



Water World

A 6-8 STEM Experience

Created by C.I.T STEM Curriculum Team

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About This Experience

In this experience students will explore water. They will study how water moves within the earth and atmosphere, the visible and invisible ways it fuels our modern society, issues surrounding access to freshwater around the world, and how they can take action to protect this precious resource on a local and global scale. Students will read high quality texts, watch engaging videos, conduct hands-on experiments, and participate in an immersive field trip as they develop a deep understanding of how water impacts their lives and the lives of people around the world. At the end of the program students will showcase the knowledge and skills they gained in a culminating project.

Materials

Quantity	Item
20	Laptops
20	Notebooks
1	Pack of Ground Coffee
1	Bottle of Vegetable Oil
2	Packages of Coffee Filters
2	Containers of Sand
1	Bag of White Aquarium Gravel
2	Bags of Cotton Balls
2	Boxes of Macaroni Noodles
1	Pack of Clear Plastic Cups
10	<u>Stopwatches</u>
10	Quart-Size Ziploc Bags
1	Electric Tea Kettle
20	<u>Pipettes</u>
1	Set of Brown Paper Towels
20	One Well: The Story of Water on Earth by Rochelle Strauss

Note to Activity Specialists

This experience comes with daily lesson plans and corresponding slides for each lesson. A projector is required to share the slides during the lesson as part of the whole class instruction. The slides contain visuals of the Essential Question, daily learning objective, as well as embedded videos, texts, activities, and experiments aligned to each lesson. The first two lesson plans in this experience are heavily scripted to help you acclimate to teaching the experience. The rest of lessons are heavily structured but less scripted to allow room for your unique voice and style.

All lessons are designed to be 45 minutes long. There are two lessons for each week of the five week summer session with some suggestions for extension activities if time permits.

We hope you enjoy teaching this experience to your students and we hope they enjoy exploring the wonderful world of water!

Week	Lesson	Guiding Question	Big Idea	Learning Objective
1	1	Why is water a critical natural resource?	Drinking water is critical to the survival of all living things, but water is also used in almost every aspect of our daily lives. The visible ways we use water include things like bathing, cooking, and cleaning, but there are also invisible ways that water is used like to produce the items we buy and the food we eat.	SWBAT explain the different ways humans use water (e.g. in industry, agriculture, and personal use).
	2			SWBAT explain where New York City's water comes from, including the processes involved in making sure it is clean and safe to drink.
2	3	How is Earth's water connected and distributed?	The amount of water on earth does not change. The water we have today was the same	SWBAT explain how all of earth's water is connected through the water cycle.
	4		dinosaurs roamed the earth. Water moves through a cycle of evaporation, condensation, and precipitation over and over again. Some parts of the world have access to larger amounts of freshwater than others due to their climate and weather patterns.	SWBAT compare water usage and access in different parts of the world.
3	5	What are the causes of freshwater scarcity?	Increasing demand, climate change, and water pollution are all factors that contribute to freshwater scarcity in some parts of the world.	SWBAT identify three distinct yet connected threats to the world's freshwater supply: increasing demand, pollution, and climate change.
	6			SWBAT explain how demand, pollution, and climate change impact the world's freshwater supply and potential solutions to the problems they pose.

Week	Lesson	Guiding Question	Big Idea	Learning Objective
4	7	Field Trip		Field Trip
	8	Culminating Project Work Time		Introduce the Culminating Project to Students
5	9	Culminating Project Work Time and Showcase		Culminating Project Work Time
	10			Culminating Project Showcase



Family Letter

Dear New York Edge Caregivers,

We are very excited to kick off our next STEM experience: *Water World*! Over the next several weeks, students will explore the fascinating world of water. They will study how water moves within the earth and atmosphere, the visible and invisible ways it fuels our modern society, issues surrounding access to freshwater around the world, and how they can take action to protect this precious resource on a local and global scale.

Over the course of the experience, students will read high quality texts, watch engaging videos, conduct hands-on experiments, and participate in an immersive field trip to The Bronx River. All of these activities will help them answer the Essential Question: *How important is water*? At the end of the Experience, students will showcase the knowledge and skills they gained by completing a project and sharing it with you and other members of the community.

Want to keep the learning going at home? The following questions would be great conversation starters with your child. They are broken down by each week of the Experience:

Week	Question	The "Big Idea" your child will take away from their learning this week
1	Why is water a critical natural resource?	Drinking water is critical to the survival of all living things, but water is also used in almost every aspect of our daily lives. The visible ways we use water include things like bathing, cooking, and cleaning, but there are also invisible ways that water is used like to produce the items we buy and the food we eat.
2	How is Earth's water connected and distributed?	The amount of water on earth does not change. The water we have today was the same water that was around when dinosaurs roamed the earth. Water moves through a cycle of evaporation, condensation, and precipitation over and over again. Some parts of the world have access to larger amounts of freshwater than others due to their climate and weather patterns.
3	What are the causes of freshwater scarcity?	The demand for water is increasing due to population growth and its connection to agricultural and industrial water use and pollution. In addition to the increase in demand, climate change is altering weather patterns and disrupting the water cycle. All of these factors combined have forced humans in many parts of the world to draw on ground water sources more quickly than these sources can be renewed.
4	Field Trip and Culminating	Project Work Time
5	Culminating Project Work	Time and Showcase

We can't wait to begin exploring water with your child! Please do not hesitate to reach out with any questions or concerns!

Sincerely,

[Insert Activity Specialist's Name and Contact Information]

Learning Outcomes

Essential Question	Enduring Understanding
How important is water?	Water is a critical natural resource that all living things need to survive. Humans use water in all aspects of their lives, in ways that are obvious and not so obvious. We drink water and use it to clean and cook. Water is also used to make everything that we consume such as food, clothes, and other material goods.

Standards

NYS Science Standards:

- **MS-ESS2-4**. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- **MS-PS1-4.** Develop a model that predicts and describes changes in particle motion, temperature, and phase (state) of a substance when thermal energy is added or removed.
- **MS-ESS3-4.** Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- **MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

NYS ELA Standards:

- **6W6:** Conduct research to answer questions, including self-generated questions, drawing on multiple sources and refocusing the inquiry when appropriate.
- **6SL1:** Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of other.
- 7R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences.

NYSDOE SEL Benchmarks:

• **2C.3b.** Demonstrate cooperation and teamwork to promote group well-being and collective efficacy.



Vocabulary

- Water Footprint: the total amount of freshwater used by a person or group. It includes the "hidden water" used in the production and supply of goods and services as well as consumption of household water.
- **Groundwater:** water that has been absorbed and held underground; has been accumulating below earth's surface for millenia
- Contaminants: substances that make something, such as water, polluted
- **Hydrologic Cycle:** the continuous circulation of water between the earth and atmosphere; also called the water cycle
- Evaporation: process by which water changes from a liquid to a gas; occurs when the sun transfers heat and energy to liquid water molecules causing them to speed up and break away and become a gas
- Water Vapor: water in a gas form
- Condensation: the process by which water vapor (or another gas) converts to a liquid.
- Precipitation: liquid or frozen water that forms in the atmosphere and falls back to the earth
- Water Scarcity: the lack of fresh water resources needed to meet the needs of living things
- **Deplete:** to use up or diminish
- Replenish: to fill up again; restore
- Aquifer: permeable rock that can hold or transmit groundwater
- **Climate Change:** long-term shifts in temperatures and weather patterns on earth; can have natural causes, but since the 1800s human activities have been the main cause



Culminating Project

Goal(s)	Help ensure all people have access to enough clean water by sharing concrete strategies to conserve and protect water with the larger community.
Audience	Community Members
Situation	The freshwater on our planet is a finite and shared natural resource. New Yorkers have access to a vast supply of clean water, but people living in other parts of the world may not. The way we use water has an impact on others, but not everyone in your community understands how the world's water supply is connected or what they can do to protect it. Your challenge is to educate people in your community about the ways humans contribute to water scarcity and the things they can do to help ensure all people have clean water.
Product	Students design a public outreach campaign about human impacts on freshwater security to educate their local community and inspire action.
	Source: National Geographic Unit, Peak Water

Rubric				
	4	3	2	1
Content	Campaign addresses all human causes of water scarcity and includes multiple ways that people can take action to address this issue.	Campaign addresses some human causes of water scarcity and includes multiple ways that people can take action to address this issue.	Campaign addresses some human causes of water scarcity and includes one way that people can take action to address this issue.	Campaign addresses one human cause of water scarcity and includes one way that people can take action to address this issue.
	It addresses these topics accurately and thoroughly.	It addresses these topics accurately and thoroughly.	It addresses these topics accurately but would benefit from greater detail.	Some of the information may be inaccurate.
Design	Campaign materials include words <i>and</i> images to communicate content.	Campaign Materials include words <i>and</i> images to communicate content.	Campaign Materials include words <i>or</i> images to communicate content.	Campaign Materials include words <i>or</i> images to communicate content.
	Images and words are well organized, visually appealing, and designed intentionally to enhance audience understanding.	Images and words are organized and visually appealing.	Content would benefit from organization and/or elements to enhance the visual appearance.	Content is presented in a way that makes it challenging for audience members to understand.
Collaboration	All team members played an active role in creating the exhibit.	All team members played an active role in creating the exhibit.	Some team members played an active role in creating the exhibit.	Team members did not play an active role in creating the exhibit.
	All team members supported one another and solved problems positively and collaboratively.	Most team members supported one another and solved problems positively and collaboratively.	Some team members supported one another and solved problems positively and collaboratively.	Teammates did not support one another or solve problems positively and collaboratively.

Essential Question	How important is water?
Learning Objective(s)	 Students will be able to explain the different ways humans use water (e.g. in industry, agriculture, and personal use).
Materials	 Experience Slide Deck Notebooks, one per student Laptops, one per student (students can also work in pairs if needed)
Vocabulary	• Water Footprint: the total amount of freshwater used by a person or group. It includes the "hidden water" used in the production and supply of goods and services as well as consumption of household water.
	Begin Instruction
Hook	Thought Experiment: Life Without WaterAsk students to reflect on the following question with a partner: What would happen if you turned on your faucet one morning and water did not come out? What if your community did not have clean water? How would this impact your daily life?Essential Question Display the Essential Question (in the slide deck or on chart paper)How important is water?
Teach/ Demo	 Video Show this video to the class. The video can be found in the <u>slide deck</u>. Video Debrief Facilitate a class discussion using the following questions: What did the video mean by "hidden" water? Is this a concept you were familiar with before watching the video? What surprised you about how water being used? How did the information that the video communicated make you feel?
Indep. Practice	 Activity: Jigsaw We are going to learn more about the concept of "hidden water" by exploring a website dedicated to helping people understand something called a "water footprint". A water footprint is the total amount of freshwater used by a person or group. It includes the "hidden water" used in the production and supply of all goods and services as well as the consumption of household water. Assign each student to read about one of the three categories listed below on the <u>Water Footprints 101 Webpage</u>. Students should take notes in their notebooks and then share their findings with the other members of their small group. Categories to Assign to Students from the <u>Water Footprints 101 Webpage</u>: Water in Your Food Water Use Around the House

	3. Water in the Things You Buy
Share	KWL Chart Display a KWL chart (in the <u>slide deck</u> or on chart paper). Transition students from their tables back to the carpet.
	Facilitate a discussion about what students already know about the importance of water (K), what they still want to know about the importance of water (W), and what they learned about the importance of water during today's Experience Launch (L). Record what students share in the appropriate column on the chart.
	Save this KWL chart on chart paper or in the slide deck.
Link	Today we learned that water is involved in almost every single aspect of our lives from obvious tasks such as cooking and cleaning to "invisible" functions such as the production of clothing and food.
Exit Ticket	Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. • What are you looking forward to learning or doing during this Experience?
Standards	6SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of others.
	2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective efficacy.
Extension	n/a



Essential Question	How important is water?
Learning Objective(s)	 Students will be able to explain where New York City's water comes from. describe the process of ensuring that the water of NYC is safe to drink.
Materials	 Experience Slide Deck Notebooks, one per student Materials for Experiment: Simulated wastewater (for one gallon add ½ cup of coffee grounds, some cooking oil, grass clippings, shredded newspaper, etc.) Empty .5 Liter Plastic Bottles (2 per group) Scissors Coffee Filter Filter Materials (clean sand, clean aquarium gravel, cotton balls, uncooked macaroni) Cups or spoons to scoop filter materials. Stopwatch (one per group) Notebook to record observations.
Vocabulary	 Groundwater: water that has been absorbed and held underground; has been accumulating below earth's surface for millenia Contaminants: substances that make something, such as water, polluted
	Begin Instruction
Hook	Yesterday we learned all about "hidden water" and had a chance to reflect on our own water footprints. I don't know about you, but I thought about the things we discussed when I got home. I started looking at things in my home differently. I noticed what was on my plate at dinner and thought about how much water may have gone into some of my food. When I laid out my clothes for the next day I thought about how much water was used to make them. Did you have a similar experience? How did you look at everyday things differently after our last lesson? Turn and talk with a partner.
	Today we are going to learn all about where New York City's water comes from. This will help us answer our essential question: How important is water?
Teach/Demo	 Video Show this video to the class. The video can be found in the <u>slide deck</u>. Note: You may want to show the video twice, time permitting. Once so that students can watch it without taking notes (the pace of the video is quick!) and then again so they can take some notes. Video Review Use the <u>slide deck</u> to review key points about how the NYC's DEP works to prevent contamination. Video Extension Use the <u>slide deck</u> to extend the learning from the video, making sure students know that all the world's drinking water comes from groundwater or surface water sources. This will be an

Indep. Practice	Experiment: Make Your Own Water Filter Review the materials and steps of the experiment using the <u>slide deck</u> . Put students in small groups of 3-4. Give each group the materials needed to conduct the experiment and allow them to work on it in their groups. Circulate and provide support as needed.
Share	Experiment Debrief Project the following questions from the <u>slide deck</u> and facilitate a class discussion:
	 Questions: What was the relationship between filtration time and the cleanliness of the filtered water? Which order of filter materials produced the cleanest water? Why do you think this might be? What did this experiment make you think about the DEP's efforts to protect New York City's water sources from contaminants?
	 Answers: 1. The longer it takes for water to move through a filter, the cleaner it gets. 2. Water slips easily through the filter materials, but bigger gunk, like dirt, gets trapped. It is most effective to layer filter materials so that they get finer and finer toward the end of filtration, so they can catch whatever was missed earlier. 3. Student answers will vary
Connection	Today we learned about where our own water comes from and how critical it is to keep this water clean and free from contaminants.
Exit Ticket	Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. • Come up with your own "Two Truths and a Lie!" Based on what you learned today, write two truths and one lie about where New York City's water comes from.
Standards	6SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of other.
	2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective efficacy.
Extension	n/a

Essential Question	How important is water?	
Learning Objective(s)	 Students will be able to explain how all of Earth's water is connected through the water cycle. 	
Materials	 Experience Slide Deck One Well: The Story of Water on Earth by Rochelle Strauss (ideally one copy per student) Notebooks, one per student Experiment Handout Source: <i>The American Chemical Society</i> Materials for the Experiment: 2 quart-size ziploc bags, one set for each partnership Way to make hot water (e.g. portable kettle) Room temperature water Two squares of brown paper towel, one set for each partnership 2 droppers, one set for each partnership 	
Vocabulary	 Hydrologic Cycle: the continuous circulation of water between the earth and atmosphere; also called the water cycle Evaporation: process by which water changes from a liquid to a gas; occurs when the sun transfers heat and energy to liquid water molecules causing them to speed up and break away and become a gas Water Vapor: water in a gas form Condensation: the process by which water vapor (or another gas) converts to a liquid. Precipitation: liquid or frozen water that forms in the atmosphere and falls back to the earth 	
	Begin Instruction	
Hook	 You probably know that water can exist in different states, as a solid, liquid, or gas. You may also know that water is made up of molecules and these molecules behave differently in each state. Solid Water Molecules move very slowly and stay packed close together. Liquid Water Molecules move more quickly. They stay close together and move past one another fluidly, but are not packed tight. Gas Molecules move around the most quickly. They do not touch except for when they bump into one another they bounce apart and do not maintain contact. Can you think of examples of times you have witnessed water change states? Turn and talk with a partner. Today we are going to learn about how all of the water on earth is connected through something called the water cycle. This will help us answer our essential question: How important is water? 	
Teach/Demo	Video Show this <u>video</u> to the class. The video can be found in the experience <u>slide deck</u> . Pause to pose questions and engage students in discussion about the key points in the video.	

Indep. Practice	Independent Reading and Small Group Discussion Ask students to read this <u>article</u> independently and take notes on the questions listed below. They will discuss the question in a small group after reading.		
	 Question: 1. What is evaporation? 2. What is needed for evaporation to occur? 3. How could you make water evaporate more quickly? Why would this work? 		
	 Answer: Evaporation is the process by which a liquid turns into a gas. When liquid water evaporates it turns into a gas called water vapor. Evaporation occurs when the temperature increases. In the water cycle this happens when the sun heats water. The heat (or energy) from the sun makes the water molecules move more quickly until they are moving fast enough to break free from one another into a gas. The greater the source of heat, or energy, the faster water will evaporate. This is because higher heat makes the water molecules move faster, and the faster the molecules move, the more quickly they can break free into a gas. 		
	Experiment: The Water Cycle Review the States of Matter diagram from Encyclopedia Britannica with the whole class. This diagram can be found in the <u>slide deck</u> . Make sure students notice the arrow that runs along the top of the diagram representing increasing energy. As energy increases, the motion of water molecules also increases. When water molecules are moving fast enough they can break away from the attractions holding them to other molecules and change states.		
	Distribute this experiment handout to each student.		
	Review the materials and steps of the experiment using the <u>slide deck</u> .		
	Put students in partnerships. Give each partnership the materials needed to conduct the experiment and allow them to work on it. Students should discuss the questions at the end of the <u>experiment handout</u> .		
	Circulate and provide support as needed.		
Share	Experiment Debrief Project the following questions from the <u>slide deck</u> and facilitate a class discussion:		
	 Questions: One of the variables in the experiment was the amount of water placed on the brown paper towels. Why was it important to use the same amount of water on both pieces of paper towel? Another variable was when the paper towels were placed on the plastic bags. Why was it important to put each paper towel on the plastic bag at the same time? Does adding energy increase the rate of evaporation? What evidence do you have from the experiment to support your answer? 		
	 Answers: The amount of water will affect the rate of evaporation. Larger amounts of water will take longer to evaporate. This variable needed to be held constant in order to determine the effect of temperature on evaporation. The amount of time will also affect the rate of evaporation. This variable needed to be held constant in order to determine the effect of temperature of evaporation. The amount of time will also affect the rate of evaporation. This variable needed to be held constant in order to determine the effect of temperature on evaporation. Yes, adding energy does increase the rate of evaporation. The bag with hot water caused the water spot to evaporate more quickly. This is because the hot water was 		

	a greater source of energy and caused the water molecules on the paper towel to warm up more quickly. As water molecules warm up they move faster and faster and break away to evaporate.			
Connection	Today we learned that all of the water on earth is finite and connected. We also learned how water cycles between the earth and atmosphere in a process called the water cycle.			
Exit Ticket	 Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. Draw a diagram of the water cycle that shows how water moves through the hydrosphere changing from a liquid, to a gas, and back into a liquid (or solid!) again. Label your diagram with the words below as well as any others you may need to describe the process: Evaporation Condensation Water Vapor 			
Standards	MS-ESS2-4 . Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.			
	MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and phase (state) of a substance when thermal energy is added or removed.			
	6SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of other.			
	7R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences.			
	2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective efficacy.			
Extension	n/a			

Essential Question	How important is water?		
Learning Objective(s)	 Students will be able to compare freshwater access in different parts of the world. 		
Materials	 Experience Slide Deck One Well: The Story of Water on Earth by Rochelle Strauss (ideally one copy per student) Notebooks, one per student Article, printed copies for each student Laptops, one per student (students can also work in pairs if needed) 		
Vocabulary	 Water Scarcity: the lack of fresh water resources needed to meet the needs of living things Deplete: to use up or diminish Replenish: to fill up again; restore 		
	Begin Instruction		
Hook	Here in New York City we are extremely lucky. We have an abundant supply of freshwater and we can access it by simply turning on the tap. This is not the case for everyone around the world. Access to freshwater is a large problem in many parts of the world. Can you think of any reasons this might be? Turn and talk with a partner.		
	Today we are going to learn about freshwater scarcity in different parts of the world. This will help us answer our essential question: How important is water?		
Teach/Demo	Shared Reading Distribute copies of this <u>text</u> to students. Call on volunteers to read aloud while the rest of the class follows along. The text can also be found on the <u>slide deck</u> . Pause to pose questions and engage students in discussion about the key points in the text.		
	Video Show this <u>video</u> to the class. The video can be found in the experience <u>slide deck</u> . Pause to pose questions and engage students in discussion about the key points in the video.		
Indep. Practice	Independent Reading and Small Group Discussion Ask students to read <u>this article</u> independently and take notes on the question listed below. They will discuss the question in a small group after reading.		
	 Question: Why is Cape Town running out of water? Answer: Cape Town is running out of water because it has experienced rapid population growth. Population growth increases the demand for drinking water and food (which requires lots of water to produce). Cape Town has also experienced record drought, most likely due to climate change. Although the city put measures in place to conserve water, the decrease in rainfall was too significant and the measures were not enough to avert the crisis. Activity: Find Your Water Footprint Show students how to use this Water Footprint		

Share	Activity Debrief Facilitate a class discussion using the following questions (and any others you may want to include). These questions can be found in the <u>slide deck</u> .	
	 Questions: Were there any questions asked by the Water Footprint calculator that surprised you? Did this activity give you any ideas for how you might make changes to your water use? Were there any questions you were not sure how to answer and want to investigate further (e.g. whether or not you have low flow faucets at home). How did doing this activity make you feel? 	
Connection	Today we learned that freshwater is not evenly distributed around the world and some people do not have access to enough freshwater to live healthy lives. We also explored our own Water Footprints and began to reflect on solutions to water scarcity around the globe.	
Exit Ticket	 Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. The video we watched today posed the question, "Are we running out of clean water?" and said the answer was both "yes" and "no." What does this mean? Why doesn't this question have a single, simple answer? 	
Standards	 MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical 	
	or biological components of an ecosystem affect populations. 6SL1: Engage effectively in a range of collaborative discussions with diverse partners; express ideas clearly and persuasively, and build on those of other.	
	 7R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences. 2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective. 	
	efficacy.	
Extension	 Below are links to additional resources related to today's lesson. Please feel free to use these resources to extend student learning as time permits. <u>Video - Water Footprints</u> <u>Video - The Water You Wear</u> <u>Video - What Will Life Look Like As Major Rivers Run Dry?</u> 	



Essential Question	How important is water?		
Learning Objective(s)	 Students will be able to identify three distinct, yet connected, threats to the world's freshwater supply: increasing demand, pollution, and climate change. 		
Materials	 Experience Slide Deck Notebooks, one per student <u>Article</u>, one copy per student 		
Vocabulary	 Aquifer: permeable rock that can hold or transmit groundwater Climate Change: long-term shifts in temperatures and weather patterns on earth; can have natural causes, but since the 1800s human activities have been the main cause 		
Begin Instruction			
Hook	We have been studying water for several weeks now and we have learned so much! Let's think back to the KWL chart we did at the beginning of this experience. What is one thing you learned about water that you didn't know before? What are you still hoping to find out in these remaining few weeks?		
	Today we are going to learn about the impact of increasing demand, pollution, and climate change on the earth's water supply. This will help us answer our essential question: How important is water?		
Teach/Demo	Shared Reading Distribute copies of this <u>text</u> to students. Call on volunteers to read aloud while the rest of the class follows along. The article can also be found on the <u>slide deck</u> . Pause to pose questions and engage students in discussion about the key points in the text.		
Indep. Work	Video Show this <u>video</u> to the class. The video can be found in the experience <u>slide deck</u> .		
	Stop at key moments in the video to discuss the content with students and provide time for them to take notes.		
	Pausing points, questions, and sample notes are listed below:		
	Time Question to Pose Student Notes		
	1:11 This first stopping point is not to pose a question, but rather to extend the learning from the video so far. Make sure students understand the significance of using groundwater by saying the following:		
	We just learned that places experiencing drought, like California, lack surface water and are thus forced to rely on groundwater in aquifers. When groundwater is used as a source of freshwater, it can get depleted very quickly. Groundwater has taken millenia to build up, and in many places it is being used much more quickly than it can be replenished due to modern society's increasing demand fo water.		

	2:36	How does climate change contribute to freshwater scarcity?	Climate change causes changes to the water cycle. Warming temperatures cause ice caps and glaciers to melt more quickly, putting more water into the cycle. Warmer temperatures cause more evaporation which leads to even more warming. It becomes a positive feedback loop. Increasing evaporation dries up surface water supplies causing drought. Global warming also causes more extreme weather events such as hurricanes and severe storms. Big storms can intensify water scarcity because when too much water arrives all at once it can't be absorbed back into the ground and replenish aquifers. It turns into runoff picking up sediments and other pollutants along the way.
	4:09	What did we learn about the impact of pollution on freshwater supplies?	Agriculture is one of the biggest sources of freshwater pollution. Chemical byproducts of agriculture runoff into freshwater supplies and make water undrinkable.
	6:39	What did we learn about the rising demand for water?	As populations have boomed, demand for water has risen putting a real strain on freshwater supplies. More people means greater consumption of food, and agriculture uses the bulk of all freshwater resources.
	8:00	What have we learned about potential solutions?	There are ways for the agricultural industry to employ practices that use less water. Regulating water pollution and improving wastewater treatment is another way to help the problem. If we can address climate change, this will also help address the issue of water scarcity.
	End	We know that increasing demand, pollution, and climate change all cause water scarcity. We also know that these three things do not occur in a vacuum. How are these three issues interconnected?	As populations increase, there are more people on earth using water and relying on industries that use water, pollute water, and create greenhouse gasses that contribute to climate change.
Share	Independent Reflection and Research Topic Selection Ask students to reflect independently on what they have learned today about how high demand, pollution, and climate change impact our world's freshwater supply and select one of these issues to research more deeply in the next lesson.		
Connection	Today we learned about three specific causes of freshwater scarcity: increasing demand, climate change, and pollution.		uses of freshwater scarcity: increasing demand,

Exit Ticket	 Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. Imagine you run into one of your neighbors who is used to having as much freshwater as they need and doesn't understand why water is scarce in other places. Pick one of the causes of water scarcity to explain to your neighbor. Explain how and why it contributes to water scarcity. 	
Standards	 MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. 7R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences. 2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective efficacy. 	
Extension	n/a	



Essential Question	How important is water?		
Learning Objective(s)	 Students will be able to explain how demand, pollution, and climate change impact the world's freshwater supply propose potential solutions to the problems posed by demand, pollution, and climate change on the world's freshwater supply. 		
Materials	 Experience Slide Deck Notebooks, one per student Laptops, one per student 		
Vocabulary	n/a		
	Be	gin Instruction	
Hook	Yesterday we each picked a cause of freshwater scarcity to research more deeply. Which one did you pick and why? Turn and talk with a partner.		
	Today we are going to conduct research to learn more about specific causes of water scarcity and what we can do to address them. This will help us answer our essential question: How important is water?		
Teach/Demo	Not applicable for today's research-focused lesson		
Indep. Work	Activity: Research Students will research one of the three threats to the earth's freshwater supply: increasing demand, pollution, or climate change as well as potential solutions.		
	The texts and videos for research are linked in the chart below and in the <u>slide deck</u> .		
	 Students will take notes in their notebooks on the following two questions: How does [increasing demand, pollution, climate change] threaten earth's freshwater supply? What are potential solutions to the problems these issues pose? 		
	At the end of this lesson, students will share their findings with a group of students who researched the same topic.		
	Increasing Demand	Pollution	Climate Change
	Book Excerpt - One Well- Demand	Book Excerpt - One Well - Pollution	Article - How Climate Change Impacts Water Access
	Video - How Do We Meet the Growing Need for Water?	<u>Video - What is a</u> <u>Watershed</u>	<u>Video - Climate</u> <u>Change:The Water</u>
	Video - Are We Running Out of Clean Water?	Article - Stop Pointless Personal Pollution	Article - Water and Climate
	Infographic	Solutions	

	Article - Water Pollution is a Rising Global Crisis		
Share	 Small Group Share Group students according to the topic they researched to discuss their findings related to the two questions below (students who researched the same topic should be in a group together). Ask groups to chart the key points from their discussion. How does [increasing demand, pollution, climate change] threaten earth's freshwater supply? What are potential solutions to the problems these issues pose? 		
Connection	Today you learned even more about the causes of water scarcity by engaging in research and sharing your findings with your group. You also began discussing potential solutions to these problems.		
Exit Ticket	 Ask students to write a response to the following prompt or question in their journal. Collect each student's journal and review their response before the next class meeting. What was the most interesting or surprising thing you learned form your research today? What is one fact that someone in your small group shared that you had not found in your own research on that same topic? 		
Standards	 MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. 6W6: Conduct research to answer questions, including self-generated questions, drawing on multiple sources and refocusing the inquiry when appropriate. 7R1: Cite textual evidence to support an analysis of what the text says explicitly/implicitly and make logical inferences. 2C.3b. Demonstrate cooperation and teamwork to promote group well-being and collective efficacy. 		
Extension	n/a		



Lessons 7-10

The last two weeks of the Experience revolve around a culminating field trip and project. The table below outlines the sequence of activities as well as a suggested structure.

Lesson #	Activity	Suggested Structure / Notes	
7	Field Trip	Students will take a field trip to a historic reservoir and wetland in one of the five boroughs through <u>NYCH2O</u> . Please work with your Site Director to plan and book this field trip as far in advance of beginning this Experience as possible.	
8	Introduce the Culminating Project to Students	Introduce the culminating project to students by explaining the project goal, audience, situation, and product. Then share and give each student a copy of the project rubric so that they know the criteria for their work.	
		Show students this <u>video</u> about a public interest campaign that took place in New York City many years ago to provide for students.	
		All of this information can be found in the <u>slide deck</u> and in the section of this Experience titled, "Culminating Project".	
		 Engage students in a brainstorming and planning session for their project where students walk away with the following questions answered: What information do we want to communicate? How do we want to communicate it? (e.g. individual posters, a large mural, artifacts with descriptions like in a museum) Who will be responsible for creating the things that we need for our exhibit? (e.g. will students each create something independently, will they work in small groups or teams on different components?) 	
9	Culminating Project Work Time	Provide students with structured time to work on their culminating project. Circulate and support students as they work.*	
		Students will need more than a single lesson to work on this project. Find time throughout the week to provide additional time as schedules permit.	
10	Culminating Project Showcase	Identify a date, time, and location for students to share their culminating project with an audience. You may want to rehearse elements of the showcase with students in advance.	

