they move around the school campus.
- **If appropriate**, schedule opportunities for the Club to tour areas of the school that are generally closed off to students where water is used. Examples might be the kitchen or landscaping shed. Ask the tour guide if any information about water use in these areas (gallons per day, per year, etc.) is available; if so, perhaps the tour guide could bring that information to the tour.

Conduct the Audits (2 meetings)

1. Individually, **conduct the Personal Water Audit** at the pre-determined time.
2. **Gather supplies** for the **“Leaky Faucets” Audit**, referring to the list on p.1. Depending on the shape of your school's faucets, you may need smaller cups to collect the water from the leaks; then you can pour the water from the cup into the graduated water bottle.

