Name	Jayne Lecky, San Ramon Valley High School
Lesson title	California's Freshwater Flow: Ecosystems, Biodiversity & Human Impact
Grade and Subject	9-12 Biology (Can be modified for 6-8)
Standard	HS-LS2-7. Design, **evaluate**, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. HS-LS4-6. Create or **revise** a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity
Water & Wastewater Industry Connection (e.g. career, skill, challenge)	As all regions in California will be studied, all water careers in delivering freshwater to customers, while protecting ecosystems will be presented. Each individual watershed will have it's own challenges on the careers that help deliver water safely. For example, the Pardee Dam has a salmon focus while the Orinda watershed is on carrying capacity, all have equipment, chemical and regulation issues. All need specific personnel to solve these problems and get the job done.
Objective	Students will continue their investigation of California's biomes and ecosystems. Introduced will be bodiversity's importance in California's ecosystem stability concerning freshwater availability . The focus is on the industry that makes this possible.. Learning the challenges they face to deliver fresh water in a sustainable manner that benefits all stakeholders. Including the salmon! This is a human issue with humans carrying out the solutions.
Instructional Plan Outline	Students have learned about the 4 main biomes in California: Desert, Valley, Coastal and Mountains. They have also learned of the 10 Bioregions (Klamath, Modoc, Central Coast, San Joaquin Valley, Mojave, Sac/Central Valley, Bay Delta/Central Coast, Sierras, South Coast) To begin the umbrella topic of freshwater throughout semester one, we will combine ecosystem study in terms of freshwater availability. Students will focus on one of 8 water regions in groups of 4-5: 1. North Coast 2. Sacramento River Valley 3. SF Bay 4. Central Coast 5. South Coast 6. San Joaquin River area 7. Tulare Lake

	8. Colorado River 9. North and South Lahonton The task will be to research the abiotic and biotic features of water region, or a specific watershed, and the private and public stewards of region. The most important outcome will be to determine the challenges (availability during drought, high demand times, subsiding land ala central valley, contaminants, flood control, protection of native species, control of non native/invasive species, protection of ecosystem and biodiversity, special laws and regulations) and highlight the solutions proposed or ongoing. A focus should be on the planning and management and safety concerns. This is not simply a report on something that happened in the watershed, it is focus on an ongoing challenge and possible solutions. AND WHO GETS THIS DONE HOW? Groups may be able to collaborate (for example EBMUD has an emergency plan in place with Walnut Creek for command central and pipeline) Students will prepare a verbal presentation, and a visual document, and a written report with minimum list of resources, to add to large California maps with Bioregion information on classroom walls. So…. 1. What is the name of your water region? 2. Where is your water region? 3. Which water facility have you determined to be the most interesting to your group? 4. Who are the partners responsible for managing this water facility? 5. Who are the main customers? How many are there? 6. How is water provided to customers there? How much water is delivered? 7. What are the top three challenges to sustainable nonstop service? 8. How do you know this information to be true? Did you communicate with a staff member there via phone or email? If not, is your report or article from a reputable source and written within the last 2 years? Do you have quantitative data directly from the source? 9. How is the water facility meeting these challenges? Explain two in brief and focus on the main challenge. 10. What type of personnel are meeting these focuses? How have they trained for these jobs? (Please be specific- do not answer, “went to college or classes” What were the classes or tests they had to pass to become water operators or electrical engineers or mechanics etc? 11. What is the conclusion of your group in terms of the main challenge? Are these solutions working? What would you do to refine the solution? How did you come to this refinement? What is the most surprising thing you

	learned about the water industry in California?
Assessment	Group work, verbal checks for understanding, group presentation with each group member presenting individually, visual to add to bioregion maps, resource reliability checks
Materials/Resources	Teacher Resource: Nature Conservancy Below the Surface: **Teacher Resource**: Nature Conservancy Article: "Freshwater Biodiversity" https://www.scienceforconservation.org/assets/downloads/Below_the_Surface_CA_Freshwater_Diversity_May_2013.pdf **Student resources** water resources links to be added via student research. (bioregion resources attached below as an example). A google classroom doc will be created for each group to show their work- resources, interviews, visuals, etc Videos from water district
Needs/Host Org Requests	Guest speaker from water company would be AMAZING! Water conservation goodies like water bottles or low flow heads or colorful handouts. Handout with career opportunities. Like some more info/data on why salmon are the keystone species of watersheds to share with students Videos to show students

Students have previously completed their Bioregions research. Links:

Bioregions research links

1. Central Coast
    1. http://www.forestsforever.org/archives_resources/cabioregions/centralcoastbioregion.html
2. San Joaquin Valley
    1. http://www.forestsforever.org/archives_resources/cabioregions/centralvalleybioregion.html

3. South Coast
    1. https://calswap.wordpress.com/2013/06/19/ecoregion-spotlight-southern-california-coast/
4. Colorado Desert
    1. http://www.forestsforever.org/archives_resources/cabioregions/desertbioregion.html
5. Mojave
    1. https://www.worldwildlife.org/ecoregions/na1308
    2. Article: https://www.researchgate.net/publication/51880595_Impact_of_Demographic_Trends_on_Future_Development_Patterns_and_the_Loss_of_Open_Space_in_the_California_Mojave_Desert?_sg=opKc5WIuDsqZb_zh45LsRskrRtJQFyGwwJ1Dg0A8lVsGxtP5cGB64Ar3rDtsd9brU4OPgB-j4Q
6. Klamath
    1. http://www.forestsforever.org/archives_resources/cabioregions/klamathbioregion.html
7. Modoc
    1. http://www.forestsforever.org/archives_resources/cabioregions/modocbioregion.html
8. Sacramento/Central Valley
    1. http://www.forestsforever.org/archives_resources/cabioregions/centralvalleybioregion.html
9. Bay-Delta/Central Coast
    1. http://www.forestsforever.org/archives_resources/cabioregions/centralcoastbioregion.html
10. Sierra
    1. http://www.forestsforever.org/archives_resources/cabioregions/sierrabioregion.html

General links (info on multiple regions):

- http://www.forestsforever.org/archives_resources/cabioregions/index.html
- https://www.usgs.gov/centers/werc/science/bioregions-pacific-us?qt-science_center_objects=0#qt-science_center_objects
- BIOREGIONS: An Ecological and Evolutionary Perspective and a Proposal for California
- Slide Share - California's Bioregions
- California's Bioregions
- California's Biomes