Day 4
The water in my cup

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Introduction

This day focuses on access to clean water:

- How cities and towns use river water as a municipal water supply
- How municipal water systems supply clean water for citizens
- How people without a municipal water supply get their water

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Questions to guide explorations and experiments

- How does water get to your house from the river? What is the process?
- How do I know if the water is clean?
- What happens if the water people drink isn't clean?
- In other places, how do people get water?

Books and activities

- **Books:** water access, water quality, and the water treatment process.
- **Activities:** water use, access to water, and water treatment.

Children's Books

Fiction

- *A Country Far Away* by Nigel Gray (Gr 1-2)
- *Letting Swift River Go* by Jane Yolen (Gr 1-3)
- *Luz Makes a Splash* by Claudia Davila (Gr 3-5)
- *The Water Princess* by Susan Verde (Gr 1-3)

Poetry

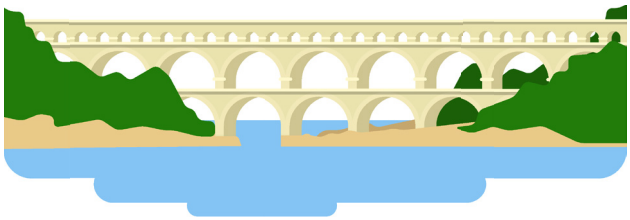
- *The Negro Speaks of Rivers* by Langston Hughes (Gr 3-5)

Nonfiction

- *A Cool Drink of Water* by Barbara Kerley (Gr K-2)
- *The Drop in My Drink* by Meredith Hooper (Gr 1-4)
- *Every Last Drop: Bringing Clean Water Home* by Michelle Mulder (Gr 3-5)
- *I Walk for Water* by Lindsey Andrews (Gr 1-2)
- *The Magic Schoolbus Inside the Waterworks* by Joanna Cole (Gr K-3)
- *My Water Comes From the San Juan Mountains* by Tiffany Fourement (Gr 4-5)
- *Not a Drop of Water to Drink (National Geographic Investigates)* by Michael Burgan (Gr 4-5)
- *One Well: The Story of Water on Earth* by Rochelle Strauss (Gr 3-5)
- *Our World of Water* by Beatrice Hollyer (Gr 3-5)
- *Trout Are Made of Trees* by April Pulley Sayre (Gr 1-3)
- *Water Wow! An Infographic Exploration* by Antonia Banyard and Paula Ayre (Gr 1-5)

Water Words

Aqueduct
A large pipe or canal that carries a water supply to a city or a farming area. Or, a bridge with many arches for carrying water across a valley or river. The ancient Romans built enormous stone aqueducts.



Aquifer
An underground layer of rock, sand, or gravel that stores large amounts of water. Aquifers provide water for wells and springs.

Ground water
The water beneath the earth's surface that supplies springs and wells.

Municipal water supply
Water that is provided by your local city or town government.

Reservoir
A place where water is collected and stored. Towns and cities often have reservoirs for their water supply.

Sewers
Large underground pipes that carry off the liquid and solid waste of a town or city.

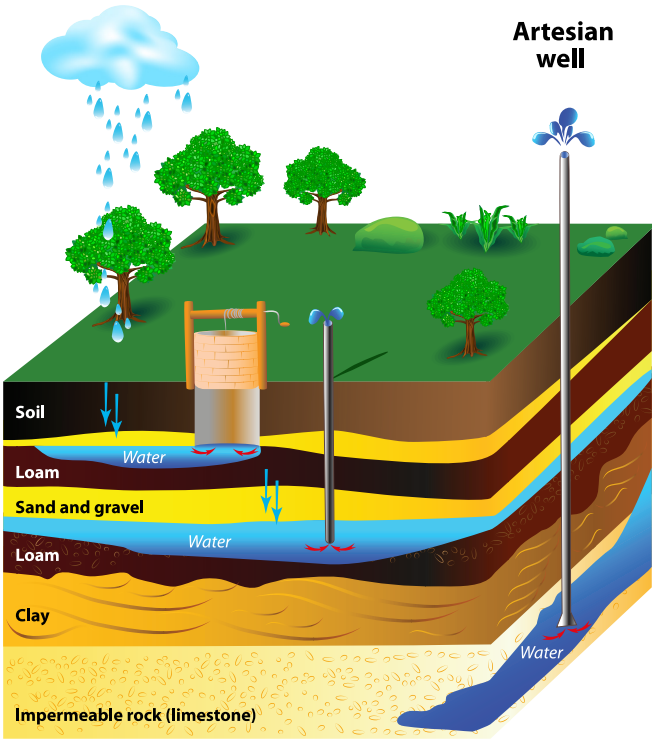
Storm sewer
A drain designed to carry away large amounts of water during heavy rains or flooding.

Utility
An important service such as water, electricity, or gas that is provided for everyone, and that everyone pays for.

Waste water
Water that has been used, either in homes or in industry, and contains contaminants.

Water treatment
Any process that improves the quality of water for drinking, industrial water supply, irrigation, recreation, or many other uses.

Well
A deep hole dug in the ground to get water.



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Anacostia & Potomac Connections

When kids see the connections between what they read about and their own local communities, the information is more relevant to them and expands their background knowledge about the world. Browse these links to learn more about where people in the DC Metro area get their water, and how the water supply stays safe to drink.

Where does our local drinking water come from?

District of Columbia, Arlington County, Falls Church, and parts of Fairfax County
Drinking water comes from the Potomac River. Water from the river is collected at the Washington Aqueduct, built by The Army Corps of Engineers from 1853 to 1863. It is a National Historic Landmark! The water is treated at the Dalecarlia Reservoir to be sure it is safe to drink.

City of Alexandria
Drinking water comes from the Potomac River or the Occoquan River. Water from the Potomac is treated at the J.J. Corbalis plant and water from the Occoquan is treated at the Griffith plant at the Occoquan Reservoir.

More information

History of the Washington Aqueduct
http://historicsites.dcpreservation.org/items/show/647

Arlington County Water Treatment Plant (video)
https://www.youtube.com/watch?time_continue=406&v=lC5v8Joi-_I

New Sewage-Storing Tunnel to Transform Polluted Anacostia RIver (Chesapeake Bay Magazine)
https://www.chesapeakebaymagazine.com/baybulletin/2018/3/25/new-sewage-storing-tunnel-to-transform-polluted-anacostia-river

TapIt DC: Find free, clean sustainable tap water on the go (app)
https://freetapwater.wordpress.com/

Activity 1: Make a Water Filter

Introduction

Help kids understand how water from lakes, rivers, and groundwater that ends up in their cup gets cleaned and ready to drink when they engineer a water filter.

Supplies

- Clear 2-liter plastic bottles cut into two pieces, about a 1/3 of the way down the bottle
- Thick paper towels
- Gravel
- Sand
- Dirt
- Items to "pollute" water such as dirt, grass, twigs, bits of plastic, cooking oil, food coloring, etc.
- Water
- Containers for mixing polluted water

Let's get started!

Talk with kids about the importance of water in our daily lives. Get them thinking and talking about how many times today they have used water. **Ask the kids:** What would you do if you turned on the faucet and no water came out? Where else could you find water? Is that water good to drink? What if you couldn't buy bottled water or get water from a faucet? What would you do?

Together brainstorm water sources in your community. Have kids identify local bodies of water and ask, Does it look clean? Would you drink that water? Use it to cook or wash or brush your teeth? Even if it looks clean, is it okay to drink it?

Talk about what kids know about filters. Ask, Have you seen a filter before? What does a filter do? Come up with examples kids may have encountered such as coffee filters or aquarium filters and talk about how a filter works. **Ask the kids:** Can you think of how a filter could help get water clean?

Put some of those ideas to the test. First, pour water into several containers and give kids materials to "pollute" it. Have them make notes about what goes into each container.

Activity 1: Make a Water Filter

(continued from previous page)

Now that that there is dirty water ready to be cleaned, it's time to make a water filter! Have kids turn the part of the 2-liter bottle with the neck upside down and fit it into the bottom half of the bottle. Let kids engineer their filter as they see fit, but have them start by putting a layer of paper towels into the bottle right above the neck. Encourage them to layer gravel, sand, dirt, etc. **Ask the kids:** What do you think will happen when the polluted water is poured through these layers?

Photo © Three Little Rascals

Have them make predictions for each of the polluted waters they've created and note their results. To avoid flooding the filter — and to get a good look at the filtered water — empty the bottom of the bottle after each test.

Kids may want to redesign their filters after testing. Remind kids that even though water that went through their filter looks "clean" it will still have invisible items, such as bacteria or other contaminants, that need to be removed. Talk about how an additional chemical process is necessary to remove those impurities.

More water filter activities

Walter Filter Science Project (video)
https://www.youtube.com/watch?v=tPP_Yn2w2Sk

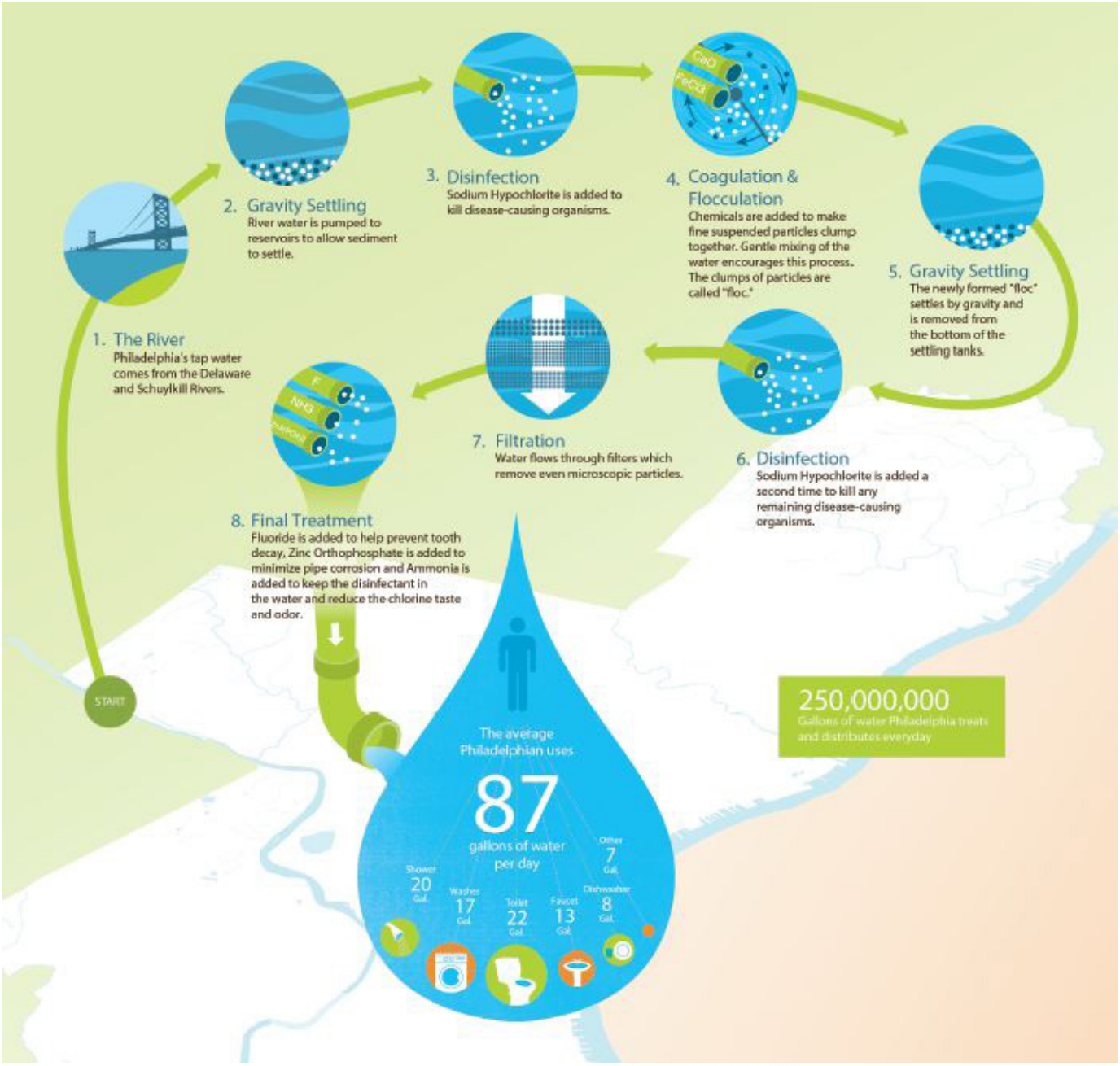
Filtration Investigation (Try Engineering)
http://tryengineering.org/lessons/filtration.pdf

Make a Walter Filtration Plant Model (U.S. Environmental Protection Agency)
https://www3.epa.gov/safewater/kids/flash/flash_filtration.html

Steps in Water Treatment: Example 1

Diagram from Willamette Water Supply, Oregon.

Steps in Water Treatment: Example 2



Philadelphia's Drinking Water Treatment Process © Fairmount Water Works

Activity 2: Daily Water Use

Introduction

Many people around the world can't turn on a tap and get any water at all. Folks have to go get and transport their water. 600 million people spend up to 6 hours each day doing just that. The need for transporting fresh water prevents many children, especially girls, from going to school. In this activity, kids will look at their own water use and explore what it would be like to provide water for their family.

Supplies

- Printout of Daily Water Use chart for each child
- Two jugs or buckets filled with 1 gallon of water, or two 8-lb weights

Let's get started!

Ask kids to calculate how much water they use in a day, in gallons. Give each child a printout of the Daily Water Use chart (see next page). There are several different ways to figure out usage:

- Ask kids to fill out their Daily Water Use chart at home based on one day of observations.
- Estimate usage with this free H2O Tracker app: https://itunes.apple.com/us/app/h2o-tracker/id566633837?mt=8&ls=1
- Use this online tool from DC Water to record usage: https://www.dcwater.com/kids/activities/dailywaterusage.html)

When every child has their daily water usage estimate, it's time for some simple math! Ask the kids to multiply the number of gallons they use per day by 8 lbs (the weight of a gallon of water) to determine how heavy it would be if they had to carry that water in a container instead of just turning on a tap.

Number of gallons you use each day X 8 lbs = your daily water load to carry

Have each kid lift the two buckets or jugs, each with a gallon of water, or the two 8-pound weights, to feel how heavy it is. **Ask the kids:** What would it be like if you had to carry this much water every day on foot, walking for a mile or more? What if you also had to carry water for a grandparent or a baby brother?

Activity 2: Daily Water Use

(continued from previous page)

Imagine a day without water

Now imagine that the **well** or **spring** you usually walk to for water is empty. **Ask the kids:** What could be the reason that there is no clean water? (drought, monsoon rains). What would a day be like without water? Write down each child's thoughts.

When the water in your tap is unhealthy

Sometimes we think that access to clean water is a problem that happens "over there" — not in our own country. But there are communities in the U.S. where people lack safe drinking water. The drinking water crisis in Flint, Michigan is a recent story. The town's water was contaminated with lead as a result of improper water treatment and old pipes. You can learn more about what happened in Flint in these stories:

The Water Crisis in Flint, Michigan (DOGO News)
https://www.dogonews.com/2016/1/20/the-water-crisis-in-flint-michigan

Flint Water Crisis: Rap Video (Flocabulary)
https://www.flocabulary.com/unit/week-in-rap-extra-flint-water-crisis/

Flint's Water Crisis Explained in 3 GIFs (Time Magazine)
http://time.com/4191864/flint-water-crisis-lead-contaminated-michigan/

Reflection questions

- What surprised you about how much water you use? How would your life be different if you didn't have easy access to clean water?
- Cities and towns clean the water for their residents. Some people get water from wells on their property instead. What are the advantages and disadvantages of both sources of water? Which would you rather have?

Water Usage Charts

Daily water usage in the U.S.

The average American family uses more than 300 gallons of water per day. About 70% of that is water we use in our homes. Use this chart to record how many gallons of water you use each day.

My name: _____

Toilet: 3 gallons (each flush) _____

Bath: 36 gallons (average) _____

Shower: 2 gallons per minute _____

Washing hands and face: 1 gallon _____

Teeth brushing: 1 gallon (average) _____

Glasses of water (128 ounces in a gallon) _____

Washing Machine: 23 gallons (average) _____

Dishwasher: 2 gallons (average) _____

Leaks: 17 gallons (average) _____

What are some ways I can save water at home?

_____

_____

_____

Water Usage Charts

Food's big water footprint

What you eat makes up at least two-thirds of your total water footprint. That's because of the large amount of water needed to grow and produce your food.

Food Item	Serving Size	Water Footprint
Hamburger	1 (includes bread, meat, lettuce, tomato)	660 gallons
Eggs	1 egg	52 gallons
Soda	17 ounces	46 gallons
Salad	1 (includes tomato, lettuce, cucumbers)	21 gallons

The hidden water in everyday things

Did you know that it takes almost 660 gallons of water to make a t-shirt? Of course, we don't "see" that water — it's hidden in the way we grow cotton, and manufacture and deliver the shirt. **Ask the kids**: What is all that water used for? This chart shows how much water is used to make other common products. The average American's daily water footprint for all the (non-food) household goods we buy, use and throw away is **583 gallons.** "Reduce, reuse, recycle" can help save a lot of water!

Item	Water Footprint
Car	13,737 – 21,926 gallons
Leather Shoes	3,626 gallons
Smart phone	3,190 gallons
Jeans (cotton)	2,108 gallons
T-shirt (cotton)	659 gallons

All information from The Water Footprint Calculator: https://www.watercalculator.org/water-use/

Writing about Rivers

Writing helps kids process and solidify new knowledge and gives them an opportunity to use new vocabulary and concepts. Offer one or more of these prompts or questions to get your River Rangers writing.

Writing prompt

- Read *The Magic School Bus: Inside the Waterworks*. Now imagine that you are a drop of water moving through a water treatment plant, from collection to clean up to storage and distribution. Write a series of "Wish you were here!" postcards to your friends about what it's like each step along the way.

Journal writing

- For one week, write down all the ways you use water at home. Reflect on things you can do to reduce your use of water.

Posters and PSAs

Water is a precious resource. A lot of effort goes into getting clean water to people, so it's important not to waste it. We use water in many ways — some are obvious like cooking or taking a shower. Some ways are hidden —like the amount of water needed to make a new cell phone.

Learn about some things you can do to save water (see the list on the next page).

Choose one or more actions and create a poster that explains what every kid can do and why it's important. Include photos or drawings, and think about a headline that will grab people's attention. If you have access to an audio or video recorder, you can also make a Public Service Announcement (PSA) to share with family, friends, and neighbors.

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10 Simple Ways to Save Water

1. Build a rain barrel to catch rainwater so that storm drains don't get overloaded. Use the stored water for your garden.

2. Add native plants to your garden. They require less water and fertilizer and are more resistant to pests and disease since they are already adapted to local conditions. If you need to fertilize, use organic options such as garlic.

3. Reduce. Reuse. Recycle. Every item we use takes water to make it and transport it. Instead of butying new things, shop at a thrift store. Recycle or donate items you don't need anymore.

4. Park that car. Transportation uses water, too! Walk, ride a bike, take the bus, carpool, or use car share to get where you're going.

5. Be water wise! Use low-flow faucets, showers, and toilets and repair any leaks.

6. Be water wise! Take shorter showers, and turn off the tap when brushing your teeth or washing dishes.

7. Be water wise! Run dishwashers and clothes washers only when full

8. Be water wise! Wash your car and water your lawn only when necessary.

9. Grow your own vegetables. Water is used to transport and store fresh produce at the grocery store.

10. Eat smart. Drink water, not soda. Did you know that it takes 45 gallons of water to make 16 ounces of soda?

Kid-friendly websites and apps

Websites

Safe Drinking Water Is Essential (Koshland Science Museum)
https://www.koshland-science-museum.org/water/new/en/index.html

Blue Plains Advanced Wastewater Treatment Facility (DC Water)
https://www.youtube.com/watch?v=Nb16X8gb9ME

Our Fragile Environment: Water Supply (Brain POP)
https://www.brainpop.com/science/ourfragileenvironment/watersupply/

DC Water for Kids
https://www.dcwater.com/kids/

Daily Water Usage (DC Water)
https://www.dcwater.com/kids/activities/dailywaterusage.html

Water Footprint Calculator
https://www.watercalculator.org/water-use/

Imagine a Day Without Water
http://imagineadaywithoutwater.org/

Educational apps

Captain Plop's Water-Saving Mission
https://play.google.com/store/apps/details?id=sawater.captainplopwatersavingmission&hl=en

H2O Tracker
https://itunes.apple.com/us/app/h2o-tracker/id566633837?mt=8&ls=1

Virtual Water $
https://itunes.apple.com/us/app/virtual-water/id369876250?mt=8

Where's My Water? $
https://www.commonsensemedia.org/app-reviews/wheres-my-water

Water1der
http://www.groundwater.org/get-informed/opportunities/water1der.html

Outings in the DC Area

Visiting a river or stream is a fun experience and a rewarding activity for both kids and grownups. But anyone visiting should be aware of potential hazards and follow safety guidelines. Before you head to the river, make time to review water safety.

Water Safety: Rivers and Streams provides helpful resources, hazards to avoid, and tips that could save your life.
https://www.recreation.gov/marketing.do?goto=acm/Explore_And_More/exploreArticles/water-safety-rivers-and-streams.htm

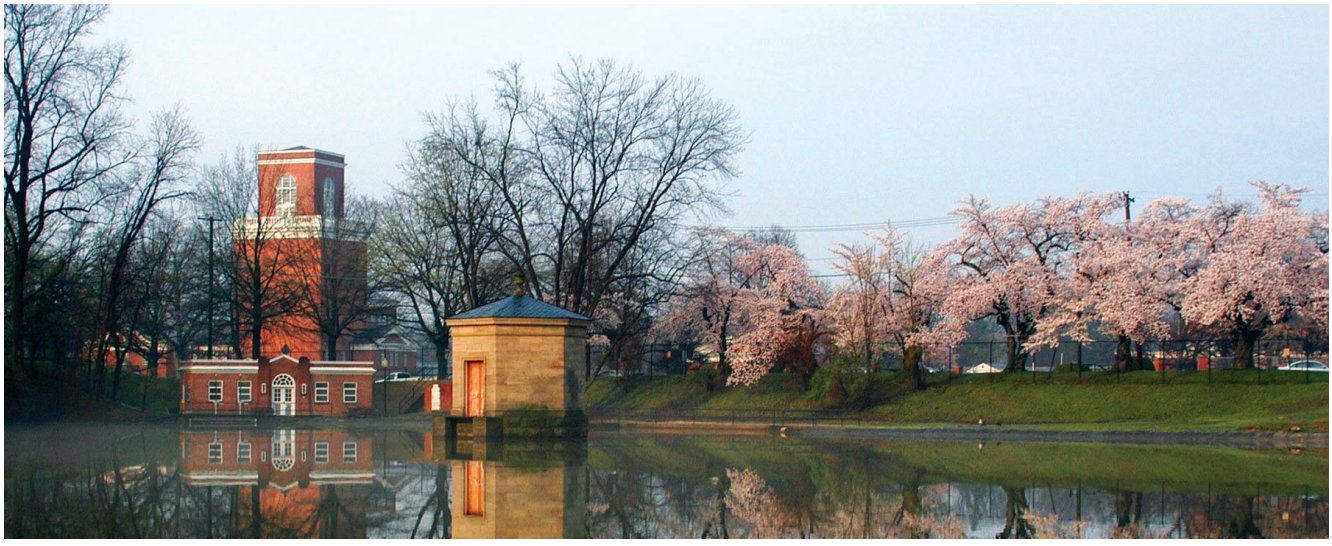
Places to visit and things to do

The Washington Aqueduct System
https://www.nps.gov/choh/learn/historyculture/thewashingtonaqueductsystem.htm

Blue Plains Advanced Wastewater Treatment Facility
https://www.dcwater.com/tours

Arlington County's Water Pollution Control Plant
https://water.arlingtonva.us/sewer/wastewater-treatment/scheduling-tour/

Year of the Anacostia Events (free and $)
https://www.yearoftheanacostia.com/events



The Washington Aqueduct. Photo © The Army Corps of Engineers