

Discovering New York City's Water Supply System

Description:

For the purpose of this lesson, we will model the New York City water supply system. Here, your students will identify the various elements of this system and physically connect these elements to illustrate the interconnections between the water cycle and our local human systems. This will also highlight the weather and climate elements that shape how the system functions, and encourage students to consider the design challenges from an urban planning perspective. Your students will consider the ways climate change impacts the systems they've created to begin a conversation on adaptation, mitigation, and resilience.

Optional: This lesson is a great continuation DEP's [Navigating NYC's Wastewater System](#) lesson. In that lesson, students follow a similar procedure to create the wastewater system. The wastewater system and the water supply system are two distinct pieces of New York City's water story, and can be explored together or separately. If your class created the wastewater system already, keep that on the side and at the end of this lesson, discuss the ways these two systems should connect. You can also provide information on both systems all at once and have students create one large water system from start to finish.

Objectives:

- Understand the key features of the NYC water supply system
- Identify the design and engineering challenges that have gone into planning, constructing and operating this system

- Model systems thinking to connect this system to our daily lives, and our understanding of the impacts of climate change

Vocabulary:

Aqueduct, conservation, filter, infrastructure, invasive species, reservoir, resiliency, sustainability, watershed

Materials:

- Markers
- Tape
- Large sheet of white paper
- Printed picture cards (samples included)
- Blank picture cards (printed on color paper)
- Optional: string or yarn

Background Information:

Each day, New Yorkers use a total of one billion gallons of water from homes, schools, and businesses across the city. New York City's water supply comes from an extensive system, including three watersheds, 19 reservoirs, three lakes, and more than 7,000 miles of aqueducts, tunnels and water mains. This system dates back to 1842 when New York City first began delivering fresh, clean drinking water from sources north of the city. Today, our water supply system continues to rely on precipitation -- rain and snow that falls on watershed mountains and forests that flows into streams, rivers, lakes and reservoirs. As water consumers, we play a significant role in this incredible system.

Method:

- Ask students, “How have you used water today? Where do you think your water came from?”
- Explain to students where our water in New York City comes from, how it is conveyed from upstate watersheds, including reservoirs and freshwater lakes by gravity through aqueducts, tunnels and water mains before it flows into the pipes in our homes and buildings.
- Show students pictures of the water supply system and ask them to try to identify what they observe. Project sample pictures for the class to view or pass out sample picture cards (see examples at end of lesson) for students to look through. Ask students, “Have you seen these before? What function do they serve?”

Part I:

- Break students into small groups. Explain that each group will use the materials provided to create a flow chart or visual depiction of the water supply system.
- Using a large sheet of white paper, tape and markers, each group will organize picture cards to depict the flow of water through the water supply system.
- Have students begin by using the provided picture cards, or select a set of picture cards, including:
 - a. **Precipitation** – freshwater, rain and snow that falls to the ground
 - b. **Watershed** – three NYC water systems; areas of land that capture and drain water to a waterway
 - c. **Mountains** – elevated areas of land that capture rain and snow
 - d. **Forests** – natural areas of trees and plants that act as filters for water

- e. **Wildlife** – species commonly found in NYC’s water supply system
 - f. **Streams** – flowing waterways that drain surface water into larger bodies of water
 - g. **Reservoirs** – 19 reservoirs and three controlled lakes in NYC’s water supply system; formed by constructing a dam, store large quantities of water
 - h. **Water quality** – scientists sample and monitor drinking water quality throughout the system
 - i. **Aqueducts and water tunnels** – pipes that convey drinking water by gravity to NYC
- Allow students 5-10 minutes to look through the picture cards.
 - Give students another 15 minutes to create their water supply system. Students can connect the picture cards by drawing how the water flows from one place to the next (i.e. streams and pipes). Have students add arrows to show the direction of flow.
 - *Optional:* students can also tape string/yarn to connect the picture cards in the flow chart. Students will then manipulate the string/yarn in Part II as new picture cards are added to the flow chart.
 - Have groups share out with the class; discuss their decision-making process and their understanding of interconnections.

Part II:

- Ask students, “How do we fit in this system”? Explain that in many ways we play a role in this system. Encourage students to brainstorm how their actions and behaviors relate to water supply, and depict their influence on the system by using additional

blank picture cards that students can write and draw on. Give groups another 10-15 minutes to use the provided blank cards (printed on color paper and pre-cut before the exercise) to illustrate our role and involvement in this system.

- Remind students humans' role in the system can be considered both good and bad (some activities may help protect the system while others harm it).
- Some examples may include:
 - a. **Water use and conservation**
 - b. **Litter and pollution**
 - c. **Stream restoration**
 - d. **Agriculture and food production**
 - e. **Forest protection and use**
 - f. **Water quality monitoring**
 - g. **Economy and jobs**
 - h. **Education and stewardship**
 - i. **Recreation**
- Flow charts will vary. Students can create systems that are cyclical, linear, or branch-like (showing numerous directions or inputs/outputs).
- Ask each group to share out what they added to their flow chart in Part II.

Part III:

- Now, have students consider what they know about climate change. How are the water cycle and climate change interconnected? How do you think such changes affect NYC's water supply system?
- Encourage students to brainstorm how their flow chart of the system will now look with the influence of climate change. Students can use markers to alter and/or highlight how climate change affects the different components of their system.
- Some examples may include:

- a. **Temperature** – higher temperatures, increased evaporation
- b. **Precipitation** – drought conditions, changes to snow cover, heavy storms
- c. **Water quality** – runoff, turbidity, stream erosion
- d. **Habitat** – availability of resources, invasive species

- Have groups share out and discuss.

Discussion:

- Where do we fit within this system? How do we affect this system?
- Were you unfamiliar with any part of the water supply system?
- How can we be good stewards to help the system function properly?
- What are actions we can take to help maintain or improve this system and protect our natural resources?
- How does climate change impact this existing system? How will it shift as the impacts of climate change intensify?
- How do our actions as stewards shift as we learn more about this system?

Extension:

- You can easily replace this with any other system you can think of. For example, you could begin with a simple food chain, or your school community, including the different stakeholders (students, parents, teachers, and natural components—air, trout tank, school garden). What other systems can you model?
- Further explore the map, [New York City's Water Story: From Mountain Top to Tap](#), with the complementary teacher's guide.

Trace the path of the Delaware Aqueduct that delivers most of NYC's daily drinking water to the five boroughs. Research the City's plan to fix existing leaks within the Delaware Aqueduct and discuss the importance of water conservation initiatives.

NYC Department of Environmental Protection

educationoffice@dep.nyc.gov

For more information visit www.nyc.gov/dep



Sample Picture Cards

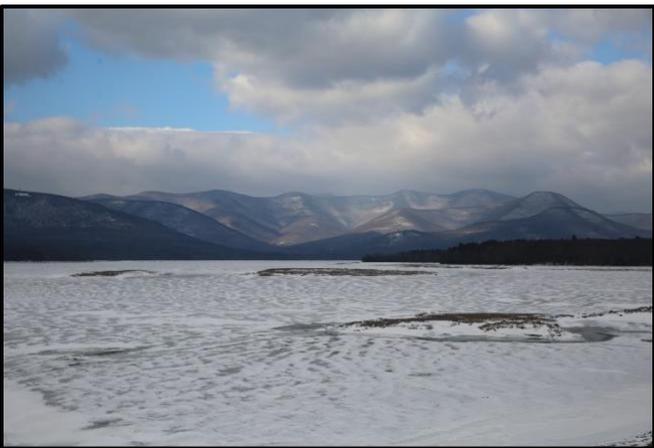
Instructions: Below you will find some sample picture cards that depict the water supply system. You can also include additional pictures. Blank boxes are provided for the picture cards that will be included in Part II of the lesson.



Watershed



Precipitation



Mountains



NYC Watersheds



Forests



Wildlife



Water Quality (scientists)



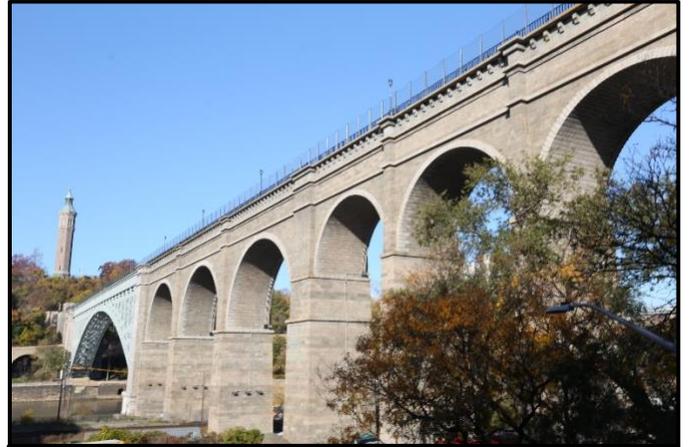
Reservoirs



Water Tunnels



Streams



Aqueducts

