

Adelaida Hydrogeology Study

Evaluation of Groundwater Resources in the Adelaida Area, San Luis Obispo County, California

April 25, 2022

Atascadero Library, Atascadero, California

U.S. Geological Survey study, in cooperation with the San Luis Obispo County Flood Control and Water Conservation District;
Upper Salinas-Las Tablas Resource Conservation District



This information is preliminary and is subject to revision. It is being provided to meet the need for timely best science. The information is provided on the condition that neither the U.S. Geological Survey nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information.

Presentation Outline

- Purpose, scope, and objectives
- Local Participation and Outreach
- Task 1 – Data Compilation
- Task 2 – Hydrologic Data Collection
 - A) Groundwater monitoring
 - B) Water-chemistry sampling
 - C) Streamgage installation and surface water monitoring
- Task AEM - Hydrogeologic Evaluation
 - Airborne electromagnetic (AEM) survey data
 - Hydrogeologic framework
- Timeline
- Local Participation Opportunities
- Questions



Photo Credit: Geoff Cromwell, USGS. Public domain.

Purpose and Scope, and Objectives

SLO County has a specific need to evaluate historical and current hydrogeologic conditions

Purpose and Scope:

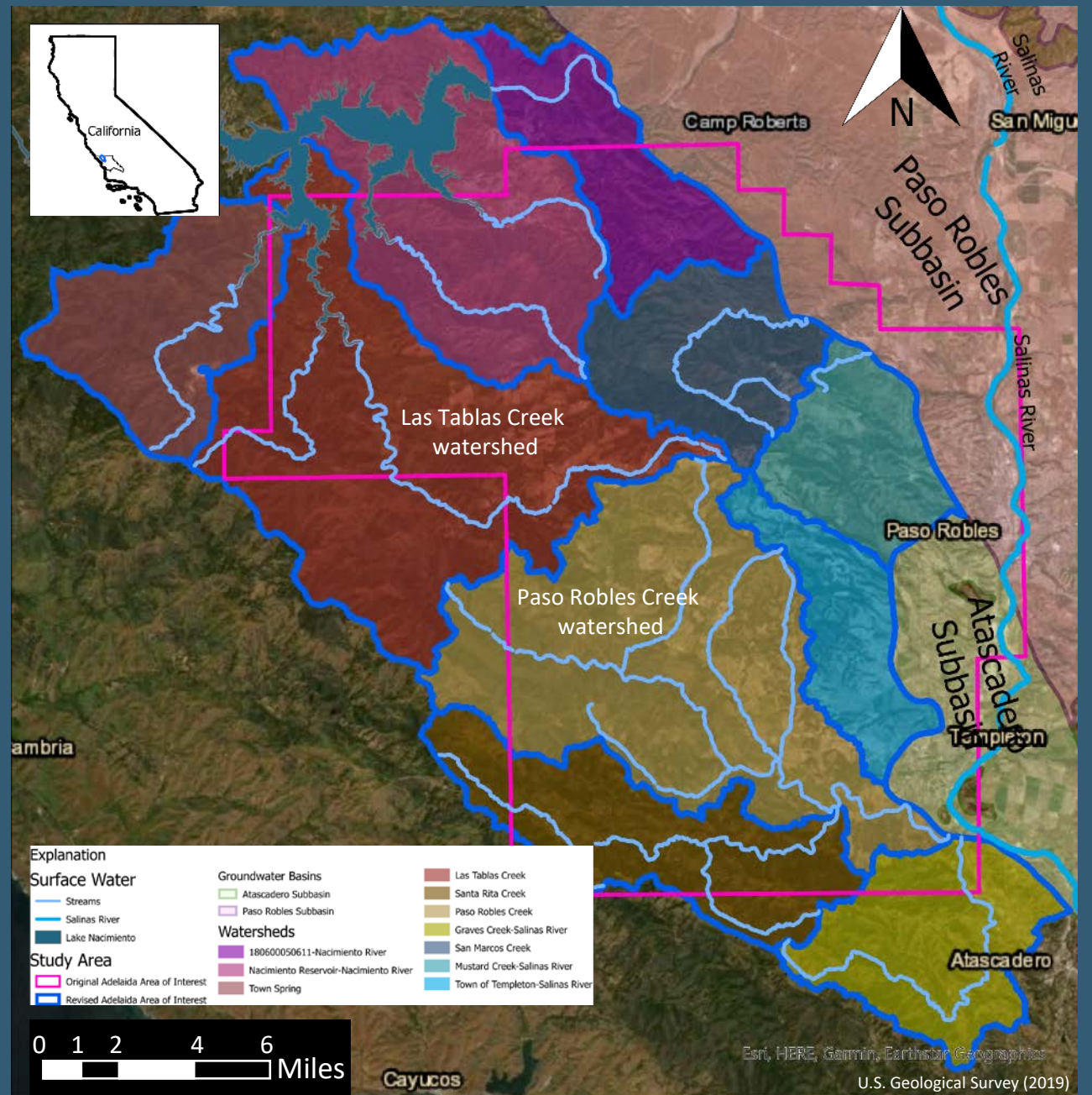
- Characterize the hydrology of the Adelaida area, SLO County, California

Objectives:

- Compile and collect geologic, hydrologic, and hydraulic data
- Quantify the hydrologic budget
- Refine the hydrogeologic understanding of the area with respect to geographic, vertical, and temporal variations

Study Area

- Adelaida area conforms with hydrologic boundaries
- Not a DWR-designated groundwater basin
- Includes 10 local watersheds



Local Participation and Outreach

- Community Meetings in August 2020 and April 2021
- Engage residents, vineyards, advocacy groups
- 17 participants in Task 1
 - Field visits
 - Local knowledge
 - Hydrogeologic data
 - Historical groundwater levels
 - Water chemistry
 - Borehole-lithology information



Local Participation and Outreach

- Website

- Project Summary

- Interactive map
 - Hydrologic information
 - Select data
 - Outreach

- Interactive Map

- Select publicly available data

- Area of interest
 - USGS sites and data
 - Surface-water features
 - DWR Well Completion Reports
 - Land-use data
 - Geologic map, folds, faults

Evaluation of Groundwater Resources in the Adelaida Area of San Luis Obispo County, California

Overview | [Data and Tools](#) | [Maps](#) | [Partners](#)

Stakeholders in San Luis Obispo County are concerned that the increased demand for water use has, and will continue to, affect [groundwater](#) levels and availability in the Adelaida area. To address stakeholder concerns, the County of San Luis Obispo Board of Supervisors has asked the USGS to conduct a comprehensive evaluation of groundwater resources of the Adelaida area.

Status - Active



[Interactive Map](#) | [Water Supply](#) | [Land Use](#) | [Groundwater Flow](#) | [Outreach](#)

Groundwater is the primary source of water in the Adelaida area and local stakeholders use private domestic and commercial wells to pump groundwater from the [aquifer](#) system. There is concern among stakeholders that the increasing demand for water is negatively affecting groundwater levels and groundwater availability. In response to these concerns, the County of San Luis Obispo Board of [Supervisors](#) (County Board) seeks to evaluate groundwater management solutions in the Adelaida area and has asked the United States Geological Survey (USGS), in cooperation with the San Luis Obispo County Flood Control and Water Conservation District (SLOFC&WCD), to provide a comprehensive evaluation of historic and current groundwater resources in the area.

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Explore More Science:

[hydrogeology](#)
[Water availability and forecasting groundwater flow and transport](#)
[Groundwater Measuring and Monitoring](#)
[View All](#) ▼



View of Paso Robles and the Adelaida area near the central California coast as taken from an airplane flying overhead. (Credit: Geoff Cromwell, USGS. Public domain.)

The USGS will gain an increased scientific understanding of the hydrologic system in the Adelaida area by compiling and collecting hydrogeologic and hydraulic data in the defined study area. The California Department of Water Resources (DWR) has not defined the highlands of the Adelaida area as a groundwater basin, therefore the area is not subject to California Sustainable Groundwater Management Act (SGMA) regulations (CADWR, 2016). The eastern border of the Adelaida area is outside of the Salinas Valley-Paso Robles Area (Paso Robles sub-basin) and Salinas Valley-Atascadero Area (Atascadero sub-basin) groundwater basins (CADWR, 2016; fig. 1). Publicly available hydrogeologic and hydraulic data (such as aquifer yield, water quality, or water availability) are limited throughout the Adelaida area, and to date, no investigation of the groundwater resources or water-bearing units of the aquifer system of the Adelaida area has been completed. The Adelaida Study (Study) will extend to the eastern area of the Paso Robles sub-basin and Atascadero sub-basin to better understand the groundwater connectivity between the sub-basin boundaries and the Adelaida areas.

This Study will benefit water managers, stakeholders and potential future interested entities and studies by providing:

- an improved understanding of the aquifer system, including identifying the water-bearing units
- evaluating the historic and current impacts of groundwater use in the Adelaida area
- quantifying the groundwater resources in an undefined local aquifer system
- advancing monitoring networks in the County for groundwater and water-quality data
- providing a more thorough understanding of geological controls on water availability

<https://www.usgs.gov/centers/california-water-science-center/science/evaluation-groundwater-resources-adelaida-area-san>

Local Participation and Outreach

- Website

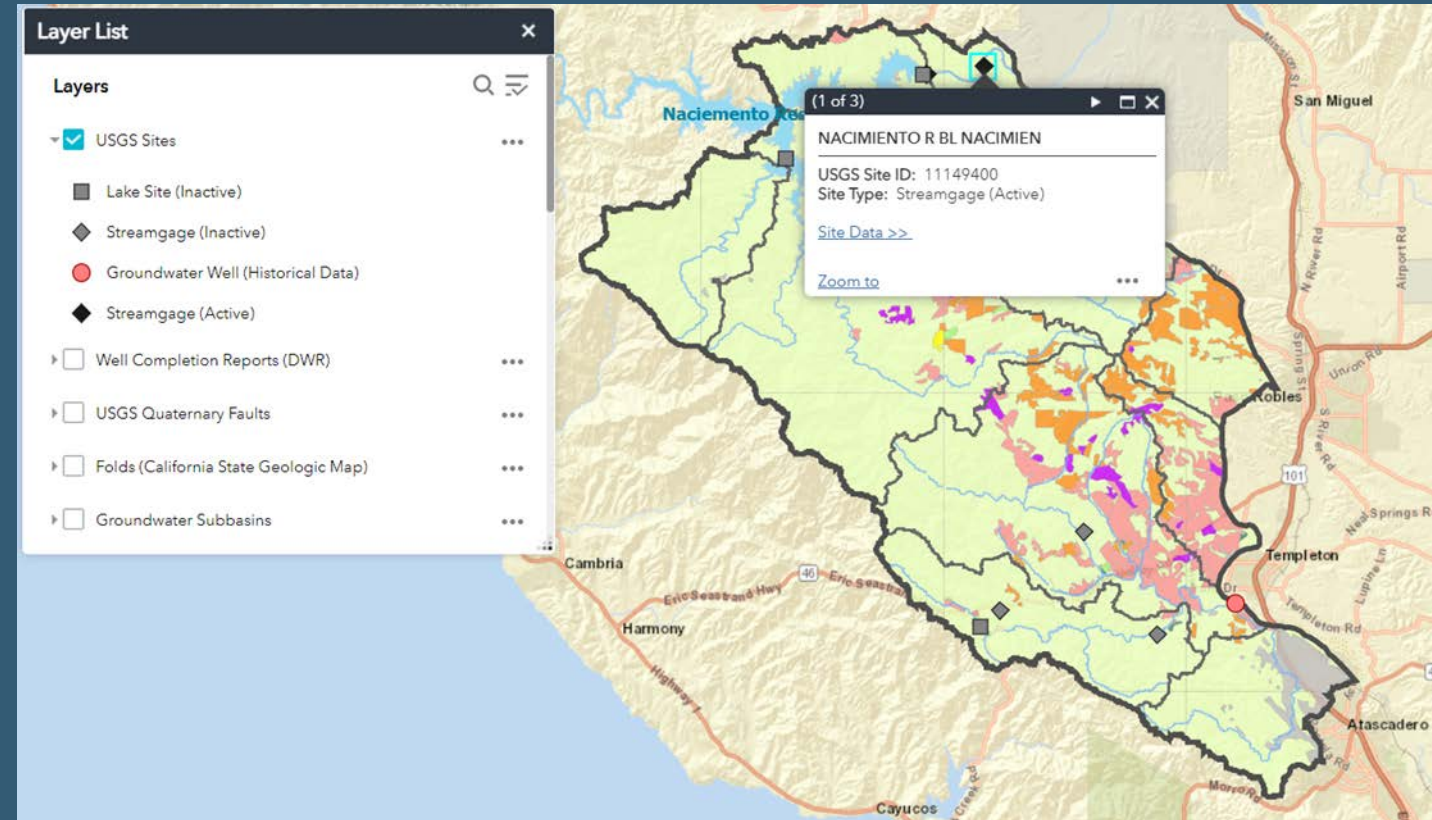
- Project Summary

- Interactive map
 - Hydrologic information
 - Select data
 - Outreach

- Interactive Map

- Select publicly available data

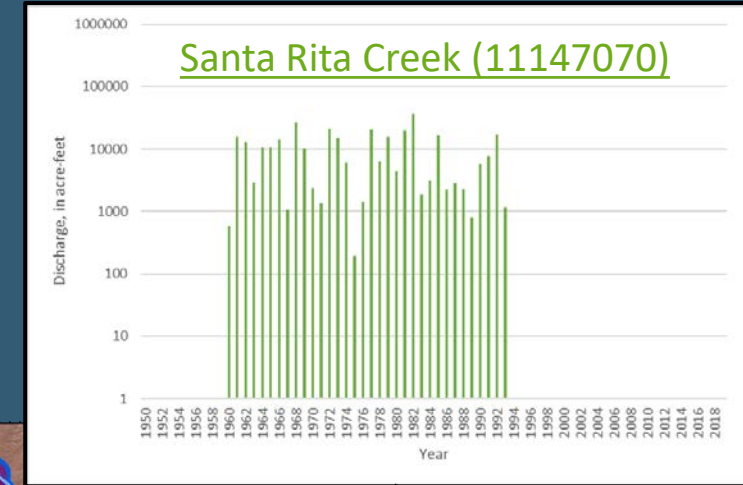
- Area of interest
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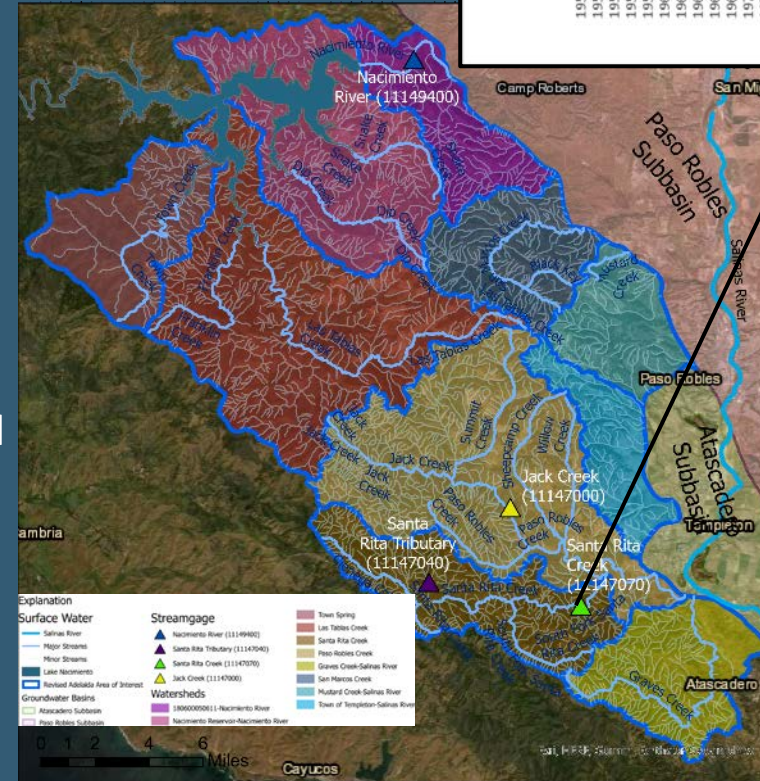
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Task 1 – Data Compilation

- Compile and synthesize available hydrogeologic data
 - Public databases, reports, local stakeholders
- Compiled data include:
 - **Surface-water streamflow and discharge measurements;**
 - groundwater-level measurements;
 - groundwater- and surface-water quality data;
 - estimates of groundwater recharge;
 - historical climate records;
 - land-use surveys;
 - surface and subsurface lithologic, geologic, and geophysical data.
- *Need for additional data collection and historical information*



U.S. Geological Survey (2020)

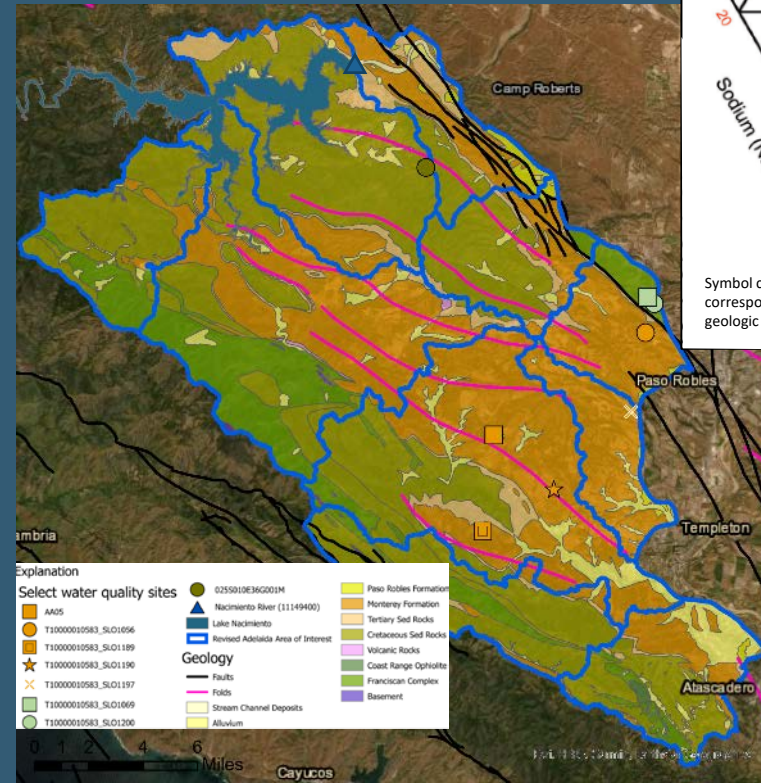
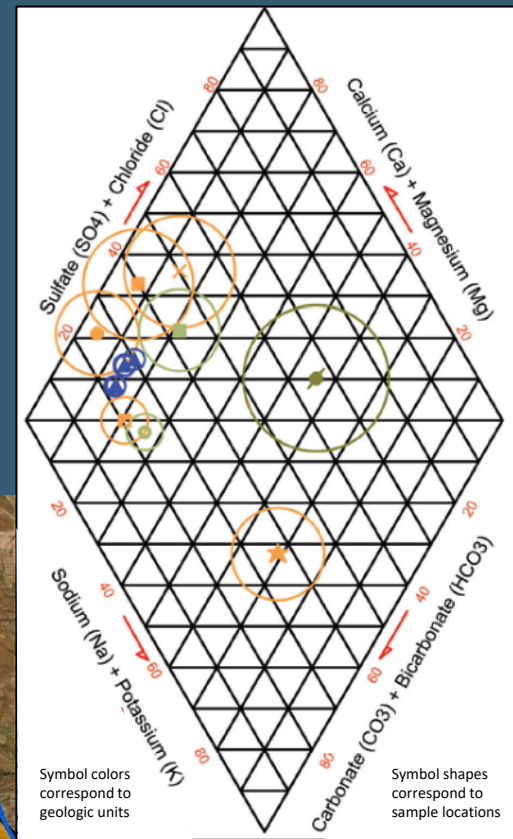


U.S. Geological Survey (2019, 2020)

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Water chemistry sample locations and Piper diagram with sample data

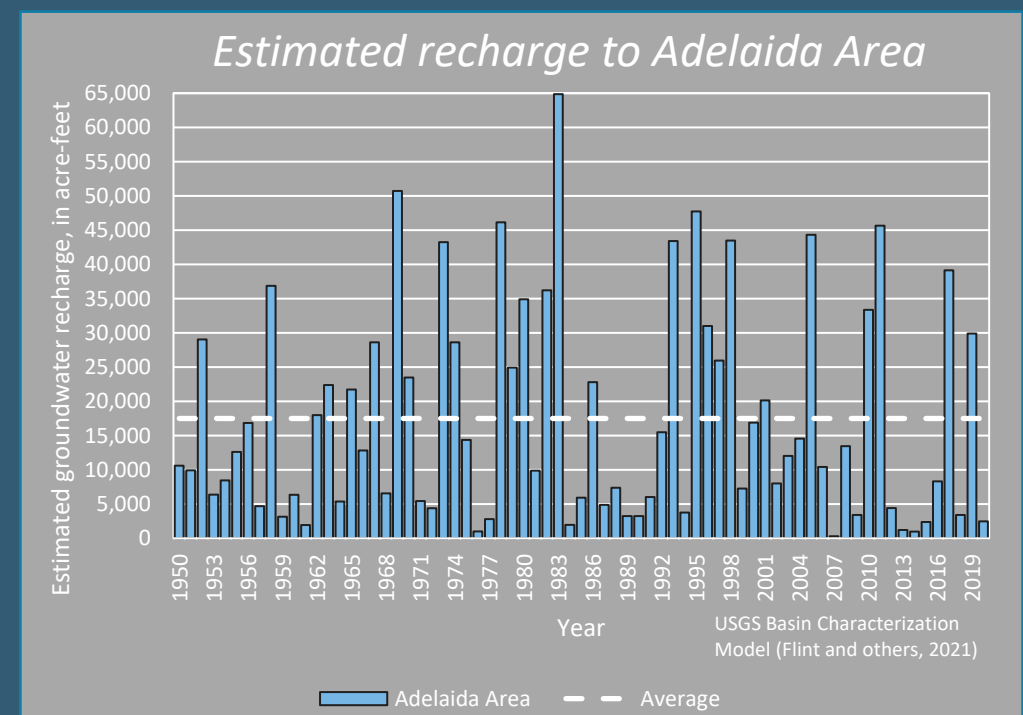


U.S. Geological Survey, 2020; California State Water Resources Control Board, 2016; Task 1 – Landowner data

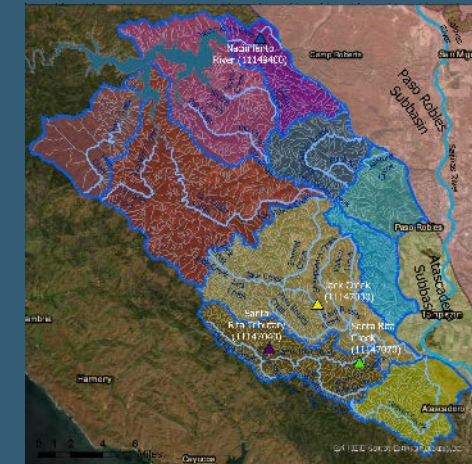
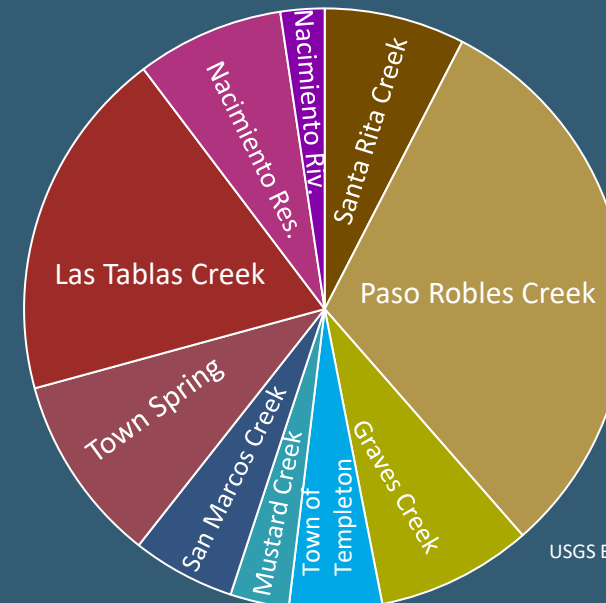
California State Water Resources Control Board (2016); County of San Luis Obispo Planning and Building Department – Geographic Technology Section (2017); Jennings (2010); U.S. Geological Survey and California Geological Survey (2019); U.S. Geological Survey (2020)

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Relative Recharge by Watershed

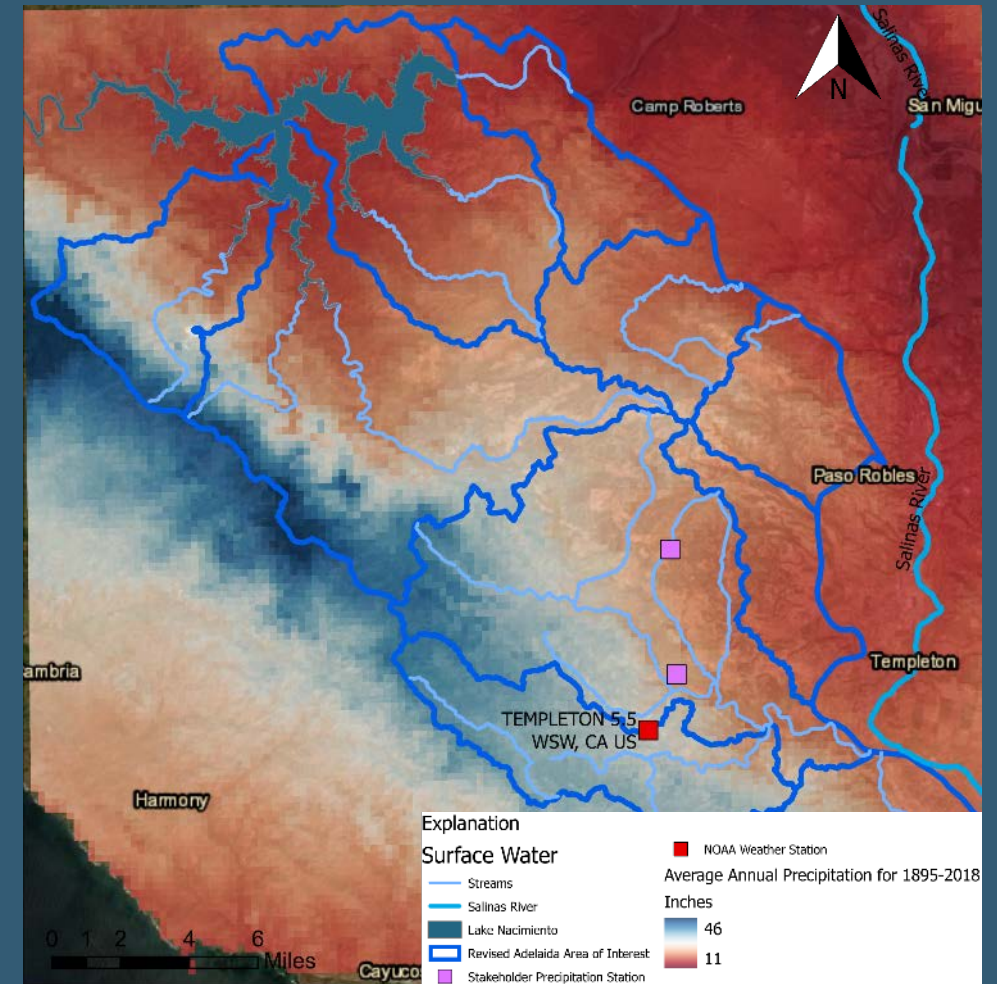


USGS Basin Characterization Model (Flint and others, 2021)

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Interpolated Average Annual Precipitation for 1895–2018

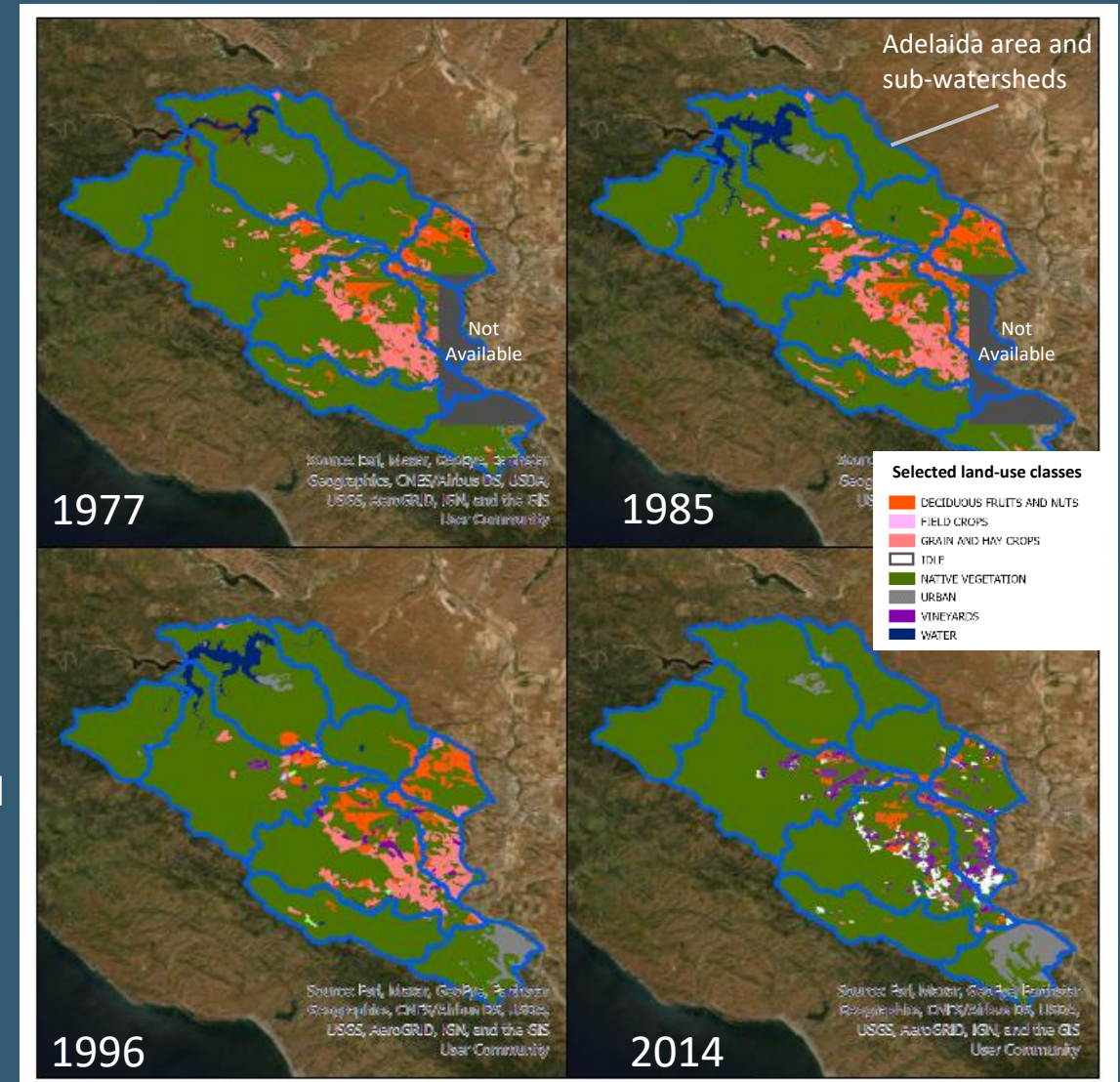


Flint and others (2021); National Centers for Environmental Information (2021)

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Maps of historical land-use survey information

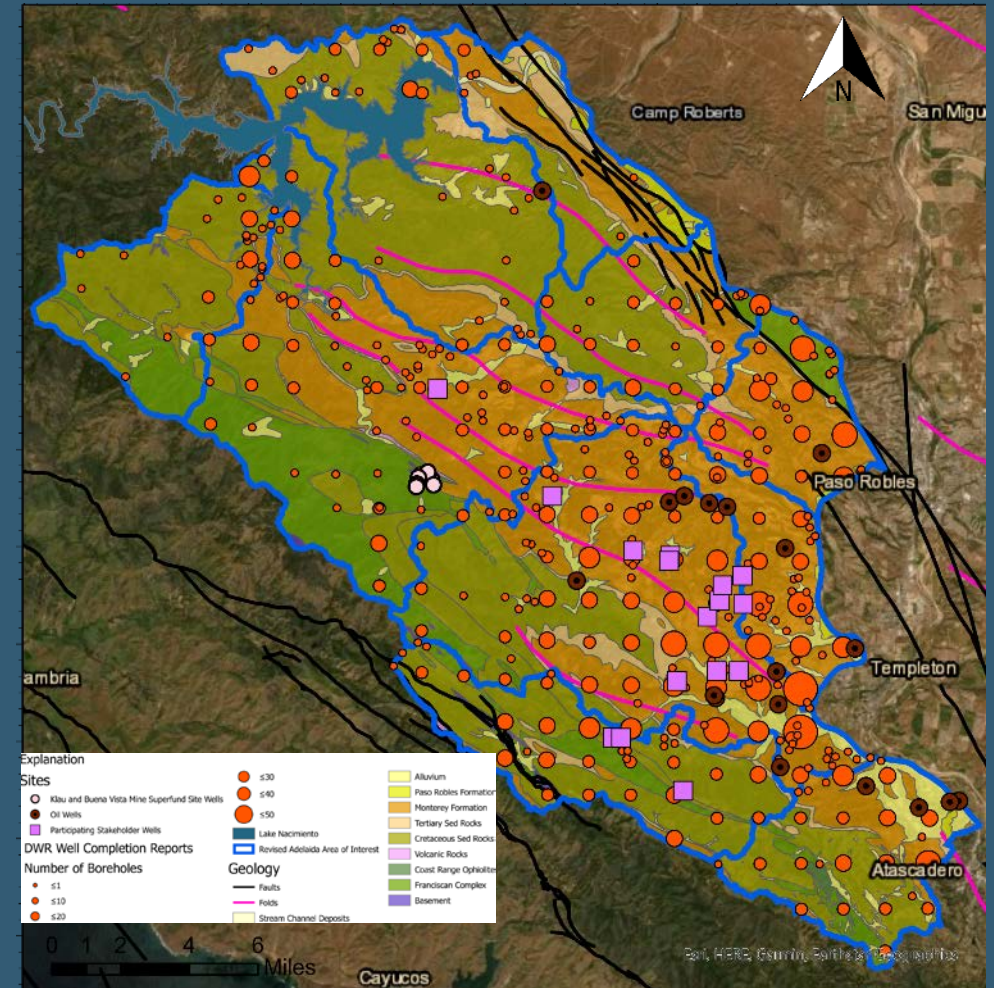


California Department of Water Resources (1977, 1985, 1996); LandIQ (2017)

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- *Need for additional data collection and historical information*

Available borehole data from different sources



California Department of Water Resources (2020); California Department of Conservation (2021); County of San Luis Obispo Planning and Building Department – Geographic Technology Section (2017); Jennings (2010); U.S. Geological Survey and California Geological Survey (2019)

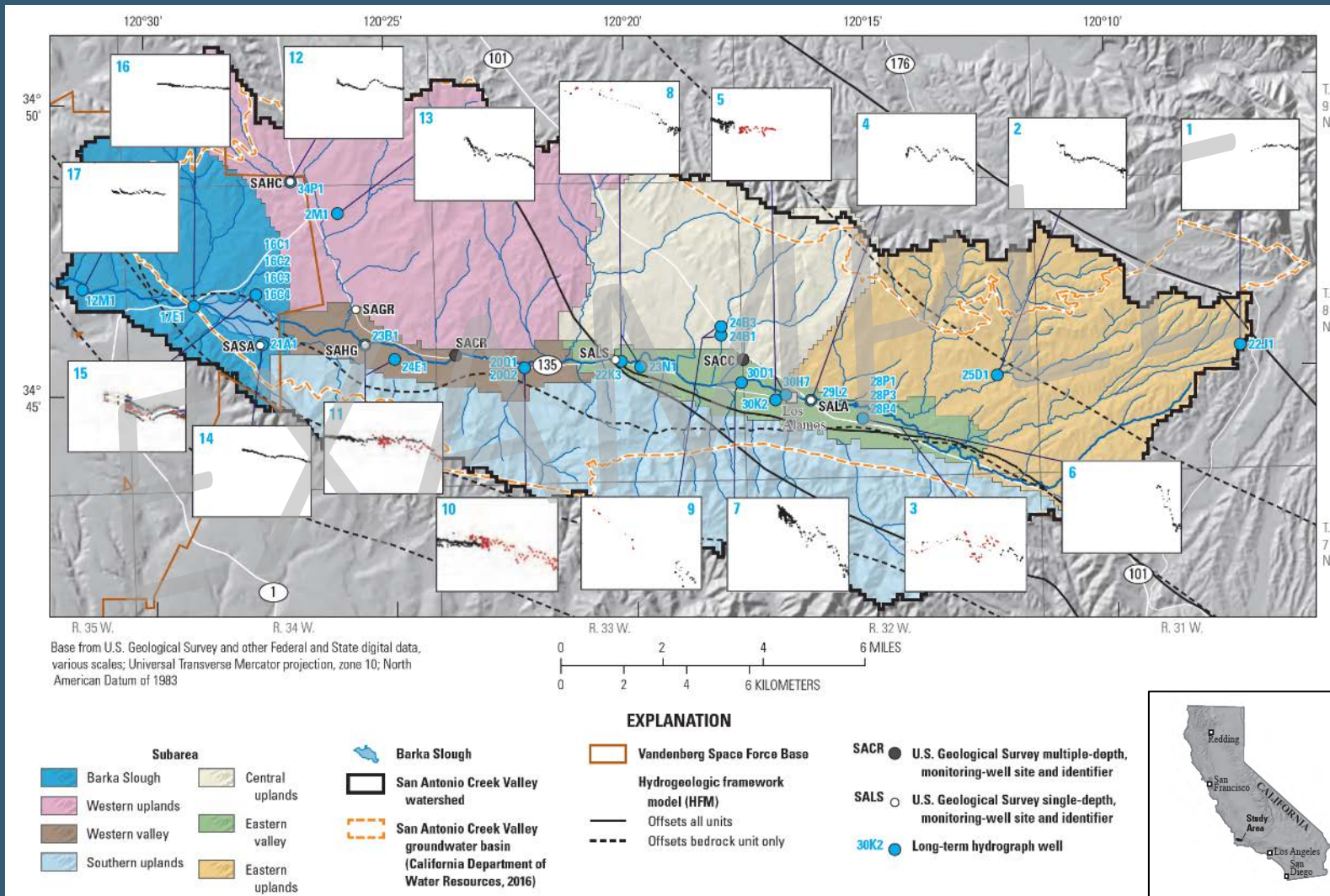
Task 2 – Hydrologic Data Collection

- Collect new data over a period of two years to supplement information compiled as part of Task 1
 - A) Groundwater-level monitoring
 - B) Water-chemistry sampling
 - C) Surface-water monitoring
- All collected data will be archived and publicly available in the [USGS National Water Information Systems](#) (NWIS) database
- Project Website and Outreach
 - Website will be updated during the project
 - <https://www.usgs.gov/centers/california-water-science-center/science/evaluation-groundwater-resources-adelaida-area-san>
 - Annual community meetings

Task 2 – A) Groundwater-level Monitoring

- Data can be used to evaluate sensitivity of the aquifer system to seasonal changes in climate and groundwater withdrawals
 - Verify landowner data from private collection systems
- Identify and canvass selected wells for groundwater-monitoring network
 - Target 30 wells, publicly and privately owned
 - Repeat measurements quarterly (every three months), for two years
 - Install equipment for automated measurements at 3 of the 30 wells
- Monitoring to begin Summer 2022
- Groundwater levels, well depth, well location will be publicly available on the USGS NWIS database

Task 2 – A) Groundwater-level Monitoring



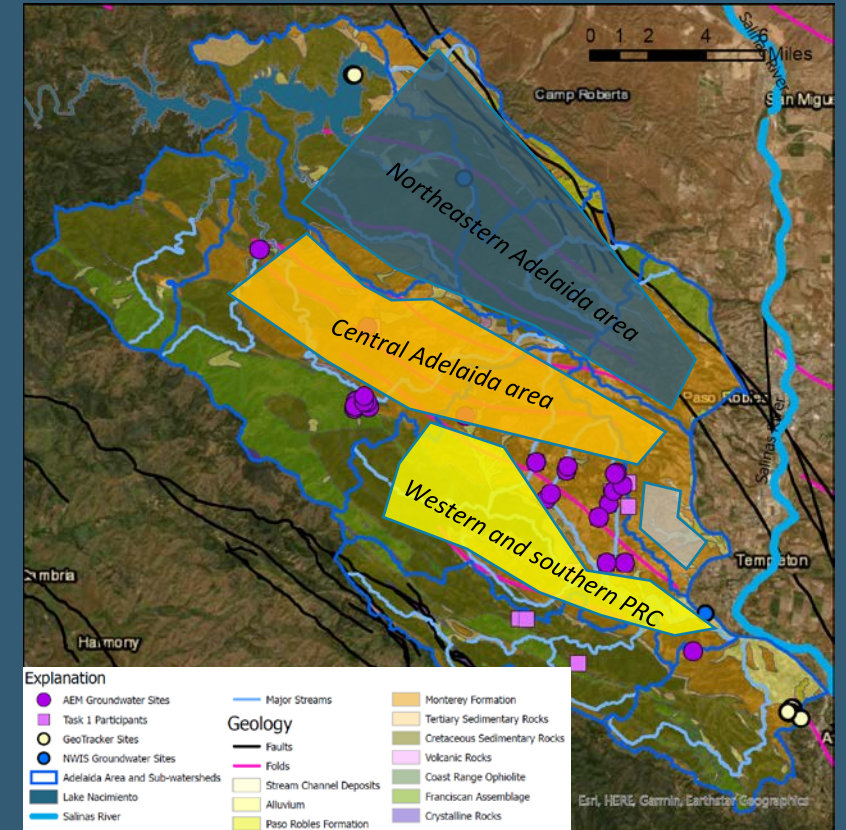
Example groundwater-level data from a groundwater basin in Santa Barbara County, California

Cromwell and others (2022)

Preliminary, subject to revision. Do not cite or distribute.

Task 2 – A) Groundwater-level Monitoring

- Potential wells for groundwater-monitoring network
 - 33 wells known from Task 1 and Task AEM
 - Additional wells known from public datasets
- Add potential wells in selected areas
 - Western and southern Paso Robles Creek watershed
 - Central Adelaida area
 - Northeastern Adelaida area
- Wells will be chosen based on:
 - well depth and hydrogeology
 - geologic structures
 - groundwater recharge and discharge locations
 - Availability

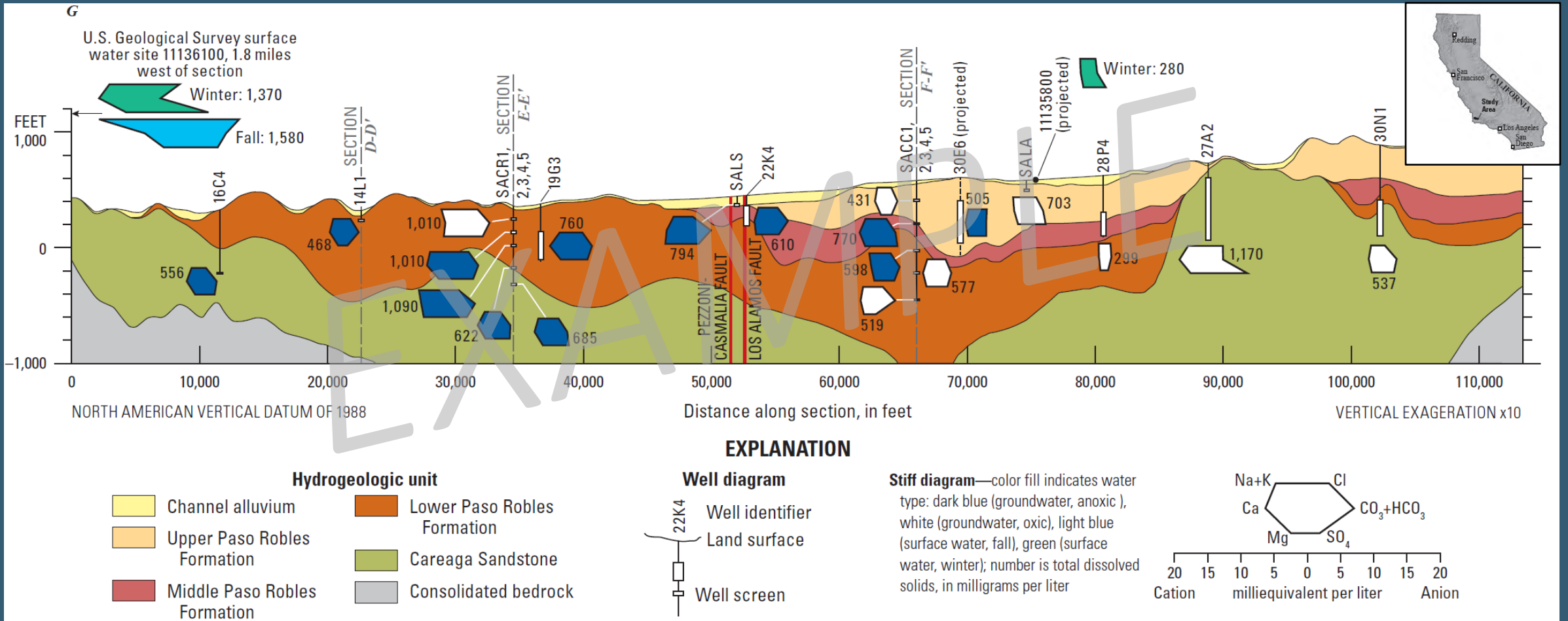


California State Water Resources Control Board (2016); CH2M Hill (2012); County of San Luis Obispo Planning and Building Department – Geographic Technology Section (2017); Jennings (2010); U.S. Geological Survey and California Geological Survey (2019); U.S. Geological Survey (2019, 2020)

Task 2 – B) Water-Chemistry Sampling

- Water-chemistry data can be used to:
 - Characterize the source(s), movement, and age of groundwater
 - Use chemical and isotopic ratios to identify the source and climatic conditions at the time of groundwater recharge
- Sample selected wells and surface-water sites
 - Target 14 wells from the groundwater-monitoring network
 - Target 4 streams and springs
- Sample for:
 - Major, minor, and trace ions
 - Nutrients
 - Stable isotopes of oxygen and hydrogen
 - Tritium and carbon-14/13 (groundwater only)
 - Field parameters (groundwater only)
- Sampling to occur Summer/Fall 2022
- Test results, well depth, site location will be publicly available on the USGS NWIS database

Task 2 – B) Water-Chemistry Sampling



Cromwell and others (2022)

Example water-chemistry data from a groundwater basin in Santa Barbara County, California

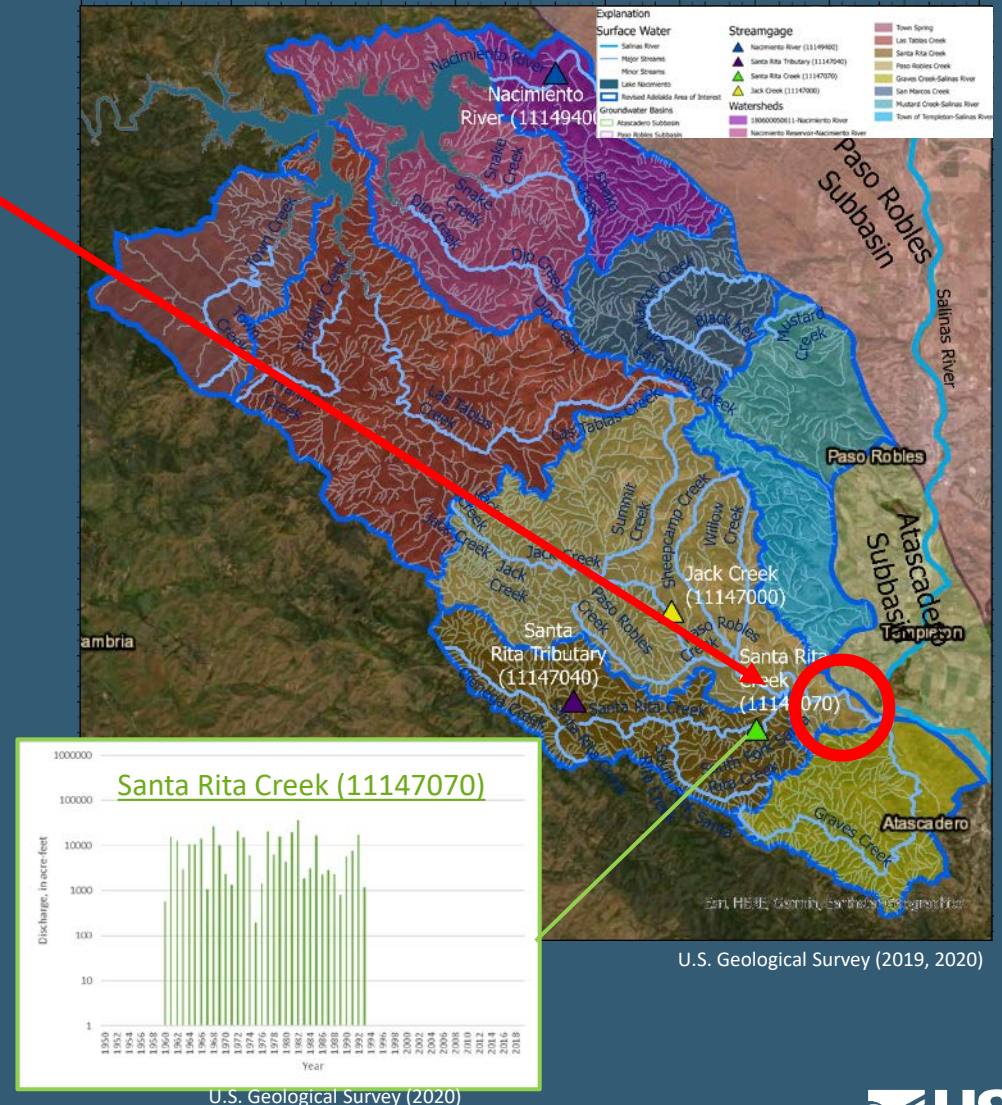
Preliminary, subject to revision. Do not cite or distribute.

Task 2 – C) Surface-water Monitoring

- Surface-water data can be used to evaluate the amount of discharge along a stream and be used to analyze groundwater/surface-water interactions
- Install a new streamgage and monitor streamflow
 - Target downstream reach of Paso Robles Creek
 - Continuously monitor the gage for two years
 - Manually measure discharge at selected streams across the Adelaida area for comparison
- Monitoring to begin Fall 2022
- Measured streamflow and site location will be publicly available on the USGS NWIS database

Task 2 – C) Surface-water Monitoring

- New streamgauge along Paso Robles Creek
 - Second largest watershed in Adelaida area
 - Large estimated contribution to groundwater recharge (Flint and others, 2021)
 - Historical streamflow records
- Two potential site locations
 - Finalize permissions and begin permitting process
 - Install and begin monitoring by October 1, 2022
- Manual, discrete measurements
 - Downstream stream reaches of other watersheds
 - Compare to streamgauge
- Potential to reactivate Santa Rita Creek (11147070) streamgauge (active 1960–1994)



Task AEM - Hydrogeologic Evaluation

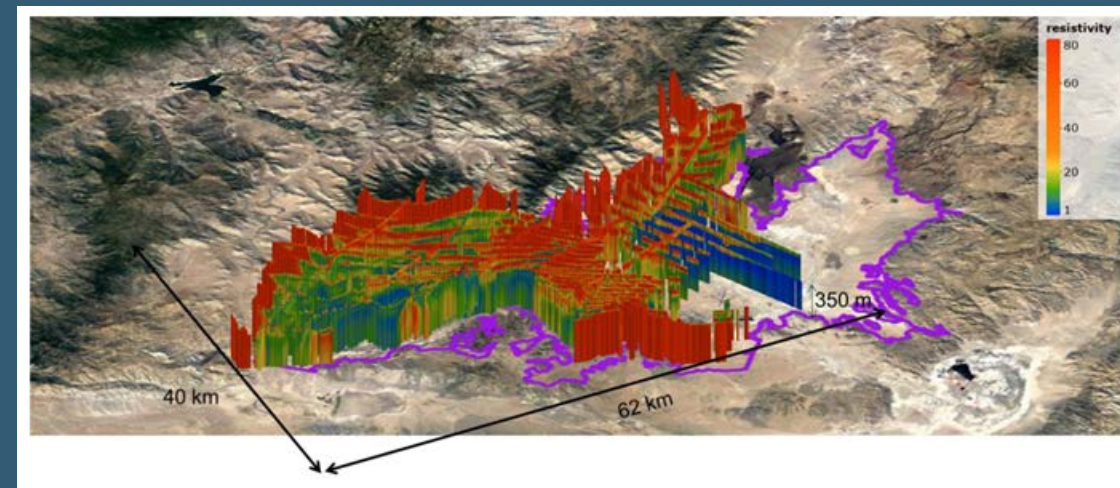
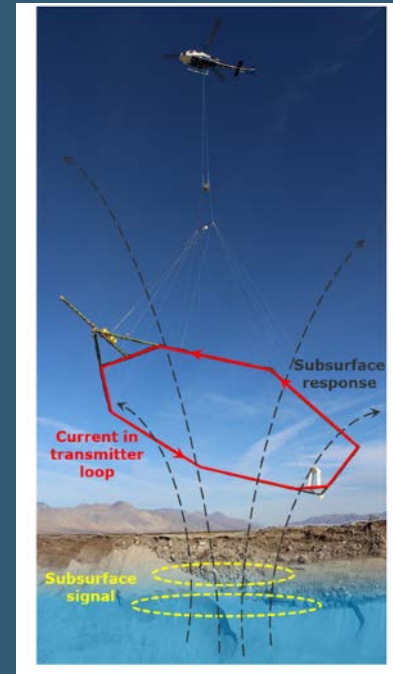
- Evaluate the hydrogeology and characterize hydrologic conditions of the Adelaida area
- Integrate airborne electromagnetic (AEM) survey data
 - Construct hydrogeologic framework
 - Preliminary analysis of hydrologic conditions
- AEM survey data collected by DWR
 - Funded by voter-approved Proposition 68, Senate Bill 5, and general fund
 - Support water managers as they implement the Sustainable Groundwater Management Act (SGMA)
- Hydrogeologic evaluation funded through USGS Integrated Water Availability Assessments (IWAAs) program

Example AEM survey data, geophysical method, and survey equipment



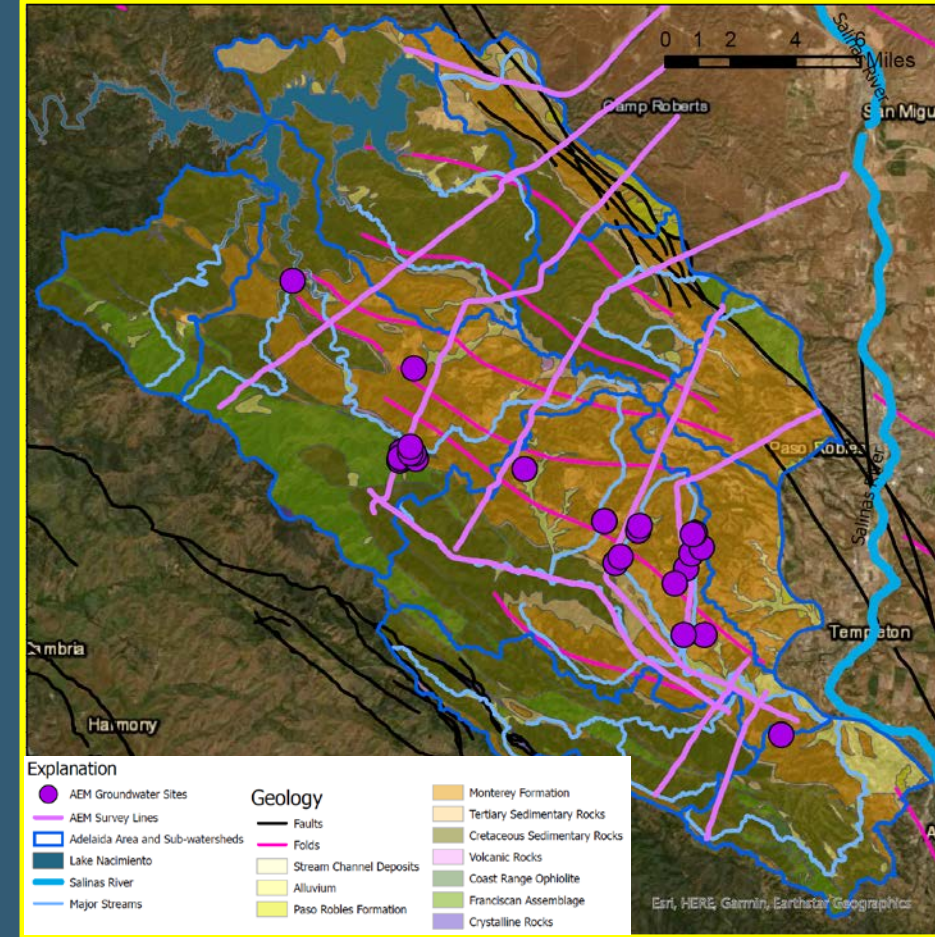
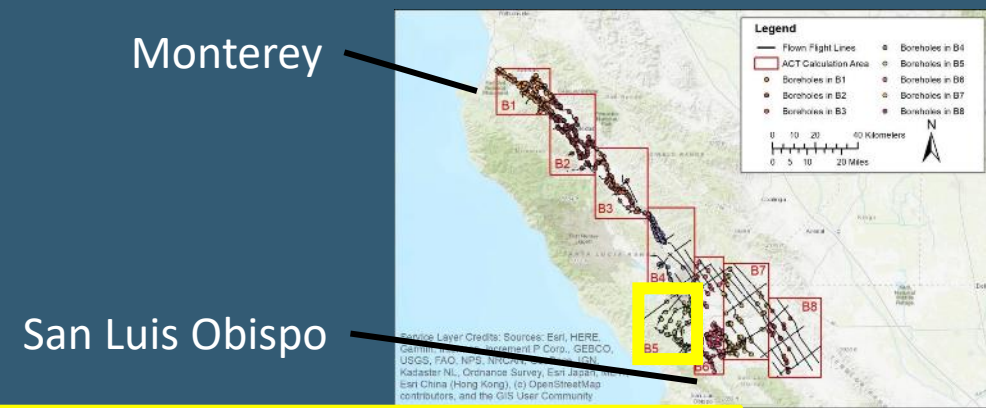
Photo credits:

<https://water.ca.gov/Programs/Groundwater-Management/Data-and-Tools/AEM>



Task AEM - Hydrogeologic Evaluation

- Surveys flown in August 2021
 - DWR Survey Area 1 – Salinas Valley
 - Survey lines requested by USGS
 - About 150 km of data
- Survey lines cross geologic units and structures, avoid infrastructure
- Groundwater levels measured at 27 wells



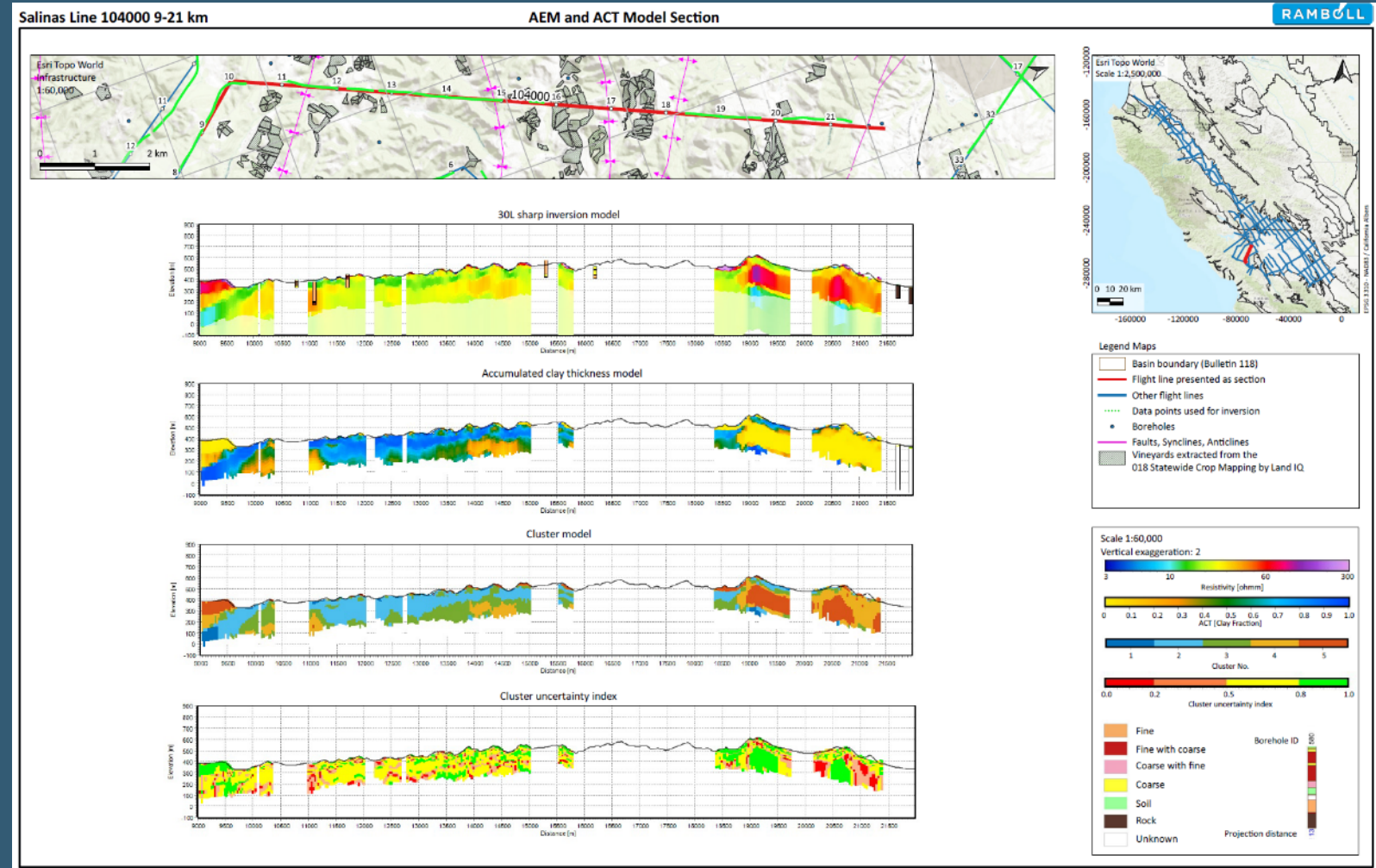
California Department of Water Resources (2022)

Preliminary, subject to revision. Do not cite or distribute.



Task AEM - Hydrogeologic Evaluation

- Provisional survey data and reports
 - <https://data.cnra.ca.gov/dataset/aem>
- Survey data will be re-evaluated using information from Task 1 and Task 2
- Interpret regional geologic structure, identify areas for detailed study
- Construct hydrogeologic framework and analyze hydrologic conditions
- Anticipated completion Fall 2024

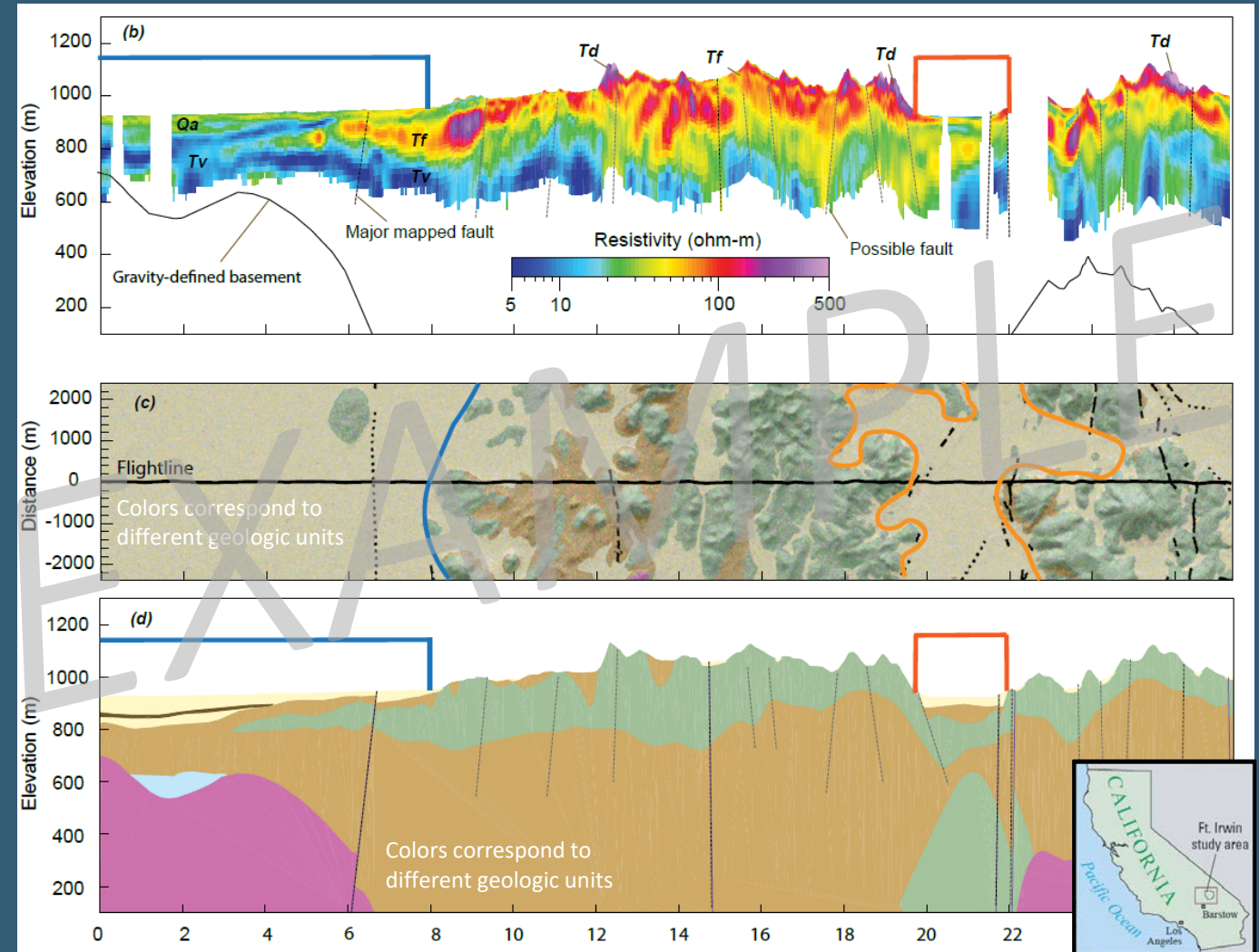


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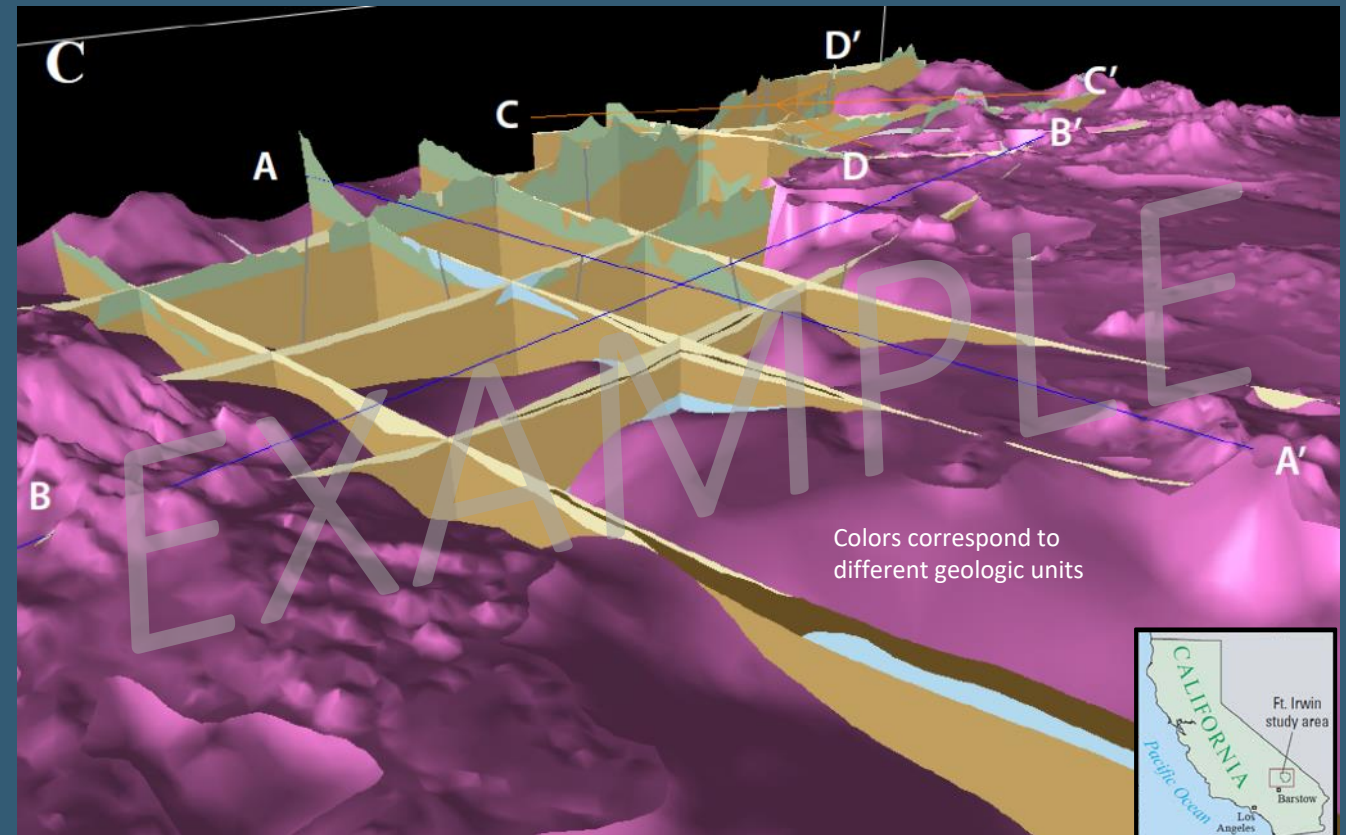
Cromwell and others (2018)

Example AEM survey data and geologic hydrogeologic interpretations for a groundwater basin in the Mojave Desert

Task AEM - Hydrogeologic Evaluation

Example hydrogeologic framework based on AEM survey data for a groundwater basin in the Mojave Desert

- Provisional survey data and reports
 - <https://data.cnra.ca.gov/dataset/aem>
- Survey data will be re-evaluated using information from Task 1 and Task 2
- Interpret regional geologic structure, identify areas for detailed study
- Construct hydrogeologic framework and analyze hydrologic conditions
- Anticipated completion Fall 2024



Cromwell and others (2018)

Timeline (Spring 2022– Fall 2024)

Task 1 – Data Compilation

- Completed Spring 2021

Task 2 – Hydrologic Data Collection

- Establish groundwater-monitoring network – Spring 2022
- Initial groundwater measurements – Summer 2022
- Water-chemistry sampling – Summer/Fall 2022
- Streamgage installation and monitoring – Fall 2022

Task AEM – Hydrogeologic Evaluation

- AEM survey data re-evaluation – Summer 2022
- Hydrogeologic framework and preliminary hydrologic analysis– Fall 2024

Local Participation Opportunities

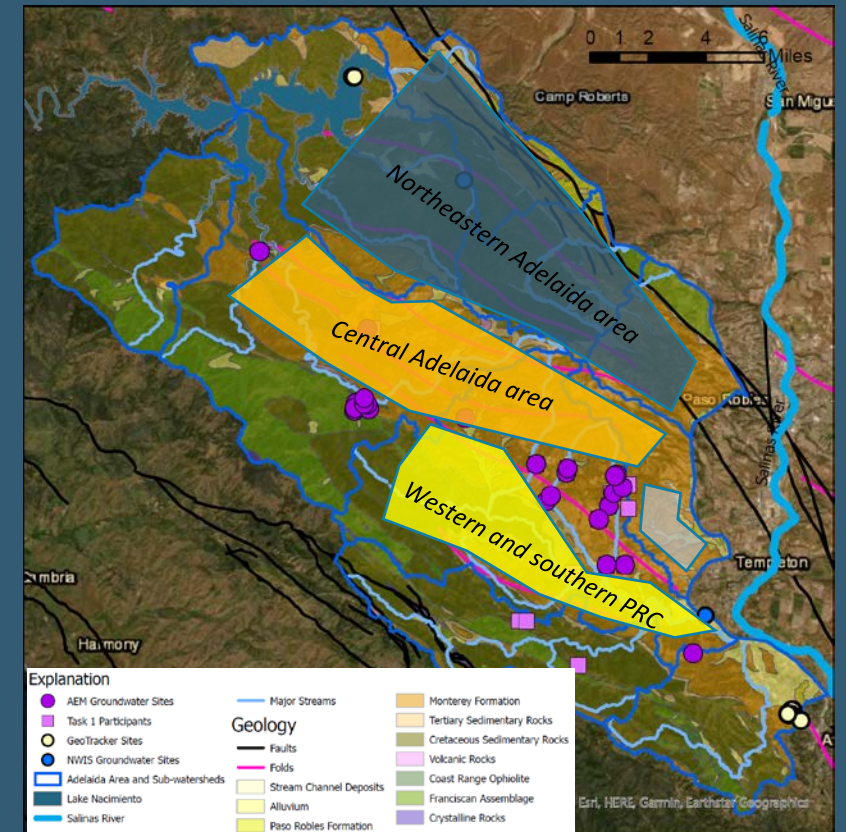


Opportunities to provide Information and Input:

- ▶ Join the County's email lists to stay informed
- ▶ Contact RCD and (or) USGS staff to provide groundwater-level data or arrange field visits

Local Participation Opportunities

- Help establish groundwater-monitoring network
 - Target about 30 wells for Task 2
- Add potential wells in selected areas
 - Western and southern Paso Robles Creek watershed
 - Central Adelaida area
 - Northeastern Adelaida area
- Ideal network will have wells with:
 - geographic distribution
 - different depths
 - different geologic units



California State Water Resources Control Board (2016); CH2M Hill (2012); County of San Luis Obispo Planning and Building Department – Geographic Technology Section (2017); Jennings (2010); U.S. Geological Survey and California Geological Survey (2019); U.S. Geological Survey (2019, 2020)

Thank you!

Sign up for EMAIL LIST at:

<https://www.slocounty.ca.gov/AdelaidaStudy>

CONTACTS:

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- Nicole Fenton, Hydrologist
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Websites:

Upper Salinas – Las Tablas Resource Conservation District:

<https://www.us-ltrcd.org/adelaida-hydrogeologic-study>

San Luis Obispo County Flood Control and Water Conservation District:

<https://www.slocounty.ca.gov/AdelaidaStudy>

U.S. Geological Survey:

<https://www.usgs.gov/centers/california-water-science-center/science/evaluation-groundwater-resources-adelaida-area-san>

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