University of California
Agriculture and Natural Resources

UC DAVIS WATER MANAGEMENT LAB

CIWR

California Water Course

Water System Self-Assessment

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Water System Self-Assessment

Introduction

This self-assessment is designed to determine the current conditions, future threats and alternative water management strategies of your water systems by gathering information and data that will improve your understanding of the water system of your interest.

Keep responses brief enough and provide references (weblinks/webpages, citation of document/papers and others whenever they are available) so that you can quickly dive deeper, if necessary. In cases where you do not have information, simply acknowledge what you do not know and discuss it with the instructor during the in person meetings how can you get that information. Do not get discouraged if you cannot find information right away, contact your classmates and ask where they found similar information. Remember that 80% of the time is typically spent in gathering information.

Each of the four sections will likely be completed by using the references, databases and websites provided in this document. However, if a website link, document or database does not work, please report it with the instructor and look for alternative information sources. Remember that you will be gathering information from different data sources, so, chances are that not all those sources may be available. You can also ask some of the organizations (through email) about the information that you are looking for, there is no harm in requesting information. A spreadsheet format is available upon request. When using multiple copies of this document, please list your name and date of last version on the header of each document.

Module 1 – gathers the basic data related to your water system and its spatial extent. This information come from local, state and national databases and resources already available. This information is important because it will provide you a deeper understanding on the natural and human-made aspect of your water system. You will also identify current threats that your community, tribes and local disadvantaged communities are likely to experience due to climate change, economic activities, etc. At the end of this module, you will have a deep understanding of the natural and human components and threats of your water system.

Module 2 – identifies the water policies and related that apply to your water systems, they are dependent on the location of your water system. This information come from statewide databases, state legislation, local ordinances, among others. This information is important because you will recognize and comprehend the array of policies your water systems is subject to, as well as the different decision making bodies that have an influence in your water system. At the end of this module you will identify, evaluate and maneuver the water policies that apply to your water system.

Module 3 – identifies the water management plans already developed for your water systems. Using a water balance approach, you will perform a diagnostic for your water system, what are the current threats and solutions already thought. The water plans evaluated in this section comes from: the California Water Plan Updates, California Groundwater Plans (Bulletin 118), integrated regional water management (IRWMs) plans, Urban Water Management (UrWM) plans, Irrigation Districts Water plans, Groundwater Sustainable Plans (GSPs), among others. Analyzing all these plans is important because

they provide a diagnostic of the conditions of your water system. At the end of this module you will develop a water diagnostic for your water system that identifies current management strategies and you will propose alternative water management strategies.

Question? Suggestions? Contact Dr. Samuel Sandoval Solís at samsandoval@ucdavis.edu

Module 4 – [What does it do]. [Where the information comes from]. [Why it is important]. [At the end of this section, SLO – Student Learning Objective].

Other relevant courses of water in California
(1) California Water Virtual Tour for overview of water conditions in several regions of the state of California,
(2) Growing water smart for linking land use and water management, delivered by the Sonoran Institute
(3) WELL untapped program focused on training local elected officials on obtaining relevant information, delivered by Water Education for Latino Leaders.
(4) Water Education Foundation Water Tours providing experiential knowledge on California Water Systems,
(5) Community Water Leaders Network (CWLN), a water leadership course for community members lead by the Community Water Center. Also, this center provides the drinking water guide, an outstanding guide for community members and water advocates to defend their right for access to safe, clean, affordable and accessible water.
(6) Self-Help Enterprises, Environmental Defense Fund and Rural Community Assistance Corporation. Water Leadership Institute, a water leadership course for community members,
(7) Central Valley Partnership has training programs for community member related with water, labor and land,
(8) California Indian Water Commission provide training and support to tribal and non-tribal members related to issues related water rights, water quality, quantity, access, natural resources stewardship, among others.

Part 1 gathers data related to trends that influence your community's water supply and demand, such as growth rates and drought. This information is likely to be found in current plans such as the general plan, climate adaptation plan, or hazard mitigation plan, or statewide resources such as the California Climate Data Archive. The suggested lead entity for this section is the planning department.

Part 2 gathers information typically found in water planning documents about your water supply and demand. This information is likely to be found in current plans such as Integrated Water Resource Management Plans or statewide resources such as the California Water Boards Data & Databases. The suggested lead entity for this section is the water provider.

Part 3 gathers information on current water conservation and efficiency efforts. This information is likely to be found in current plans such as Urban Water Management Plans or statewide resources such as the California Water Boards Water Conservation and Production Reports. The suggested lead entity for this section is the water provider.

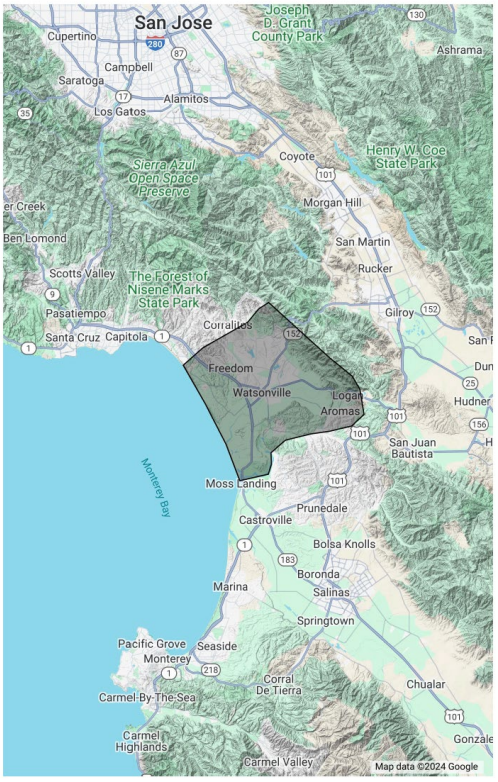
Part 4 gathers information regarding your community's current land use plans and policies that link water and land use. This information is likely to be found in master plans, land use code, and manuals. The suggested lead entity for this section is the planning department.

Please enter your responses into the green highlighted boxes. Please review your completed self-assessment(s) with your team before the workshop to accelerate your team's progress during the Growing Water Smart Workshop.

Questions? Suggestions? Contact Sonoran Institute at growingwatersmart@sonoraninstitute.org.

Module 1: Characterization of your water system

Resources: *Guidebook (page 4 to 5) OR videos (1 and 2).*

Defining your water system	Response	Notes or specific numbers
1. What is the name of the water system that you are interested?	Pajaro Valley	
2. Why are you interested in your water system?	Because it has water issues since 1950 due to sea water intrusion that has been caused by groundwater overdraft	
3. Provide a map with the location and spatial extent of your water system		
4. In which basin is your water system located?	Pajaro River Basin	
5. In which sub-basin is your water system located? (if applicable)	Pajaro River	HUC 8 number(s): 18060002 HUC 10 number(s): 1806000208 HUC 12 number(s)
6. Are there any groundwater basins or aquifers in your water system?	Yes: X / No:	
7. List all the groundwater basins or aquifers in your water system (If applicable)	Corralitos – Pajaro Valley, Gilroy – Hollister Valley (Llagas Area, North San Benito), Santa Ana Valley, Quien Sabe Valley, San Benito River Valley, Hernandez Valley	
8. List all the Disadvantaged Communities (DACs) located in your water system	Watsonville – Watsonville City	
9. List all the tribes that are located in your water system	1. Tribal homelands: Ohlone and Popeloutchom (Amah Mutsun) 2. Currently located: There are no tribal land area representation in my water system	

Resources: Guidebook (page 5 to 6) OR video(3).

Defining the Natural Elements	Response

10. What is(are) the main natural landscape(s) of your water system?	Within: Pajaro Valley. North: Santa Cruz Mountains. West: Monterey Bay and the Pacific Ocean. East: Coastal Range and San Andreas Fault. South: Monterey.
11. Describe the main orographic features of your water system	To the east are the Coastal Range and the San Andreas Fault. The Pajaro river crosses the San Andreas fault at ### constraint.
12. List relevant soil types in your water system	LS – Arenoso Franco, SL – Franco Arenoso, L - Franco, CL – Franco Arcilloso , C - Arcilla, SICl – Franco Arcillo Limoso
13. List the land cover and vegetation of your water system	Agriculture: Strawberries, Lettuce, Artichokes, Truck, Nursery, Berry Crops, Brussel Sprouts, Processing Tomatoes, Apples, Bush Berries. Annual Grassland. Coastal Oak Woodland. Coastal Shrub. Redwood. Urban,

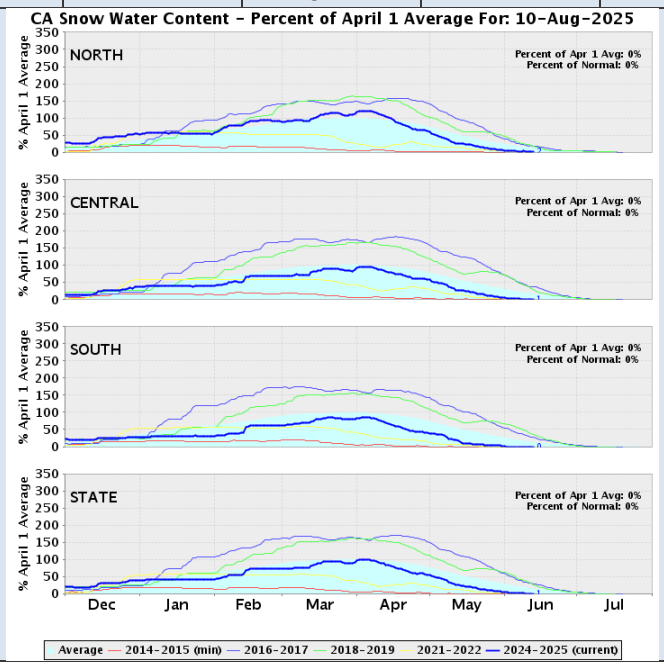
14. Select the climate(s) that are present in your water system

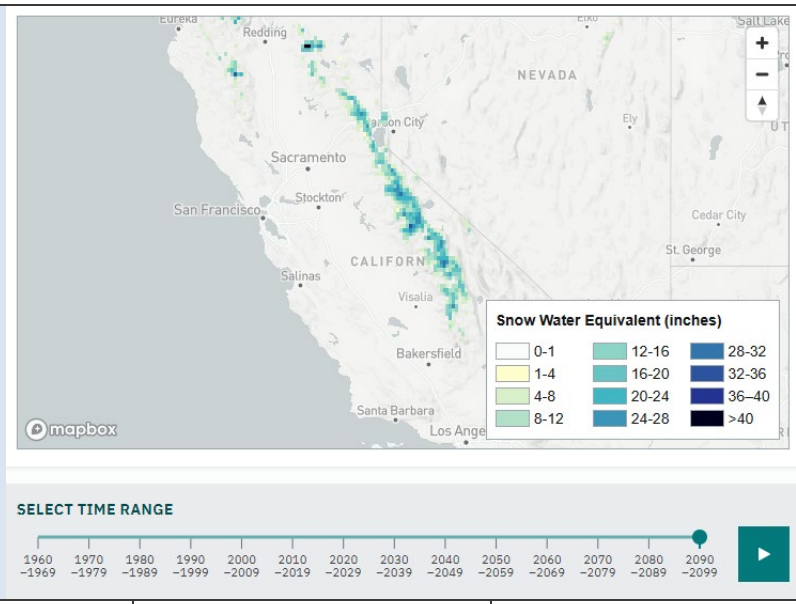
Semi-arid			Arid		Mediterranean			Cool/Cold		Highland
BSh	BSk	BSkn	BWh	BWk	Csa	Csb	Csbn	Dsb	Dsc	H
						X	X			

15. Select the natural ecosystem(s) that are present in your water system

Coastal	Valley	Wetland	Riparian	Mountainous	Desert
X	X		X	X	

Resources: Guidebook (page 9 to 11) OR video (5).

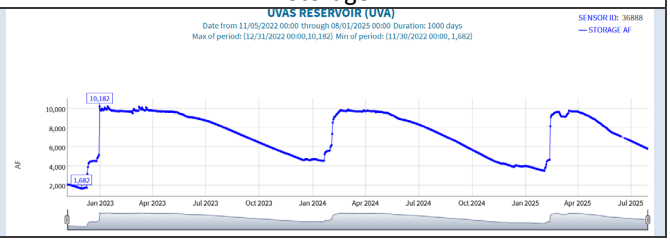
Event of the Water Cycle	Response				
16. Statistics for Precipitation	1900-1960	1981-2010	1961-1990	2035-2064	2070-2099
	Avg: 22.5	Avg:22	Avg: 20.09	Avg: 22.9	Avg: 22.7
			Range: 8.0-51.1	Range: 6.4-77.1	Range: 7.6-50.5
17. Sierra Nevada Current Snowpack					

18. Sierra Nevada Predicted Snowpack	

19. Temperature	1961-1990	2035-2064		2070-2099	
	Avg. 68.8	Low Emiss.	72	Low Emiss.	73
		High Emiss.	72.8	High Emiss.	75.9

20. Evapotranspiration	ETo Zone	Annual ET_0	Avg. Precipitation mid-century
	3	46.3 inches/year	22.9 inches/year

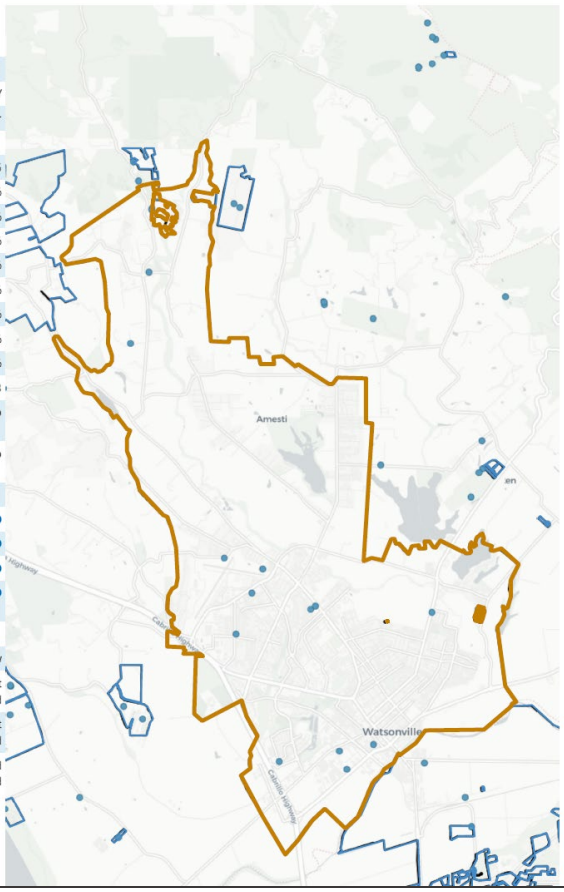
21. Aquifer Storage	Elevation 2014 (fasl)	Elevation most recent year (fasl)	Overall increase, decrease or about the same
	-11.77	12.4	Increase

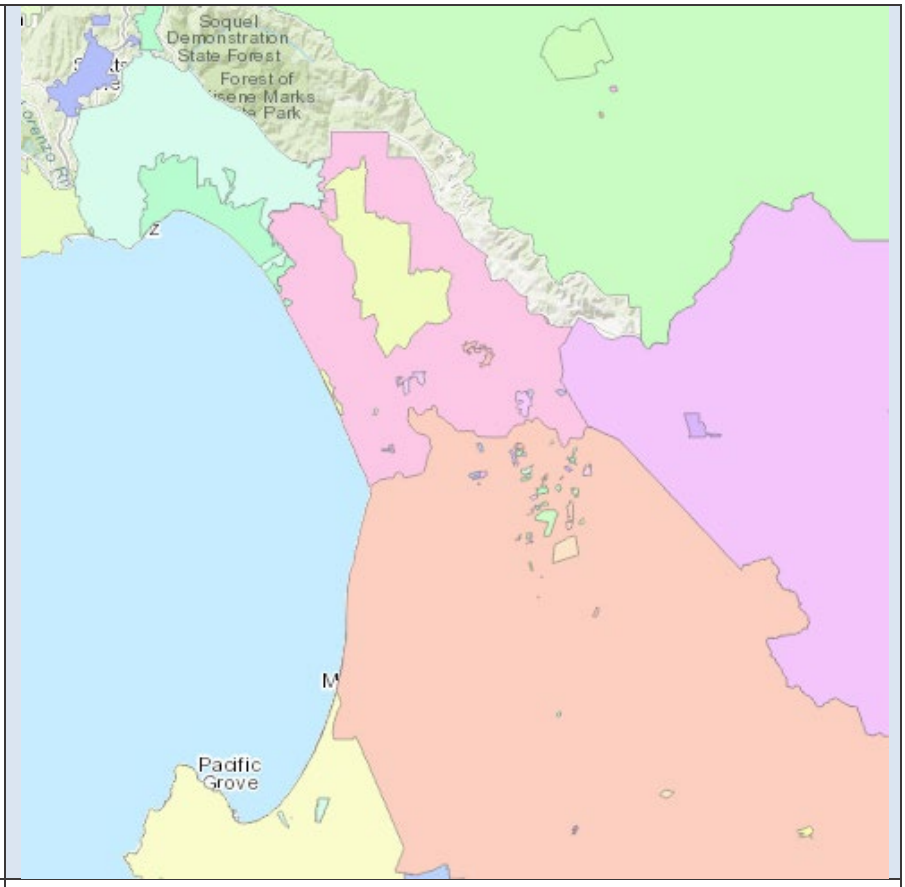
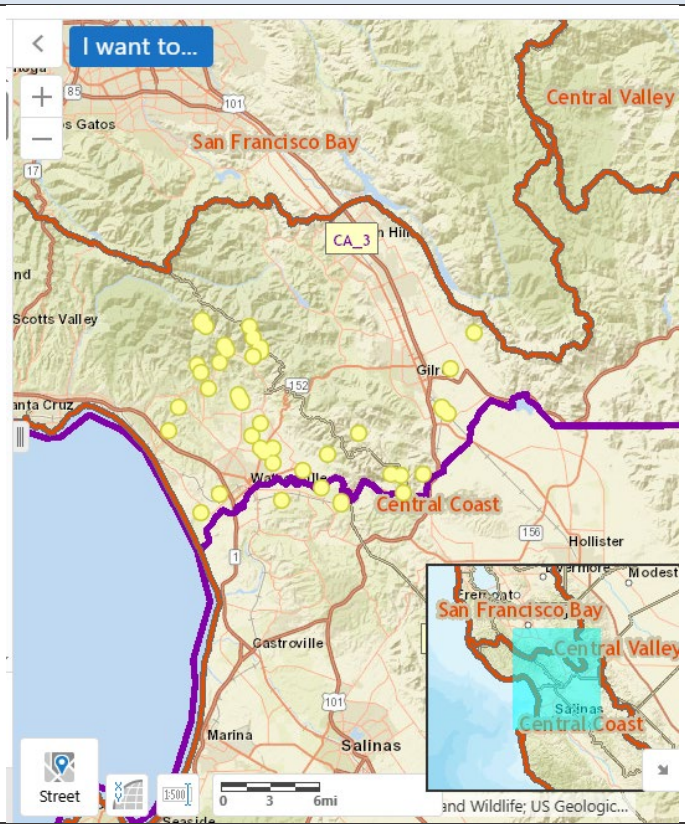
22. Water Storage	Reservoir(s)	Storage
	UVA – Uvas Reservoir	

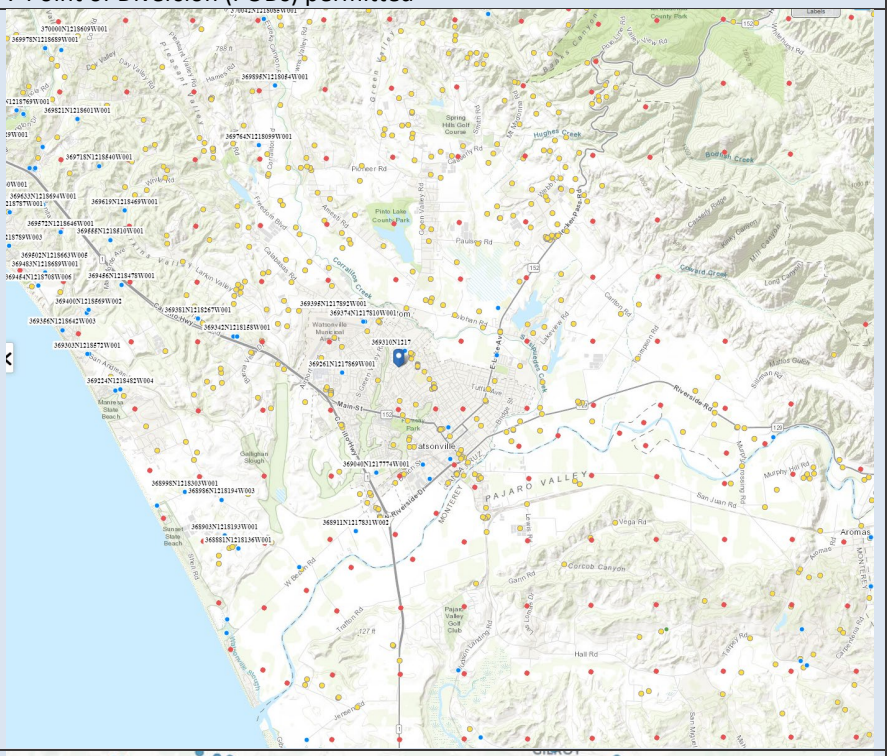
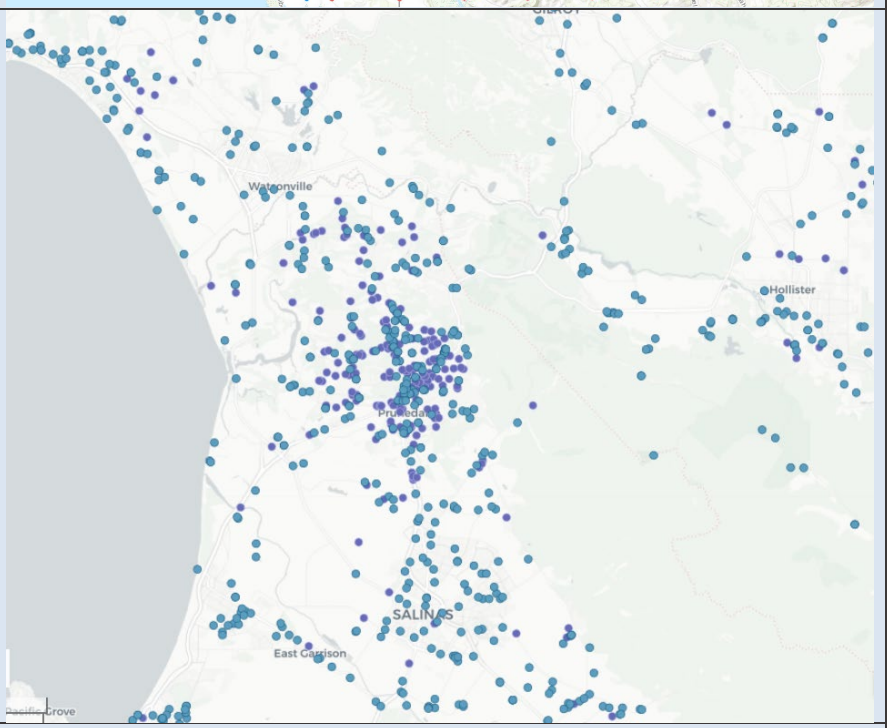
Natural Streamflow Classes	Response								
23. Major drivers of the natural streamflow classes in your water System	Snow Driven		Rainfall Driven			Rain and Aquifer (Low Elevation)			
			X			X			
24. Select the natural streamflow classes that are present in your water system	SM	HLP	LSR	WS	FER	HSR	GW	PGR	RGW
				X	X			X	X
25. List and describe the type of streamflow classes that are located in your water system	WS – Winter Storm, FER – Ephemeral Flashy Rain PGR – Perennial Groundwater and Rain RGW – Rain and Seasonal Groundwater								

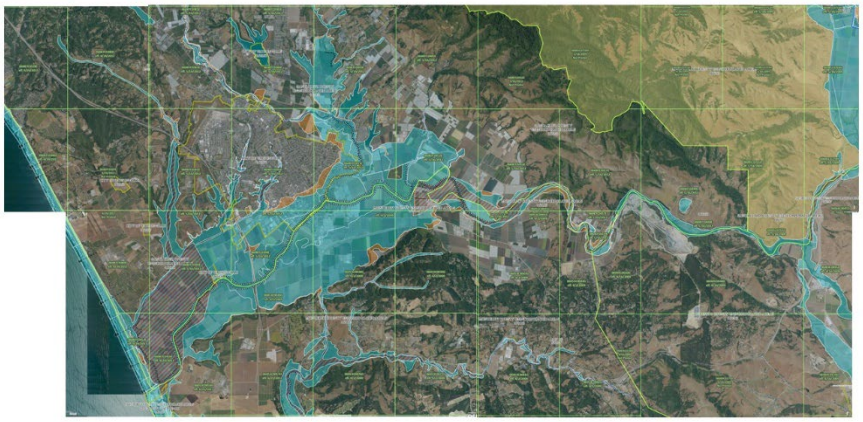
Defining the Human-made Elements	Response
26. Does your water system is supplied of water from a large water infrastructure project?	( ) Central Valley Project. Dams: Shasta, Trinity, Friant, Whiskeytown, Keswick, San Luis, Folsom, New Melones, Black Butte. Conveyance: **Delta-Mendota Canal**, Madera Canal, Friant-Kern Canal, Madera Canal, Tehama Colusa Canal, San Luis Canal, Pacheco Conduit, Santa Clara Conduit, Hollister Conduit, Corning Canal, Coalinga Canal, Contra Costa Canal, Clear Creek Tunnel. Clifton Court Forebay. Tracy Pump Plant (Fig. ES-4, Pg. 9). Mostly Agriculture.

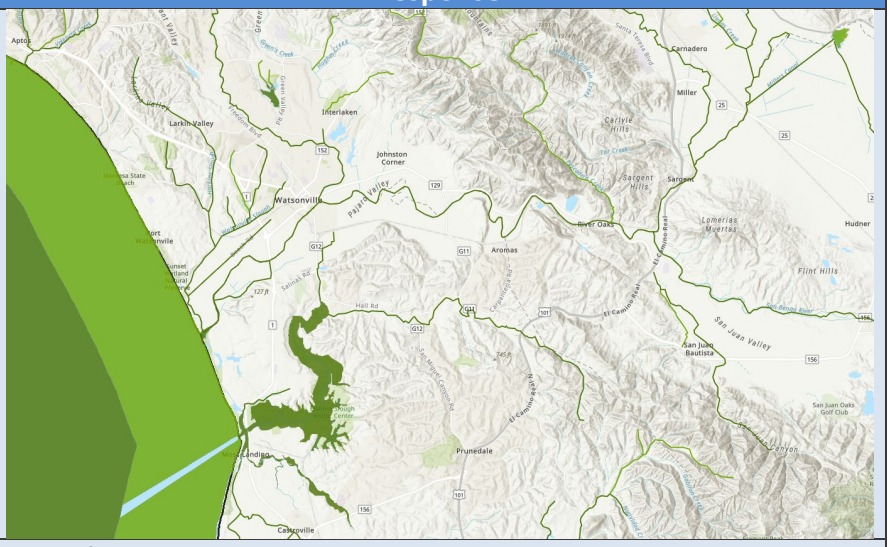
	( ) Other Federally built infrastructure. Dams: Pine Flat, Kaweah Lake, Lake Success, Lake Isabella, New Melones Lake, Lake Berryesa, Lake Sonoma, Lake Mendocino, East Park Reservoir, Stony Gorge Reservoir, Cachuma Reservoir, Lake Casitas, Twitchell Reservoir. Mostly Agriculture with Urban users. ( ) State Water Project. Dams: Oroville, Antelope Lake, Frenchman lake, Lake Davis, Pyramid Lake, Castaic Lake, Silverwood Lake, Lake Mathews, Lake Perris, Diamond Valley Lake, Lake Skinner. Aqueduct: **California Aqueduct**, North Bay Aqueduct, South Bay Aqueduct, Coastal branch, East branch, (Fig. ES-4, Pg. 9). Both, Agriculture and Urban uses ( ) Colorado River. Dams: Lake Havasu. Conveyance: **Colorado River Aqueduct**, San Diego Aqueducts. Urban: Los Angeles and San Diego ( ) Imperial and Coachella. Dams: Imperial, Pilot Knob, Lake Cahuila. Conveyance: **All American Canal**, Coachella Canal. Agriculture: IID, CVID, PVID ( ) Los Angeles Aqueduct. Dams: Mono Lake, Grant Lake Reservoir, Lake Crowley, Owens Lake, Bouquet Reservoir. Conveyance: **Los Angeles Aqueduct** ( ) San Francisco, SF Bay, Hetch Hetchy System. Dams: **Hetch Hetchy reservoir**, Lake Eleanor, Lake Lloyd. Urban: San Francisco and BAWSCA. ( ) Mokelumne Aqueduct. Dam: Comanche Reservoir. Conveyance: Mokelumne Aqueduct. ( ) Eel River – Russian River. Dams: Scott Dam, Van Arsdale, Lake Mendocino. Conveyance: Potter Valley Project. ( ) North Marin (County) Aqueduct. Dams: Mendocino Lake, Sonoma Lake. Conveyance: Sonoma Water transport pipelines. (**X**) Not Applicable	
27. If it applies, include a map of your large water infrastructure system	Not Applicable	
28. Does your water system is supplied of water from a small water system?	Yes or No	If yes, name(s) of your small water system(s):
	Yes	City of Watsonville, Pajaro Valley Water Management Agency

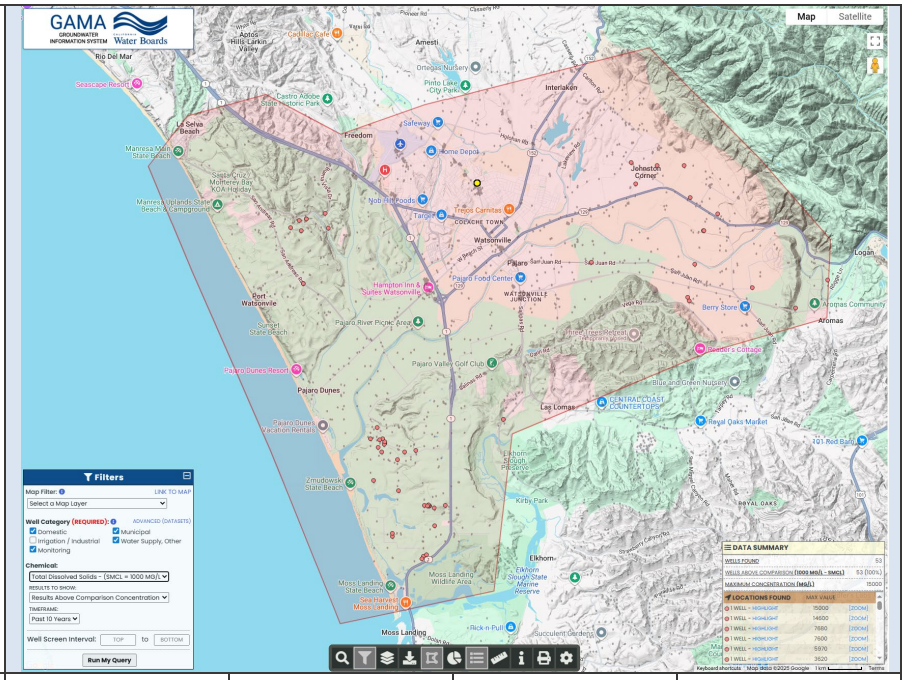
29. If it applies, include a map of your small water system	WATSONVILLE, CITY OF Public Water System ID: CA4410011 Type of CWS: COMMUNITY Primary Water Source: Surface Water **Demographics** Population Served: 67,886 White: 67.01 % Hispanic or Latino: 17.55 % African American: 1.74 % Asian: 7.38 % Pacific Islander: < 1 % American Indian: < 1 % Other Race: < 1 % Mixed/Multiple: 5.53 % Median Household Income: $111,563 Disadvantaged Community Status: No Severely Disadvantaged Community Status: No **Recent Water Quality (6 - 9 yr avg.)** Arsenic, µg/L: 0.435 Nitrates, mg/L: 1.625 1,2,3-Trichloropropane, µg/L: 0.000 Hexavalent Chromium (Cr6), µg/L: 6.694 **Drinking Water Affordability** Affordability Burden: Low Percent Median Household Income: Threshold Not Exceeded Extreme Water Bill: Threshold Not Exceeded Household Socioeconomic Burden: Threshold Exceeded 
30. Write down the names of the irrigation/water district that are located in your water system	Name(s) of the water district(s) that are located in your water system: Pajaro Valley Water Management District (in pink), City of Watsonville (in yellow), Pajaro Sunny Mesa Community Service District, Monterey County Water Resources Agency

31. If it applies, include a map of the water systems that are located in your water system	
32. Number of Points of Diversions (PODs) identified in eWRIMS GIS System:	Number of Point of Diversions (PODs) 95
33. Include a map of the PODs shown in eWRIMS	

34. Link of the search	https://waterrightsmaps.waterboards.ca.gov/viewer/index.html?viewer=eWRIMS.eWRIMS_gvh&project=4e40305f9fa042cea43a8ba1d3802e1d
35. Point of Diversion (PODs) permitted?	7 Point of Diversion (PODs) permitted
36. Location of the Groundwater Wells in your water system	
37. Location of wells supplying water to Public and State Small Water Systems	
38. Is there a flood management reservoir in your water system?	Not Applicable

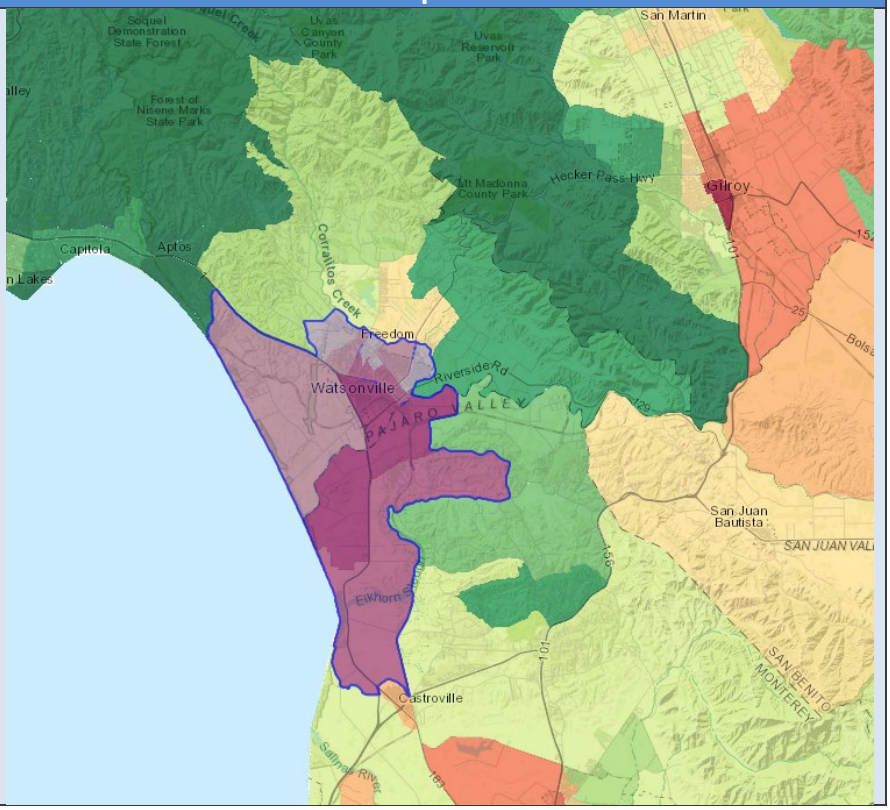
39. Floodplain area.	

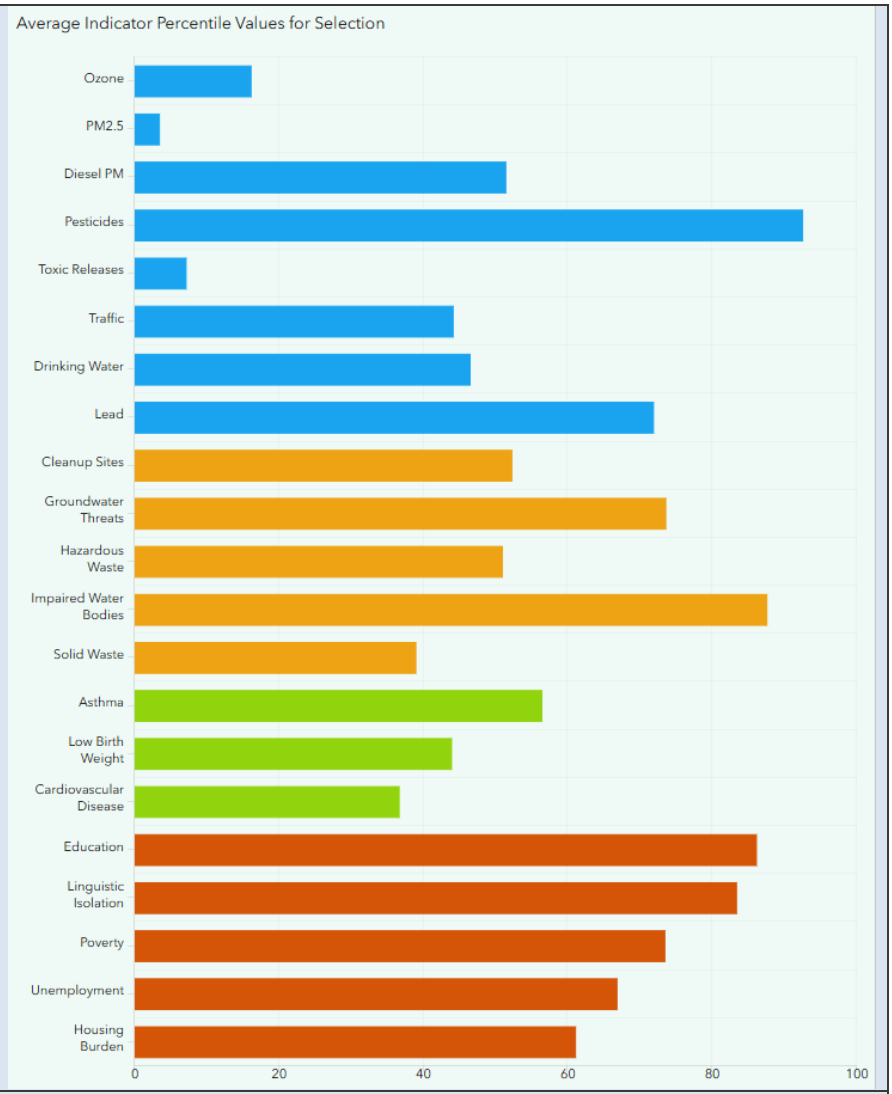
Water Quality	Response
40. Map of water bodies listed [] for not meeting water quality standards who has a process for developing a Total Maximum Daily Load (TMDL)	
41. For one water body that is in the 303 (d) list, write down the primary and/or secondary Maximum Contaminant Levels (MCLs) that have been exceed or are of concern.	Nameof the river: **Pajaro River** Diazon – Delist Fecal Coliform -Delist Chromium – Delist DDD (Dichlorodiphenyldichloroethane) – Do not delist DDE (Dichlorodiphenyldichloroethylene) – Do not delist DDT (Dichlorodiphenyltrichloroethane) – Do not delist Dieldrin – Do not delist Escherichia coli (E. coli) – Do not delist Imidacloprid – Do not delist PCBs (Polychlorinated biphenyls) – Do not delist Turbidity – Do not delist pH – Do not delist Chlorpyrifos – Do not delist Nitrate – Do not delist Oxygen Dissolved – Do not delist Toxicity – Do not delist Sedimentation - List

42. Map of wells with groundwater quality data	

43. Number of wells exceeding an MCL

Chemical	1,2,3 TCP	Nitrate	TDS
# of Wells	48	122	53

Optional – Overall Environmental Risk	Response
44. Take a screenshot of the map in the CalEnviroScreen Data Dashboard of your water system.	

45. CalEnviroScreen indices	
46. List the three largest value indicators.	Pesticides, Impaired Water Bodies and Education.

Congratulations! You have completed Module 1 of 2!

Instructions to fill the Module 1 section

Defining your water system

Resources: Guidebook (page 4 to 5) OR videos (1 and 2).

In this activity, you will define "*Your Water System*." This can be an iterative process as you move forward in the course, so don't feel bad if you re-define your water system later. What we are looking in this activity is that you name a place and define an **area** of your interest that you will analyze throughout this course. We will provide you tools and databases to find most of the information that you need, such as natural and human-made elements, components of the water cycle, and policies that may apply. However, it is very important that you *have some familiarity* with the water system of your interest, so it is easy to find and describe your water system. Remember the definition of a water system:

"*A **water system** is a group of natural and human-made elements in a **basin** that are linked naturally or because of human intervention where the water cycle occurs*"

There can be different types water systems, such as your own home, the ranch or a property that you are interested, the city that you live or that you are interested in knowing more about, the county that you lived, a basin (e.g. Los Angeles River) or a larger region (e.g. Southern California).

Some examples of water systems can be found here:

- My own home
- City of Davis
- Pajaro Valley
- Russian River
- Clear Lake
- Sacramento basin

1. Write the name of the water system that you are interested to learn more about.
2. Provide the rationale for why you selected the water system. There can be plenty of reasons, such as:
   - it is the region that you live,
   - it is a region that you are aware it has problems with water (quantity and/or quality),
   - it is a region that has environmental degradation,
   - It is a region where diverse communities do not have adequate access to water as other more affluent communities
3. Provide a map of the water system that you are interested to know more about.
   - First, make a internet search for a map of the water system that you are interested to know more. If you find a map please copy the figure into this question and provide at the end the citation or link from where you found the map.
   - If you can't find a map, there are different ways in how you can create your own map. Of course, you use specialized software (ArcGIS, QGIS) to create a map. However, there is an easy way that you can do this in My Maps of Google Maps. This webpage shows how to create a polygon in google maps that you can use to show the extent of your water system. Here is a link of a video that we create to show you how to draw your own map.

Identifying your basin

4. Identify the main basin that your water system is located. Here we will use a specialized tool: Online ArcGIS. Go to the following link of Online ArcGIS. We will need to add the following layers, so it will make it clear which rivers are draining each basin: North America Lakes and Rivers. To add this layer, click on the "Add" icon below the layer "California WDB HUC8 Watersheds" and in the "Search" tool type "North America Lakes and Rivers" and then click on "+ Add". Now, click on the location of your Water System and a window will pop up with the name. This video shows how to do this procedure.
5. Identify the sub-basin that your water system is located. Here you will continue using Online ArcGIS. You will need to add the layer "Watershed Boundary Dataset HUC10s" as you did in the previous question. This video shows how to do this procedure.
6. Now that you are more familiar with your water system, basin and sub-basin, you have to identify if there is any groundwater resources (groundwater basins and/or aquifers) in your water system. Go to the following page and look

for aquifers that are located within your water system. Instructions. Scroll down and accept the terms. On the bar menu on the left, click on "Reference Layers" that is at the bottom left corner of the page. Select "Bulletin 118 Groundwater Bains – 2018". When this layer is activated, you can see all the groundwater basin in the state of California. Make a zoom to the location of your water system. Also activate the layers of "Watersheds" and "Major Rivers and Creeks" you can made them more transparent or opaque with the scrolling bar. This video shows an example of this task and the following two.

7. Identify all the groundwater basins that are located within your basin and write them down in this question.
8. Identify all the Disadvantaged communities that are located in the basin where your water systems is located and write them down. This video shows an example of this task.
9. Since time immemorial, tribes lived in California. First, go to the Native Land map, zoom into your water system and identify the territories of the tribes whose homelands are located in your water system. Second, identify all the Tribal communities that currently are located in your water systems and write them down. Go to the SGMA Data viewer, open the tab of "Reference Layers", go to the section of "Political" and click on "Tribal Representation Tracts", "Tribal Land Area Representation", and "Tribal Leaders Directory". Zoom into your water system and identify the different Tribes that are located within your water system.

Defining the Natural Elements

Guidebook (page 5 to 6) OR video(3).

10. Identify what are the main natural landscapes that are located within and surrounding your water system. This is where the familiarity with your water system becomes handy. This map shows the main landscape in California, which is a starting point. Look on internet for the natural landscapes that are located within and surrounding your water system.
11. Identify what are the main orographic features that are located within and surrounding your water system. This is where the familiarity with your water system becomes handy. This map shows the main orographic features in California, which is a starting point. Look on internet for the natural landscapes that are located within and surrounding your water system.
12. Identify what are the main soil types that are located within and surrounding your water system. This website shows some of the soil type properties. In the upper tabs, click on "Properties" then on "Physical" and scroll down and click on "Soil Texture (0 - 25 cm)". Then zoom in the location of your water system. This map shows the different soil textures for the first foot of soil. Click on the "?" icon right next to the Soil texture triangle to read about the different soil texture classes. Write down and identify the main soils textures of your water system. This video shows an example on how to do this task.
13. Identify the Land Cover(s) that are present in your water system. You can use the information in this website to identify the land cover in 2010. Click on the "Open in Map" and wait some time for the database to upload. Then, zoom on the region where your water system is located and click on the "*i*" icon on the horizontal menu bar. The "*i*" icon or *identify* will pop up a window where it will display the category of the land use (e.g. Raster.WHRNAME Agriculture) and the sub-category (e.g. Raster.Class Strawberries). Also, you can take a look at the SGMA Data viewer, open the tab of "Water Budget", go to the section of "Land Use Datasets" and click on the most recent year when land use data is available. Zoom into your water system and identify the different land uses and crops that are gown in your water system.
14. Identify the climate(s) that are present in your water system. You can use the information in this document (page 15) to select the climates that are relevant for your water system.
15. Identify the natural ecosystem(s) that are present in your water system. You can use the information in this website to select the ecosystems that are relevant for your water system.

What are the key event of the water cycle to remember?

Guidebook (page 9 to 10) OR video(5).

Precipitation

16. We will explore three data sets so you have an idea of how much precipitation has changed.
    1900 – 1960. Go to Data Basin in the following link to access the Average Annual Precipitation for California, for the period 1900 to 1960. Click on "Open in Map". On the upper left side of the map there is a menu with "Datasets" and the dataset that we are visualizing, "Average Annual precipitation for California, USA (1900-1960)" Click on the arrow to the right that is right next to the previous text, then click on "transparency" and change to "60%". Now zoom on the region

where your water system is located, click on the information icon "i" ( ) and click on one location of your water system. A window should pop-up showing the pop, the field of "PRECIP" displays the average annual precipitation in inches for that location for the period of 1900 to 1960. Write this value down. If you want to explore different locations, write them down, but make sure you click on the same locations.

1981 – 2010. Go to the link of the Online Arc GIS that we used before. Click on "Open in Map Viewer". On the right hand menu change in "Appearance" the "Transparency" bar to 35% and zoom into the region of your water system. Now click on the same location(s) of the previous dataset. A window should pop-up showing the average annual precipitation in inches per year. Write it down.

1961-1990, **2035 – 2064** and **2070 – 2099**. Now, we will visit Cal-adapt, it is an amazing data tool to explore mid- and end-century projected data considering climate change (medium and high emission scenarios). Click on the following link of Cal-Adapt Annual Averages, click on "Change Location", a Window should pop-out. In the map of the left move to the region where your water system is located. Click on the grid that is the closest to the locations that you used before and in the menu at the bottom click on "Confirm". This action should retrieve the annual averages for that grid. Below the map of the right there should be a drop-down menu to "SELECT THE CLIMATE VARIABLE". In this drop down menu select "Precipitation". Now the window shows the Annual Average Precipitation of the baseline period (1961-1990), Mid Century (2035-2064) and End-Century (2070-2099) for Medium Emissions (RCP 4.5). Write down the "30 YEAR AVG" for all these periods. Also write down the "30 YEAR RANGE" values, which shows how much precipitation will range. For California, many times it is not that the average precipitation will change dramatically, what it changes is the range or in other words, its variability. Now, change the emission scenario, on the right menu in the "SELECT SCENARIO" section click in "High (RCP 8.5)" and write down the "30 YEAR AVG" and "30 YEAR RANGE" for the high emission scenario.

Snowpack

17. **Current Snowpack**. Almost every community, city, or place in California depend (directly or indirectly) in the Sierra Nevada snowpack. Let's take a look at the historic and predicted snowpack for the Sierra Nevada. Go to the interactive snowpack webpage of DWR, and select the current year, two wet years [wettest: 2016-2017 , 2018-2019) and two dry years (driest: 2014-2015 and 2021-2022) and click on "Draw Chart". For a quick summary of the snowpack with respect to the statistical average, take a look at this DWR webpage.
18. **Predicted Snowpack**. Go to CalAdapt - Snowpack and explore the snowpack. Go to the tab of "Map" then on the left menu select "Medium (RCP 4.5)", select the month of "April", select the period of "10 years" and select any climate model of your preference. Then click Play ( ) below the legend's figure. You will see a depiction of how much snow (as snow equivalent) has historically happened and is predicted until the end of the century. We selected April because April's snowpack is the maximum amount of snowpack that is available for summer considering that all the large storms have already passed and it is the beginning of the snowmelt season. Copy in your form a picture of the snowpack at the end of the century.

Temperature

19. Let's explore the impact of temperature in your water system. Go to CalAdapt – Climate Change Snapshot, in the map, zoom into the location of your water system, select "Watershed (HUC10)" and click on the HUC that is related to your water system. Then click on "GENERATE SNAPSHOT". Write down the "30yr Average" temperature in the form. For temperature, trends are upward, no matter in which part of the state your water systems is located. Increased temperatures will have an effect in other events of the water cycle, such as evaporation, evapotranspiration, etc. Also, increased temperatures will affect disproportionally disadvantaged communities that may not access to adequate air conditioning or whose jobs are exposed to temperature, e.g. farm workers. In the same webpage, in the dropdown menu of "SELECT CLIMATE INDICATOR" you can choose "Extreme Heat Days" and you can see how many extreme heat days will occur by mid and end of century.

Evapotranspiration

20. We are lucky to have CIMIS in the state of California. CIMIS (California Irrigation Management Information System) is a group of weather stations that calculate reference evapotranspiration throughout the state. Open the Reference Evapotranspiration Zones Map, go to the map on page 2, identify in which Reference Evapotranspiration (ETo) zone your water system is located and write it down on the form. Then go to page 3 take a look at the monthly average reference evapotranspiration. Write in the form the total reference evapotranspiration (value of the last column), which is the

average annual vale. From the section of temperature (#18) copy the average precipitation for the mid-century. Compare this two values. Many time the reference evapotranspiration is greater than the precipitation, meaning that a well-watered grass uses more water than what it rains in that given location. Also, many crops use more water than a well-watered grass, meaning that rainfall not only falls in winter when is not needed for crops, but also that if we were able to capture all that water, it would not be enough to meet the crop water requirements.

Aquifer Storage

21. It is very difficult to estimate aquifer storage because it is very difficult to estimate que water storage in aquifers. However, one way to estimate how much water an aquifer has it to compare the water levels (the water table) through time. Go to the SGMA Data viewer, click on the "Ground water Levels" tab, in the section of "Seasonal Reports" select "Elevation", select the season of "Fall" and "Select year" 2014. The check the box of "Elevation Points" , it will show the feet above sea level (fasl). What you are seeing is the estimated groundwater elevation in 2014. Zoom to the location of your water system and identify a well that is close to your water system. Write down the elevation, sometimes you can have negative elevations when the water table is below the mean sea level. Then go to the most recent year and write down the groundwater elevation. Then compare if the groundwater elevation has increased, decreased or about the same.

Water Storage

22. There are plenty of surface water reservoirs in the state of California, more than 1,000! Now, let's identify the reservoirs that are located in your basin. Go to the CDEC-DWR Daily Reservoir Reporting Stations and look for the reservoir(s) that are located in your basin. When you identify the reservoir in your basin, click on the "ID" of the reservoir, it is a three letters acronym of the reservoir that is right next to its name. A new window should show up, that shows the Date, reservoir elevation (RES ELE), Storage (STORAGE), and reservoir change. Click on "STORAGE". A window with a graph should appear, then change the "Span:" to 1000 days, so we can take a look at the last three years of storage. Take a screen shot of the graph and past it on your form.

How water moves naturally in California?

Guidebook (page 9 to 10) OR video(5).

23. Take a look at this map (you can also download it) of the natural streamflow classification of California, and roughly identify the natural streamflow classes that are located in your water system.
24. Go to the eflows website and click on "Hydrology". On the map of the left, zoom into your water system location and with your mouse, hover over the rivers. You will see that the name of the natural river classification on the mouse cursor. On the list of river on the left you can see the name of the streamflow classification as well as its abbreviation in parenthesis. Using the abbreviation, select the natural streamflow classes that are located in your water system.
25. Using the following table of the natural streamflow classification, write down the names of the classes located in your water system and briefly describe/summarize the information from the table that are relevant to your water system. Just for your reference (you don't have to read them), all the information for this section is explained in the following peer-reviewed documents: Lane et al. (2018), Patterson et al. (2020).

What are the Human-made Elements of my water system?

Here comes the tricky part, which is to identify the human made elements considering that there has been a lot of infrastructure built throughout the state. Please take a look at the figures and text of this cartoon pamphlet that provides a good overview of the California water system. The first step is to evaluate if your water systems is supplied by large water projects, and the second step is to evaluate if it is supplied by more local water project.

Large water infrastructure and small water systems

26. **Large Water Infrastructure Projects**. Take a look at the executive summary of the California Water Plan Update (**pages ES-9 to ES-10**) where the large water systems projects are depicted (page ES-9) and all the rivers and places that share their waters through infrastructure to other region for agriculture and cities (page ES-10). This can provide you a first pass to identify if the location of your water system is supplied by large water infrastructure systems. Take a look at the maps of TNC's whitepaper (**pages 14 to 31**) that provide a closer look to the different large water project infrastructure in California. Now in this section of your form, you have links of figures for every large water infrastructure project.

Identify if any of them supply water to your water system. Select the large water system if it applies to your water system.

27. If it applies, include a map of the large water infrastructure that your water system receives water from.
28. **Small Water Systems**. Your water system may be supplied from a small water system. The Community Water Center (Centro Comunitario para el Agua) Drinking Water Tool is a great tool to identify small water systems. When you open the CWC Drinking Water Tool scroll to the bottom and click on "Your Water Data" and select the language of your preference. A pop-up window should appear, go to the section of "Step 1" and type an address, the name of a city, or the zip code. In "Step 2" select if your water system is supplied from a "Water System" or a "Domestic Well". If you are not sure about the water source, then click "Water System". Four results will be displayed: (1) Who manages my water?, (2) What about water supply?, (3) What about water quality? And (What about drinking water treats?. For now, let's focus on "Who manages my water?" This section will tell you who manages the surface and groundwater of that region. Write the name of the agency(ies) and the source of water for your system.
    Important: If it doesn't come any results in Step 1, you can go back to the CWC Drinking Water Tool scroll to the bottom and click on "California Water Data", select the language of your preference. Select "Skip" and on the menu of the left select toggle "Water Systems". Then zoom in to your water system and click on the location. It should show the small water systems and the agency that is providing the service to your water system. Write it down. Click on the print icon (Print) to print the data of your small water system. Download these data as a pdf file. Include a screenshot of the file in your form for # 27.
29. Click on "Explore the Map", check the box of "Public and State Small Water System Boundaries", "Public Supply Well Locations" and activate "Water System" toggle. Now click on the location of your water system. On the menu bar of the left it should come the information of your water system. Right next to the name of your water system, there should be an icon (Print) to print the data of your small water system. Download these data as a pdf file. Include a screenshot of the file in your form.

Irrigation and water districts

30. **Irrigation/Water Districts**. The largest user of water is agriculture (for consumptive use). Thus, it is important to know the water and irrigation districts that are located in your water system. Go to the data basin website, click on "Open in Map" and this map shows you the different water districts in California. Zoom to your water system and click on a given location. If there is a water district, a window will pop up with the number of water districts that have jurisdiction over your region. Notice that there are arrows ">>" on the upper right corner of the pop up window, so you can see how many water districts have a jurisdiction over the location that you clicked.
31. If it applies, take a screen shot of the water systems that are located in your water system and paste this picture in your form.

Surface water users

32. **Surface Water Diversions**. Now we will explore the surface water Points of Diversion (**POD**) on our water system. Go to the electronic Water Rights Information and Management System (eWRIMS) which is a database of all the surface water rights maintained by the California State Water Resources Control Board. eWRIMS will sunset in 2025 and CalWATRS will replace it, but in the meantime, let's use eWRIMS. Let's go to eWRIMS GIS System and click on "Find water Rights", then check the box of "HUC Watershed number", click on "Search", and them provide the HUC10 number that you identified for your water system in #5 of this form (e.g. for the Pajaro Valley example the HUC number is 1806000208). Then click "Search" again. A new window will come showing you a map with all the PODs (point of diversions) for surface water rights, the bar on the left shows the total number of PODs, and if you move your mouse over the PODs, it will highlight in the map where they are located. In the form write down the number of PODs located in your water system
33. **Map of diversions**. Take a screenshot of the map displayed in eWRIMS and paste it in the form.
34. **Link of the search.** In the bar of the upper left corner of the map, there is a test that says "I want to …" click in it, and select "Save". A window should pop-up asking you about the name of this project and other questions. There should appear a URL link of the project, copy and paste the link in the form, so next time that you want to check on this results, you can always come back.
35. **Downloading PODs records**. On the bar of the left, there is a ≡ icon that displays a drop down menu. In that drop down menu select "Export to XLSX" and save this file. This is a very important file, because it contains the PODs the data of all the legal point registered to diver surface water in your water system. You can explore this file, specially to know the

name of the individuals or companies with a POD (Columns AV and AW), if this permit is active (Column AN), the diversion amount (Columns AK and AM), the storage amount (Column AL) and units (Column AU), and the water right type (Column AR), just to mention a few. Identify how many PODs are "Permitted" (you can filter these data in excel) and write it down on the number of PODs in your form.
IMPORTANT: You can also search PODs and water rights in eWRIMS on your own, this webpage describe common searches and a dictionary of terms.

Groundwater users

36. **Groundwater Diversions**. We will use two databases to identify the wells in your water system that are the groundwater diversions points. In the SGMA Data viewer, in the left bar, go to "Groundwater Levels", then go to the "Well Completion Reports" section and select "Well Completion Reports". You have to zoom in to see the wells. The map will show the location of wells that have been drilled since 1949. This map provides a good idea on the number of wells located in your water system. Also, in the same section of "Groundwater Levels" , subsection of "Monitoring Network" select "DWR GW Measurements", it will show the location of monitoring wells maintained by DWR. Take a screen shot of the map and paste it on your form. Now you know the location of the wells in your water system.
37. **Public Supply well and State Small Water Systems wells**. Now let's identify what are the location of the public supply and small water systems wells. In the Drinking Water Tool of the Community Water Center (Centro Comunitario por el Agua), select "California Water Data" at the bottom of the webpage. on the left bar, in the "Groundwater Users" section, check the boxes of "Public Supply Well Locations" and "State Small Water Systems". Zoom in to the location of your water system. This dataset shows you the location of well that are supplying water to public and state small water systems.

Floodplain areas

38. **Flood Management Reservoirs**. Let's switch gears here a little bit. Now, let's identify if there are dams in your water system that are operated for flood management. Go to the US ACE website (United States Army Corps of Engineers) and identify if there is a reservoir that is owned or operated by the USACE (Section 7) that influence your water system. If so, write its mane in the form.
39. **Floodplain Inundation Maps.** Now, let's explore the flood inundation maps using the National Flood Hazardous Layer (NFHL Viewer) of FEMA. Zoom in the location of your water system. Maps of the floodplain area will appear as you are zooming in to your water system. Take screen shots of the floodplain area of your water system. If you water system is larger that the screenshots, then take several screenshots and overlap them in power point to create a mosaic of figure to show all your water system.

Water Quality

Rivers and Water Bodies

40. **Water Quality in Rivers**. The SWRCB has the Surface Water Quality Assessment Program that reports water quality in surface water bodies. This program puts surface water bodies (e.g. rivers, reservoirs, lakes, estuaries, and even ocean waters) in a list [303(d)] that initiates the process to develop a TMDL (Total Maximum Daily Load) or another restoration project to restore or maintain water quality standards. This program also develop a report, "305(b) report" that assigns an overall water quality condition to all water bodies, it is submitted the US EPA for the National Water Quality Inventory Report. Go to the latest California Integrated Report Map, and explore the surface water bodies (e.g. rivers, lakes, etc.) of your water system. Zoom in your water system. The main menus of this GIS tool are located in the upper right corner. If you click on the legend icon "  " you will see that water bodies are depicted in two types of green: (1) dark green color for those water bodies listed in the 303(d) list of which a TMDL should be developed, and (2) light green color for those water bodies not listed. If you click on a water body (e.g. river or lake) a window should pop up providing information related to the regional water quality board, and the listing status: listed or not listed. If you keep scrolling down in this window, a link of the "More info" should come up, click on it and you will see a list of all the test done for primary and secondary Maximum Contaminant Loads (MCLs), the Line of Evidence (LOE), and if the water body is: listed, do not delist, not listed, or delisted for a given MCL. Take a screenshot of the map and paste it in your form.
41. **Impaired water quality constituents**. Click on a surface water body of your interest in your water system, for example, the mainstem of the river that passes through your water system. Then, scroll down on the pop-up window that came up

and click on "More info". Typically, the impaired pollutant or the impaired water quality parameter are listed at the top of this screen. Every pollutant is identified by a green horizontal bar displayed across the window. In your form, write down the name of the river and the list of pollutants or water quality constituents that are impaired (list, do not delist) or those that have been delisted.

Groundwater Quality

42. **Groundwater Quality**. The SWRCB in their GAMA (Groundwater Ambient Monitoring Assessment) program provides the groundwater quality data of well throughout the state. GAMA GIS is an excellent way to explore groundwater quality data. IMPORTANT: Keep in mind that there are Primary and Secondary MCLs. Now, please access the GIS interface of GAMA and zoom into your water system. You should have a window on the lower left corner and a menu bar on the bottom center of the window. In the bottom menu, click on the polygon icon "  " and draw a polygon of the area of your water system. This action will retrieve results from wells that are located within the polygon. On the bottom left menu, in the "Well Category" section select "Domestic", "Municipal", "Monitoring", "Water Supply, Other"; in the section of "Chemical" select one of the Top ten Chemicals in California, e.g. "Nitrate as N" or "123-Trichloropropane (1,2,3 TCP)TCP", then in the drop down menu of "RESULTS TO SHOW" select "Results Above Comparison Concentration" which is the MCL. In the lower right corner there is a window that shows you the number of wells that have results for that chemical selected, and the percentage of well above the comparison level (which is the MCL). If you click in "HIGHLIGHT" it will highlight the well that exceeded the vale. You will be able to identify wells that have exceed the chemical that you selected within your water system. In your form, copy and paste the map of the wells with groundwater quality parameters.
43. Chose three groundwater quality parameters and evaluate how many wells exceed the chemical parameter (MCL) that you selected.

Optional Extra Knowledge - Overall Environmental Risk

44. Water issue are not isolated, they are compounding issues that challenges that occur with other challenges. The CalEnviroScreen is a tool that summarizes environmental risks at the census track level, this tool shows the compounding effects that communities throughout the state are facing. This dashboard analyses the pollution burden and population characteristics to come up with one summary value, the greater the value of the overall indicator, the worse. The description of this summary index and all the indicators in described in the CalEnviroScreen report. Take a look at this video for a quick tutorial on how to use the dashboard. In the Open the Data Dashboard and zoom in to the location of your water system. You have two main panels, the panel on the left where all the "Area, Indicator, and Rece/Ethnicity Filters*" are located and the right panel where results are shown. In the upper left corner of the map there is a icon of a wrench (), click on it, a menu should appear. If you click on the ">>" icon, then the legend of the tools should appear, click on the "Lasso" tool. Then, on the map, create a polygon (by right-clicking and dragging the mouse) that selects all the census track polygons of your water system. On the right panel, it should appear the summary results of the tracks that you selected. Click on the "Indicators" tab in the bottom right, and now you can see all the values for the different indicators that are used. You can see that water is included with three indicators: drinking water, groundwater threats and impaired water bodies. Also, notice that are other indicators such as Ozone, Pesticides, Lead, Hazardous Waste, Asthma, Cardiovascular Disease, Education, Poverty, etc. The values of this indicator show the percentile of where these indices fall compared to the entire estate. For example, a value of 92.6 in the category of Pesticide means that these region falls into the 92.6% of most use of pesticides, when compared with all the census tracks in the state, the larger the number the worse conditions. Take a look at their report for further clarifications of the indicators. Take a screenshot of the map with the census tracks selected of your water system and pase it in your form.
45. Take a screenshot of the indices of your water system and pase it in your form.
46. List the three largest value indicators.