PROBLEM BASED LEARNING
EDUCATING *for* SUSTAINABILITY

WATER SYSTEMS COLLECTION

Coolest Graph Ever on the History and Future of Water Conservation

Grade Level: 6-12
Subject: Human Geography, Local History, Science, Engineering

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PROBLEM STATEMENT

If the human population in our region continues to expand, but our water supply is limited, and climate change continues to alter our local water cycle, what do we need to do?

SUMMARY

Presented in front of a live audience, this **6-minute talk by Annalisa**, a 9th grade student, and member of Sustainability Ambassadors, is built around a single, **thought-provoking graph.**

Coolest Graph Ever on Local Water Conservation

The graph covers the time period from 1930 to 2014 and shows the curious relationship between our region's **population growth** and **water consumption.**

The consumption data of millions of gallons of water per day is drawn from our primary water supply system which is managed by **Seattle Public Utilities** and **Cascade Water Alliance.** Historical explanations for rising or falling water consumption rates provide a fascinating lens for analyzing our socio-economic choices and their systemic implications, intended and unintended.

The centerpiece of this story is how the line on the graph for population growth and the line for water consumption **decoupled** about three decades ago and these two trends continue today in opposite directions. The question is.... ***"How can we be consuming water at the same rate as in 1950 when the population since that time has doubled?"***

The second part of the video is an inquiry into how we might design systems for net zero water over the coming decades. **Net zero water?** How is that even possible? Is anyone doing it?

Students will gain skills in **understanding graphs** and applying **systems thinking** as they explore the **cause and effect relationship** between social, economic, and ecology issues related to water consumption in our region.

Lessons feature **historical and contemporary news analysis**, fact finding related to the **three pillars of water equity,** and **engineering a net zero water building.**

Students are challenged to develop an **impact project** that measurably reduces their water consumption and aligns the outcomes of their project with local water conservation goals.

Learning Objectives

1. I can interpret data on a graph and tell stories about the systemic relationship between population growth and water consumption in our region, past, present, and future.
2. I can apply systems thinking to understand the issues and opportunities related to building a net zero water future.
3. I know how to take personal action to measurably decrease my water consumption.

Formative Assessment

Menu of possibilities...

1. An initial analysis of the graph prior to watching the video.
2. A critical analysis of both content and presentation style after watching the video, including a list of research questions.
3. Research notes on the past, present, and future events related to population growth and water consumption.
4. Draft vision statement for what it is like to live in a net zero water future, say, in the year 2050.
5. A draft impact project plan.

Summative Assessment

1. Develop a team presentation on one strategy for how we get to a net zero water future by 2050.
2. Design and implement a water conservation impact project that demonstrates a clear connection between personal action and one or more policy frameworks or performance measures from your city or water utility.
3. Produce a personal reflection, mind map, or video-self-interview on your growth as a learner.

ACADEMIC STANDARDS

Science and Engineering Practice of Analyzing and Interpreting Data

Construct, analyze, and/or interpret graphical displays of data and/or large data sets to identify linear and nonlinear relationships.

Social Studies Learning Standards: H2 Understands and analyzes causal factors that have shaped major events in history.

Historians examine cause and effect to see relationships between people, places, ideas, and events. Causes include social, political, economic, and geographic factors.

ELA: 9-12th grade Common Core Standards for Informational Text.

Determine the central idea of a text and analyze its development - be able to cite textual evidence to support claims. Analyze how evidence is organized, supported, and connected. Evaluate for sound reasoning and relevant evidence. Integrate and evaluate multiple sources of information presented in diverse formats.

NGSS #HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Examples for limiting future impacts could range from local efforts (such as reducing, reusing, and recycling resources) to large-scale geoengineering design solutions.

HS-ETS1-2. High School Engineering Design.

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3. High School Engineering Design

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.

BIG PICTURE

NGSS Global Climate Change

NGSS Human Sustainability Standards

OSPI Environmental Sustainability Standards

OSPI Social Studies Standards

College, Career, and Civic Life (C3)

Common Core State Standards

COMMUNITY CONTEXT

My family's sustainable practices

My Neighborhood Association

Nonprofits focused on this issue

Nonprofits focused on equity

My School's Green Team goals

My School District Sustainability Policies

My City policies on this issue

My County policies on this issue

My City or County Equity Strategy

My Energy Utility (Hydropower)

My Water Utility

My Watershed Salmon Recovery Plan

Puget Sound Regional Council

Puget Sound Ecosystem - Vital Signs

Washington Dept of Ecology

Tribal Treaty Rights

Breaking Down the Problem Statement

If the human population in our region continues to expand... but our water supply is limited... and climate change is altering our local water cycle... what do we need to do?

If the human population in our region continues to expand...

- How do we define our "region?"
- What has been the rate of population growth over the last century? What is the projected population growth over the next century?
- Why is our population increasing instead of staying the same? Are there more people moving here? More babies born? Older people living longer lives?
- Where does population growth level off?
- Where is population growth in our region most concentrated?
- What are the racial demographics of our population growth?

but our water supply is limited...

- What is the source of our drinking water? What percentage comes from our snowpack in the Cascades? What percentage is from groundwater?
- Is it possible to harvest and store all of the water we need for our home or school just by collecting the rain that falls on the roof? How might that be engineered?
- Can we recycle wastewater? What's the engineering behind this opportunity?
- Who manages our water supply system? How is it paid for?
- How is it transported to my neighborhood? How is it stored?
- Can the treatment and conveyance process ever stop? Even at night?
- How do I use water directly from pipes and faucets?
- How do I use water indirectly from the water inputs embedded in producing, processing, transporting, and consuming products?

and climate change is altering our local water cycle...

- How will climate change impact our water supply?
- Do you see evidence of this already happening? Shrinking snowpack, fires, floods, heat waves, droughts, shifts in the timing and intensity of our water cycle?

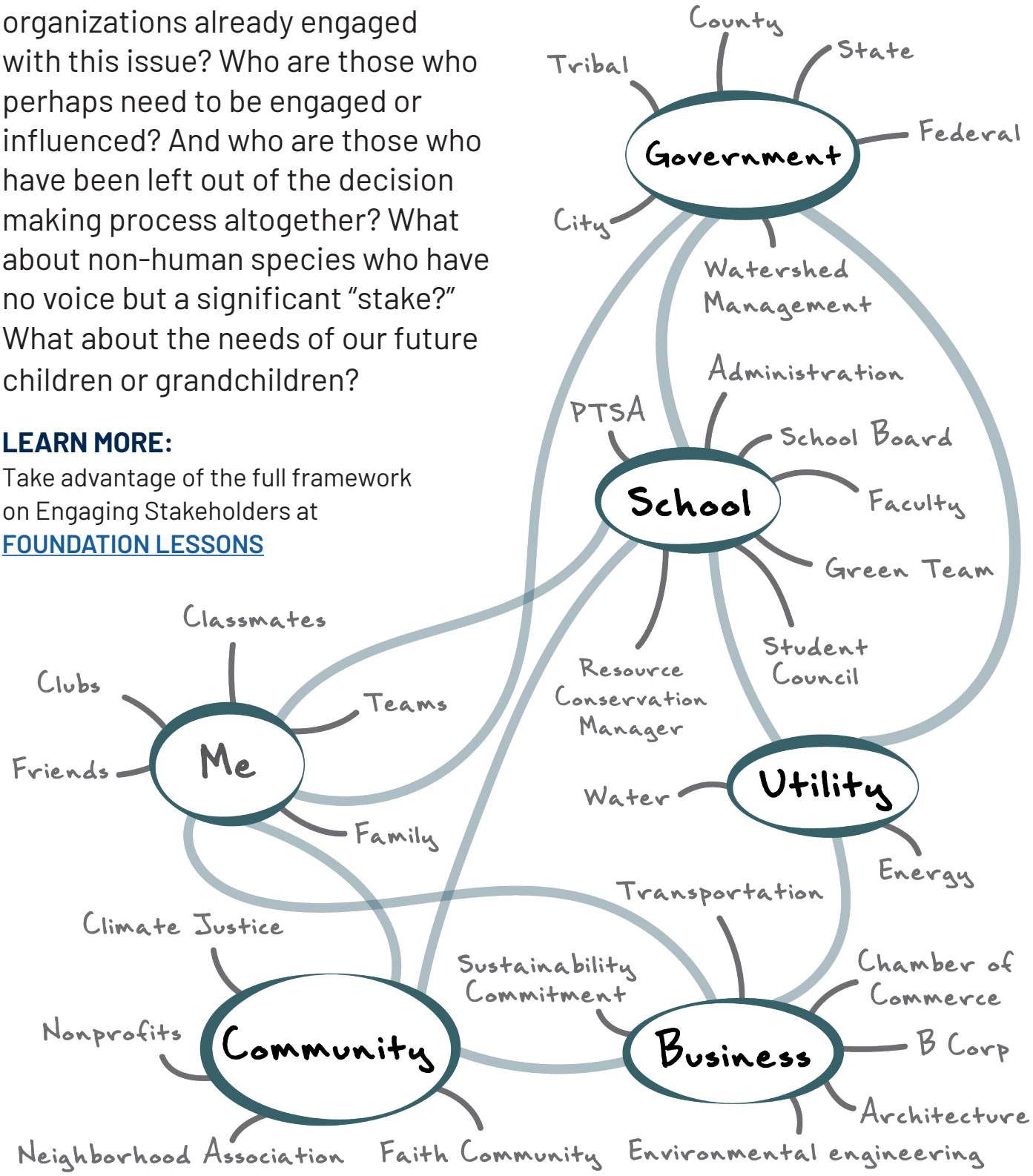
what do we need to do?

- Who is the "we" here?" As a student, do I have a role in this? Does my family?
- What are all the ways I use water every day? Do I take it for granted?
- Did human society always take water for granted? What were the historical innovations that made this assumption possible?
- Do all people in our region or in the world have this same privilege?
- How can we achieve a sustainable or net zero water system? What are the priority actions? Who's already working on it? Are there examples?

Stakeholder Brainstorming

Who are the people and organizations already engaged with this issue? Who are those who perhaps need to be engaged or influenced? And who are those who have been left out of the decision making process altogether? What about non-human species who have no voice but a significant "stake?" What about the needs of our future children or grandchildren?

LEARN MORE:
Take advantage of the full framework on Engaging Stakeholders at
FOUNDATION LESSONS



Stakeholder Perspectives and Engagement Strategies

Students need to consider each point of view with integrity. This practice develops social-emotional learning skills and cultural competency by building an awareness of our own internalized biases and expanding our capacity for empathizing with stakeholder perspectives different than our own.

EXAMPLE: Stakeholder Engagement Table

STAKEHOLDERS	INTERESTS	GOALS	APPROACH
Name of stakeholder group	**What motivates them? What do they care about? What are they responsible for?**	**Do they have specific action plans, goals, or projects they are pursuing?**	**What is the best message and timing to engage with this group?**
My family	Survival and the ability to carry out normal activities (drinking, cooking, washing).	Survival. Saving money on water bills.	Word of mouth, informal family resolutions.
School (Green Team, RCM, PTA, ASB)	Implementing water conservation and efficiency actions at school.	Saving money. Conserving natural resources. Building community.	Green Team group chat or social media. PTA & school e-news.
My City	Ensuring residents have access to clean water for drinking, cooking, washing, and irrigation.	Functioning drinking water, wastewater, and stormwater infrastructure.	Presenting at City Council meetings. Proposing resolutions. Contacting city staff and elected representatives.
Local Water Utility	Ensuring rate-payers have access for domestic and commercial uses. Rate-payer capacity.	Meeting needs for future water use. Maintain and update infrastructure as needed.	Email or call utility staff responsible for community engagement. Speak at public hearings.
Tribal Goverments	Access to healthy fishing grounds for salmon, shellfish, and plants as guaranteed by treaty rights.	Maintain natural resources for current and future livelihoods as well as cultural connections.	Letters of support and allyship acknowledging treaty rights and improving relationships.

Background on the History and Future of Water Conservation

The Coolest Graph Ever on Local Water Conservation captures the story of changing populations and historical moments that informed water use in the **Seattle Regional Water System.** Back in 1870, in the US there were 244 waterworks systems. Today, there are about 148,000 public drinking water systems regulated by the Environmental Protection Agency (EPA). These systems provide water to 90% of Americans across various states and tribes.

So why is this the coolest graph ever?

The graph covers nearly 85 years of water use, measuring water demand in millions of gallons of water per day. **Since we each use water every day, we are important players in this story.** As of 2019, the Puget Sound region was increasing by 188 people per day. There is a compelling investigation to be had in the **decoupling** of population growth and water use. What caused the decoupling in the 1980s? What caused even further decoupling in the 1990s? How do we explain the continued decrease in water consumption alongside the continued increase in human population? Nationally, we can explore the intersections of these events that changed water infrastructure and water use in homes, businesses, and communities.

The Coolest Graph Ever presentation takes us on a tour through the following historical events.

The Dust Bowl, The Great Depression, & The New Deal

In the early to mid 1930s there was a severe drought in the midwestern US. Farmers who owned and worked land acquired through the **Homestead Act of 1862,**

saw devastating winds removing fertile topsoil. This crippled American farmers. In response, President Franklin D. Roosevelt wanted to help. **The New Deal** employed out of work US residents by planting trees, learning and teaching soil conservation, and restoring damaged farmland. An ultimate goal of this work was to aid in water conservation. Watch this video to learn more about Franklin D. Roosevelt's administrative efforts to combat The Dust Bowl, support unemployed US residents, and conserve land and water.

Throughout the 1930s The New Deal provided **employment opportunities** for people as well as **financial assistance for public works projects**. This included expanding and improving sewer systems and drinking water systems (sometimes called waterworks systems).

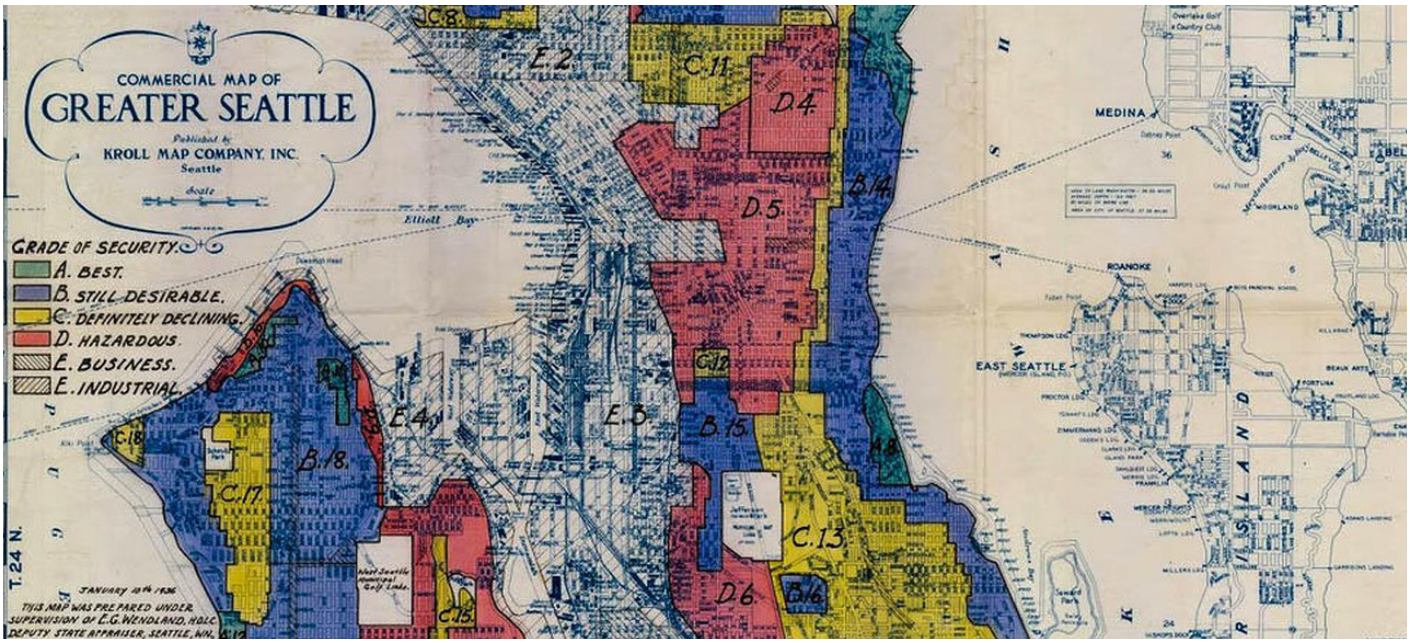
The G.I. Bill

The Servicemen's Readjustment Act of 1944 (G.I. Bill) provided critical support to veterans returning home after World War II. The G.I. Bill included items like unemployment insurance, the opportunity to get higher education, loans for homes, and pensions. This would cause a **massive increase in homeownership and the completion of higher education.** Between 1944 and 1952, the Veterans Administration backed almost 2.4 million home loans. By 1955 that number went up to 4.3 million.

One of the central critiques of the G.I. Bill was the **systematic discrimination against veterans of color.** This would play out economically, socially, and politically with ramifications of the unequal treatment and distribution of resources still felt today. An example of this is redlining - a policy that intentionally restricted insuring home loans for Black people as suburban neighborhoods expanded.

Groups like The Greenlining Institute are working to reverse the long term effects of redlining to ensure "communities of color can build wealth, live in healthy places filled with economic opportunity, and are ready to meet the challenges posed by climate change."

Redlining in Seattle's History Plagues us Still



Social Unrest in 1960s and 1970s

After Rachel Carson published *Silent Spring* in 1962, there was increasing concern about pollution in the environment. This **environmental movement converged** with the Civil Rights movement, which expanded to include **Mexican American** (Chicano) activism, the feminist movement, and opposition to the Vietnam War. Other important moments during this time included the first ever **Earth Day Celebration** in 1970. During this first Earth Day, 20 million Americans protested against impacts of industrial growth and pollution. This was the same year that the **Environmental Protection Agency** (EPA) was established. This important piece of legislation was quickly followed by the 1972 **Clean Water Act** and the 1974 **Safe Drinking Water Act.** Even with these foundational policies, the US still struggles to provide clean and safe water to everyone

Baby Boomer Generation

Baby boomers are people born in the US between 1946 and 1964. Like a financial boom in a new business market, this was a population boom. Servicemembers came back from World War II, got married, and began families - these children became **the Baby Boomer Generation.** This unprecedented increase in population drove home ownership, millions of more people adopting what we consider suburban lifestyles including activities like caring for large yards and gardens, and installing numerous appliances (dishwashers, washing machines, and sprinkler systems).

Boeing Layoffs

Sometimes called the **"Boeing Bust",** massive layoffs by Boeing and related industries impacted the Puget Sound region dramatically. More than 60% of the workforce lost their jobs in the late 1960s and early 1970s. These layoffs were a result of an oversaturated airplane market. In the 1950s Boeing found great success in the construction of commercial airplanes including the Boeing 707, 727, and 737. The financial challenges connected with the Boeing 747 and Super Sonic Travel project pushed Boeing into a **financial crisis in 1970.**

Housing prices dropped and stores and restaurants laid off many people. People were leaving the area and at one point some real estate agents rented a billboard near Sea-Tac Airport that read **Will the last person leaving SEATTLE Turn out the lights.** You might have a parent, grandparent, aunt, or uncle who experienced the impacts of this time - ask them if they or have a story to share.

Severe Drought 1992

Throughout the mid-1980s water consumption in Seattle continued to rise but ultimately leveled off before 1992. The severe drought in 1992 forced a dramatic shift in water consumption. This is where the decoupling of increasing population and decreasing water use began in earnest. There were temporary use restrictions, increases in rates, and concerted efforts to teach communities about water conservation behaviors. Water utilities began promoting water conservation and private companies began working on more efficient appliances.

The continued decrease in water use was the result of intersecting efforts which included...

Local Water Utilities

Operations at local water utilities increased efficiency and the pricing structure for ratepayers changed. Previously water was so inexpensive, people took it for granted. Conservation programs launched by water utilities encouraged people to pay attention to their water use.

Government and Business Innovation

Changes in government policies regulating water use and business innovations in efficient appliance design helped reduce water use commercially and in households. In 2003 a new law was passed in Washington State called the **Water Use Efficiency Rule.** This rule required water providers to take the following actions,

- Establish a water savings goal
- Develop a Water use Efficiency planning program to support the established goal
- Report annually on progress towards achieving the goal
- Install meters on all customer connections by January 22, 2017
- Achieve a standard of no more than 10% water loss

Innovations in the business sector are exemplified by more efficient faucets, irrigation systems, dishwashers, clotheswashers, and perhaps most importantly, our toilets. See how the design and manufacturing of toilets since the 1950's has really improved.

1950 to 1980 / 5.0 gallons per flush (gpf)

1980 to 1994 / 3.5 gallons per flush

1994 to present / 1.6 gallons per flush

Present / 1.28 or less gallons per flush

Social Changes

A new stewardship ethic oriented around water conservation encouraged communities to implement simple strategies and reduce their impact.

Next Step Actions

After the severe drought, major behavior changes were required. So, little by little, people began to adopt these new stewardship practices..

1. *Letting lawns go dormant in the summer.*
2. *Removing lawns and replacing with native plants acclimated to the region.*
3. *Using irrigation auto-timers to regulate water use.*
4. *Practicing natural yard care like mulching and composting to improve soil health and hold water.*
5. *Replacing old toilets with newer, more efficient models. Fixing leaking toilets.*
6. *Installing new faucet aerators and showerheads*
7. *Installing efficient dishwashers and clothes washers with **WaterSense** labels.*

Can we get to net zero water?

Moving toward **net zero water** use will require recycling water efficiently in order to limit the amount continually pulled from water sources in the environment. To accomplish net zero water use, we need to focus on places where we use a lot of water.

What tools and information would we need to design a home, school, shopping mall, or apartment building that is net zero water? How would this system work? How would we be sure the water is safe and clean for use after recycling? The Federal Energy Management Program offers an example of a net zero water building. **This infographic highlights** the different types of water being recycled, water sources being recharged, or water being reused. In this example, the water from toilets travels to a septic tank and then gets released into the groundwater.

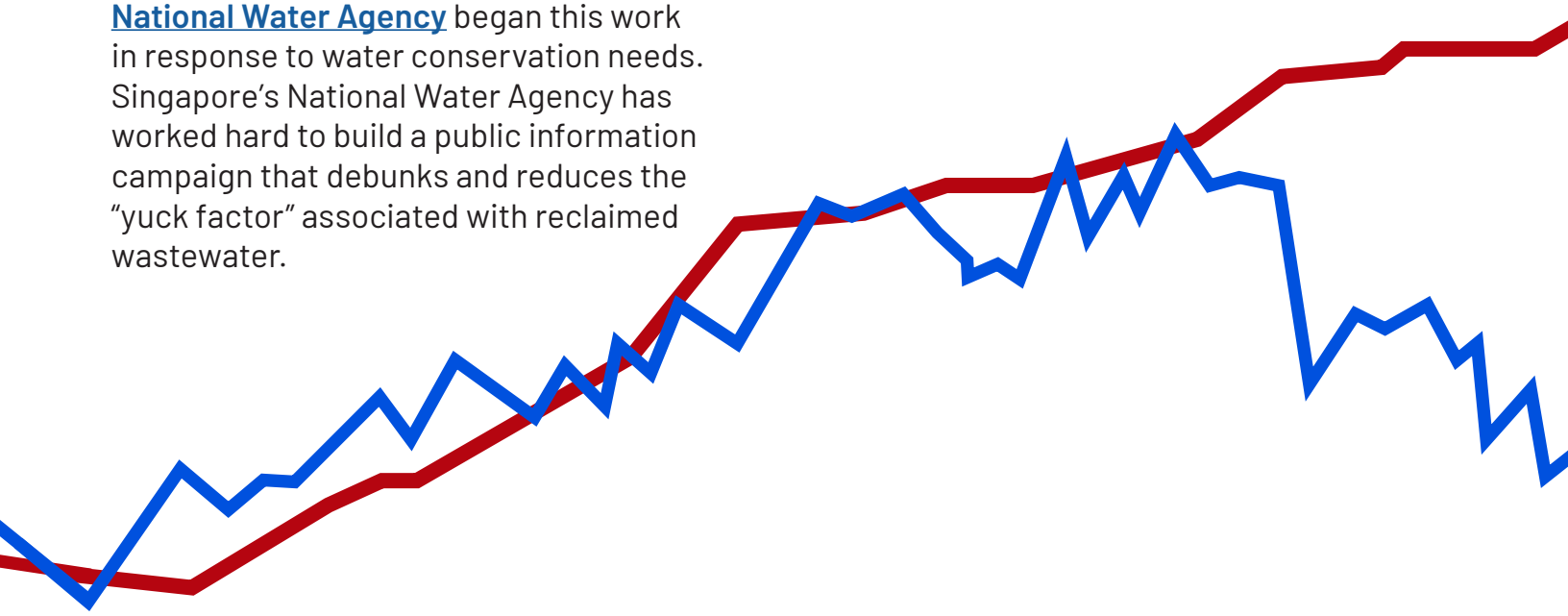
What if we could more efficiently recycle water from toilets? If this water was safe to use, how would that change commercial and household water use? **Singapore's National Water Agency** began this work in response to water conservation needs. Singapore's National Water Agency has worked hard to build a public information campaign that debunks and reduces the "yuck factor" associated with reclaimed wastewater.

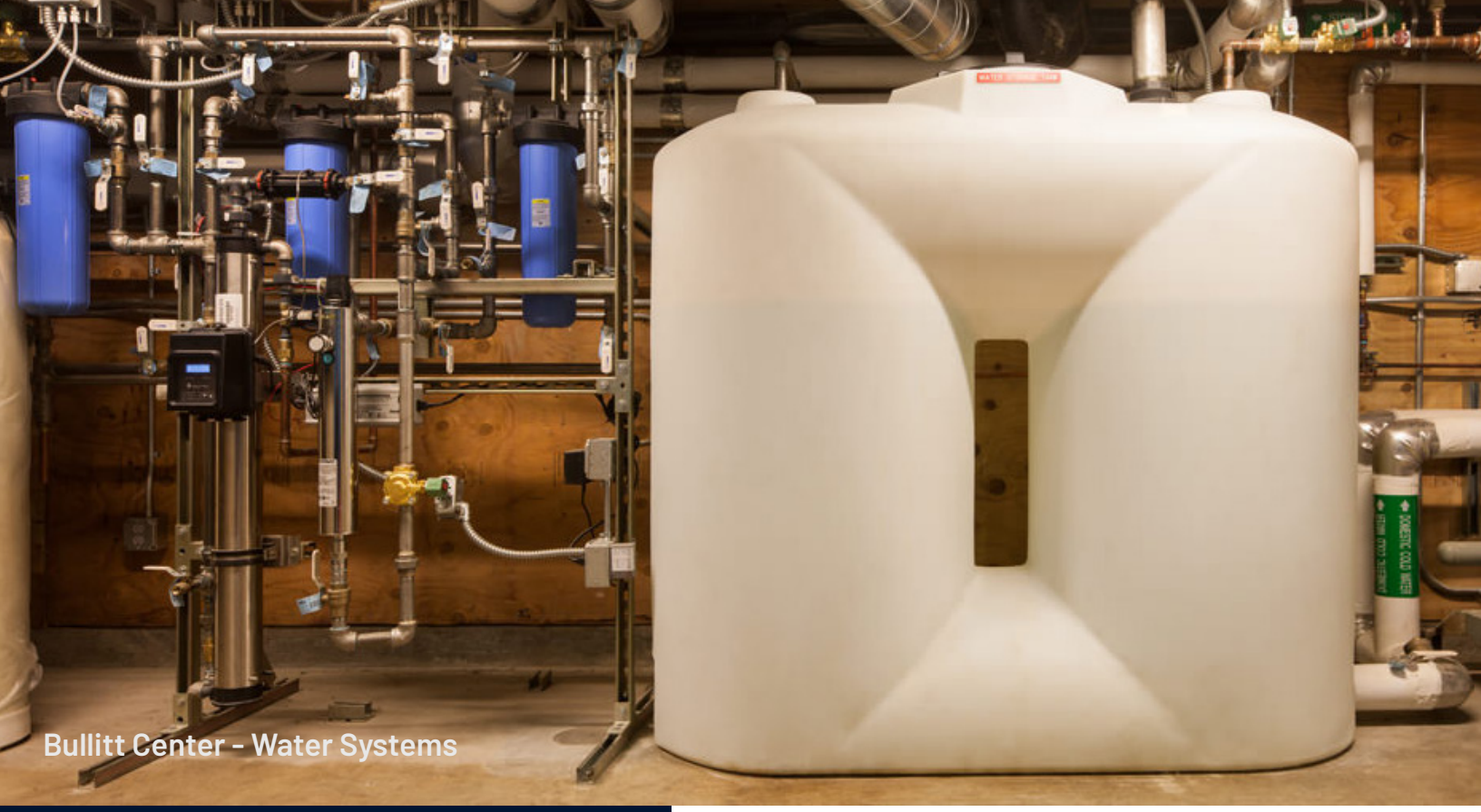
EXAMPLE: Water Recycling on the International Space Station

"There is an entire closed-loop system onboard the International Space Station (ISS) dedicated to water. First, astronaut wastewater is captured, such as urine, sweat, even the moisture from their breath. Then impurities and contaminants are filtered out of the water. The final product is potable water that can be used to rehydrate food, bathe, or drink. Repeat. The system sounds disgusting, but recycled water on the ISS is cleaner than what most Earthlings drink.

We tend to forget that sources of potable water on our planet is limited, less than 2% of the water on our planet is fresh water, including glaciers and polar ice caps. The goal is to substitute recycled water where potable water is unnecessary. For example, we can use recycled water to recharge underground aquifers, irrigate landscapes and crops, and flush toilets. By using recycled water more frequently we can sustain the limited supply of potable water for drinking and cooking."

SOURCE: **Water Recycling, NASA**




Bullitt Center - Water Systems

LESSON OUTLINE

Materials Needed

Download a pdf of the coolest graph ever 1930-2014. Since this video was produced in 2017, here is an updated graph that takes us through 2020, including a hint at how the global pandemic impacted water consumption in our region.

Download the full slide deck that Annalisa used in her video presentation.

Time Needed

Each of the lesson ideas in this collection may take 2-3 class periods.

VOCAB AND KEY SEARCH WORDS

Water Cycle
Climate Change Impacts
Precipitation Patterns
Snowpack
Consumption Patterns
Water Conservation
Water Supply / Water Quality
Water Infrastructure
Drinking Water Treatment
Reservoir
Conveyance Pipes and Pumps
Water Meter / Smart Meter
Water Tank / Tower
Rainwater Harvesting
Cistern
Recycled Wastewater
Recharge Water
Potable Water Supply
Non-Potable Water Supply
Gray/Black Water Discharge
Drought
Integrated Water Management
Fee Structure / Ratepayer
End User / Consumer
Water Equity / Water Justice
Water Affordability
Water Security
Water Utility
The New Deal
The G.I. Bill
Redlining
Greenlining
The Clean Water Act
The Safe Drinking Water Act
Water Footprint

ENTRY EVENT

Before watching the video...

Students are provided a hard copy or digital version of the **single graph** that catalyzes this entire lesson. Teachers may want to ask...

What does the X axis tell us? What about the right and left Y axes?

What happened for these two lines to decouple?

Is it a problem that the blue line is trending down?

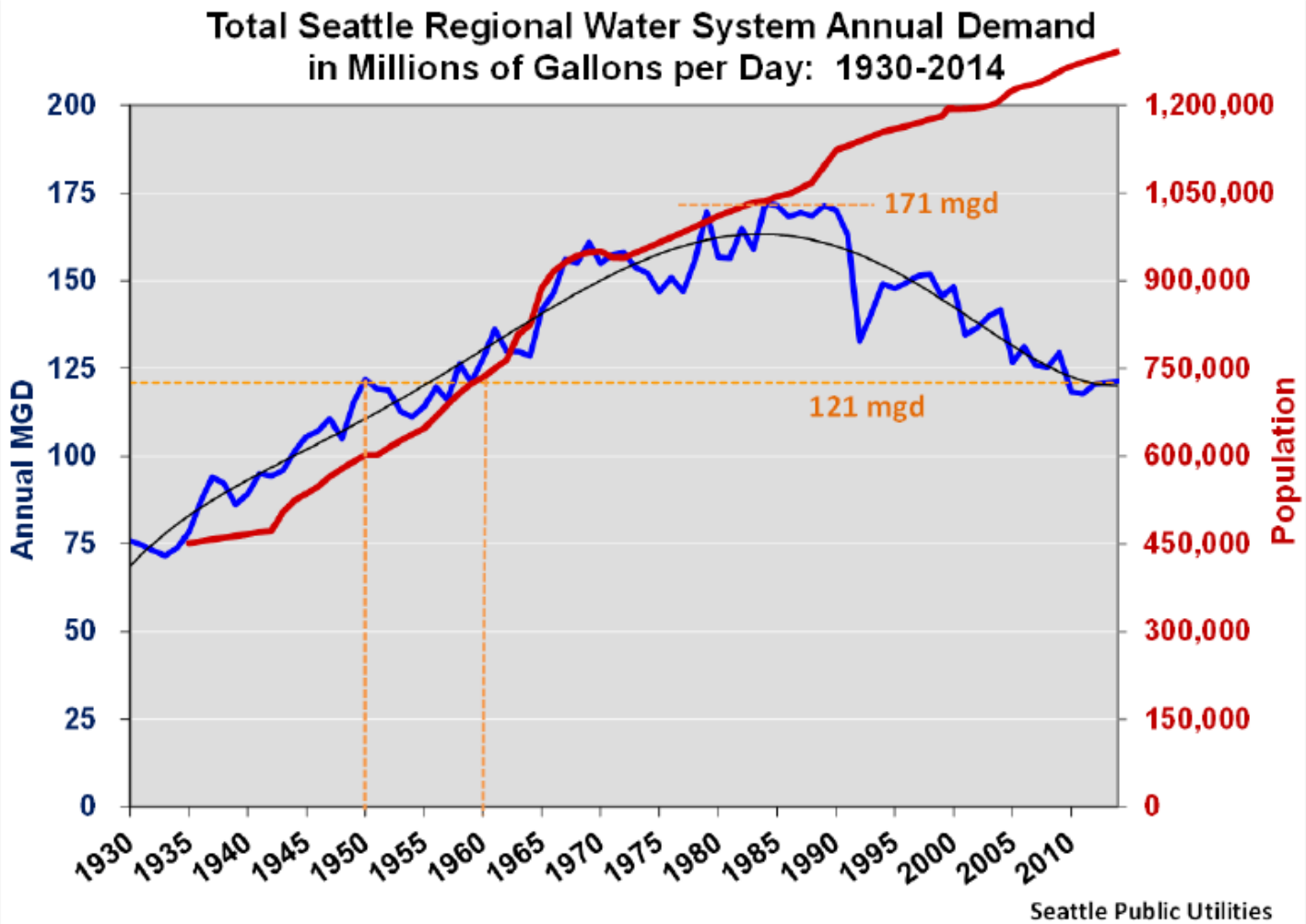
Why is the population continuing to grow in our region? What are the causes?

When did your family come to this region? What were the decision points?

Do you think this growth results in equitable outcomes for all people? What would cause some groups of people to be left behind?

What is the upper limit for population growth in our region in the coming decades? Why? What do you think are the limiting factors?

What is the meaning of the yellow dashed line, equating the 1950's with 2014? The population has doubled but water consumption has returned to the 1950's level. How could this be?



ACTIVITY 1

Watch the Video for Substance & Style

Students work in small groups to digest the video and curate a list of research questions about the graph story. They are encouraged to watch the video 2-3 times, pausing when needed to catch key points and build their expertise as a group.

TEACHER TIP: Here's a handy list of time stamps for watching different sections of the video

0:59 Right before "history lesson"
2:32 Right before "first solutions"
3:23 Begins "decoupling"

Prompts may include...

What stood out to you as key points in the video?

What did you admire most about Annalisa's presentation style and narrative structure?

What specific elements of this story did you already know?

What are you curious about? Did anything surprise you?

How do events in history impact other systems, socially, economically, politically and environmentally?

Do you have any family stories about water conservation, recent or historical, here in our region or in some other country?

Identifying History Research Questions

Invite students to write down 3-5 history research questions that interest them about how local events led to a change in water consumption patterns. Support students in developing a set of key search words. Guide them in practicing their own internet searches to develop short background pieces for each of their research questions.

So What Happened in 2020?

Take a look at this **updated graph.** What new stories or research questions can we add through the year 2020 when the global pandemic was causing major disruptions? How will these disruptions impact our local water system?

Strengthen Your Research! What is our Water Budget?

Invite students to generate a list of all the ways they use water. They can do this as a large group, small groups, or individually. Students may capture their ideas in a list, a mind map, or artistically as a hand drawn or digital infographic. Push them to think critically about **direct and indirect** uses of water. For example, we use water directly when washing our hands or flushing the toilet. We use water indirectly when we wear a cotton t-shirt or eat a burger.

Students are challenged to expand their thinking beyond their personal, individual water use. How does your household use water? What about your school? What about restaurants or recreation centers? What about Lumen Field where the Seahawks play? Or the various hospitals in Seattle? Go bigger! How is water used on a national scale **commercially, agriculturally, and for electricity**?

Invite students to conduct a more in depth webquest of the EPA's excellent website to flesh out their research questions and expand their understanding: **How do we use water?**

With a grounding in how we use water, revisit the Coolest Graph Ever and come back to the 1992 drought. Knowing how we use water can provide a deeper connection to the restrictions put in place and the actions taken to mitigate the amount of water being used.

The checklist of stewardship actions comes straight from the Coolest Graph Ever presentation. **Reflect on your water use:**

Which actions from the checklist are you already doing as a family or individual?

What actions do you think you could improve on or initiate from scratch?

How much water could you save?

Does saving water save your family money?

How might you graph your water use reductions over time?

FAMILY CHECKLIST

Download as Classroom Handout

NOTE: If you live in an apartment or shared living space, what do you notice about water use? If appropriate, have an informational interview with your landlord or building manager.

- ☐ Let your lawn go dormant.
- ☐ Remove your lawn and replace it with native plants.
- ☐ Use irrigation auto-timers and drip irrigation systems for your garden or lawn.
- ☐ Practice natural yard care (mulching & composting).
- ☐ Replace high-flow toilets with low-flow toilets.
- ☐ Fix leaking toilets (and any other leaky plumbing).
- ☐ Install new faucet aerators
- ☐ Install new showerheads (low flow showerheads).
- ☐ Use efficient dishwashers.
- ☐ Use efficient clothes washers.

Get the Calculator: Explore the lesson that accompanies the **Home Water Conservation Audit** for a more thorough, data-driven analysis. The lesson includes an awesome **calculator** showing the relationship between your water consumption, energy use, and associated greenhouse gas emissions. **See Water Supply Collection.**

ACTIVITY 2

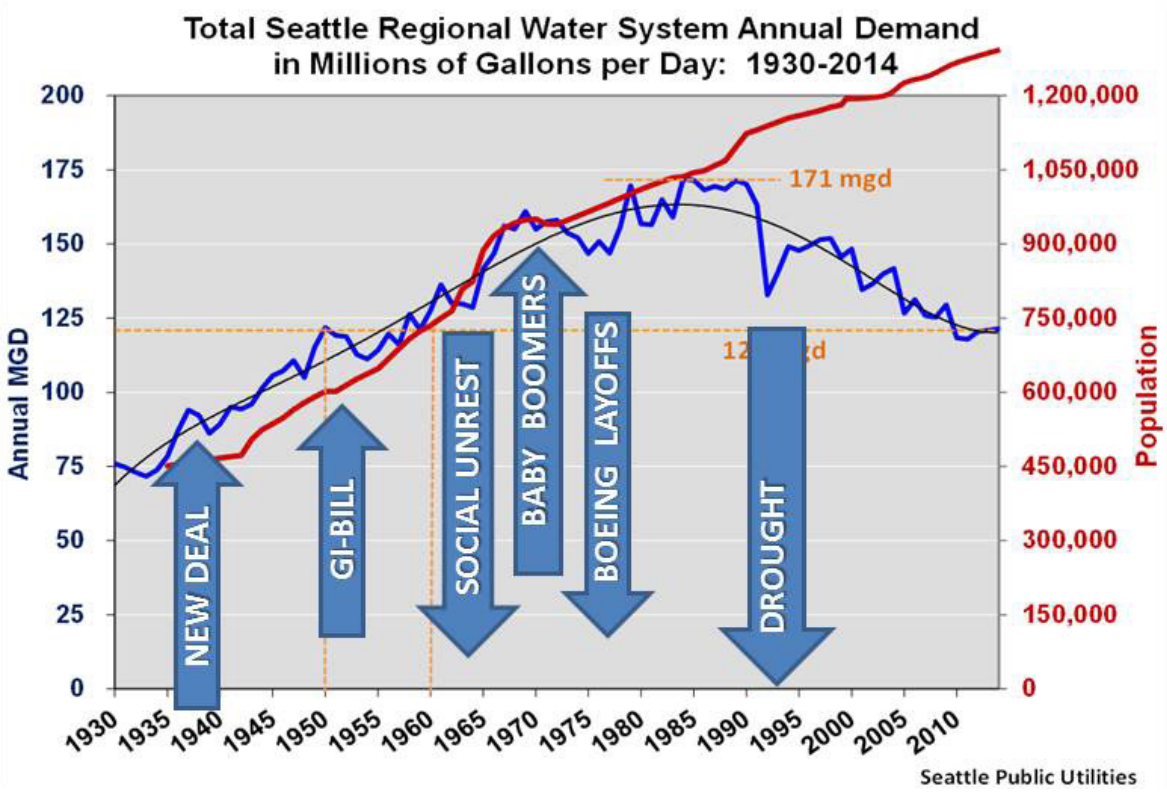
The Drought of 1992 Shook Seattle

The intensity of the 1992 drought was matched by hard hitting headlines in local, regional, and national news outlets. To get a sense for what it is like to live through a drought, invite students to read several of the articles listed below. Students explore what is considered a drought, what causes a drought, and what we can expect moving forward as drought conditions persist. They might project trends for water supply in our near future using graphs and online models. See the Water Systems Collection for the lesson; **Is Drought the New Normal?**

Understanding drought in the Puget Sound region means understanding that we depend on snowpack. Over the last hundred years, we have constructed dams across a number of our cascade alpine canyons to hold water in huge man-made reservoirs that serve the water supply needs of millions of people. In our region it rains a lot, especially at the higher elevations. This rain can be captured and held in our system of reservoirs.

What is not known by most people, is that we have been depending on a certain depth of snowpack each year to serve as a **second, natural reservoir** of water. **A frozen one.** This is important, because as we enter the summer months with little or no rainfall until October, our reservoirs would be drained by the water consumption demands of millions of people if not for our snowpack. The snow that packs down through the long winter will **slowly melt through the summer.** We count on this phenomena to supplement water levels in our reservoirs. ***We drink snow in August.*** See Snowpack Lesson Collection

With a shrinking snowpack, water resource managers, policy makers, and each of us within our own families, schools, and cities, need to make critical decisions about how to conserve water.



Comparative News Analysis: 1992 and 2021

Download as Classroom Handout

This is an opportunity to compare news of the shock our region experienced in the 1992 drought, which seemed to most people like a ***really unusual singular event,*** something just to get through, to what's in the news about our situation today, where all of the climate models point to sustained and severe drought ***becoming the new normal.***

1992 News Analysis

For a 1992 contemporary news article that provides a sense of "we are there", students can analyze the content and style of the New York Times writer Timothy Egan in, Dust Coats Wet Image of Seattle. This 1992 article has been archived using a photocopier on microfilm. Google and the internet were not yet developed.

Direct students to go to page 22 to find the correct headline, then zoom in and navigate to read the full article. **Some possible inquiries...**

What do you notice about the news article style of writing from 1992?

What are the stories of the people interviewed for this article? Why does the author use personal interviews?

How does the author use date to build his argument? What does the data tell you?

What did it feel like to be there in 1992 during this crisis?

Do you have any family stories from this time of sudden and severe water shortage?

Do you have any family stories from some other place in our country that has experienced severe water shortages?

"Surrounded by water, the city of Seattle is parched with thirst. Lawns are bronze. Fish are confused. Fountains are dry. Showers are short."

-Seattle, June 6, 1992

2021 News Analysis

Invite students to analyze at least three different news articles listed below related to the drought we experienced in 2021. Refer to Comparative News Analysis Handout.

Inquiries:

1. What qualifies as a drought? Have you lived in a place where you experienced drought? What about any of your friends and family?
2. What caused the severe drought in 1992? What about the drought in 2021?
3. Based on the headlines and articles you read, what are the community reactions to the drought? What are people forced to change about their lifestyles or daily behaviors? What are businesses or governmental agencies forced to do to control and limit water use?
4. Look at the Coolest Graph Ever again. In the coming decades, how will climate change impact our strategic choices for securing a dependable supply of water?

Sample News Articles from 2021 Drought

Monday, June 28, 2021 - Pacific Northwest's record-smashing heat wave primes wildfire, buckles roads; health toll not yet known.

Tuesday, June 29, 2021 - How Weird Is the Heat in Portland, Seattle and Vancouver? Off the Charts. To understand the magnitude of the departure from historical norms, it helps to visualize it.

U.S. Drought Monitor - This series of state-by-state maps are released every Thursday, showing parts of the U.S. that are in drought. The map uses five classifications: abnormally dry (D0), showing areas that may be going into or are coming out of drought, and four levels of drought: moderate (D1), severe (D2), extreme (D3) and exceptional (D4).

The Western Drought Is Bad. Here's What You Should Know About It - Answers to questions about the current situation in California and the Western half of the United States.

Where's the Water? Drought Threatens California's Lifeline - According to the United States Drought Monitor, 84 percent of the West is now in drought conditions, with 47 percent rated as "severe" or "extreme." In California, 73 percent of the state falls into those categories.

Amid Historic Drought, a New Water War in the West: - A drought crisis has erupted in the Klamath Basin along the California-Oregon border, with fish dying en masse and farmers infuriated that they have been cut off from their main water source.

California's Drought Is So Bad That Almond Farmers Are Ripping Out Trees - The famed farming valleys of California are being swept into what feels like permanent dryness, raising the specter of food inflation.

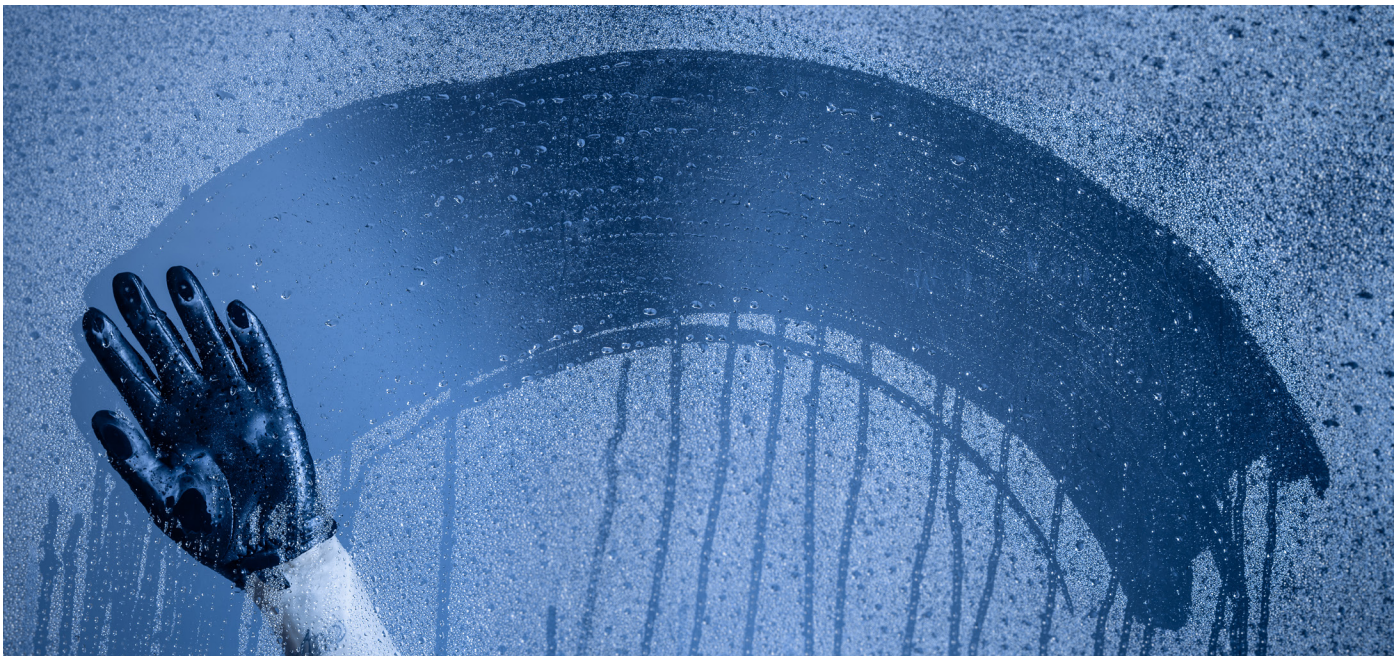
The Drought and Food Access in California - An excellent PowerPoint listing the multiplier effects of drought on food systems, workers, and public health. And, much of the nation, including our own families depend on food grown in California.

In California's Drier Future, What's the Best Investment for Securing Water? - California's water system, already stressed by the dueling needs of massive urban centers and its agricultural sector, is crumbling in the face of climate change. What are the options?

How Severe Is the Western Drought? See For Yourself - Startling US maps reveal that extreme drought conditions are more widespread than at any point in at least 20 years, according to the U.S. Drought Monitor.

ACTIVITY 3

Water Equity Pillars and Local Fact Finding



Water equity is an important part of a sustainable and just future around the world. It means that all communities can access safe, clean, and affordable drinking water and water for sanitation. This also means that the systems that supply this water are prepared for the anticipated changes and impacts of climate change. Finally, water equity means communities have a say in what happens and can participate in decision making when it comes to our collective water future.

Exploring Personal Identity

Invite students to share in small groups or in a reflective writing piece, their own lived experiences in relation to water equity.

Inquiries might include...

How do I take water for granted each day?

Several billion other people in the world do not have this same privilege. Is our assumption about clean water supply and sanitation services connected directly or indirectly to their experience? See UN Water Scarcity

Does your family have stories about water issues from where you live now or from where your family came from?

Have you heard about the water equity issue that happened in Flint, Michigan? What happened there? How does this relate to our local situation? See NRDC - Flint Water Crisis: Everything You Need to Know

What percentage of your monthly household expenses is your water bill? Is this the same for all folks in our region?

Do you and your family know how to have a say in water management decision making? How does this work?

What do you think were some of the impacts from Covid-19 on people's ability to pay basic bills like water, energy, and rent? Does your family have any recent stories or experiences like this? How are families coping locally, nationally, internationally?

EXAMPLE

Seattle Public Utilities

COVID Bill Payment Assistance

Seattle Public Utilities (SPU) knows the COVID-19 pandemic has made it harder for some of its customers to afford essential services. We're here to help. SPU has several financial assistance resources available.

Pay what you can now and the rest over time.

About utility bill payment plans: With a payment plan, residential and small business customers can break up their SPU bills into segments and pay over time with no late fees. SPU will work with you to set up a plan that makes sense for your budget.

Flexible payment options: In response to the COVID-19 pandemic, SPU has suspended the required 50 percent down payment to establish a payment plan and will work with customers to determine a minimum payment that works for them. SPU has also doubled the amount of time customers have to get caught up on their bill from 60 days to 120 days. Payment *plan requests can be made using the payment plan enrollment form on the Utility Services Website. This form will offer options for paying your bill in smaller payments. You can request a payment plan for any Seattle Public Utilities or Seattle City Light account linked to your Utility Services Website account profile.*

You can also access this information in seven different languages.

Three Pillars of Water Equity

The US Water Alliance describes three pillars of water equity. These big picture principles describe action needed by local, regional, and national organizations and water utilities. They include:

1. Ensure all people have access to clean, safe, affordable water service
2. Maximize the community and economic benefits of water infrastructure investment; and
3. Foster community resilience in the face of a changing climate.

Invite students to read and discuss descriptions of the three pillars on the US Water Alliance website to deepen their understanding. Then, as a class, or in small groups, ***craft a professional email*** to your local city government or water utility.

Encourage students to think of the email as a **fact-finding mission.**

How is your local government or utility informed by these pillars?

How are they taking action for water equity?

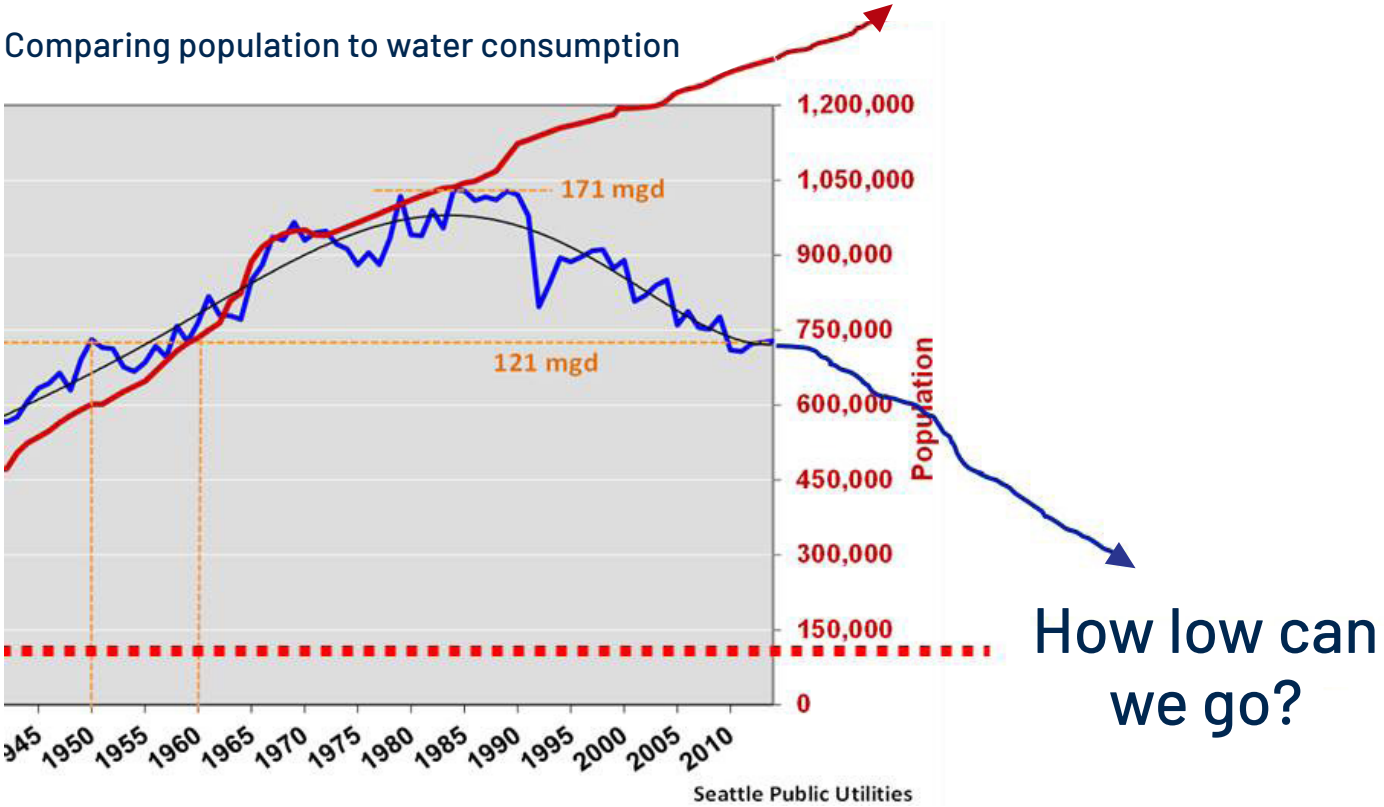
What mitigation strategies are in place related to water equity issues in the face of climate change?

What is the response? Is there a next step we can take as a class to engage with this issue?

ACTIVITY 4

Can we get to Net Zero?

Comparing population to water consumption



Invite students to ponder the speculative line drawn into the future in this image from the Coolest Graph Ever presentation. What would we need to do to keep improving water efficiency and conservation measures so that the blue trend line continues downward? Is it possible to achieve net zero water?

Prioritized List of Stewardship Actions

Have students develop an initial set of ideas based on their new understanding of all the stewardship actions they have reviewed so far in this lesson. Invite them to share, refine, and prioritize their ideas via small group discussion. Some possible inquiries...

Over the next decade or two, which of the stewardship actions will help the most in reducing the demand for water?

How can it be implemented at a huge scale?

Will the needed changes happen through government regulation, through government investment and subsidies, or through tax breaks?

Will it happen through business innovation and shifts in the marketplace?

Will it happen through education and personal behavior change?

Engineering a Net Zero Water Building

Challenge small teams to apply the engineering design process to model a net zero water system for their home, apartment, school or entire community. To support a range of research pathways and presentation options here are a few suggestions to encourage student choice and voice.

Engineering design includes three key practices

ONE: Defining and delimiting engineering problems involves stating the problem to be solved as clearly as possible in terms of criteria for success, and constraints or limits.

TWO: Designing solutions to engineering problems begins with generating a number of different possible solutions, then evaluating potential solutions to see which ones best meet the criteria and constraints of the problem.

THREE: Optimizing the design solution involves a process in which solutions are systematically tested and refined and the final design is improved by trading off less important features for those that are more important.

Presentation Options Student Choice and Voice

OPTION 1- Engineering Design Schematic: Students draw and label a schematic that shows the engineering needed to develop a Net Zero Water home, apartment building, school, or community. They may compare their initial model to the information at these two resources and then do a second, more refined model. See Net Zero Water Building Strategies and also Schematic for Ideal Net Zero Water Building.

OPTION 2- Annotated Bibliography: Students develop keyword searches to produce a list of the best websites, articles, videos, and case studies focused on achieving Net Zero Water. See the Living Textbook for examples of annotated lists of sustainable systems resources.

OPTION 3- Case Study Comparative Analysis: Students research and analyze at least three different cases studies of actual buildings achieving Net Zero Water, or close to it. These buildings are certified as having met the most rigorous green building standard in the world. The Living Building Challenge.

- Bullitt Center
- R.W. Kern Center
- Kendeda Building for Innovative Sustainable Design
- Loom House
- Hitchcock Center for the Environment
- Sustainable Buildings Research Centre
- Frick Environmental Center
- Beacon Springs Farm
- Urban Frontier House

OPTION 4- Case Study - Singapore: Students study the Four National Taps that comprise the island nation's approach to Integrated Water Management with the goal of national water independence. What can we learn from the engineering design choices used in Singapore when applied locally, to our own home, apartment building, school, or community?

OPTION 5- Speculative Fiction: Students develop a short story about building and living in a Net Zero Water home, apartment building, or school building as if there was nothing unusual about it. Sensory detail and character development gives a feeling of "being there."

OPTION 6- Infographic: Students develop one or more infographics to tell the story of how we get to Net Zero Water. They can conduct an online search for "images water infographics" to explore how other graphic designers have used color, shape, text, and data to tell visual stories. Also see Schematic for Ideal Net Zero Water Building from OPTION 1 above.

Students analyze how NASA achieved a completely **closed loop** water infrastructure system that takes advantage of all water sources and recycles every molecule to support human life in orbit.

What can we learn from the engineering design choices used in the International Space Station when applied locally, to our own home, apartment building, school, or community?

See for yourself!

VIDEO: (2:37) **How To Recycle Water in Space.**- Infographic breakdown of the process.

VIDEO: (1:52) **Water Recycling on the ISS** - Astronaut describing the main elements of the process and showing the equipment.

VIDEO: (8:41) **Station Tour** - Great personal tour led by Commander Suni Williams.

VIDEO: (5:02) **Life on the Station B-Roll** - Fascinating, random video clips of daily life.

ACTIVITY 5

Making an Impact

There are many ways we can conserve water and increase water use efficiency. But sometimes it is hard to know where to start. Or, if we do take an action, it can sometimes feel too small to make a difference. Not true. **Every action adds up.** Here are some resources to inspire and guide student impact project development.

Use the **Water Footprint Calculator** to assess your own water use. This will give you a measure of the water you consume ***directly*** from the plumbing in your home, as well as the water you consume ***indirectly***, like the water used to grow, process, clean, or transport the products you buy. Everything has a water footprint embedded within it. Once you know your water footprint you can identify actions to reduce it.

See Sustainability Ambassadors' **Student Project Ideas.**

What types of project ideas are you most drawn to?

How many of the project ideas listed are you and your family already practicing?

If you were to pick three more project ideas that you and your family are not currently practicing but you think would be pretty easy to do, which ones would you choose?
What criteria will you develop and apply to make a choice for an impact project you can commit to?

Study some of Sustainability Ambassadors' **sample Student Impact Projects.** Especially this one which describes a **Water Footprint Campaign for Clubs or Classrooms.**
It is important for students to feel agency, voice, and choice in how they are called to make a difference in their community. And it adds rigor to the impact project design process when students are empowered to demonstrate a direct and measurable connection between the project they design and the policy goals and performance measures built into local water management plans.

For more on how to support students on designing effective impact projects, review the very helpful lesson plan frameworks for **Impact Project Design** and **Engaging Stakeholders** that you will find here in Sustainability Ambassadors' **Foundation Lessons.**

ACKNOWLEDGEMENTS

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Thank you **King County WaterWorks Grant Program** for supporting partnership building, curriculum design, and student impact projects related to water quality.

About Sustainability Ambassadors

Sustainability Ambassadors is a professional development program for student leaders, teacher leaders and community leaders committed to rapidly advance a sustainable future by aligning classroom rigor with community relevance for real world impact.

We support a year-round training program for over 60 highly motivated youth, a paid Equity Advocacy Internship, a Green Jobs Youth Pathways Portal, and a Teacher Fellows Program, working with hundreds of educators to design new models of problem-based, place-based learning around a shared vision of ***educating for sustainability.***

We focus on middle school and high school youth, the teachers and school districts that guide their learning, and the community stakeholders, local government and business leaders who are relying on the next generation to be engaged voters, informed taxpayers, conscious consumers, and employees who can create and lead sustainability initiatives.

Visit: https://www.sustainabilityambassadors.org/