Why is Water Important?
How much water do you use/eat?

Type of Lesson: Introductory

Description of lesson: When introducing the concept of water, whether that be the water cycle, watersheds, or anything else in the hydrosphere, it is important to give students context as to WHY water is important to their lives. Oftentimes students have no idea where their water comes from or what it is used on. From experience, I can say that my high school students often forget the importance of water, even if they learned about it in their elementary years. This lesson also acts as a formative pre-assessment as to how well they understand the water cycle.

Enduring Understandings:
Water is crucial for habitability. Humans are impacting water resources in various ways including agriculture, industry, and human caused climate change.

Essential Questions: How is water a valuable resource and what are humans doing to change water quality.

Academic Standards:

- HS-ENV4-2. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- HS-ENV1-2.* Use a computational representation to illustrate that humans are part of Earth's ecosystems and how human activities can, deliberately or inadvertently, alter ecosystems.
- HS-ENV2-1.* Construct and revise an explanation based on evidence for the cycling of matter through sources and sinks and how energy is transferred.
- HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes
- HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Student learning targets:

- Describe the difference between and provide examples of both direct and virtual water use and steps anyone can take to reduce either of them
  - Direct water use
  - Virtual water use
  - Virtual water content of common materials and food
- Recognize that some foods have lower water footprints than others and that meat production is particularly water intensive
- Plan and create a healthy, balanced meal that has a low water footprint
- Understand how each person's food choices affect the water availability in the environment

• Ag:IAFNR-5.1 Explain interrelationships between natural resources and humans necessary to conduct conservation practices in natural environments • Ag: IAFNR-5.2 Summarize the relationship between natural resources, ecosystems and human activity • Ag:IAFNR-5.3 Identify natural resources and their importance to the local community. • APES: ERT-1.G Explain the steps and reservoir interactions in the hydrologic cycle.	
Assessment task -	
Differentiation: • Classroom discussion can be done as a Think-Pair-Share if students are not comfortable sharing out as a whole class • In addition, journal entries or online discussion boards could be used as well.	**Accommodations:** • This lesson will be focused on setting the stage for other lessons in the module. There will be classroom discussions and an activity surrounding what food students eat • If there are students that are not comfortable with discussing what they eat (eating disorders, allergies, free/reduced lunch, etc.), care should be taken
Prior Learning: • Water Cycle	**Prerequisite skills:** • Adding and subtracting
Materials • This lesson is adapted from https://www.calacademy.org/educators/lesson-plans/how-much-water-do-you-eat o Food cards cut to size (one set per group) print pages double sided so that the water use is on the back, or tape food on top of water use so students can flip it up and look underneath o Student data sheet (one per student) o Student handout (one per student) o Paper plates (one per group, recommended group size 3 - 4 students) o Scratch paper (1-2 per group)	**Technology:** • Presenter, Smart Board, etc. • YouTube

o An empty one gallon milk container (1) o Teacher Chart 1: Pie chart showing water distribution in the world o Teacher Chart 2: Average American water consumption per day. o Teacher Chart 3: Water footprint of some typical American meals	

Vocabulary Development:

- Direct Water Usage
- Virtual Water Usage
- Water Conservation
- Food Water Content
- Personal Water Use
- Industrial Water Use
- Agricultural Water Use
- Blue Water
- Green Water
- Gray Water
- Water Footprint

Procedures:

How and Where Do We Use Our Water?

Materials

- Water Use & Conservation Slides and a way to project it
- Printed or digital copy of the How and Where Do We Use Our Water? Sheet (Activity 1)

Instruction:

1. (Slide 2) Open with the bell ringer. There may be a need for a different bell ringer if the students have not gone over water use before. A possible alternative could be, “What water did you drink today (think coffee, milk, soda, energy drinks, etc.) ?”
2. (Slides 3-7) After the bell ringer, hand out the student worksheet for brainstorming water usage. This can be open as to how you want to discuss and teach this material. Give the students 3 minutes to fill out their worksheets then put up the slide on typical water usage. Give them an additional 2 minutes to do some rough math and then have them share out answers for another 2-3 minutes.

3. (Slides 8-12) Go through the water conservation slides. Ask the students to summarize what was in the videos and what were the tips to reduce water usage. Ask the students what is missing? Almost completely absent from the two PSA videos is virtual water usage. Virtual water usage is typically 5-15x higher for an individual than their direct water usage, however it is much harder to notice. It is also harder to change as we have little control over agricultural practices.
4. You can end the day with a teaser by using Slide 12, you can change the story to be more relevant to a student.

Introduction to the Virtual Water Concept (15-20 min)

Materials

- Virtual water slides and a way to project it
- Student lab notebooks or paper to write on

Instruction:

1. (Slides 12-22) Show the slides to begin to introduce the concept of virtual water.
2. (Slides 13-19) Show the break down of total water consumption globally. Personal water usage is only around 12% of water used in the United States. This is often called **direct water usage.** This may lead to some students thinking their personal choices don't matter much. However, personal choices drive the consumption from agriculture, industry and electricity. Indirectly, all societal choices lead to indirect or virtual water usage and very little public education has been done to make the public, especially students, aware of this.
3. (Slide 20) - Show the video on virtual water. Have the students answer the following discussion prompts:

   What is virtual water?

   Why do you think the average person in the USA uses more than double the virtual water of someone living in India?

   Have you heard of virtual or hidden water before?

   Yesterday we talked about drinking water, taking a shower, brushing our teeth. What percent of water do we use is direct water vs. virtual water?

4. (Slides 21-22) Show and discuss slides 21 and 22 to reinforce the concept of virtual water.

   Optional: If time permits you can have the students utilize the water footprint calculator and then you can do a group share to see how student water footprints vary. This can be a somewhat overwhelming activity for some students and the math around how the water calculator does its calculations is not fully explained. But it does show how big of an impact personal diet choices influence virtual water in the graph at the end.

   http://www.watercalculator.org/wfc2/

5. (Slide 23) Pose the question of how a 4 oz hamburger could possibly contain 463 gallons of water? Have the students think about this (think - pair - share) and then discuss as a classroom before revealing the rest of the slide.

6. (Slide 24) Have the students think about their favorite meal and have them write down the contents of that meal (including any drinks!) to prepare for tomorrow. Alternatively they can write down what they eat for dinner and be ready to report it tomorrow.

How much water do you eat? (30-45 min)

Materials

- How much water do you eat slides and a way to project it
- Printed or digital copy of the How much water do you eat activity (Activity 2)
- Printed or digital copies of the food cards for making meals
- Devices to access the Internet to look up virtual water content of common food items. If this would be too much of a distraction for your students you can spend some time ahead of the lesson to research common food items and provide a list to students. One list with common food items to allow them choices to make a meal and another list with the virtual water content after they have made their choices.

Setup: Put paper plates (1 per student) and food cards (1 set per student) on each group table. You can alternatively prepare piles and hand them out to the students when you are ready to begin and tell them to not look at the back of the cards or it will ruin the fun of the activity.

Instruction:

1. (Slide 25) Introduce the activity: How much water do you eat
2. (Slide 26) Have the students examine the food item cards on their table. Tell them not to turn them over (or prepare paper to cover the water usage on the back to prevent peeking). Instruct them to make what they think is a healthy meal and pick and put cards onto their paper plate. Once the students are

done, ask a few students to share out the choices they made for their meals and write them on your board.

3. Have the students write down their meal choices in their science notebooks. Once most students are done with this, have them turn over their food cards and write down how much virtual water is in each item. Have a few students share their total virtual water and if any of the virtual water content surprised them. Some foods that are healthy for us are very water intensive. An example would be almonds at 483 gallons (1828 liters) per a 4 ounce serving. This is slightly more than beef!

4. Next, have the students bring out their science notebooks and have them think - pair - share on their favorite meals or the dinner that they ate last night. Have the students look up the virtual water content of their selected meals. Once most have their virtual water calculated, have them get with a partner and discuss the differences between their meals. Have a few pairs share their discussion and anything that surprised them.

   Optional: You can arrange a student food day! This is usually very exciting for students, be sure to plan for any student allergies. Have each student bring in 1 or 2 food items or use school funds to purchase food. Alternatively you can do this activity just before or after the students' lunch period and have them predict (if your class is before lunch) or examine actual virtual food water content (if your class is after lunch). How water intensive were the food items in the school lunch? Often, school lunch items are highly processed food which usually leads to higher virtual water content.

Wrap-Up (5-10 min)

Below are 3 possible wrap up activities to get your class processing what they learned from the 1-2 day lesson.

1. Have students summarize the lesson's main concepts in their own words. Prompt them with these questions:
   a. You're talking over dinner with your parents and they ask you what you learned in school today. What are two concepts you would mention?
   b. Imagine a classmate is absent from class today. How would you explain the lesson to him/her?
2. Have students get creative and draw concepts of what they learned in the lessons/labs (could be on paper or digitally)
   a. Create an advertisement directed towards students and their families about making smarter virtual water food choices. The advertisement should include a slogan and images and one to two concepts you learned today.
3. 3, 2, 1 Exit Ticket - Have students write three new words they learned and their definitions, Describe 2 main topics from the day, and ask 1 question they still have.

Attach:
Water Intro PowerPoint for Discussion
You will also need the food cards from this website:
https://www.calacademy.org/educators/lesson-plans/how-much-water-do-you-eat