

Adelaida Hydrology Study

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

April 23, 2021

In cooperation with the San Luis Obispo County Flood Control and Water Conservation District;

Upper Salinas-Las Tablas Resource Conservation District



These data are preliminary or provisional and are subject to revision. They are being provided to meet the need for timely best science. The data have not received final approval by the U.S. Geological Survey (USGS) and are provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the data.

Questions and Comments

By phone:

Press *9 to “raise your hand” to make a comment or ask a question

Press *6 to unmute or mute when prompted

From your computer:

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Opportunities to Engage



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

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

- Presentation Outline
 - Purpose, Scope, and Objectives
 - Task 1 Summary
 - Area of Interest
 - Local Participation and Outreach
 - Data Sources and Compilation
 - Preliminary Evaluation
 - Future Work
 - Project Timeline
 - Questions

Purpose and Scope, and Objectives

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

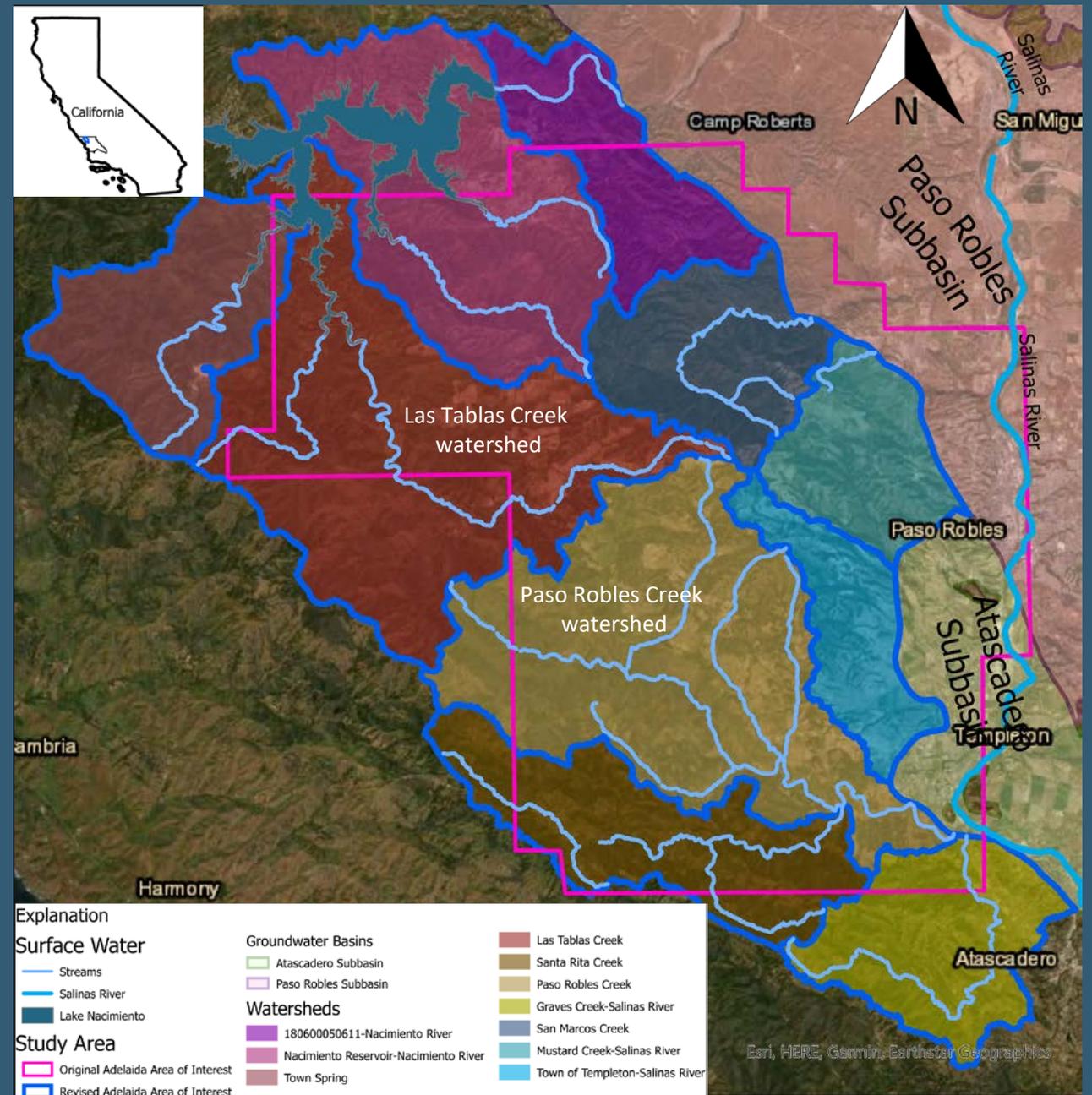
Concerns

Concerns

- Increased demand for water use likely will continue to affect groundwater levels and availability
- Adelaida Area is *not* in a DWR designated groundwater basin; comprised mostly of consolidated sedimentary rocks
- SLO County has a specific need to evaluate historic and current hydrogeologic conditions

Study Area

- Modified to conform with hydrologic boundaries
- Includes 10 local watersheds
- Areas of focus include Paso Robles Creek and Las Tablas Creek watersheds

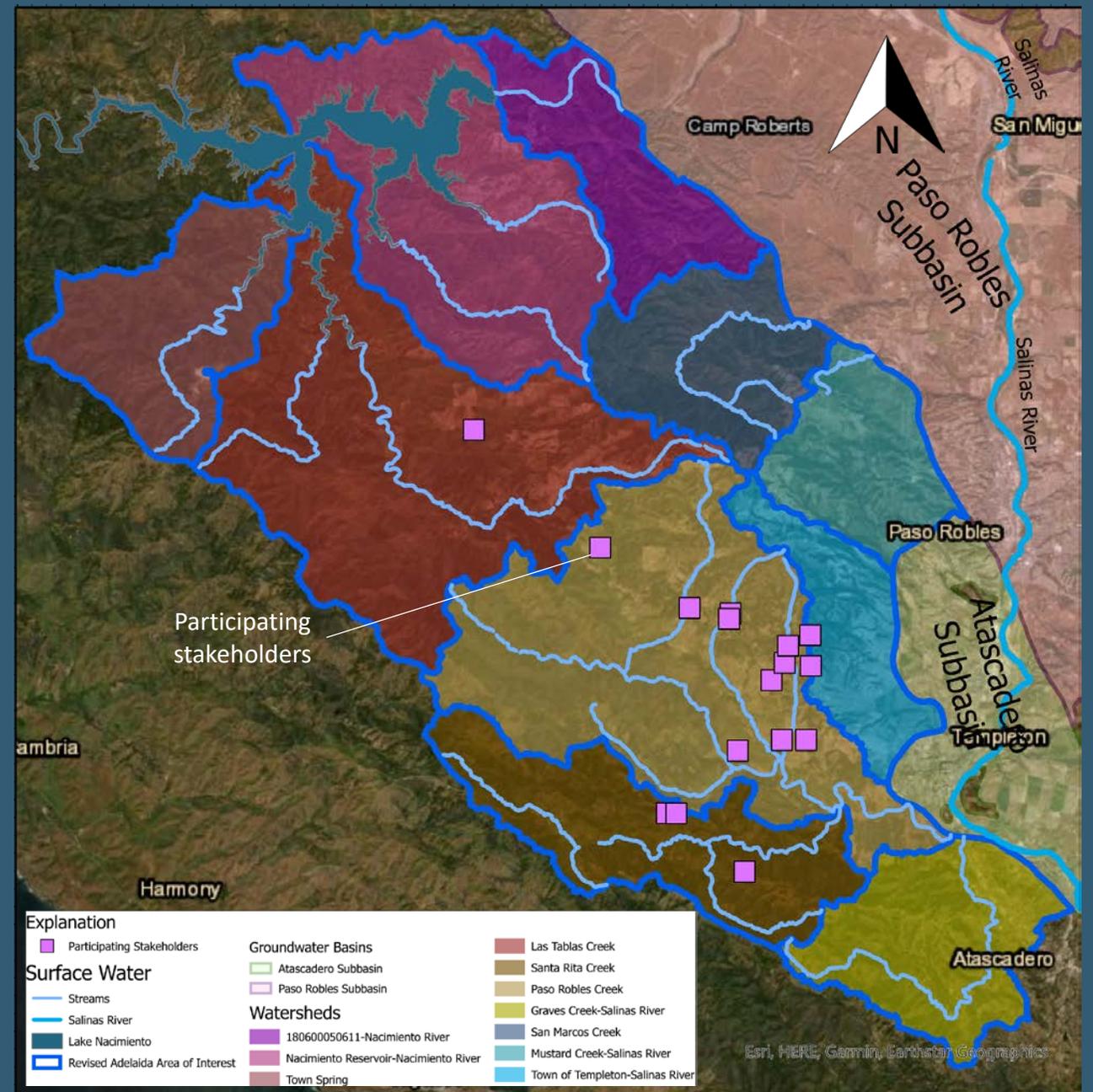


U.S. Geological Survey (2019)



Local Participation and Outreach

- Community Meeting August 2020
- Engage residents, vineyards, advocacy groups
- 17 stakeholders agreed to participate
 - Field visits, phone calls, email
 - Hydrogeologic data
 - Local knowledge—past and present



U.S. Geological Survey (2019)



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

Local Participation and Outreach

- Site Visits – November 2020
 - Upper Salinas-Las Tablas RCD and USGS
 - Multiple stakeholders in the Adelaida Area
 - Hydrologic and anecdotal information
 - Consent forms submitted



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

Photos courtesy of Amy Smart and Geoff Cromwell



Local Participation and Outreach

- Website

- Project Summary

- Interactive map
 - Hydrologic information
 - Select data
 - Outreach

- Interactive Map

- Select publicly available data

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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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/ca-water/science/evaluation-groundwater-resources-adelaida-area-san-luis-obispo-county?qt-science_center_objects=0#qt-science_center_objects

Local Participation and Outreach

- Website

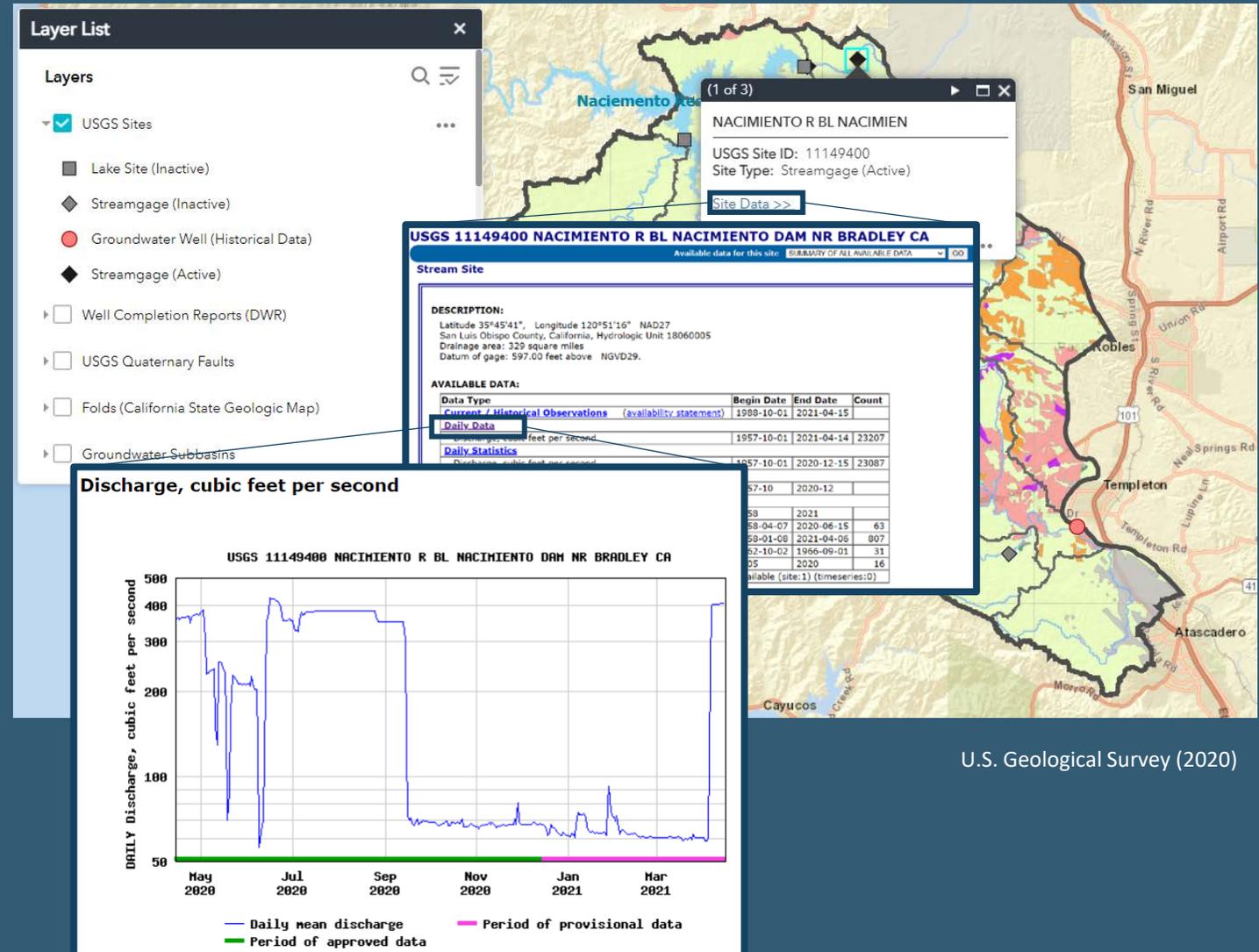
- Project Summary

- 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



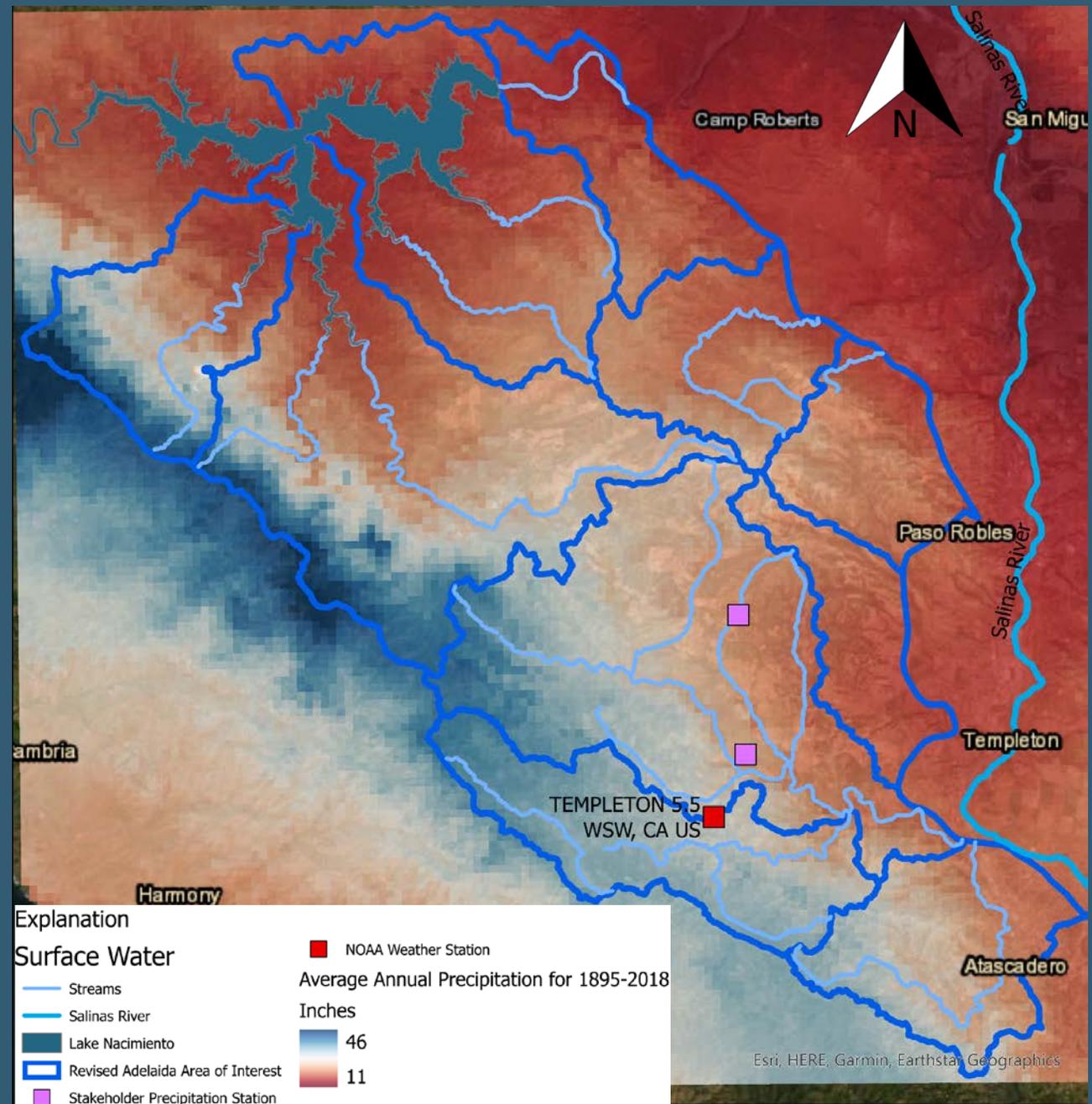
U.S. Geological Survey (2020)

Data Sources and Compilation

- Public databases, reports, and local stakeholders
 - Climate (precipitation and temperature)
 - Land use
 - Streamflow
 - Surface and subsurface geology
 - Groundwater levels
 - Groundwater and surface-water chemistry
 - Groundwater recharge and discharge

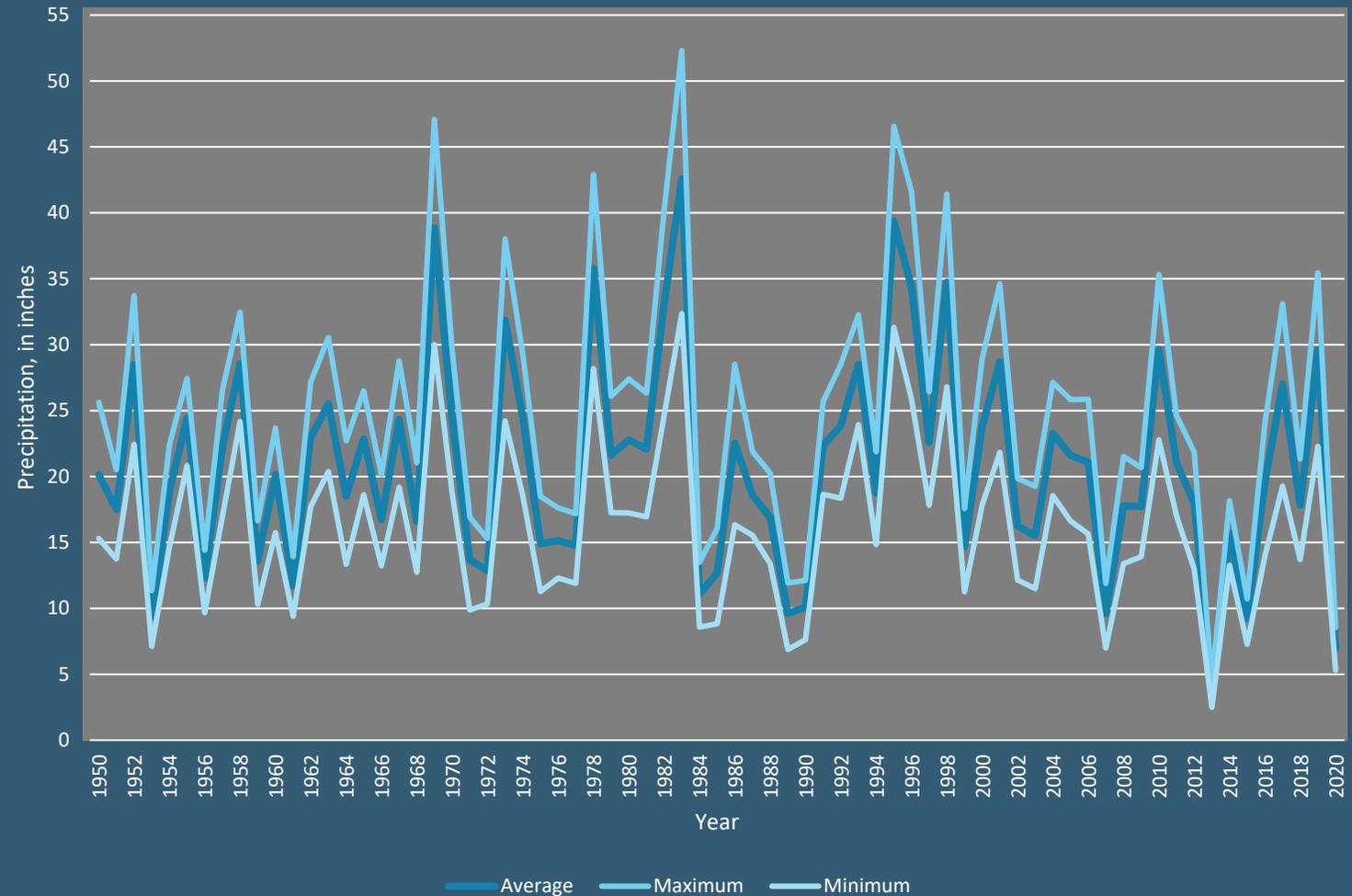
Climate (Precipitation)

- Estimated precipitation
 - USGS Basin Characterization Model (Flint and others, 2021)



Climate (Precipitation)

- Estimated precipitation
 - USGS Basin Characterization Model (Flint and others, 2021)
 - Average precipitation- about 21 inches per year

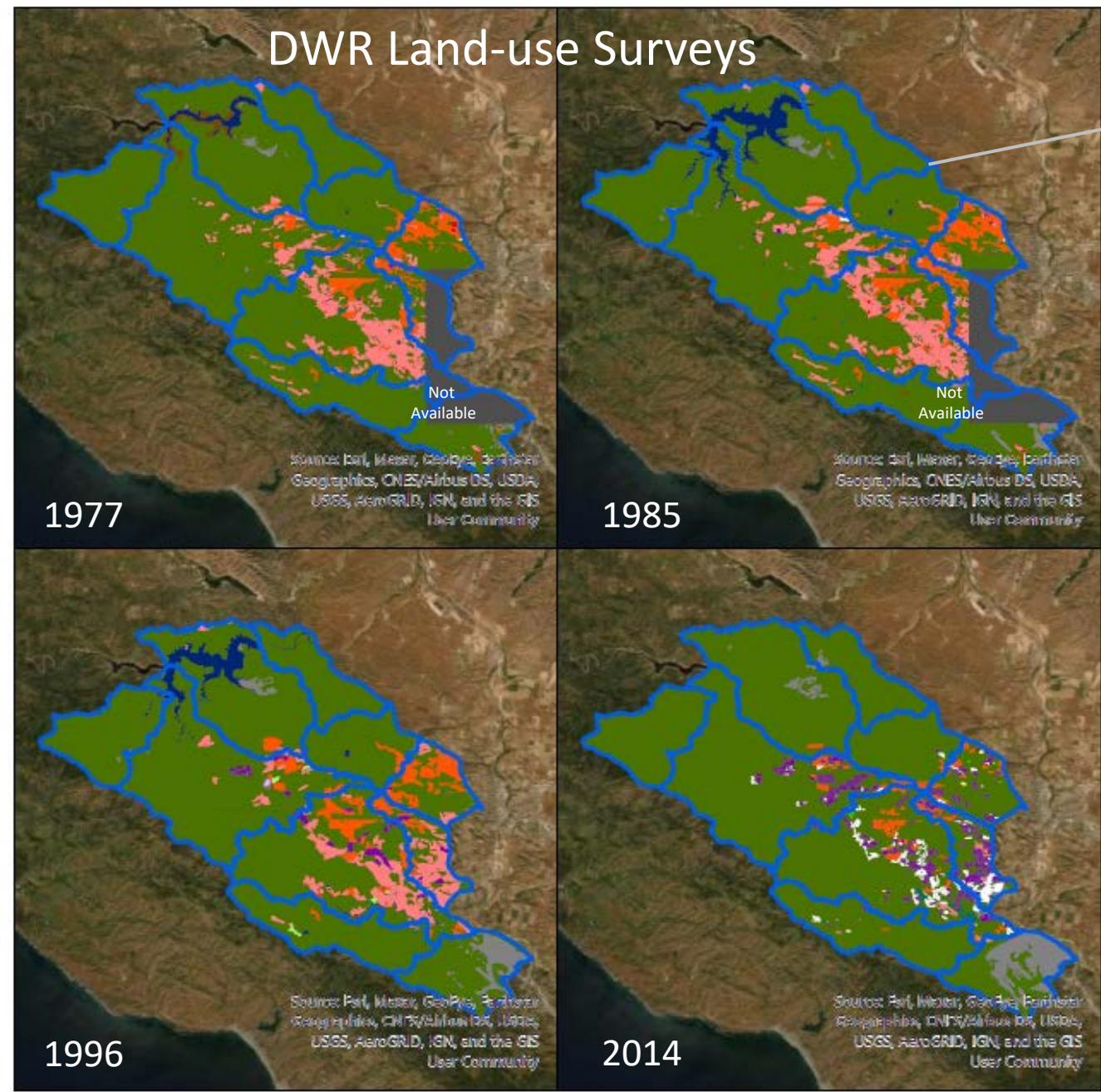


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Land use

DWR Land-use Surveys

Adelaida area and sub-watersheds



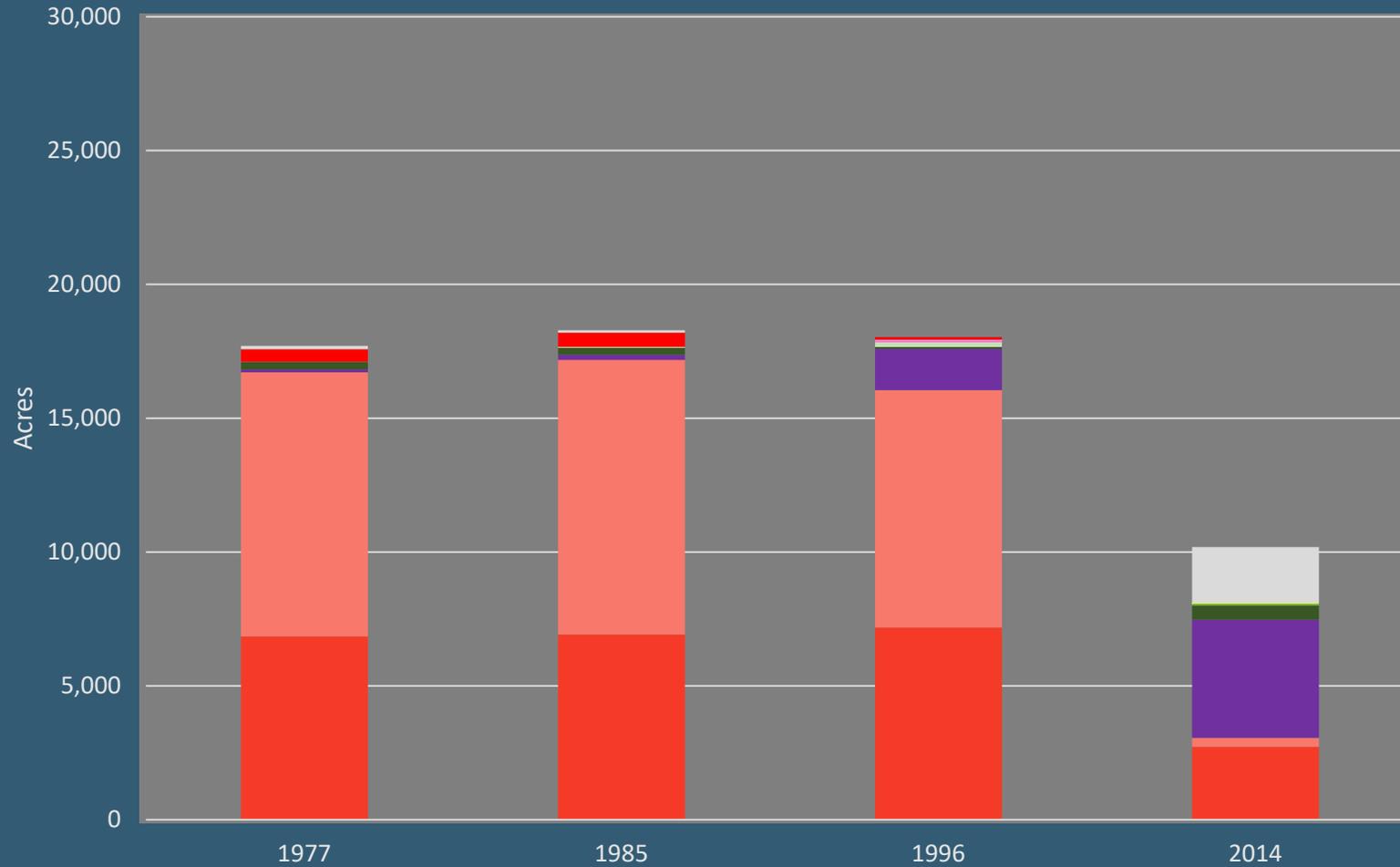
California Department of Water Resources (1977, 1985, 2000); LandIQ (2017)

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



Land use

Agriculture



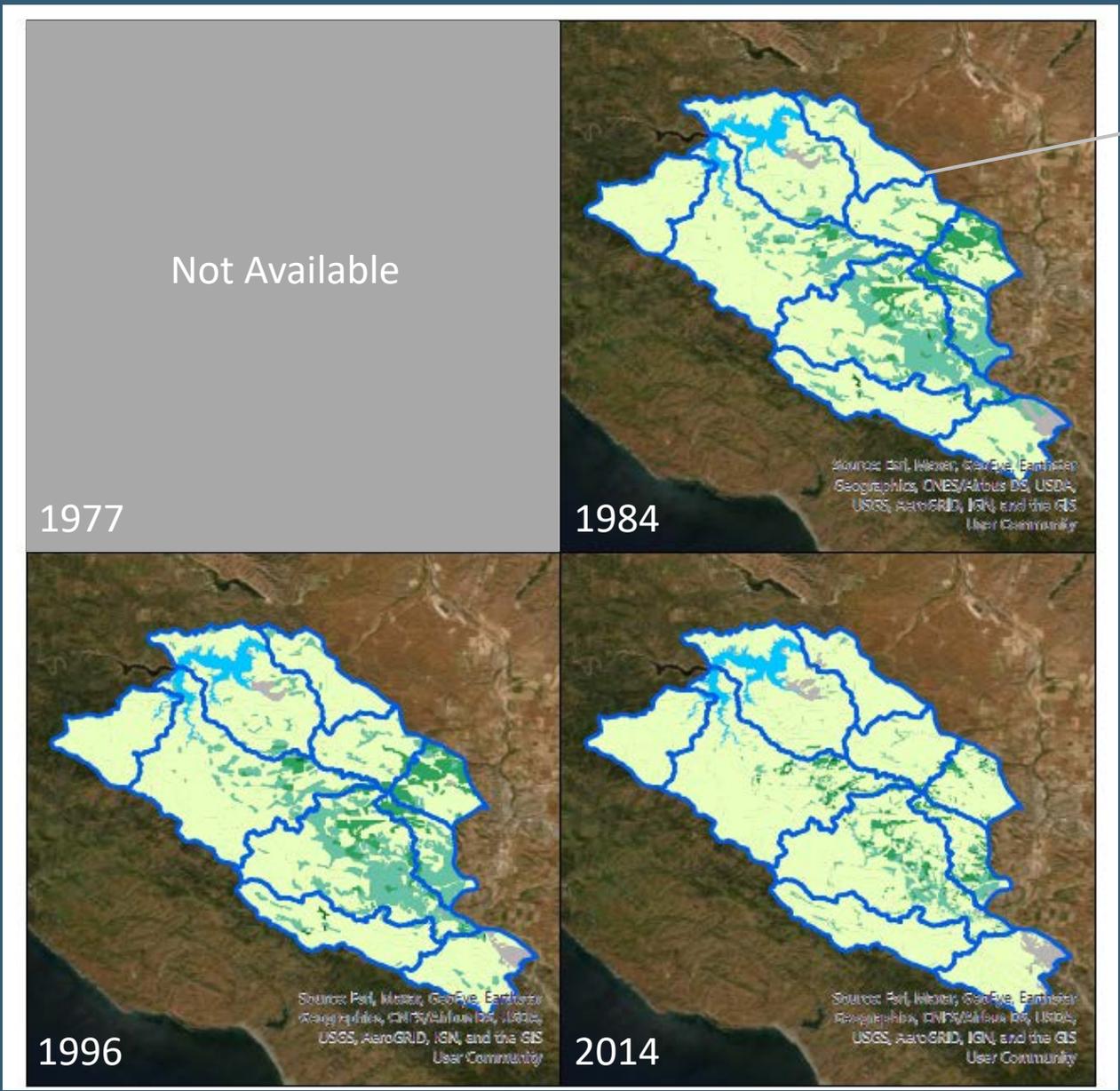
California Department of Water Resources (1977, 1985, 2000); LandIQ (2017)

- DECIDUOUS FRUITS AND NUTS
- VINEYARDS
- CITRUS AND SUBTROPICAL
- FIELD CROPS
- SEMI-AGRICULTURAL
- GRAIN AND HAY CROPS
- PASTURE
- TRUCK NURSERY AND BERRY CROPS
- YOUNG PERENNIAL
- IDLE

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Land use

DOC Farmland Mapping and Monitoring Program



Adelaida area and sub-watersheds

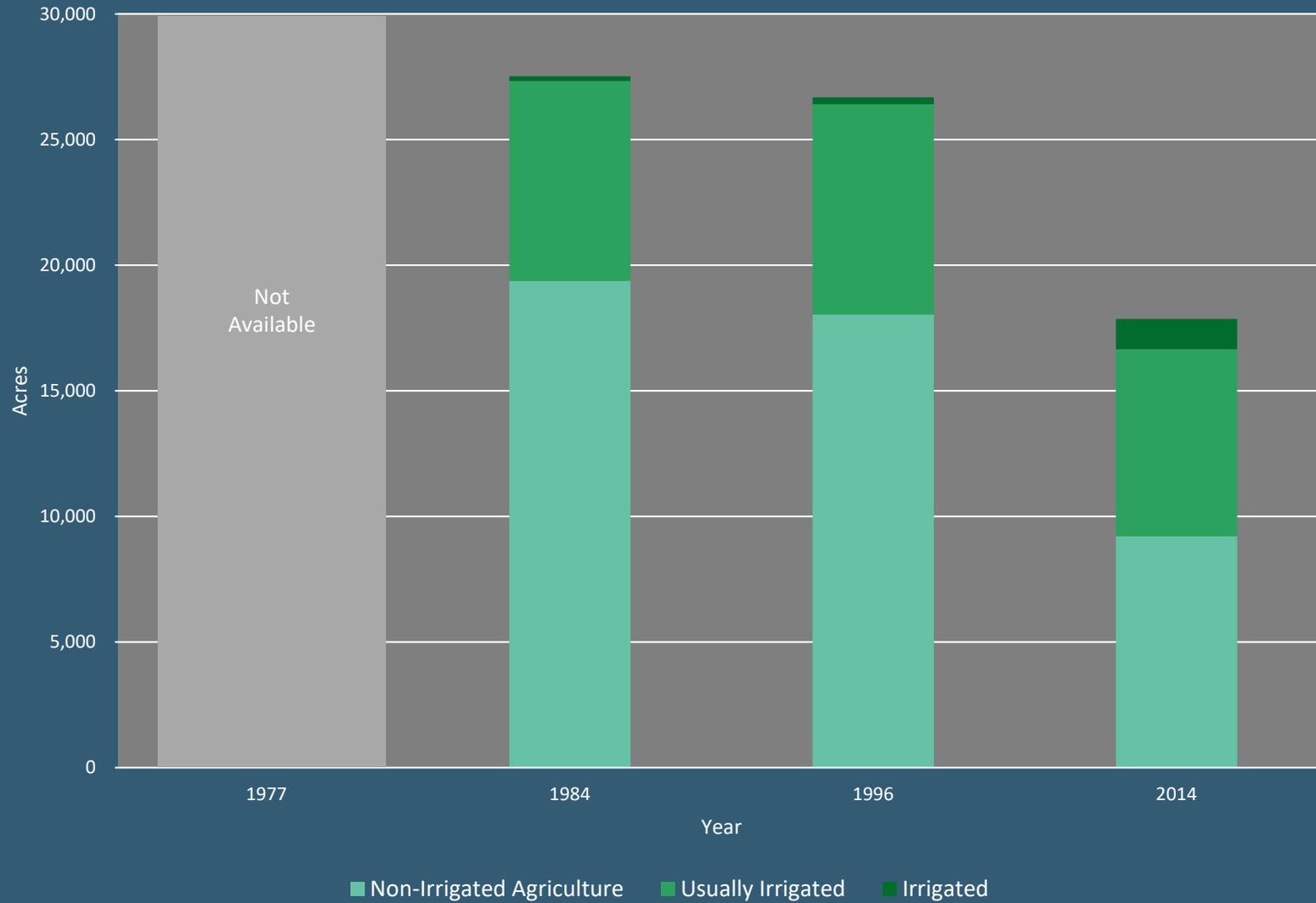


California Department of Conservation (2019)

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Land use

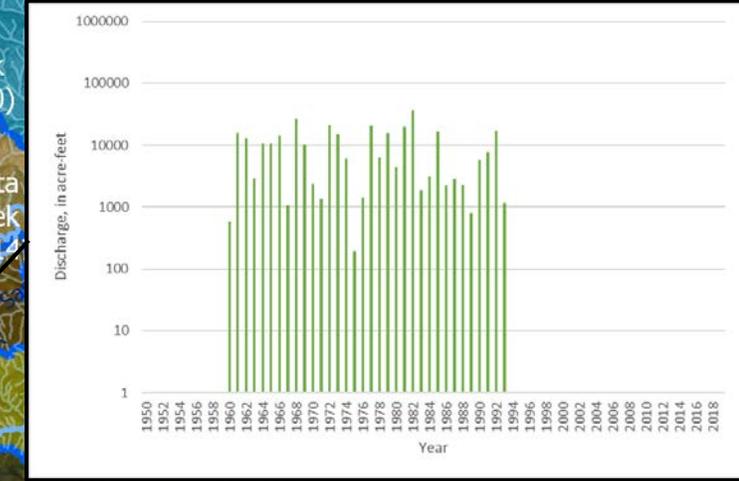
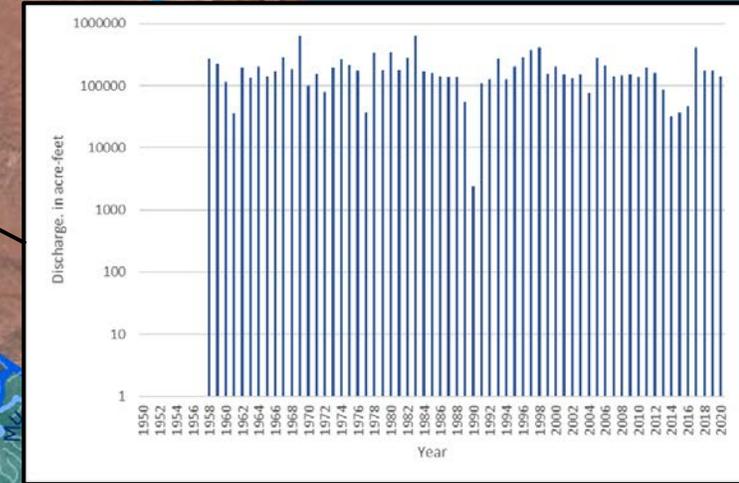
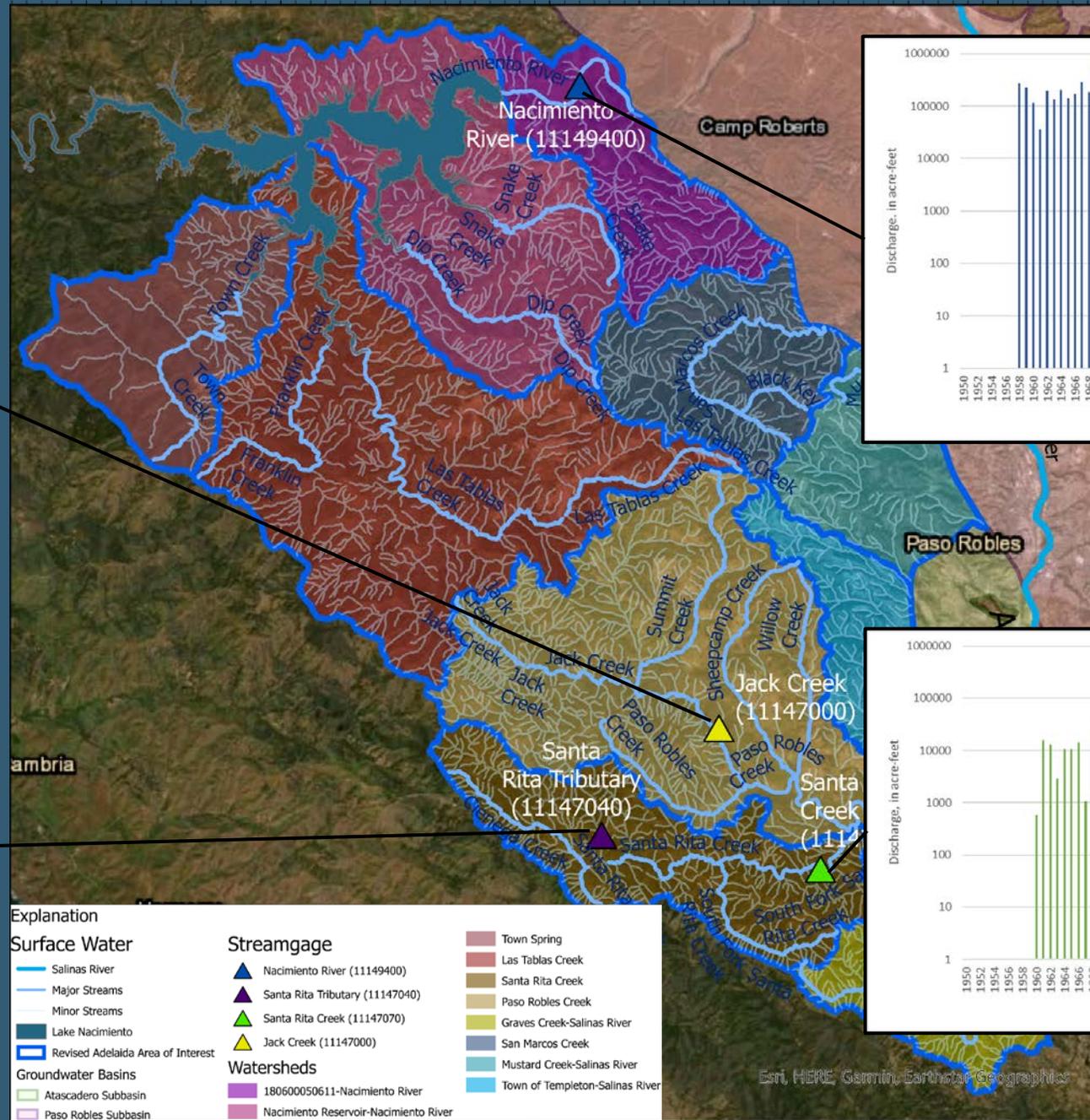
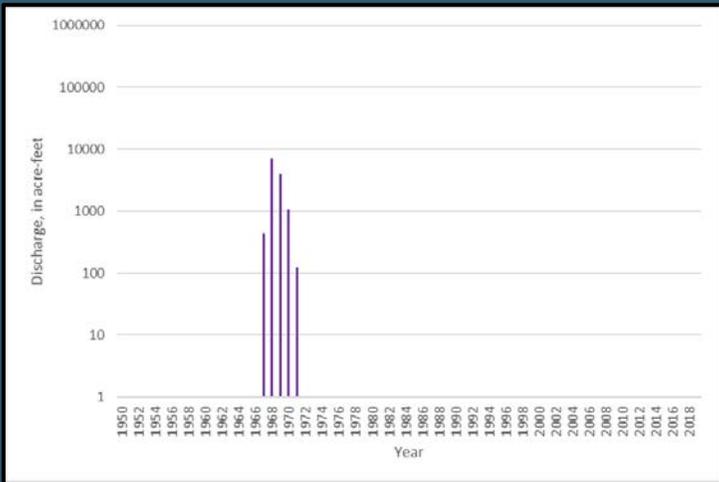
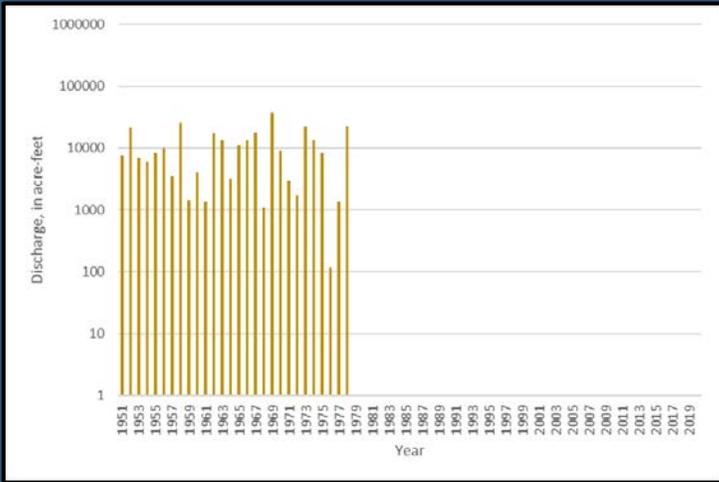
Irrigated agriculture



California Department of Conservation (2019)

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

Surface-Water Flow



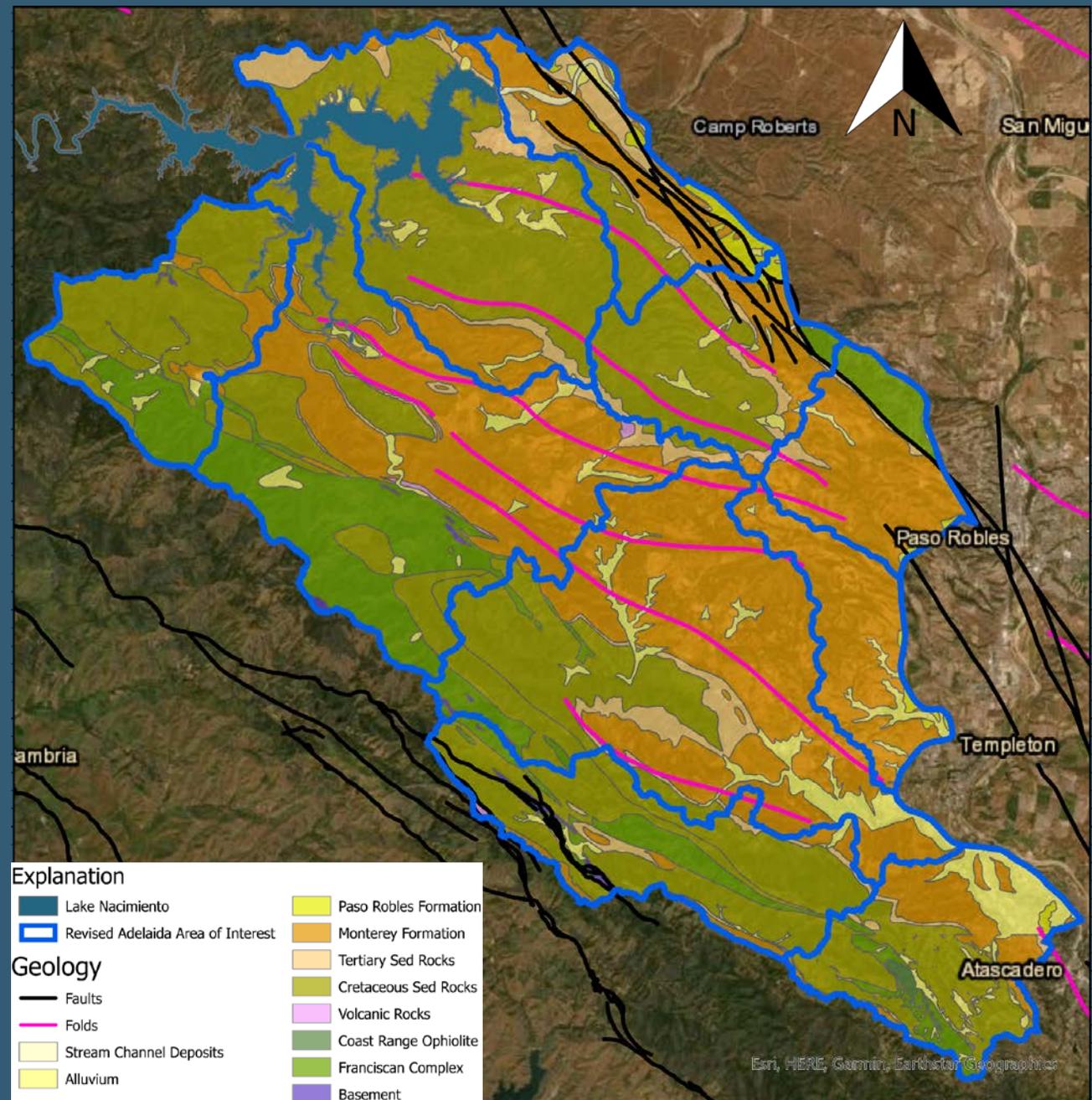
Preliminary, subject to revision. Do not cite or distribute.

U.S. Geological Survey (2019, 2020)



Surface and subsurface geology

- Surface geology sources
 - Geologic maps
 - Faults and folds
- Generalized geology
 - Unconsolidated sediments
 - Consolidated sedimentary rocks
 - Composite basement rocks

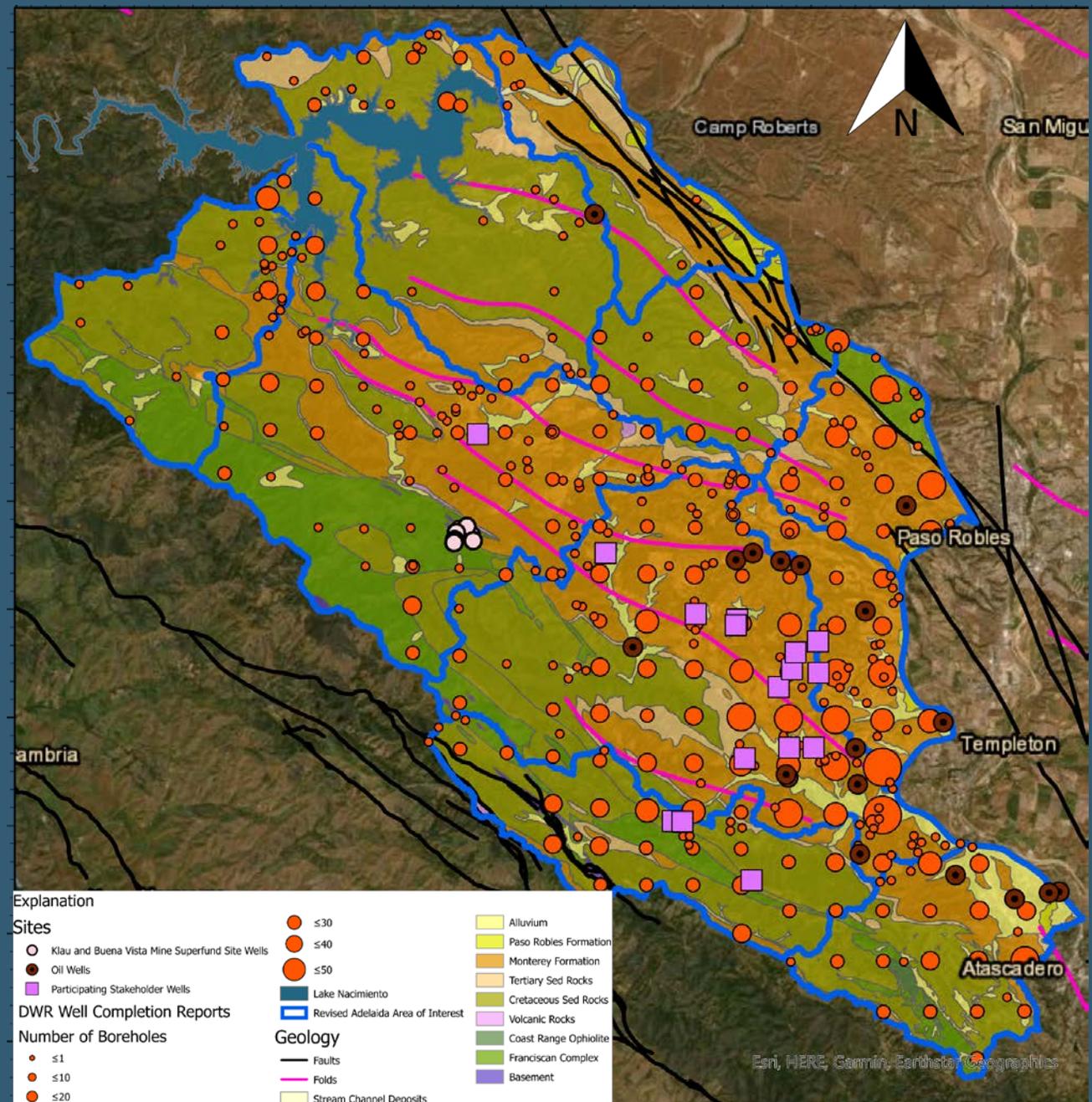


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County of San Luis Obispo Planning and Building Department - Geographic Technology Section (2017); Jennings (2010); U.S. Geological Survey and California Geological Survey (2006).

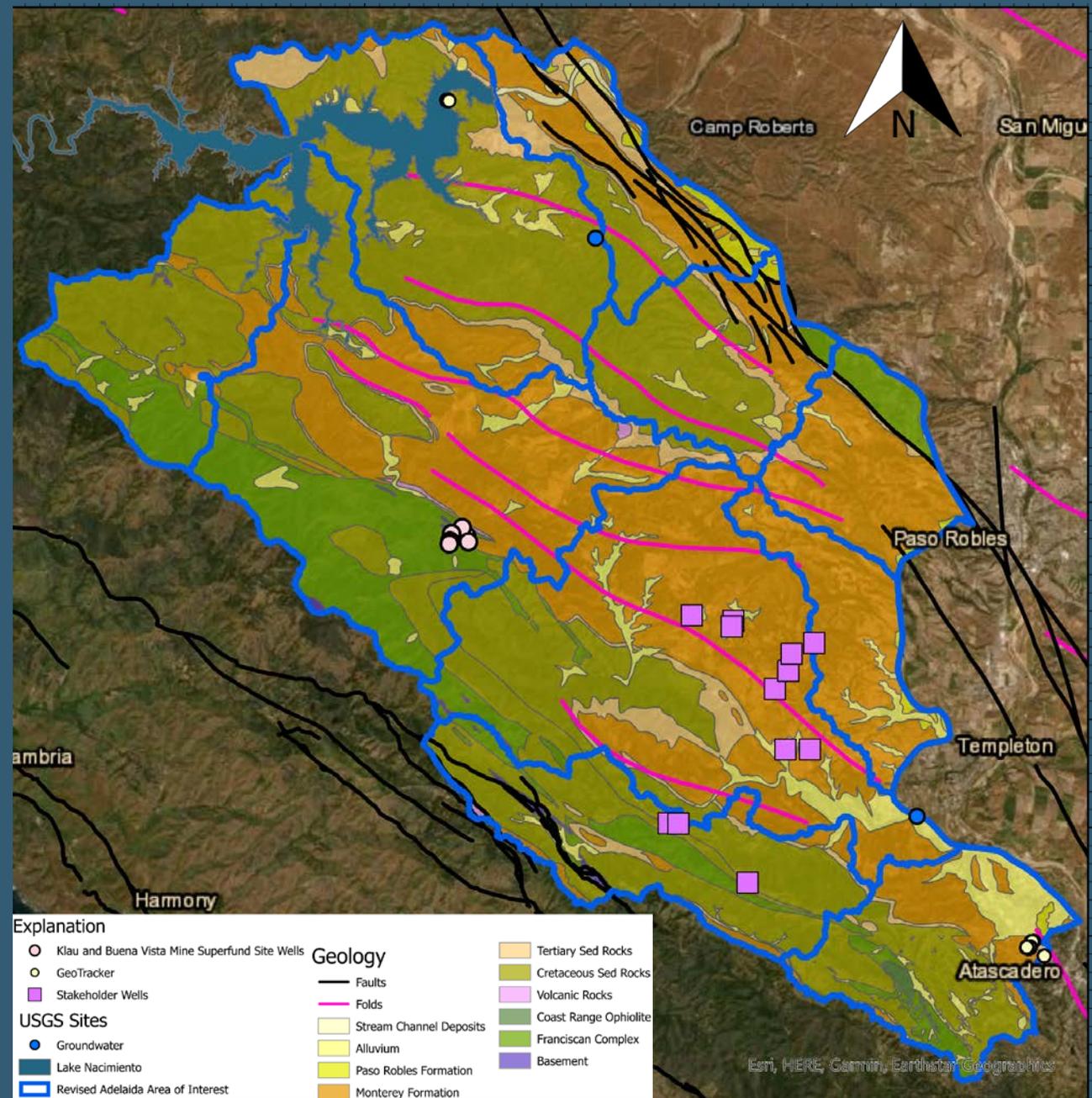
Surface and subsurface geology

- Subsurface geology sources
 - Drillers' lithology logs
 - Borehole geophysical logs
 - Regional geophysical surveys and data



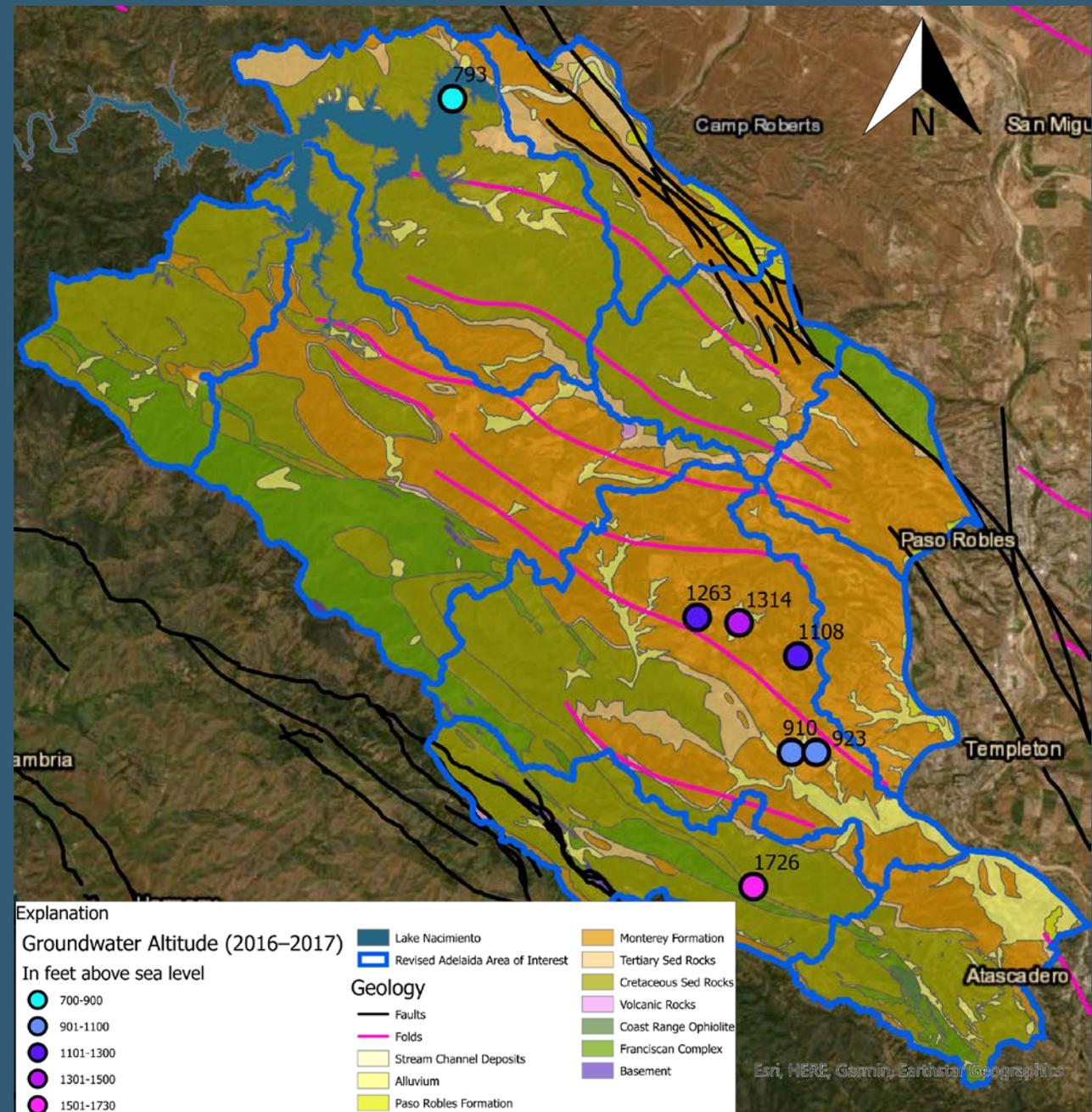
Groundwater levels

- Groundwater-level measurements
 - 1992–2021
- Length of record
 - Occasional
 - Most stakeholder wells
 - Regular
 - Klau/Buena Vista Mine
 - GeoTracker
 - Semi-continuous
 - Few stakeholder wells



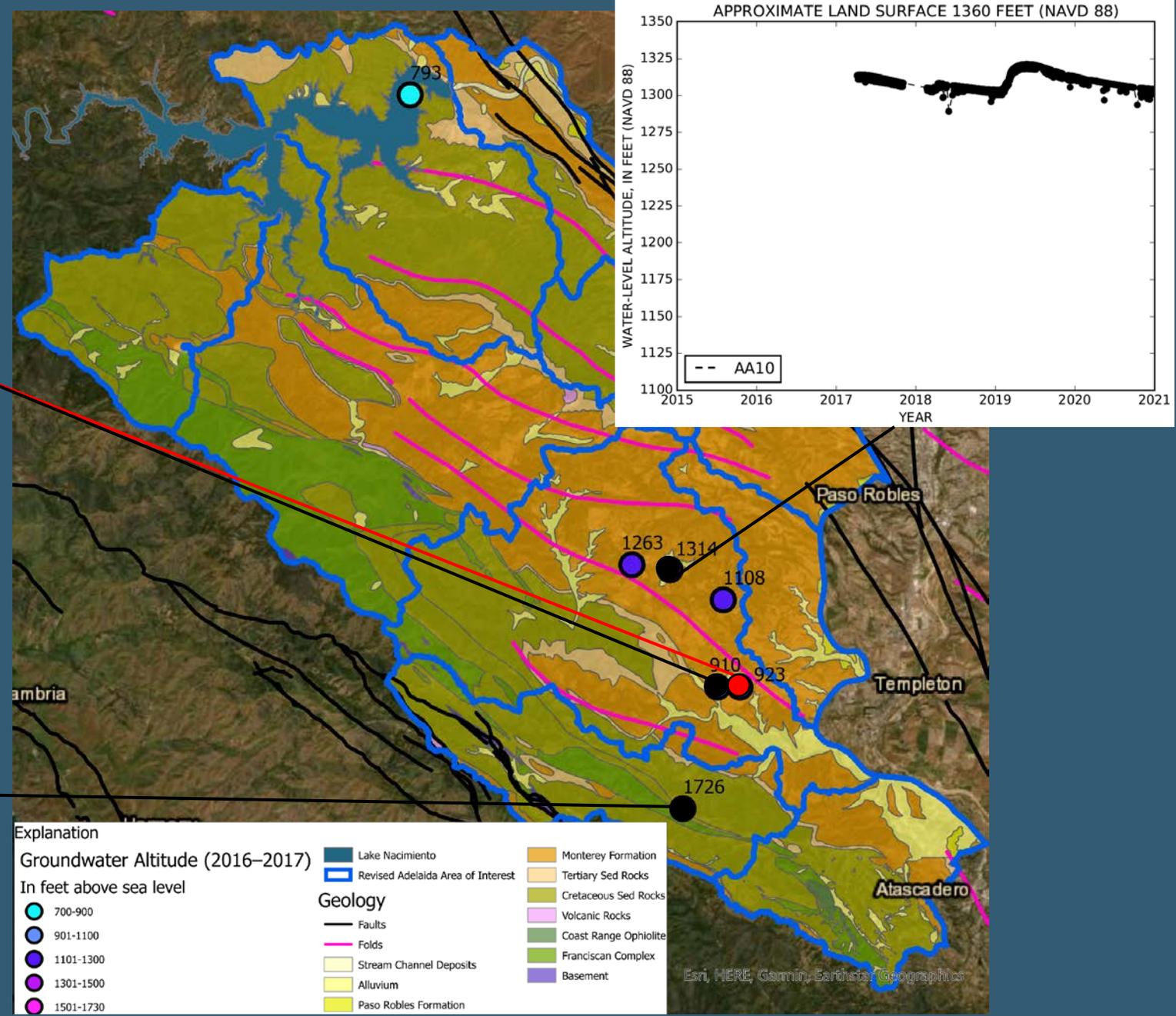
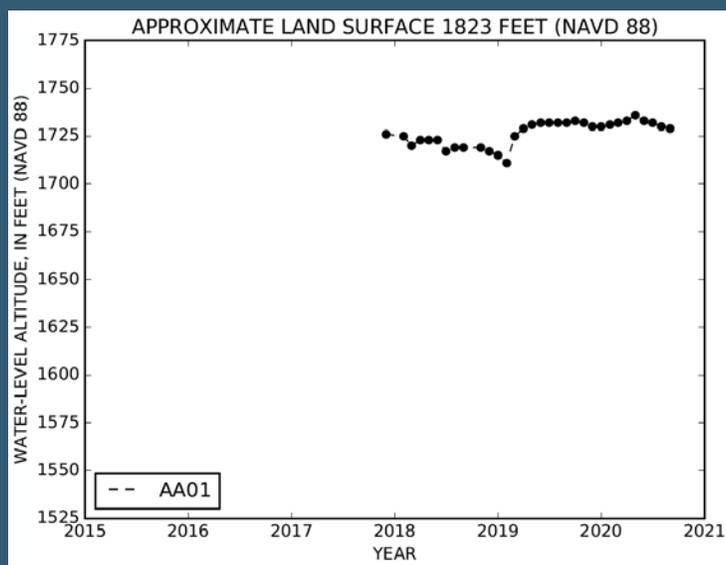
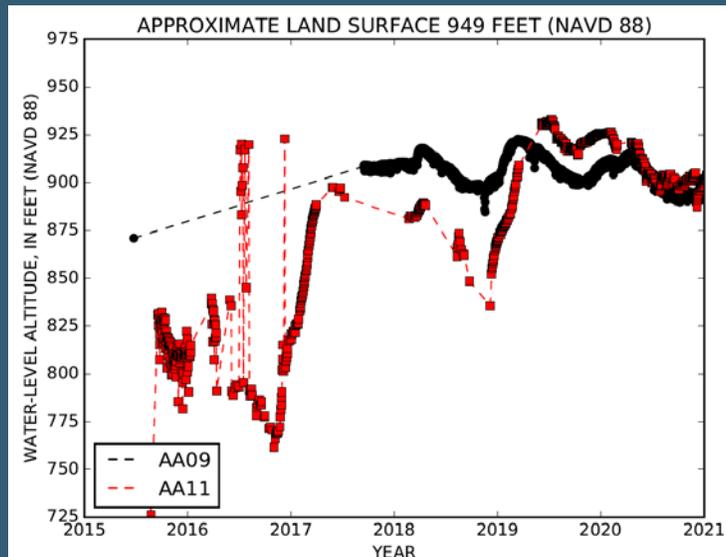
Groundwater levels

- Groundwater-level altitudes from wells for 2016–2017



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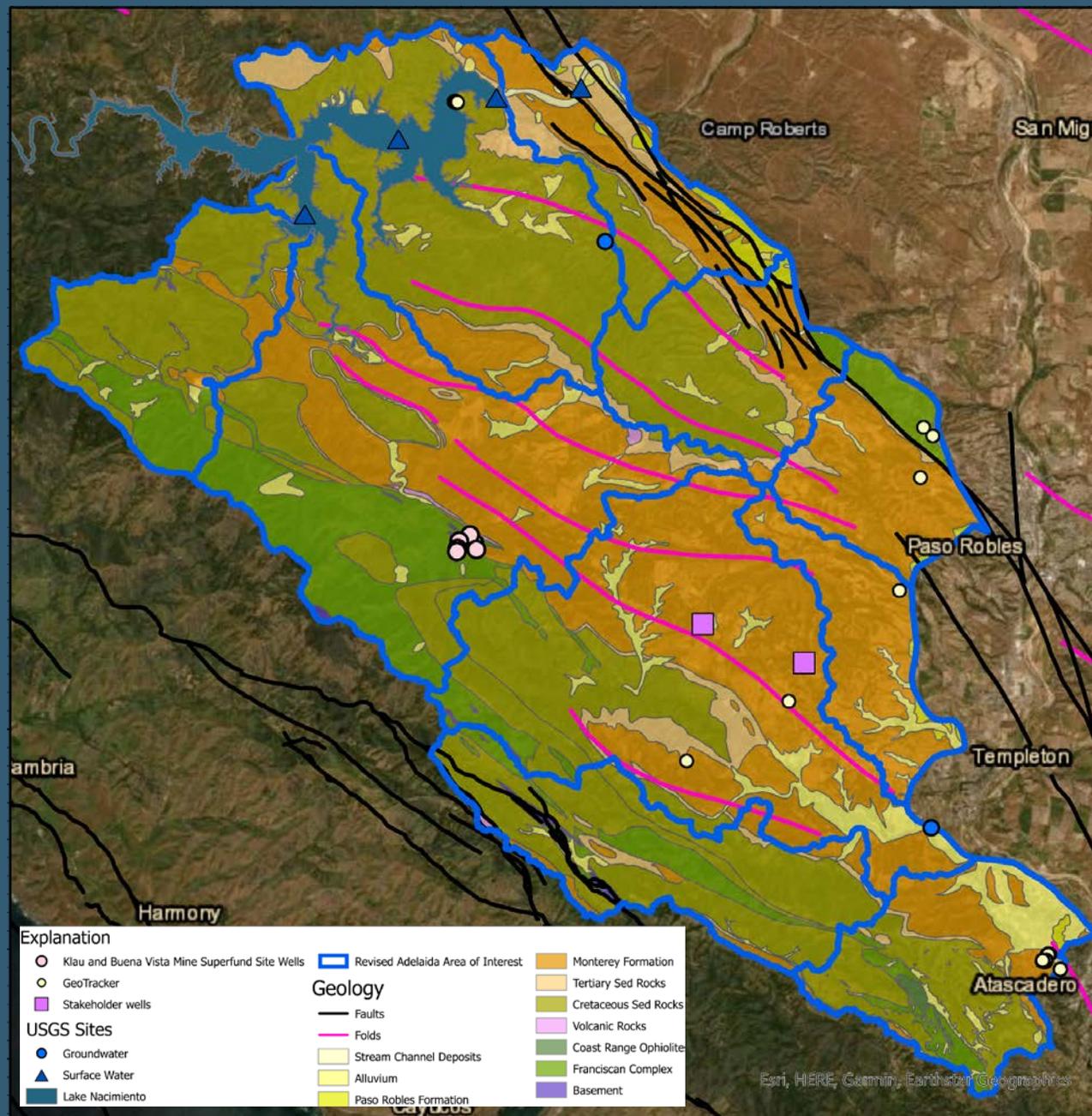
Groundwater levels



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Water Quality

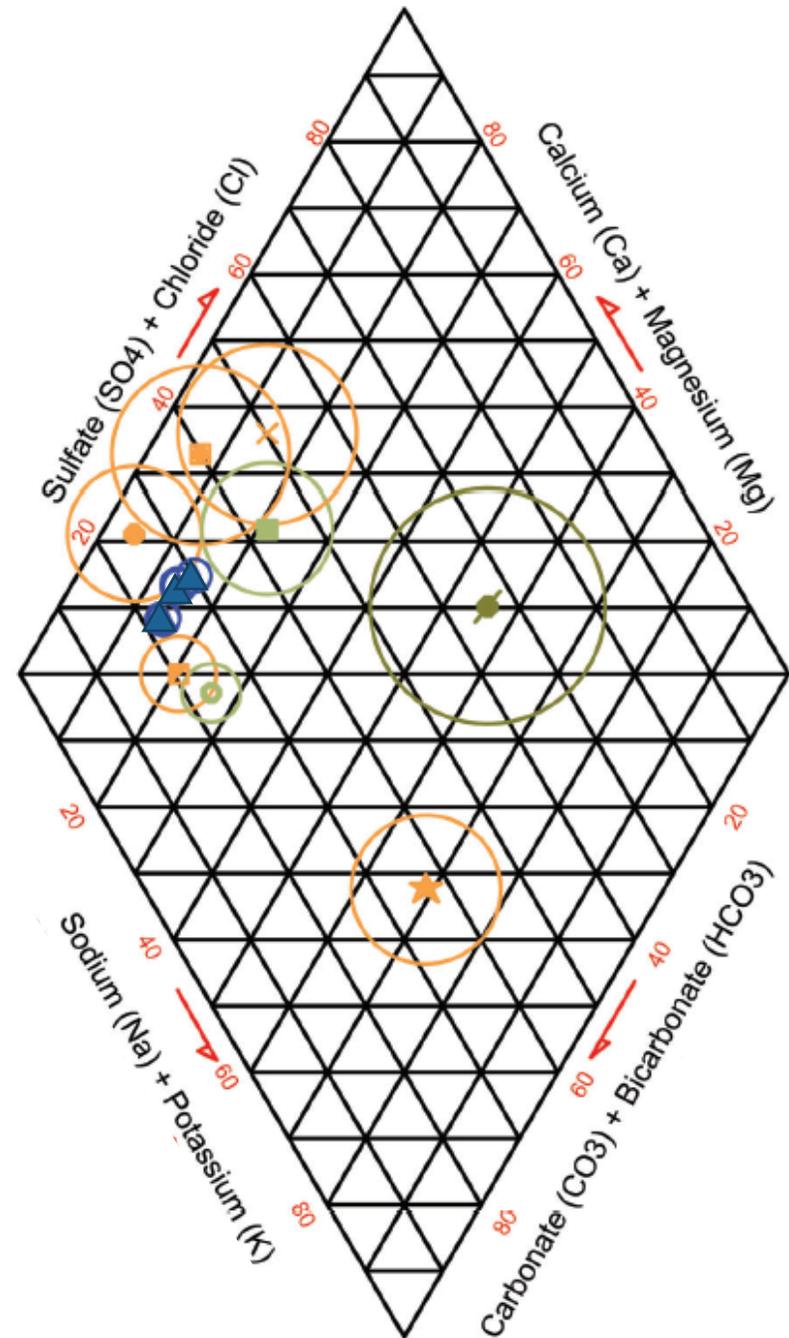
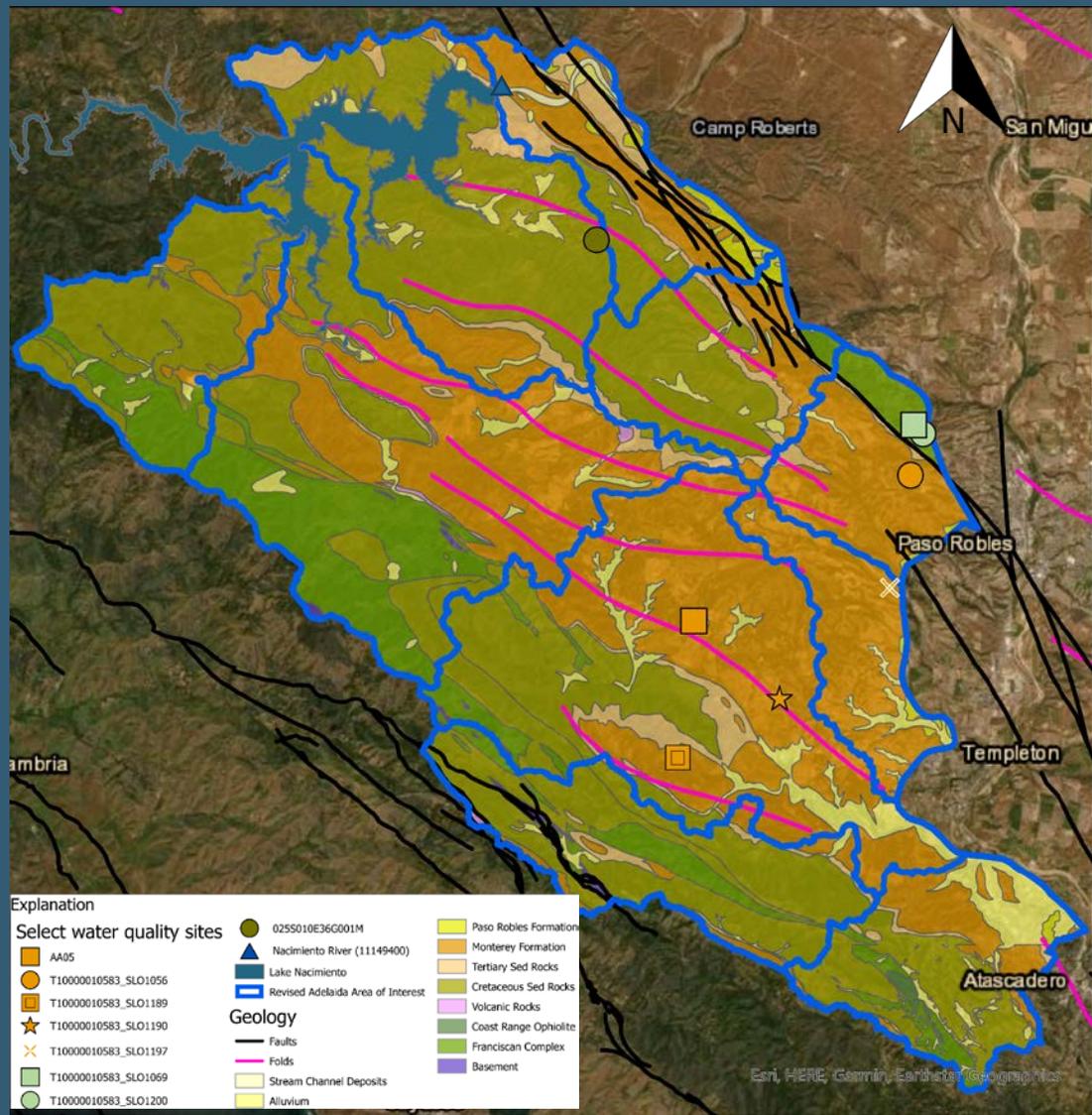
- Groundwater and surface-water quality measurements



California State Water Resources Control Board (2016); CH2MHill (2012); U.S. Geological Survey (2020)

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Water Quality

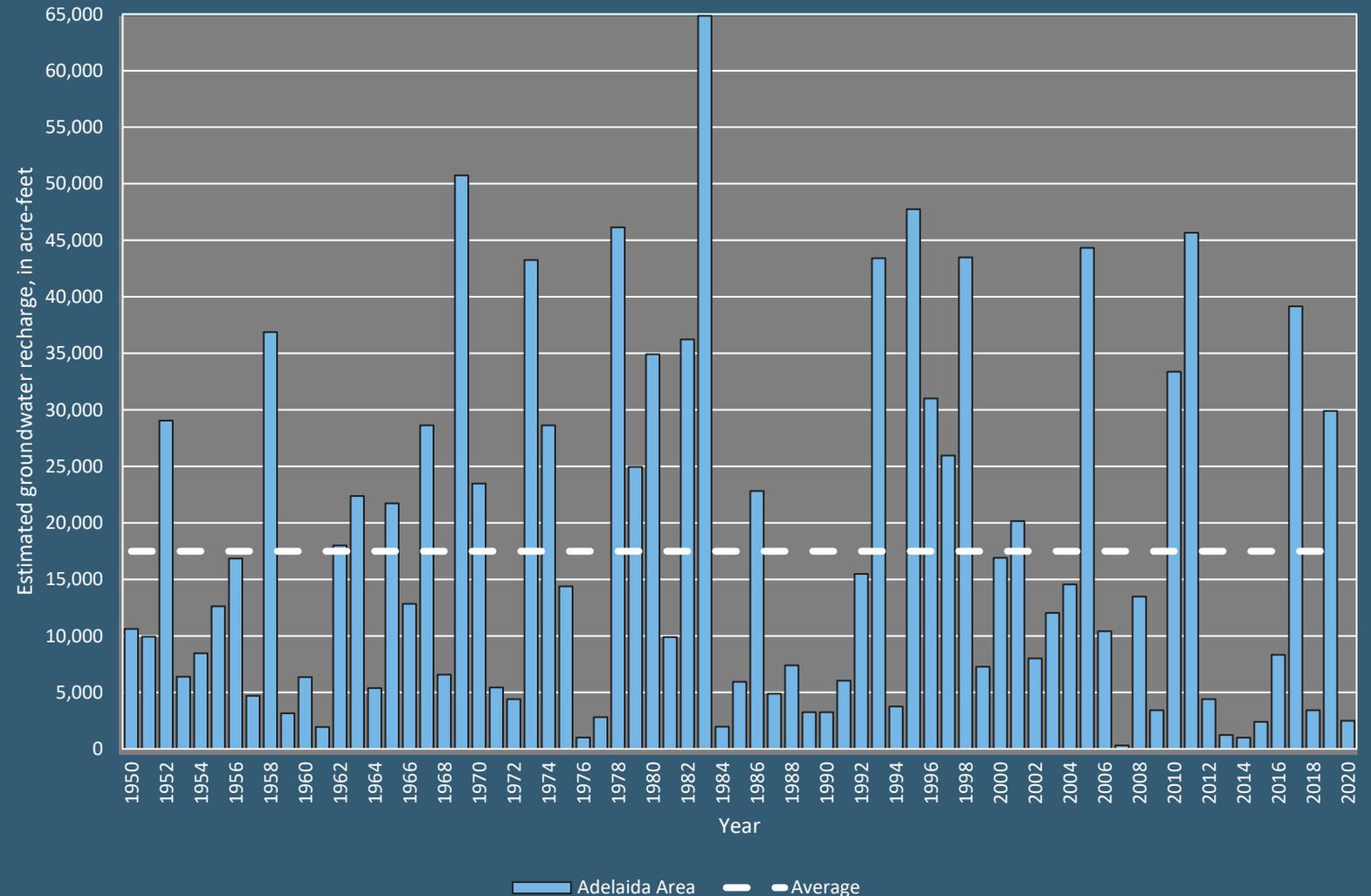


California State Water Resources Control Board (2016); CH2MHill (2012); U.S. Geological Survey (2020)

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Estimated Recharge

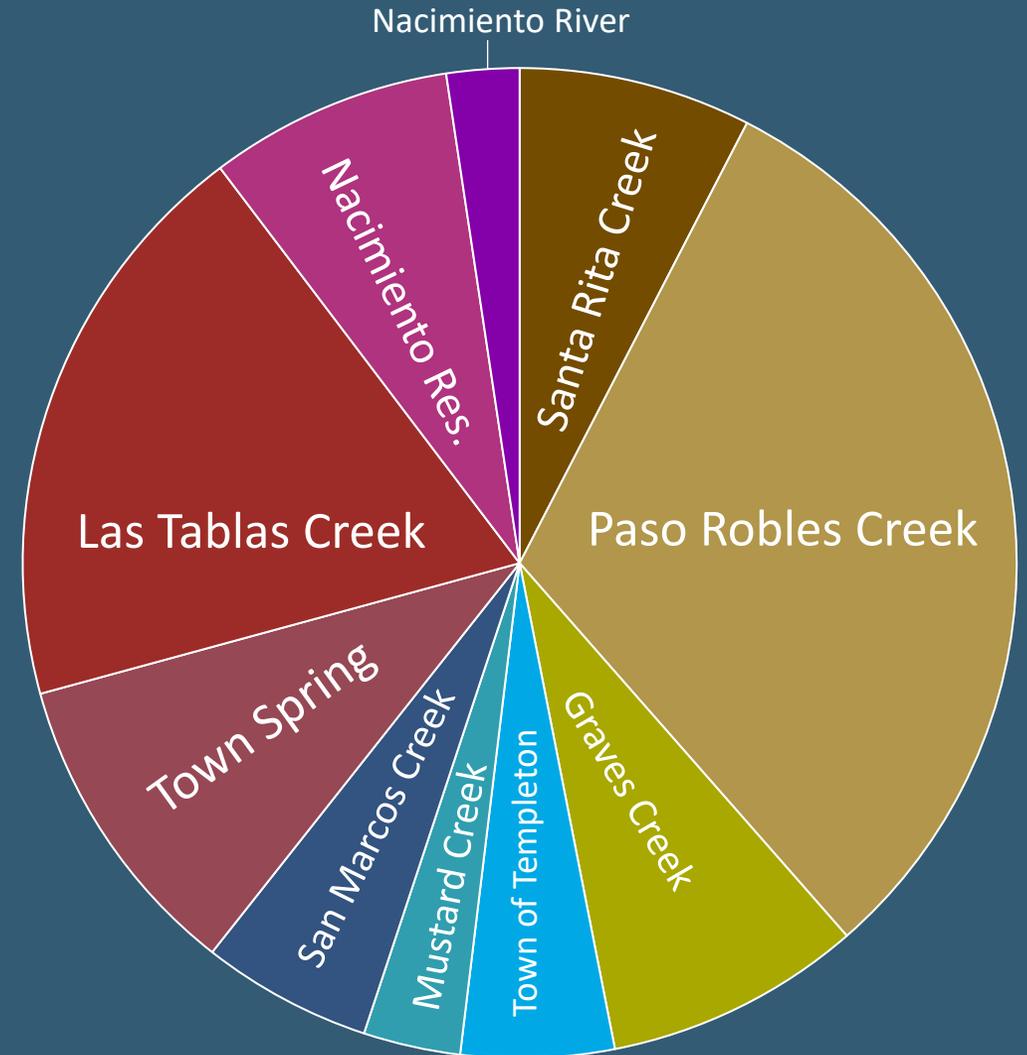
- Estimated Recharge
 - USGS Basin Characterization Model (Flint and others, 2021)



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

Estimated Recharge

- Relative estimated recharge by watershed
 - USGS Basin Characterization Model (Flint and others, 2021)



Task 1 Summary

- Stakeholder outreach and project website
- Comprehensive hydrogeologic data compilation
 - Historic changes in climate and land use
 - Groundwater and surface-water flow and quality
 - Estimates of groundwater recharge
- Foundation for integrated analysis
- *Need for additional historic groundwater-level measurements*

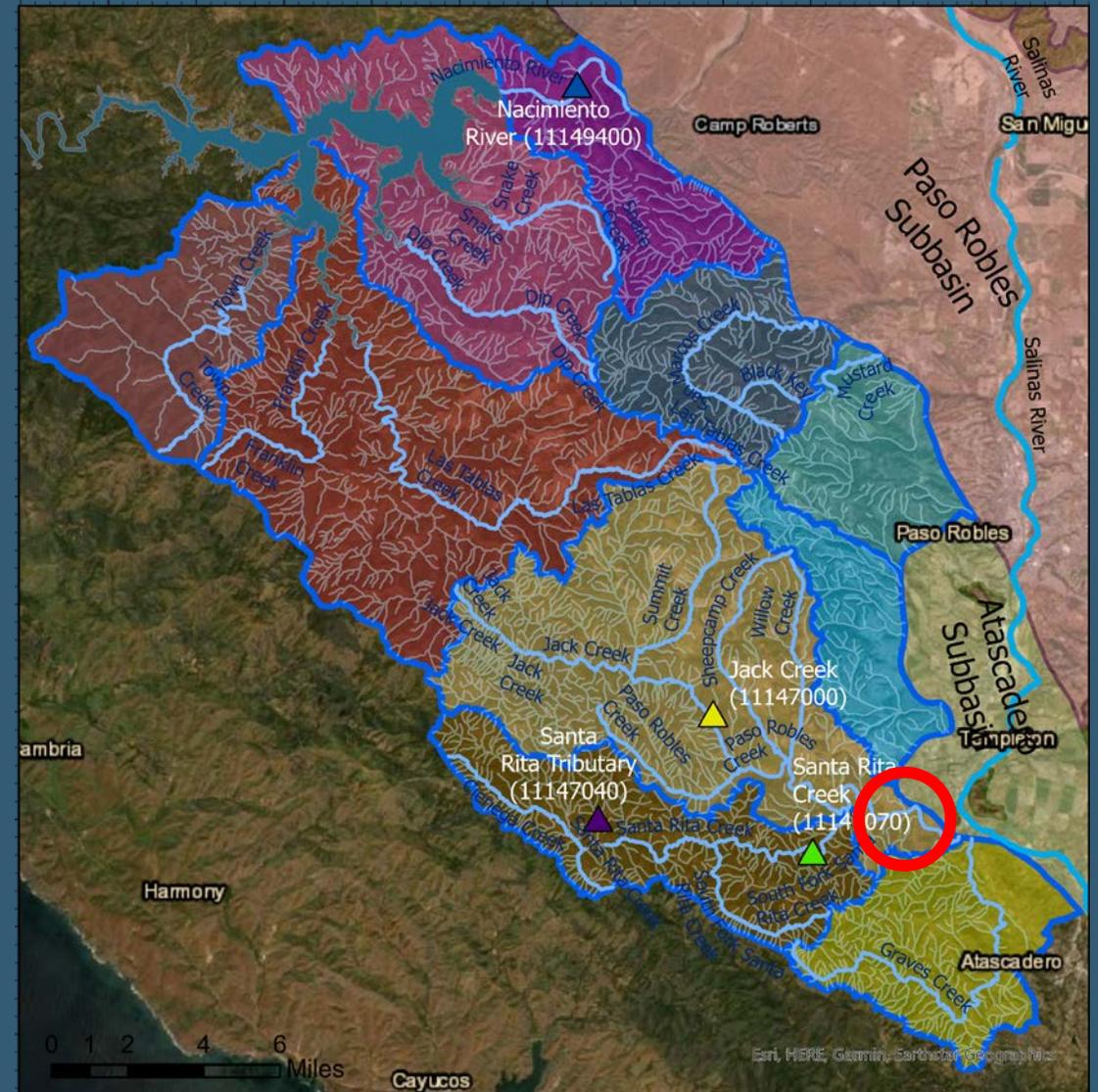
Proposed Future Work

- Data Collection
 - Hydrologic data
 - Surface-water monitoring
 - Groundwater-level monitoring
 - Water quality
 - Geophysical Data
 - Downhole geophysical logs
 - Direct-current resistivity surveys
 - Groundwater storage
 - Repeat microgravity surveys
 - InSAR
- Hydrogeologic Framework Model
- Evaluation and interpretation
- Reporting
 - USGS SIR, Factsheet, and data releases
- Project Website and Outreach
 - Annual community meetings

All collected data will be publicly available through the USGS National Water Information System database, GeoLog Locator, or ScienceBase Data Release

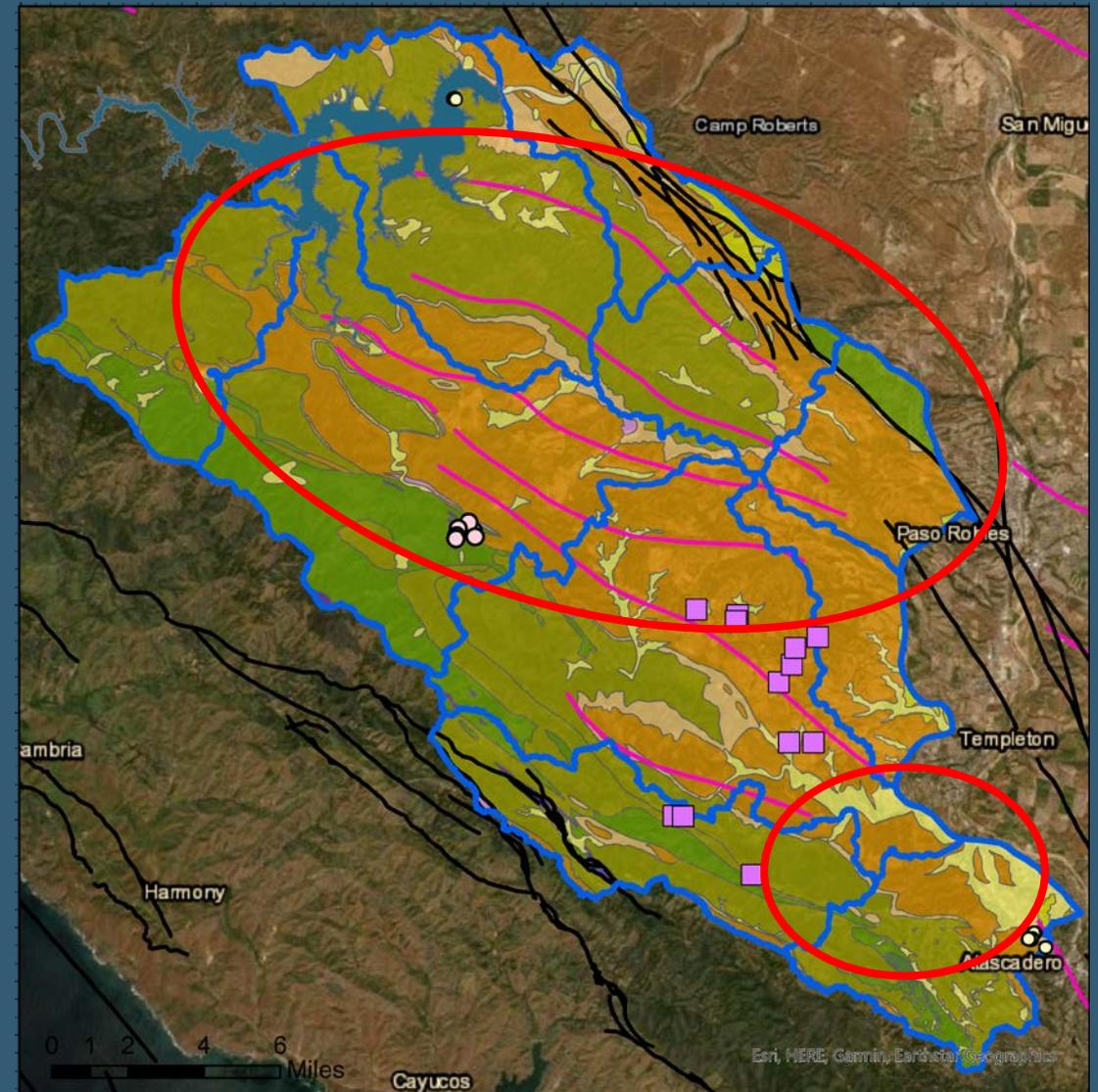
Proposed Future Work- Data Collection

- Hydrologic Data
 - Surface-water monitoring
 - Streamgauge installation
 - Discrete and continuous measurements



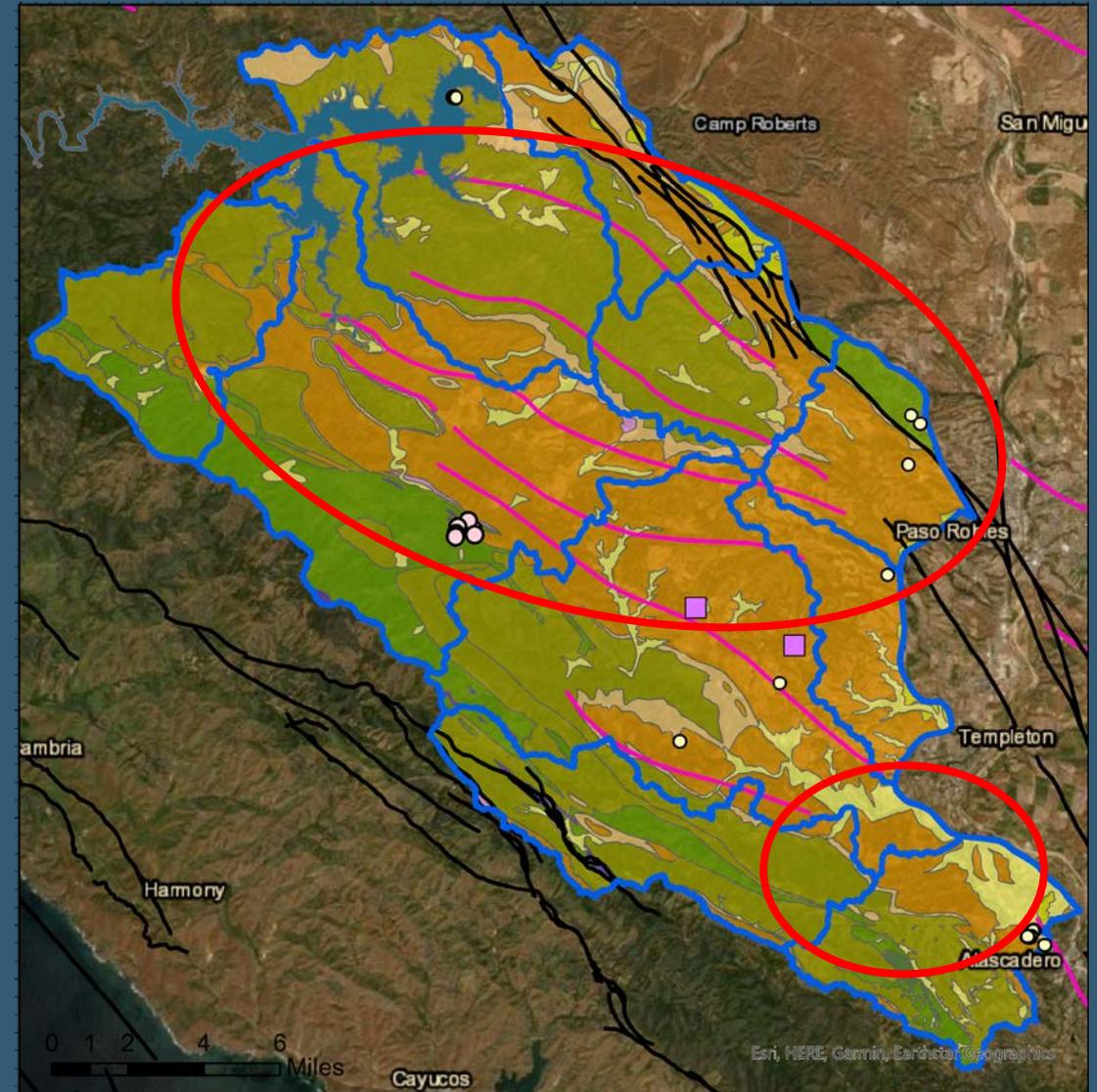
Proposed Future Work- Data Collection

- Hydrologic Data
 - Surface-water monitoring
 - Streamgauge installation
 - Discrete and continuous measurements
 - Groundwater-level monitoring
 - Expand participation network
 - Discrete and continuous measurements



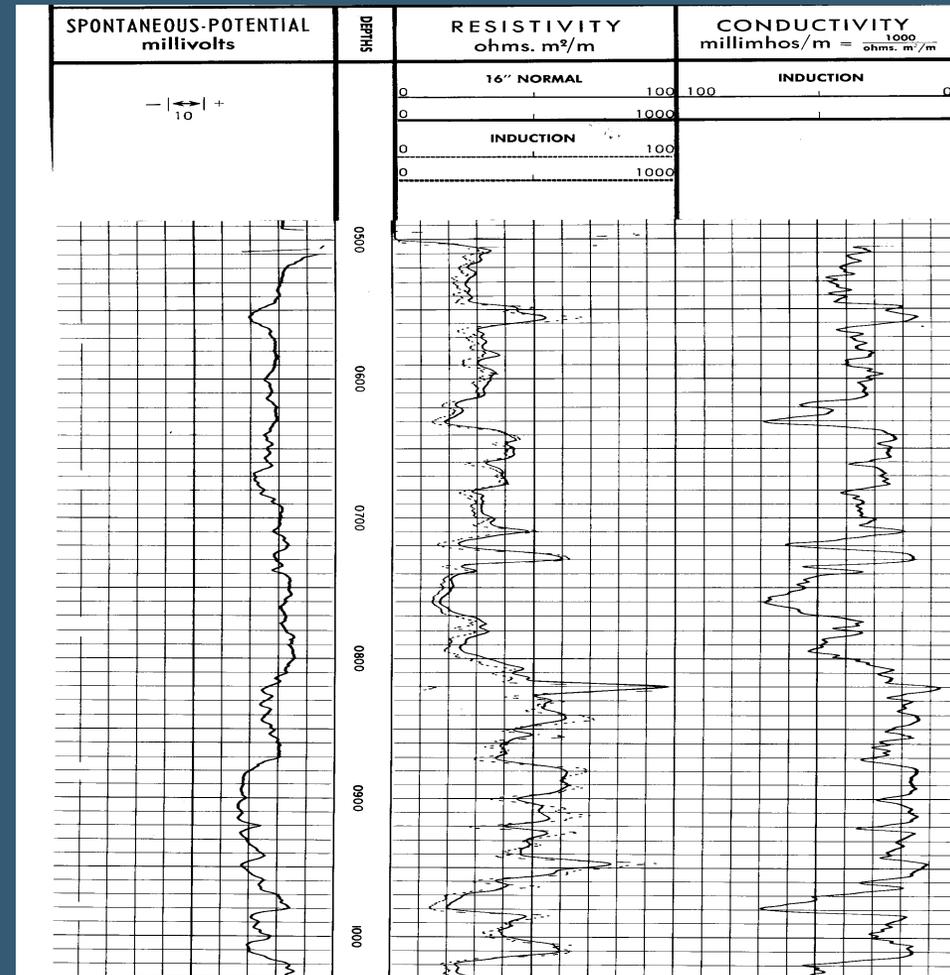
Proposed Future Work- Data Collection

- Hydrologic Data
 - Surface-water monitoring
 - Streamgauge installation
 - Discrete and continuous measurements
 - Groundwater-level monitoring
 - Expand participation network
 - Discrete and continuous measurements
 - Water quality
 - Major ions, stable isotopes, tritium, carbon-14



Proposed Future Work- Data Collection

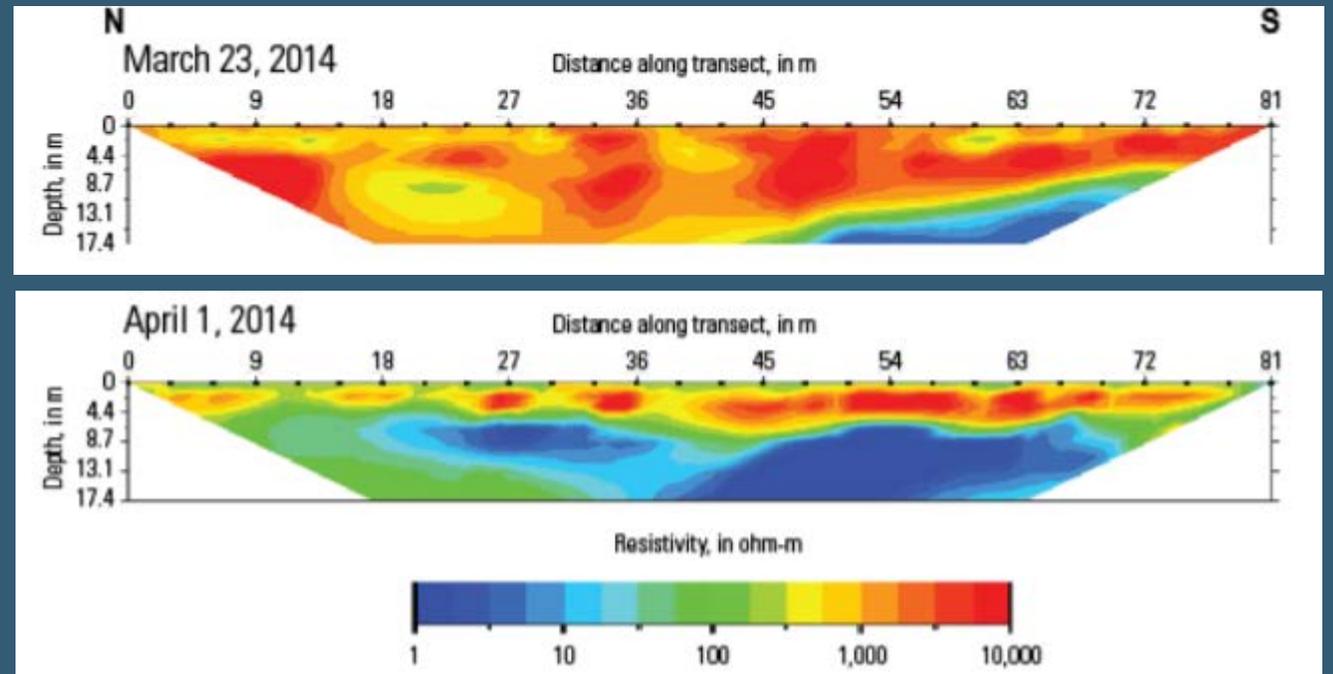
- Geophysical Data Collection
 - Downhole geophysical logs



California Department of Conservation (2021)

Proposed Future Work- Data Collection

- Geophysical Data Collection
 - Downhole geophysical logs
 - Direct-Current Resistivity Surveys

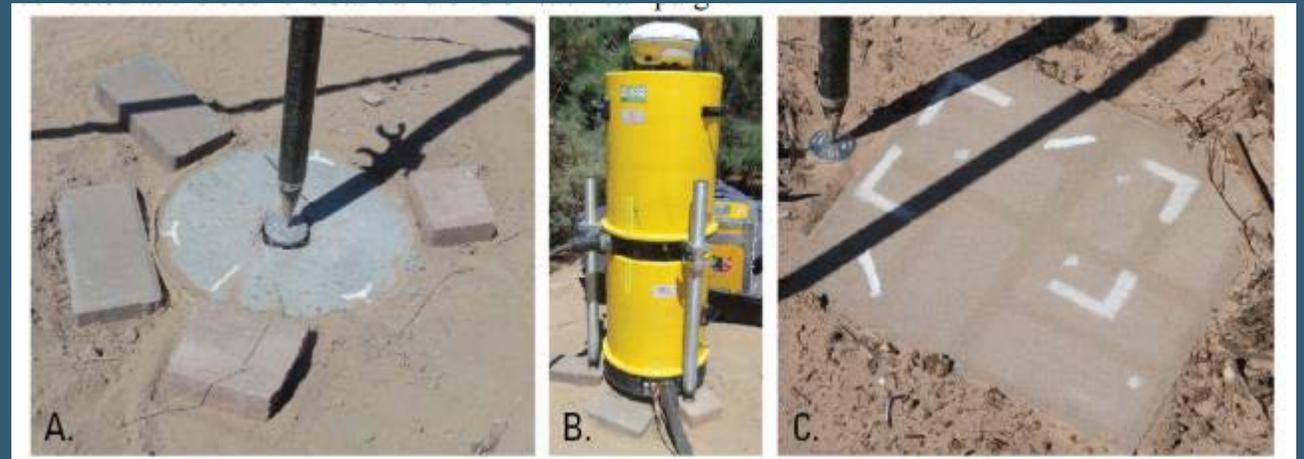


Example results along the Colorado River, Arizona

Kennedy and others (2017)

Proposed Future Work- Data Collection

- Estimates of Groundwater Storage Change
 - Repeated Microgravity Surveys



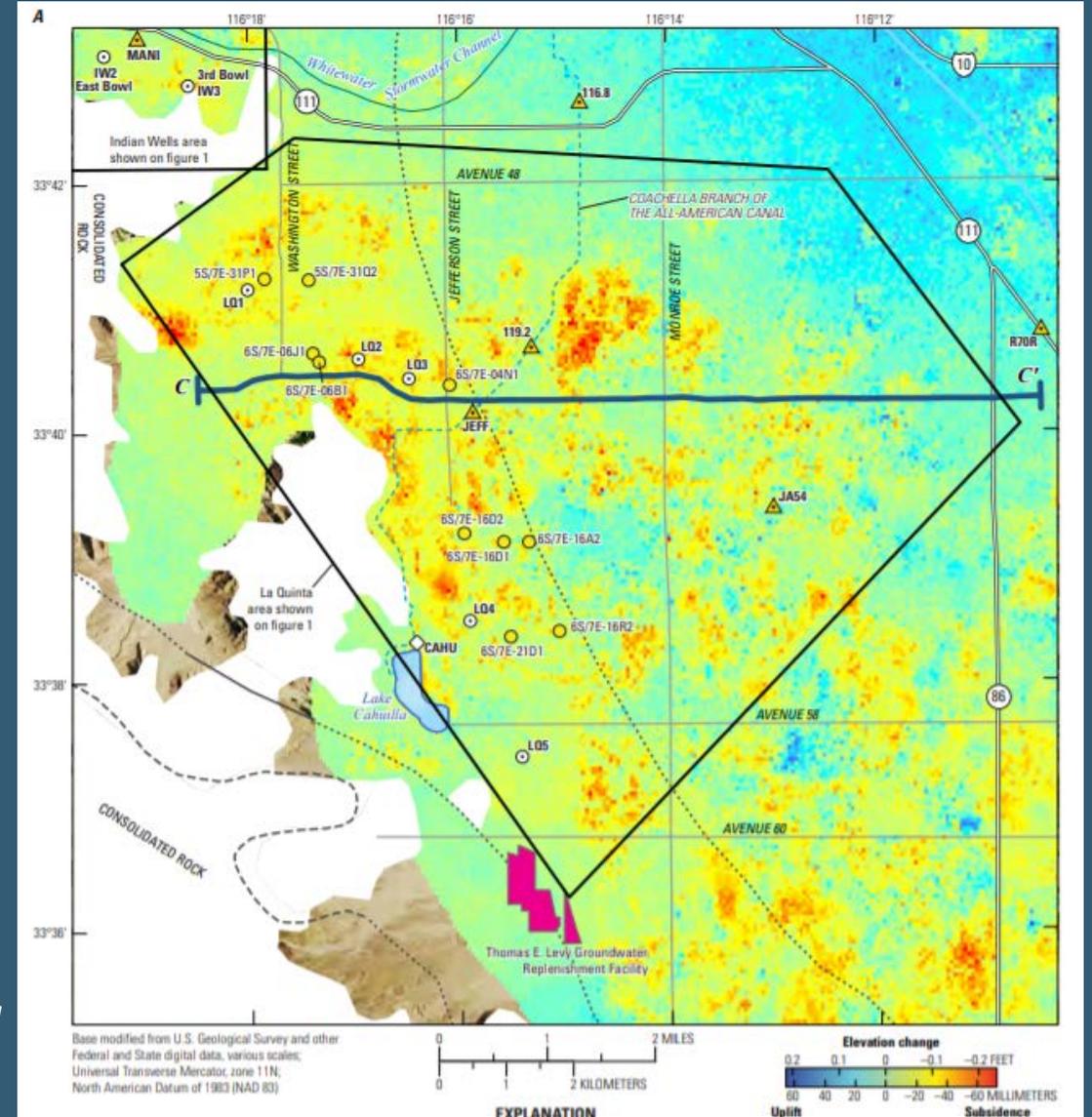
*A and B: Absolute-gravity stations
C: Relative-gravity platform*

Kennedy and others (2017)

Proposed Future Work- Data Collection

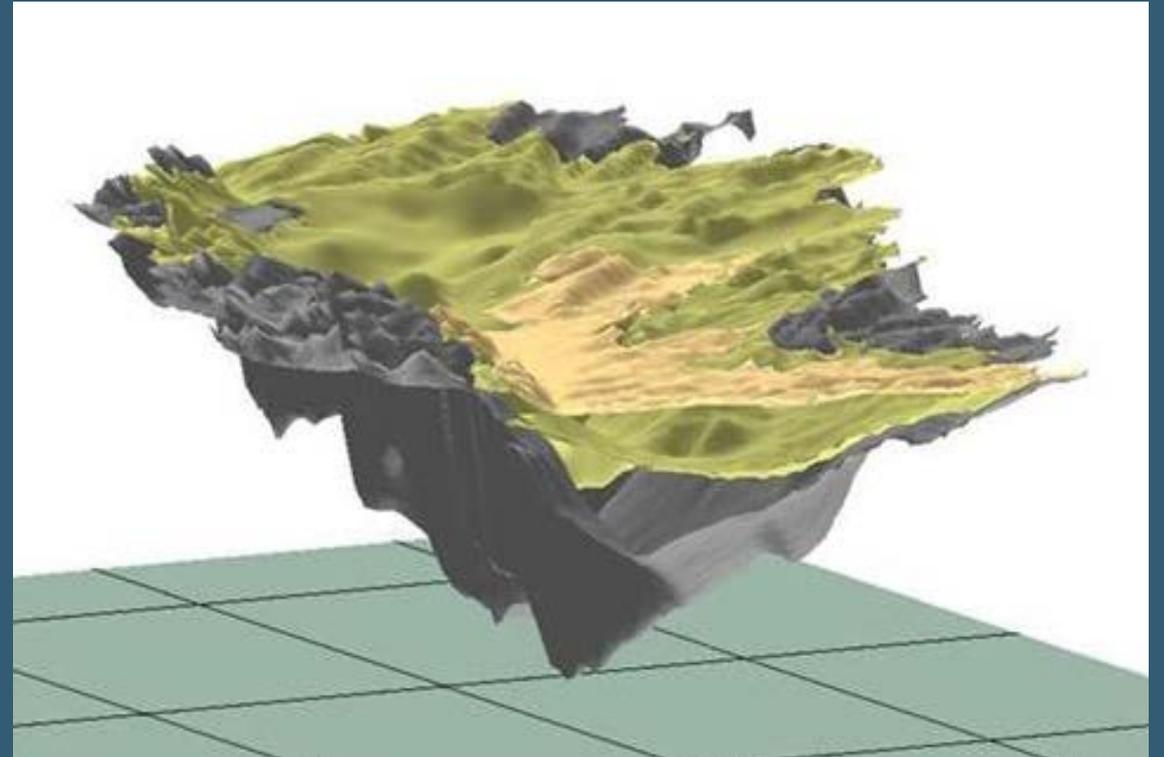
- Estimates of Groundwater Storage Change
 - Repeated Microgravity Surveys
 - InSAR (Interferometric Synthetic Aperture Radar)

Example results from the Coachella Valley, California



Proposed Future Work- Hydrogeologic Framework Model

- Hydrogeologic Framework Model
 - Three-dimensional representation of subsurface hydrogeologic units
 - Aquifer characterization



Preliminary results from the San Antonio Creek groundwater basin, Santa Barbara County, California

Cromwell and others (in review)

Proposed Project Timeline

- Proposed work to SLO County Board of Supervisors Summer 2021
- Data collection 2021-2024
 - Field visits beginning Summer/Fall 2021
- Framework and analysis 2022-2024
- Anticipated completion of study late 2025

Opportunities to Engage



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

Questions and Comments

By phone:

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From your computer:

Click the “raise hand” icon to make a comment or ask a question

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Thank you!

Sign up for EMAIL LIST at:

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

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U.S. Geological Survey

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Websites:

Upper Salinas – Las Tablas Resource Conservation District:

<https://www.us-ltrcd.org/adelaida-hydrology-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/ca-water/science/evaluation-groundwater-resources-adelaida-area-san-luis-obispo-county?qt-science_center_objects=0#qt-science_center_objects

References

- California Department of Conservation, 2019, Farmland Mapping and Monitoring Program: California Department of Conservation web page, accessed November 3, 2020 at https://www.conservation.ca.gov/dlrp/fmmp/Pages/Program_Overview.aspx
- California Department of Conservation, 2021, Geologic Energy Management Division Well Finder web page, accessed February 2, 2021 at <https://www.conservation.ca.gov/calgem/Pages/WellFinder.aspx>
- California Department of Water Resources, 1977, San Luis Obispo County Land Use Survey
- California Department of Water Resources, 1985, San Luis Obispo County Land Use Survey
- California Department of Water Resources, 2000, 1996 San Luis Obispo County Land Use Survey, accessed January 3, 2020 at <https://gis.water.ca.gov/app/CADWRLandUseViewer/>.
- California Department of Water Resources, 2020, Well Completion Reports: California Department of Water Resources web page, accessed April 15, 2020 at <https://water.ca.gov/Programs/Groundwater-Management/Wells/Well-Completion-Reports>.
- California State Water Resources Control Board, 2016, GeoTracker: California State Water Resources Control Board web page, accessed December 12, 2020 at <https://geotracker.waterboards.ca.gov/>
- CH2MHill, 2012, Operable Unit 1 Klau and Buena Vista Mines Superfund Site, San Luis Obispo County, California: U.S. Environmental Protection Agency Remedial Investigation Report, accessed November 23, 2020.
- Cromwell, G., Sweetkind, D.S., and O'Leary, D.O., in review, Three-dimensional hydrogeology of the San Antonio Creek Valley Groundwater Basin, Santa Barbara County, California
- County of San Luis Obispo Planning and Building Department - Geographic Technology Section, 2017, Geology, County of San Luis Obispo, accessed September 30, 2019 at <http://opendata.slocounty.ca.gov/datasets/geology>
- Flint, L.E., Flint, A.L., and Stern, M.A., 2021, The basin characterization model—A regional water balance software package: U.S. Geological Survey Techniques and Methods 6–H1, 85 p., <https://doi.org/10.3133/tm6H1>.
- Jennings, CW, with modifications by Gutierrez, C., Bryant, W., Saucedo, G., and Wills, C., 2010, Geologic Map of California: California Geological Survey, Geologic Data Map No. 2, scale 1:750,000, <https://maps.conservation.ca.gov/cgs/gmc/>.
- Kennedy, J.R., Callegary, J.B., Macy, J.P., Reyes-Lopez, J., Pérez-Flores, M., 2017, Geophysical data collected during the 2014 minute 319 pulse flow on the Colorado River below Morelos Dam, United States and Mexico: U.S. Geological Survey Open-File Report 2017–1050, 48 p., <https://doi.org/10.3133/ofr20171050>.
- LandIQ, 2017, i15_Crop_Mapping_2014_Final, Geospatial Dataset prepared for California Department of Water Resources, accessed January 3, 2020 at <https://gis.water.ca.gov/app/CADWRLandUseViewer/>.
- National Centers for Environmental Information, 2021, Climate Data Online: National Oceanic and Atmospheric Administration web page, accessed March 12, 2021 at <https://www.ncdc.noaa.gov/cdo-web/results>
- Sneed, M., and Brandt, J.T., 2020, Detection and measurement of land subsidence and uplift using Global Positioning System surveys and interferometric synthetic aperture radar, Coachella Valley, California, 2010–17: U.S. Geological Survey Scientific Investigations Report 2020–5093, 74 p., <https://doi.org/10.3133/sir20205093>.
- U.S. Geological Survey and California Geological Survey, 2006, Quaternary fault and fold database for the United States: U.S. Geological Survey, accessed October 21, 2019 at <http://earthquakes.usgs.gov/regional/qfaults>
- U.S. Geological Survey, 2019, National Hydrography Dataset, accessed September 17, 2019 at URL <https://www.usgs.gov/core-science-systems/ngp/national-hydrography/access-national-hydrography-products>
- U.S. Geological Survey, 2020, USGS water data for the Nation: U.S. Geological Survey National Water Information System database, at <https://doi.org/10.5066/F7P55KJN>.