Title of Unit: Thinking About Water Sustainability	**Subject/Course: Contemporary Issues in Science**
Topic: Water	**Grade Level(s): 9-12**

Stage 1- Desired Results

Established Goal(s) (NY State and/or District goal):

NY State Standards:

- Physical Setting (Standard 4/Key Idea 2) *Many of the phenomena we observe on earth involve interactions among components of air, water and land.*
- Living Environment (Standard 4/Key Idea 6) *Plants and animals depend on each other and their physical environment.*
- Living Environment (Standard 4/Key Idea 7) *Human decisions and activities have had a profound impact on the physical and living environment.*

District Goals:

- To prepare our students to live, work, and contribute in the 21st century, we will identify and address human rights and sustainability issues within the existing curriculum.
- To continue to build a strong, vibrant school community, we will expand school wide programs that encourage students, faculty and staff to learn more about each other, our local community, and international issues.

Enduring Understandings:	**Essential Questions:**
Students will understand that… • Water has several unique properties that make it essential to support life on planet earth. • Water is a finite (renewable?) resource that is endlessly cycled through the earth's systems • The quality of our water is determined by personal choices that either support or undermine the environment, our health, and our communities • When you throw something away, there is no away • Local actions affect the global water supply	• Will the next world war be fought over water? • Why do we need water? • When you throw something away, where is away? • What are the sources and sinks for the water we use? • How do your personal choices change the water quality on earth?
Students will know… • How much of the world's water we can drink and where it is located • The steps of the water cycle • Water regulates the earth's temperature and the body temperature of living organisms • Water is the only substance found in all three states of matter on earth • The density of water allows ecosystems to survive in winter • The amount of water they use daily • That every community must manage its water supply carefully • Major uses of water – commercial, residential, and agricultural • How drinking water and waste water are treated • The sources and consequences of various types of water pollution • What is meant by sustainable water use	*Students will be able to…* • Diagram the complete water cycle, including distribution of the world's water supply • Relate the boiling point and freezing point of water to the temp. range on earth • Demonstrate the importance of water density in aquatic ecosystems • Use a table to calculate daily water use • Identify direct and indirect water uses • Match a pollution source with its environmental consequence • Clean a sample of foul water • Draw a watershed • Create a water use plan • Practice water conservation • Explain to another student how groundwater is generated and used • Educate others on issues of sustainable • water management

Framework adapted from *"The Big Ideas of UbD"* by Grant Wiggins and Jay McTighe, 2004.

Stage 2 – Assessment Evidence	
Performance Task(s): I. Community water rationing is in effect, (a) determine the amount of water to truck in for the entire town to drink & cook with for 3 days (b) Plan how to use 1 bathtub full of water for all your family's other uses over 3 days II. You are marooned on an island with a murky, stagnant water source. Using a limited list of materials, plan how you'd get enough drinkable water to survive. III. Design and create a bulletin board to hang in the cafeteria to educate Somers High School students about issues of sustainable water use.	**Other evidence:** Write daily reflective journals on topic (see list) Clean a sample of dirty water in the lab Quiz on Water Cycle Quiz - Where does the water go? Current Events Folder – summarize 3 news articles on water topics (attached) Water Mastery Test – 100% is required, unlimited attempts allowed
Stage 3 – Learning Plan	
Learning Activities: **I. WAYS WATER IS NECESSARY FOR LIFE**: Develop a graphic organizer of all the ways water is needed on planet earth. Link each need to a term on a list of water's physical and chemical properties. Needs are student generated. H_2OProperties: bp=100˚C, mp=0˚C, liquid at body temperature, density of solid less than of liquid, molecule is polar so it's a "universal solvent", has hydrogen bonding between nearby water molecules **II.** Read/Class discussion on article: ***The 21st century's most explosive commodity will be … WATER***, identify the continents for countries discussed. Why are there water shortages . . . **III.World's Water Supply activity**: Students break up into 6 groups and measure out the quantity of water that represents their continent's per capita use and stand on that continent on the floor. Discuss plausible reasons for use, COMPARE to Water Balance of the Continents slide that graphs where the world's precipitation &runoff occur. **IV. Computer Lab- internet assignment** using the website: http://ga.water.usgs.gov/edu/watercycle.html. Students fill in blank template of 17 steps of the water cycle, then research and take notes on one particular step to present orally to the rest of the class. All class take notes on other students' presentation to use on an open note quiz **V.** Concept mapping direct and indirect water usage using foods as examples **VI**. Students conduct a FOUL WATER LAB where they clean a sample of foul water through 4 steps that mimic municipal water treatment steps and calculate efficiency of their treatment method and lab technique. (In the Water Solutions Packet)	**Journal Prompts:** students write a minimum of 5 sentences for each prompt. 1. WHY do we need water? 2. Who owns the world's water? 3. Will the next world war be fought over water? 4. Where is the earth's water? 5. Before & After: knowledge of the water cycle 6. Where do you think the water cycle begins? Pick a step and defend your choice 7. Where is the earth's water part II – How much of the earth's water is drinkable? Where is it? 8. Explain why it takes 120L water to produce 1 can of fruit juice or 450L of water to put 1 egg on your breakfast plate. 9. How did we clean Foul Water?

Learning Activities continued . . . **VII**. Students complete a 3 day home water use survey & calculate liters used by the household and per person, complete a histogram for entire class data & **calculate the average per person water use for the class** (In the Water Solutions Packet)	10. How much water do you use? Where could you conserve water?
VIII. Marooned! Copy attached	
VIII. CARRY YOUR OWN LOAD ACTIVITY: Prompt: How does the way you get your water affect your lifestyle, your education, your future? Students fill buckets equivalent to their daily use of water and figure out a plan to carry it across a 100 yard distance, timing how long it takes one person to accomplish this task. Discussion follows.	11. How does the way you get your water affect your lifestyle? Lifestyles of people around the world?
VIV. **Riverwood Water Emergency** Activity: Students read "News" articles on a fish kill that occurs in a fictional town's river that causes a complete shut down of the water treatment plant--forcing water rationing and trucking in a 3 day supply of drinking/cooking water for the 19,500 residents. Townspeople are instructed to clean, then fill their bathtub with 150L of water for other water uses before the town's water treatment shuts off the supply. Students calculate the # of trucks needed & cost to the town AND plan for their own household water use over the 3 days. (In the Water Solutions Chapter)	12. If you had to make a slogan for a roadside billboard in Riverwood giving a valuable water conservation tip, what would it say? Where would you put it up?
X. What is a Watershed "Lab" – copy attached Discuss that we live in the Croton Watershed	13. "If you are looking for an answer for the future of water, look no farther than your own watershed"— What does this mean to you? Will it affect your actions?
XI. Looking at Water Use through a Sustainability Lens Over several days Students Take Notes from Consider the Source: Interactive Guide to Protecting America's Drinking Water an Interactive Animated Movie from the EPA for use in Point and Click Lecture showing cross sections of the earth's crust under different communities. Details of potential sources of water pollution due to Land Use, Non-point Source, Urban Sprawl, Marinas, Local and State Land Uses, and from Source Water Protection areas are illustrated. Study for Quiz – Where Does the water go?	14. Who is polluting our water? (we are) 15. What happens to water you have used? Is it gone?
XII. Water conservation Idea- HYDRATING WATER CRYSTALS LAB students hydrate a sample of polymer water crystals and measure how much water they absorb and hold to deliver to a plant's roots at a later time.	16. Explain to a parent why and how using these water crystals at home conserves water.

Learning Activities continued . . . **XIII. TO BOIL OR NOT TO BOIL** Are you going to boil your water if you find our its contaminated by something? Students read and discuss EPA publication WATER ON TAP: What you need to know. (copy attached) Students take notes, highlighting the areas "Naturally Occurring" sources of pollution and pollution from "Human Activities" as well as pages 4-6 on mitigation techniques for microbial contamination, nitrate contamination and lead contamination	17. Outline an answer to a polluted drinking water warning telling when you should or shouldn't boil polluted water
XIV. Can you drink too much water? Reading, discussion & questions on **water intoxication**	18. How much water is too much?
XV. COMPUTER LAB Internet Search **"When the well is dry, we know the worth of water"-- Benjamin Franklin, 1746** …"Water, water everywhere and not a drop to drink"… "We forget that the water cycle and the life cycle are one"-- Jacques Cousteau FIND A QUOTE ABOUT WATER that speaks to you (copy attached)	<This sets up the final project about speaking to others about water>
XVI. Water Sustainability- Global Cafe Questions for group discussion: Why is the water cycle so important to understand? What's stopping us from having all the water we need? What does responsible water use look like? What choices have been made by our society that impact water availability and water quality?	19. From all you've heard and read - - How do your personal choices change the water quality on earth?
Culminating Activity: Design a Bulletin Board Display to Hang in the S H S cafeteria: Pick a Topic from the list and educate your peers > Class votes on favorites Displays are hung in the cafeteria (copy attached)	Do SHS students know much about the world's water? About their own water? How to conserve water? Where does water go when you are done using it? What happens to people and their lifestyles in places where water is scarce? Are they polluting their own drinking water? Where does Somers water come from? Is water a renewable resource? Are there armed conflicts over water? Who owns water? Will there be enough clean drinking water for future generations? What's stopping us from having all the water we need? What does responsible water use look like?

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