CALIFORNIA DEPARTMENT OF WATER RESOURCES

Groundwater Awareness Week 2024

03/15/2024

Planning Ahead

Data Collection and Groundwater Modeling

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Opening Remarks

Sean Spencer

DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Day 5 Speakers

Steven Springhorn, *SGMO*

Katherine Dlubac, *SGMO*

Tad Bedegrew, *SGMO*

Craig Altare, *SGMO*

California's Groundwater (Bulletin 118) Related Activities

Steven Springhorn

DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

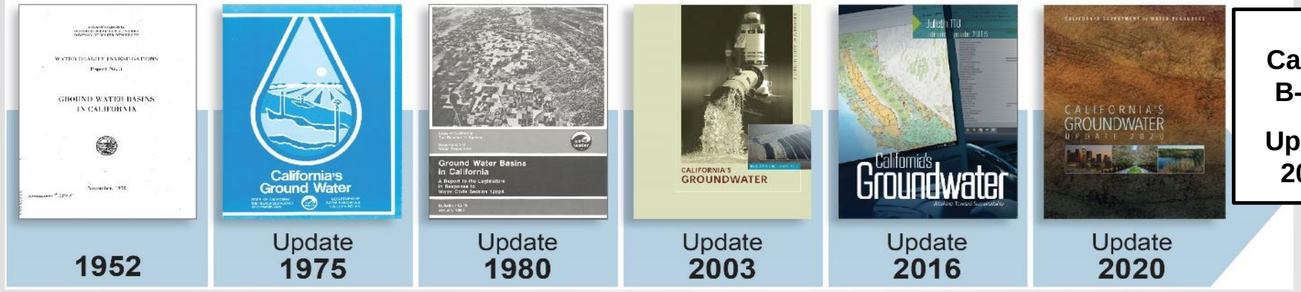
California’s Groundwater Connected Activities

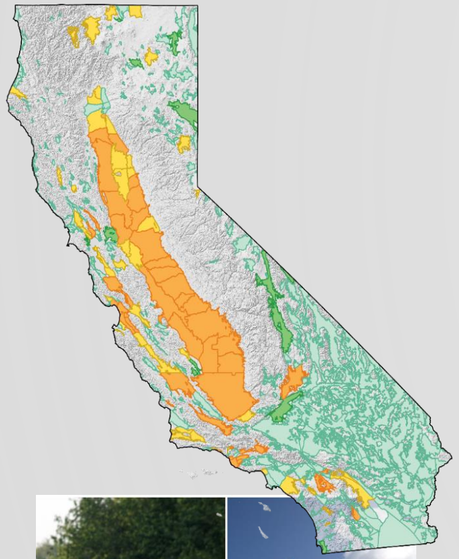
Requirements

CA Water Code
10720.1, 10729, 10920, 12924
Focus - SGMA Basins
Water Resilience Portfolio,
Water Supply Strategy,
Drought/Flood

DWR is Required to Publish Bulletin - 118, Characterize Groundwater Basins, and Provide Assistance

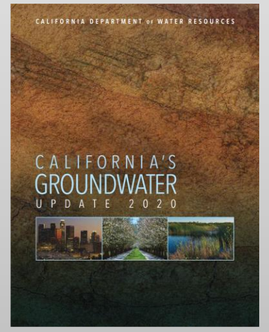
CA’s Groundwater (B-118) & CA Water Plan (B-160) (Archive & Vision)





California's Groundwater Informational Resources

California's Groundwater (Bulletin 118) Updates



- CalGW (B-118) consists of:
  - ➢Highlights (English & Spanish)
  - ➢Statewide Report
- Update 2025 in Development
- Target Release Date, Mid & End of 2025
- More Info: water.ca.gov/calgw

Updated every 5 years

Semi-Annual Conditions Updates

Updated twice a year

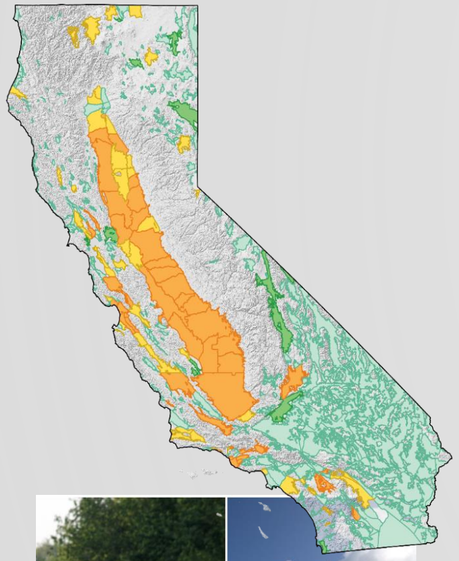
California's Groundwater Live

Updated daily

California's Groundwater Connected Activities

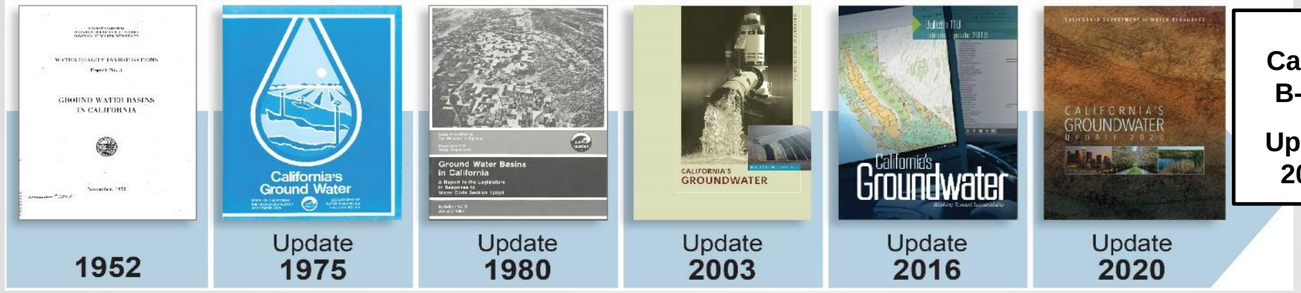
Requirements

CA Water Code
10720.1, 10729, 10920, 12924
Focus - SGMA Basins
Water Resilience Portfolio,
Water Supply Strategy,
Drought/Flood



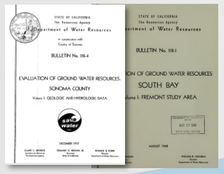
DWR is Required to Publish Bulletin - 118, Characterize Groundwater Basins, and Provide Assistance

CA's Groundwater (B-118) & CA Water Plan (B-160) (Archive & Vision)



CalGW B-118 Update 2025

DWR's Groundwater Basin Characterization (Analysis & Tools)



Statewide AEM Surveys

Local Pilots & Regional Studies

Texture Modeling & HydroStrat Analysis

Local and Regional Basin Characterization

C2VSim & Local Models

DWR's Data Collection and Stewardship (Access)

Geophysics	Wells	GW Levels	Subsidence	WQ		Land Use
Statewide AEM Infill AEM tTEM/FloaTEM NMR/e-logs	**OSWCR**	**CASGEM & SGMA**	InSAR CGPS Extensometers	DWR WQ	Board WQ	Crop Mapping Statewide County Level

New Groundwater Monitoring & Characterization Funding

Data Reporting

Public ↕ Technical (Audience)

- CalGW Live
- CalGW B-118 Reports
- SGMA Data Viewer
- 2D/3D Data Viewer
- Open Data

Education, Technical Engagement, and Inform Local & State Projects and Actions

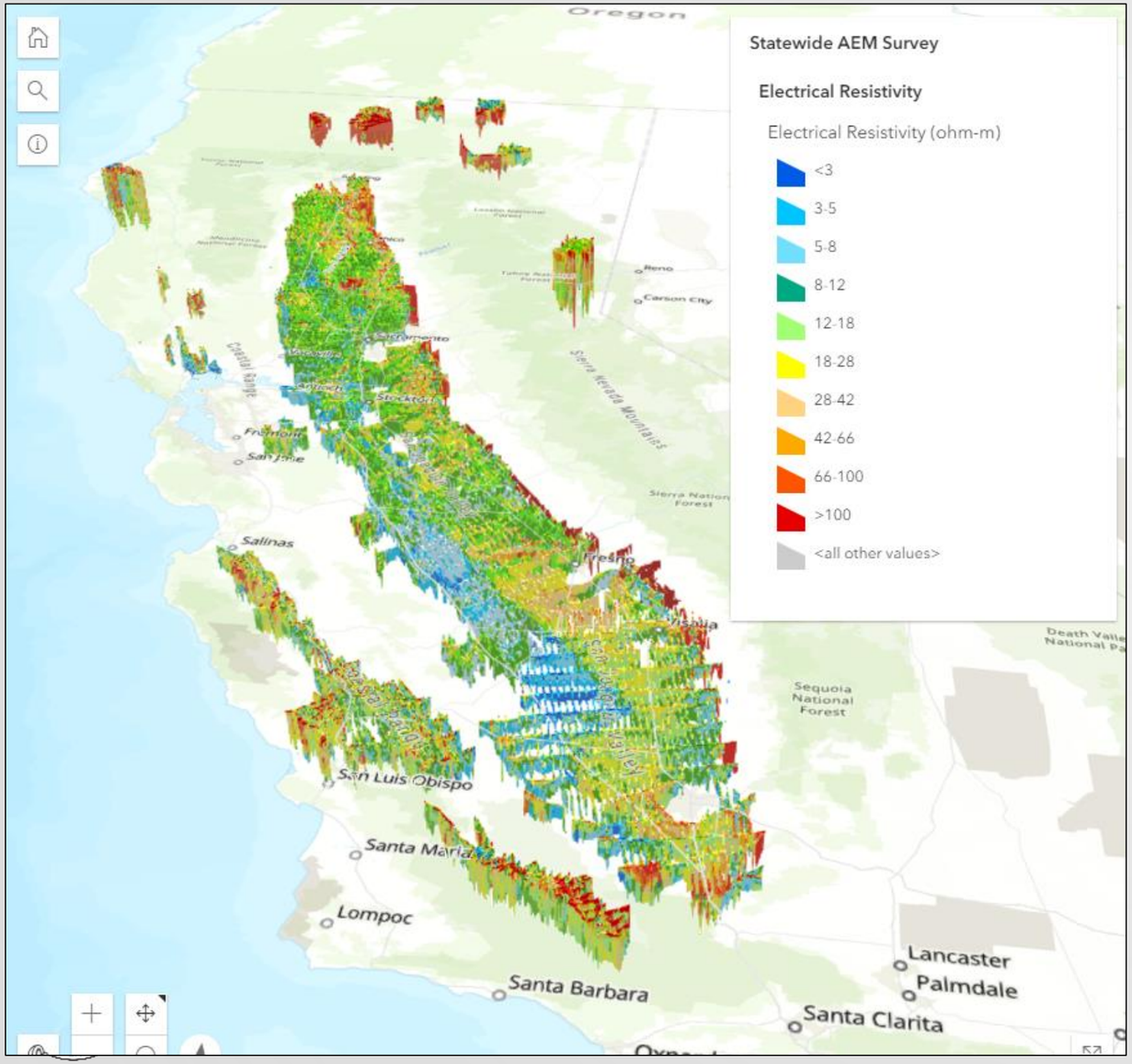
Basin Characterization

Katherine Dlubac

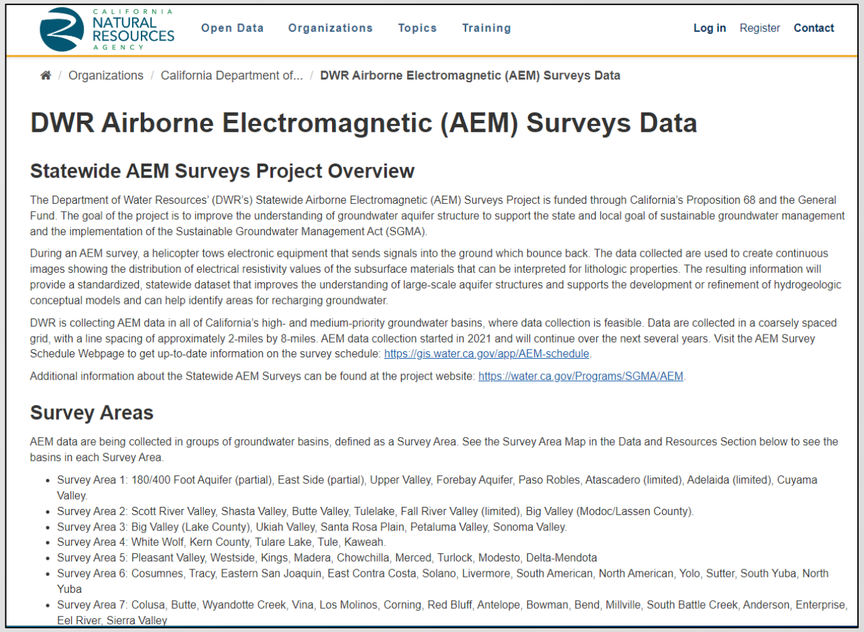
DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Statewide Airborne Electromagnetic Survey Project Successes



- Data collection completed in 2.5 years.
- 16,000 miles of AEM data collected.
- 95 groundwater subbasins surveyed.
- 130,000 letters or postcards sent to parcel owners.
- Novel 2D and 3D data visualization platforms developed.
- Data and Viewers available from the CNRA Open Data Portal: https://data.cnra.ca.gov/dataset/aem



CALIFORNIA NATURAL RESOURCES AGENCY | Open Data | Organizations | Topics | Training | Log in | Register | Contact

Organizations / California Department of... / DWR Airborne Electromagnetic (AEM) Surveys Data

DWR Airborne Electromagnetic (AEM) Surveys Data

Statewide AEM Surveys Project Overview

The Department of Water Resources' (DWR's) Statewide Airborne Electromagnetic (AEM) Surveys Project is funded through California's Proposition 68 and the General Fund. The goal of the project is to improve the understanding of groundwater aquifer structure to support the state and local goal of sustainable groundwater management and the implementation of the Sustainable Groundwater Management Act (SGMA).

During an AEM survey, a helicopter tows electronic equipment that sends signals into the ground which bounce back. The data collected are used to create continuous images showing the distribution of electrical resistivity values of the subsurface materials that can be interpreted for lithologic properties. The resulting information will provide a standardized, statewide dataset that improves the understanding of large-scale aquifer structures and supports the development or refinement of hydrogeologic conceptual models and can help identify areas for recharging groundwater.

DWR is collecting AEM data in all of California's high- and medium-priority groundwater basins, where data collection is feasible. Data are collected in a coarsely spaced grid, with a line spacing of approximately 2-miles by 8-miles. AEM data collection started in 2021 and will continue over the next several years. Visit the AEM Survey Schedule Webpage to get up-to-date information on the survey schedule: https://gis.water.ca.gov/app/AEM-schedule.

Additional information about the Statewide AEM Surveys can be found at the project website: https://water.ca.gov/Programs/SGMA/AEM.

Survey Areas

AEM data are being collected in groups of groundwater basins, defined as a Survey Area. See the Survey Area Map in the Data and Resources Section below to see the basins in each Survey Area.

- Survey Area 1: 180/400 Foot Aquifer (partial), East Side (partial), Upper Valley, Forebay Aquifer, Paso Robles, Atascadero (limited), Adelaida (limited), Cuyama Valley.
- Survey Area 2: Scott River Valley, Shasta Valley, Butte Valley, Tulelake, Fall River Valley (limited), Big Valley (Modoc/Lassen County).
- Survey Area 3: Big Valley (Lake County), Ukiah Valley, Santa Rosa Plain, Petaluma Valley, Sonoma Valley.
- Survey Area 4: White Wolf, Kern County, Tulare Lake, Tule, Kaweah.
- Survey Area 5: Pleasant Valley, Westside, Kings, Madera, Chowchilla, Merced, Turlock, Modesto, Delta-Mendota
- Survey Area 6: Cosumnes, Tracy, Eastern San Joaquin, East Contra Costa, Solano, Livermore, South American, North American, Yolo, Sutter, South Yuba, North Yuba
- Survey Area 7: Colusa, Butte, Wyandotte Creek, Vina, Los Molinos, Corning, Red Bluff, Antelope, Bowman, Bend, Millville, South Battle Creek, Anderson, Enterprise, Eel River, Sierra Valley

Basin Characterization Program – Overview

DWR is required to provide assistance, characterize groundwater basins, and update California's Groundwater (Bulletin 118).

SGMA, Recharge, & GW Applications

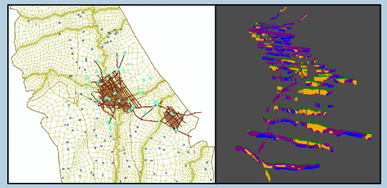
- Primary Aquifers
- Extent of Clays
- Recharge Sites
- Interconnected Surface Water (ISW)
- Subsidence Potential
- Base of Fresh Water
- Vulnerable Domestic Wells
- Salinity Mapping

Community of Practice

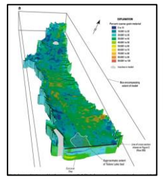
- Local, State, & Federal Agencies
- NGOs, Academia, & Private Sector
- Basin Characterization Workgroup

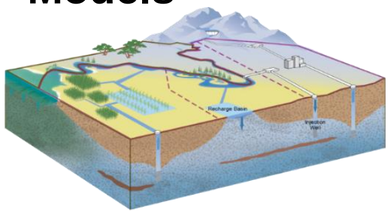
Collect & Compile Data

Integrated Analysis of All Subsurface Data

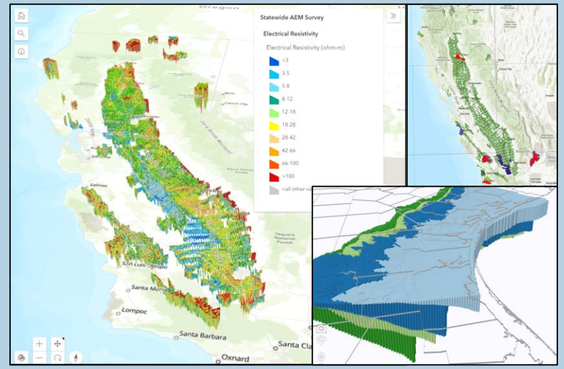


Stewarded Texture & Hydrogeologic Conceptual Models



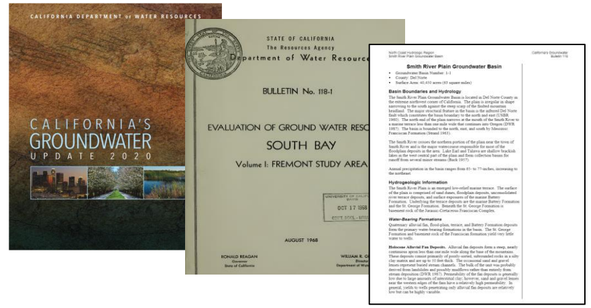


Data Access & Visualization



Data Archive

California's Groundwater



CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Basin Characterization Program – Data Collection & Pilot Studies

Explore methods and techniques that address SGMA initiatives and create guidance for state and local groundwater managers.

SGMA Initiatives

- Groundwater Recharge
- ISW
- Subsidence
- Base of Fresh Water
- Seawater Intrusion
- Vulnerable Domestic Wells

Methods and Datasets

- Infill AEM
- t-TEM
- FloaTEM
- NMR-logs
- E-logs
- Cone Penetrometer
- Monitoring Wells
- Lithology logs
- Well re-activation
- Aquifer tests

Pilot Study 1: Groundwater Recharge

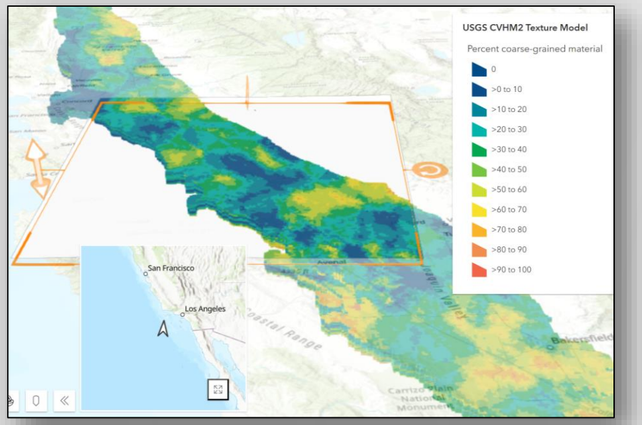
Pilot Study 2: ISW

Pilot Study 3: Domestic Wells/Subsidence

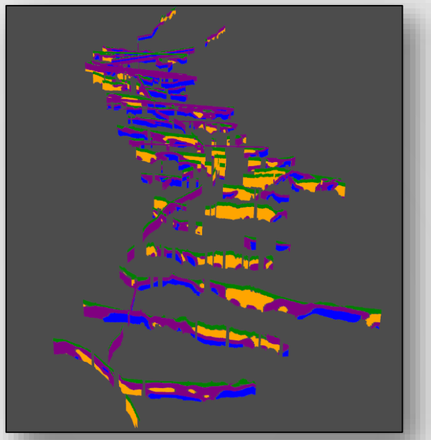
CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Basin Characterization Program – Applications

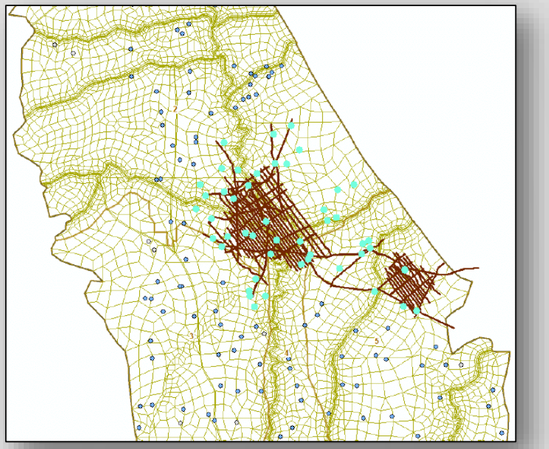
Texture Models



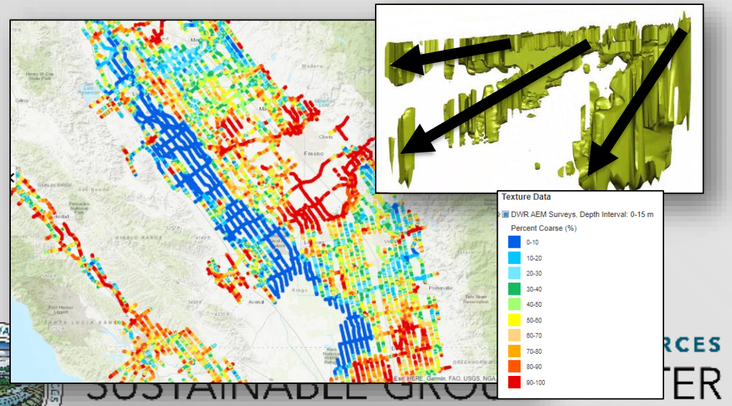
Hydrogeologic Conceptual Model



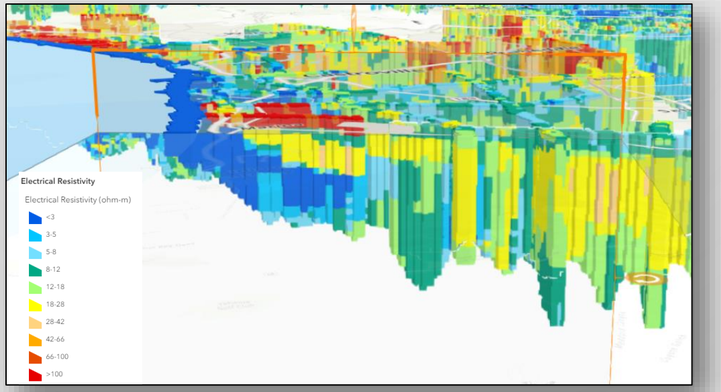
Groundwater Flow Model



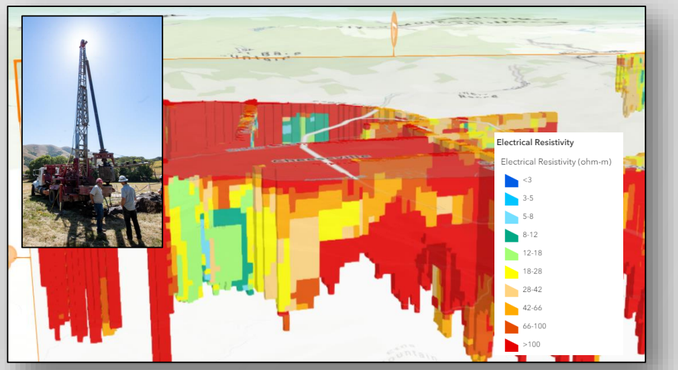
Recharge Areas & Pathways



High Salinity Zones



Site Wells



SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Basin Characterization Program – Timeline

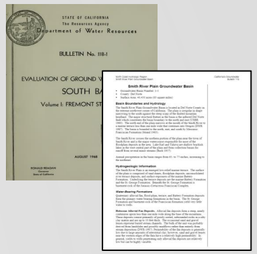
Continued Technical Engagement

Local Scale

Pilot study 3

Pilot study 2

Pilot study 1

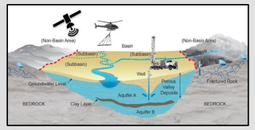


2024 2025 2026 2027

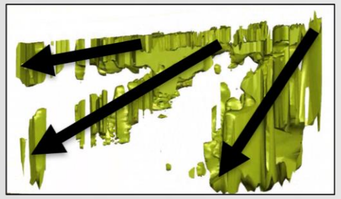
Statewide Scale

Statewide AEM Surveys

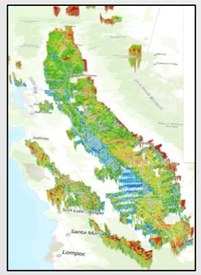
Program Kickoff



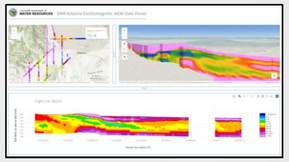
Recharge Suitability/ Aquifer Connectivity



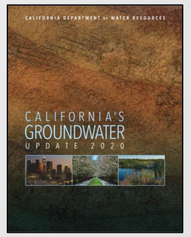
Central Valley Texture Model



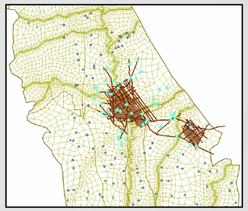
Advanced Data Viewer



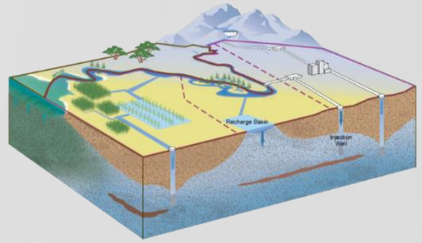
California's Groundwater



Analysis Tools



Central Valley Hydrogeologic Conceptual Model



Basin Characterization Workgroup

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Tentative Timeline & Activities - Subject to Change

Basin Characterization Program – Stay Connected

Basin Characterization Program Website:

https://water.ca.gov/Programs/Groundwater-Management/Bulletin-118/Basin-Characterization

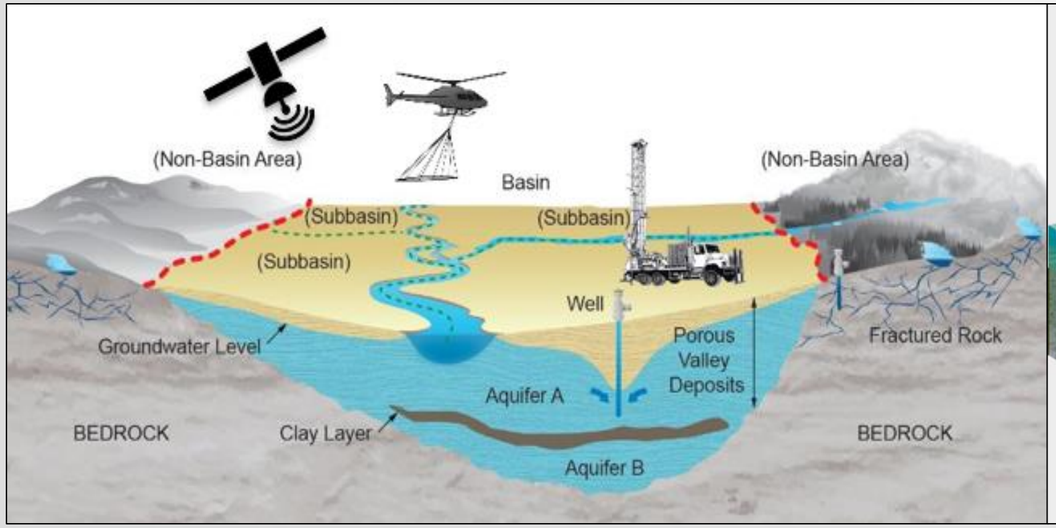
Statewide AEM Survey Project Website:

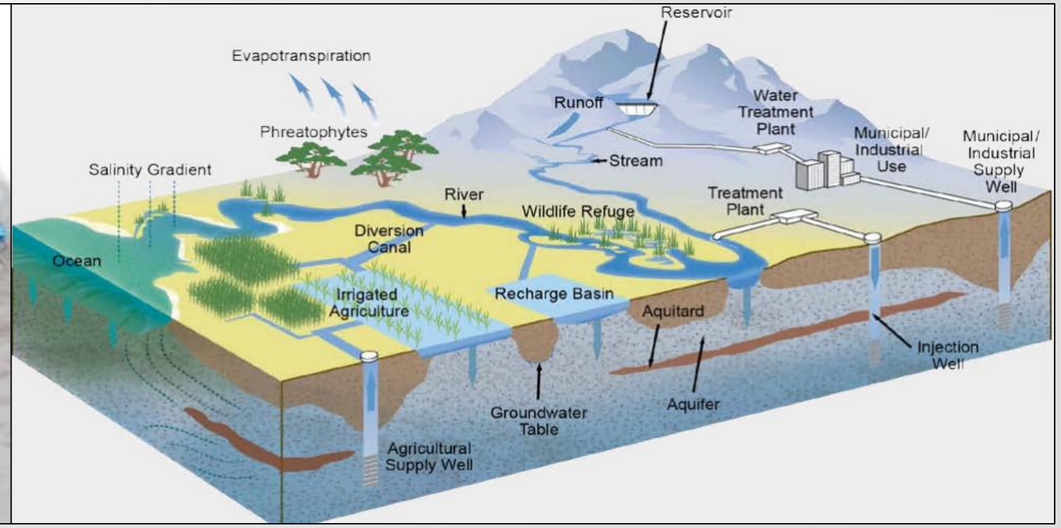
https://water.ca.gov/Programs/SGMA/AEM

California Natural Resources Agency Open Data Portal:

https://data.cnra.ca.gov/dataset/aem

Email: Basin.Characterization@water.ca.gov





CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Statewide Groundwater Monitoring

Tad Bedegrew

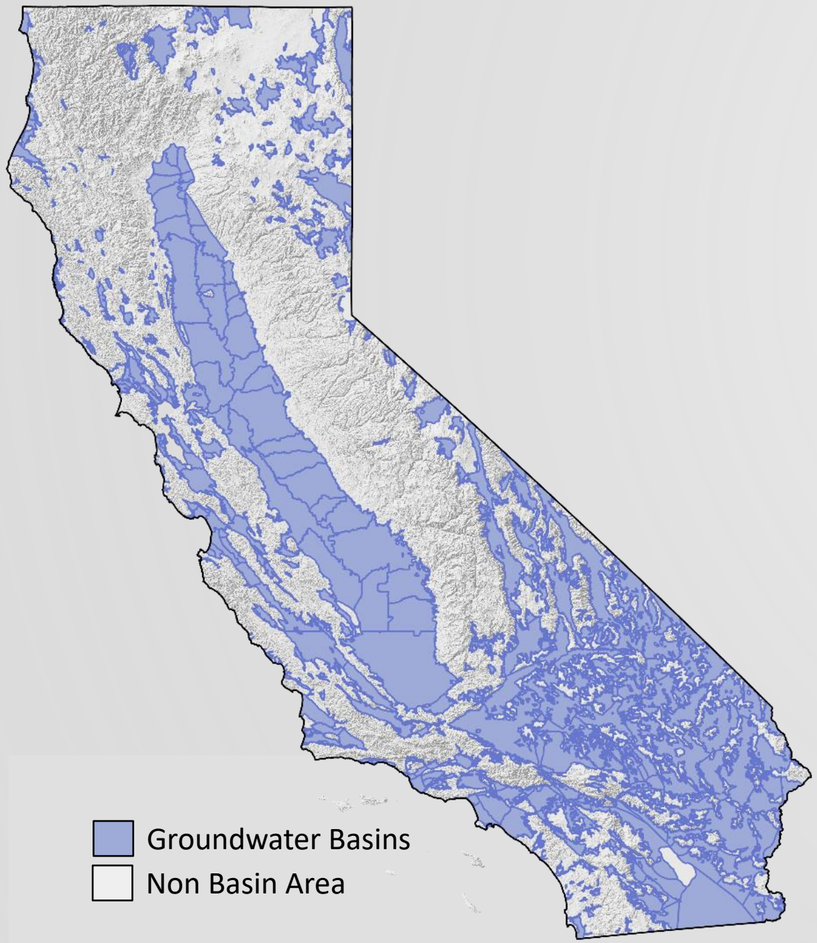
DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Statewide Groundwater Monitoring – Groundwater Landscape

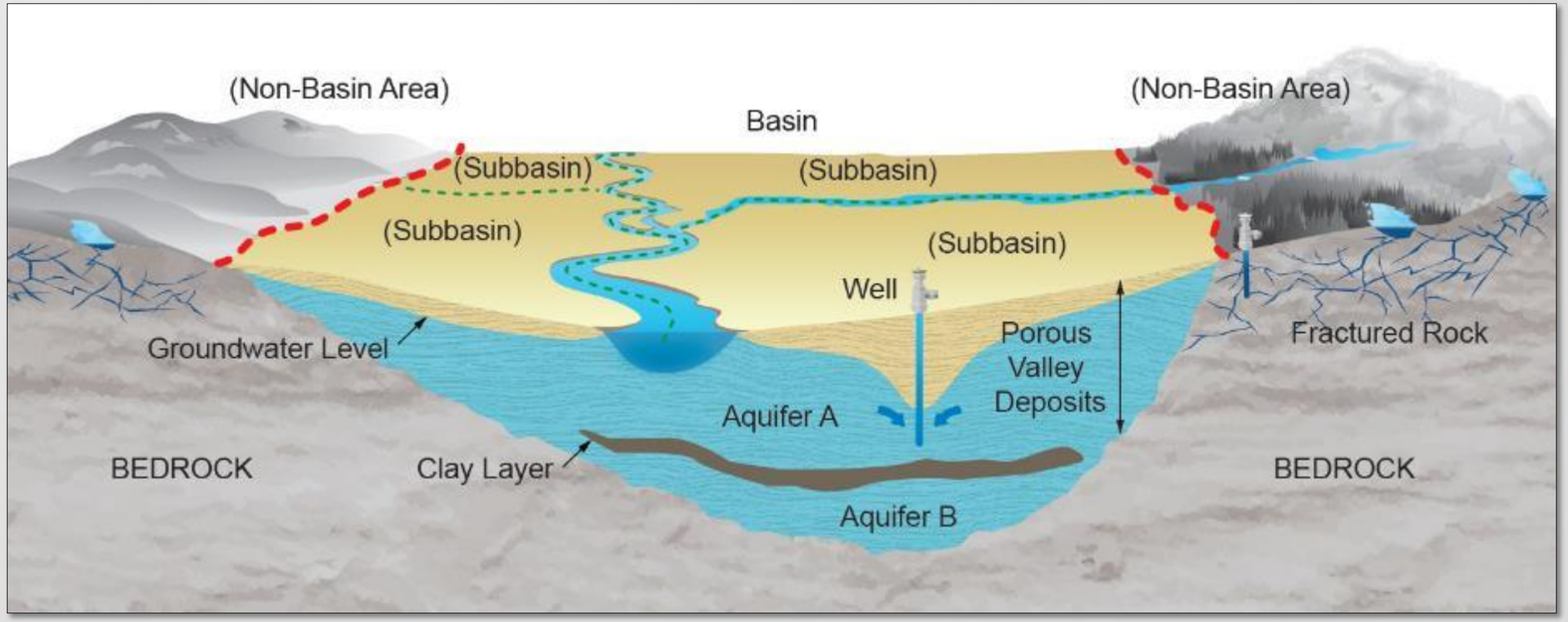
515 Groundwater Basins (40% of CA)

- GW Pumping: 20.5 MAF (94%)
- Population: 30.4 M (82%)
- Irrigated Acres: 7.5 M (97%)



Non Basin Areas (60% of CA)

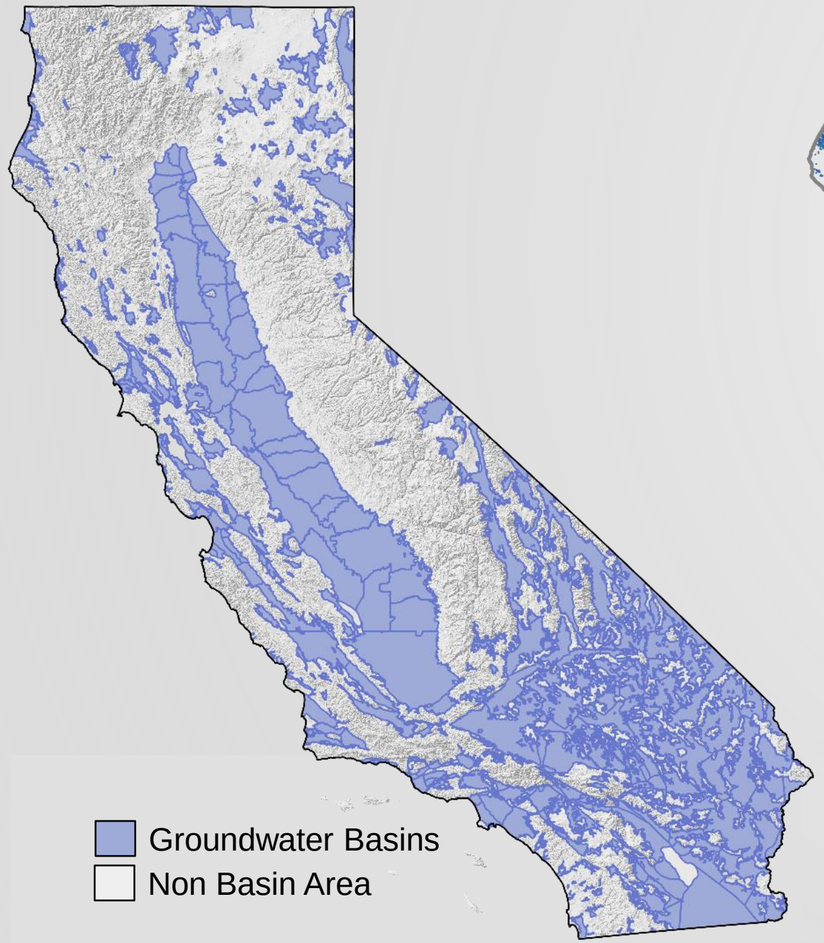
- GW Pumping: 1.3 MAF (6%)
- Population: 6.8 M (18%) – 60% of S/DAC
- Domestic Wells: (53%)

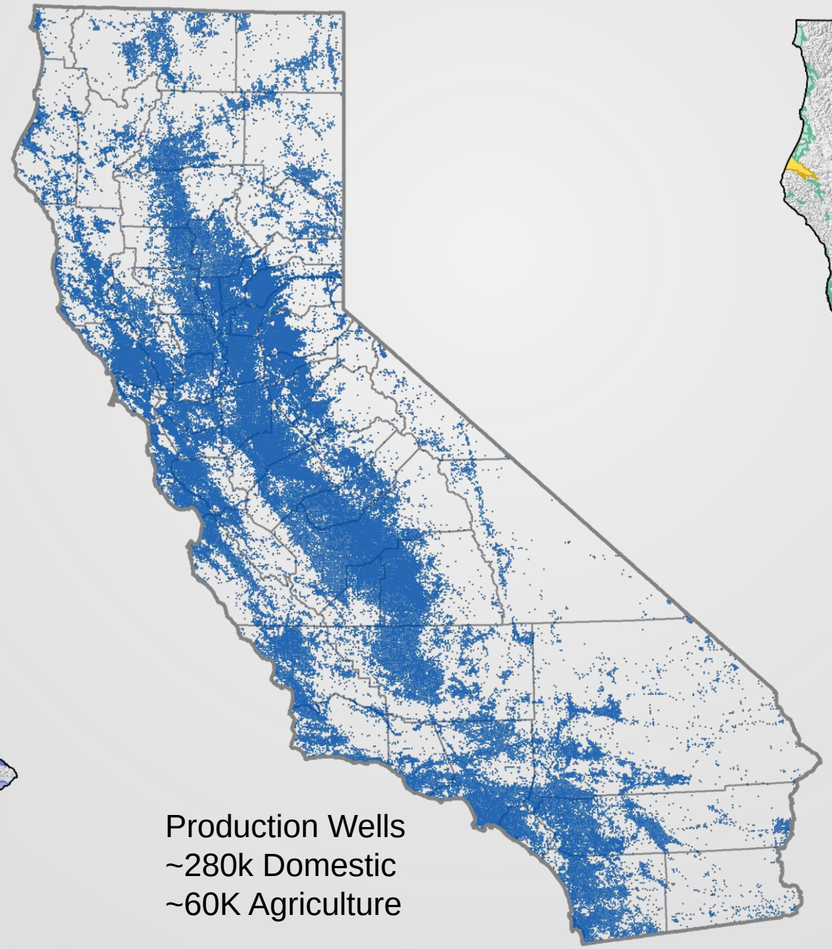


Statewide Groundwater Monitoring – Groundwater Landscape

515 Groundwater Basins (40% of CA)

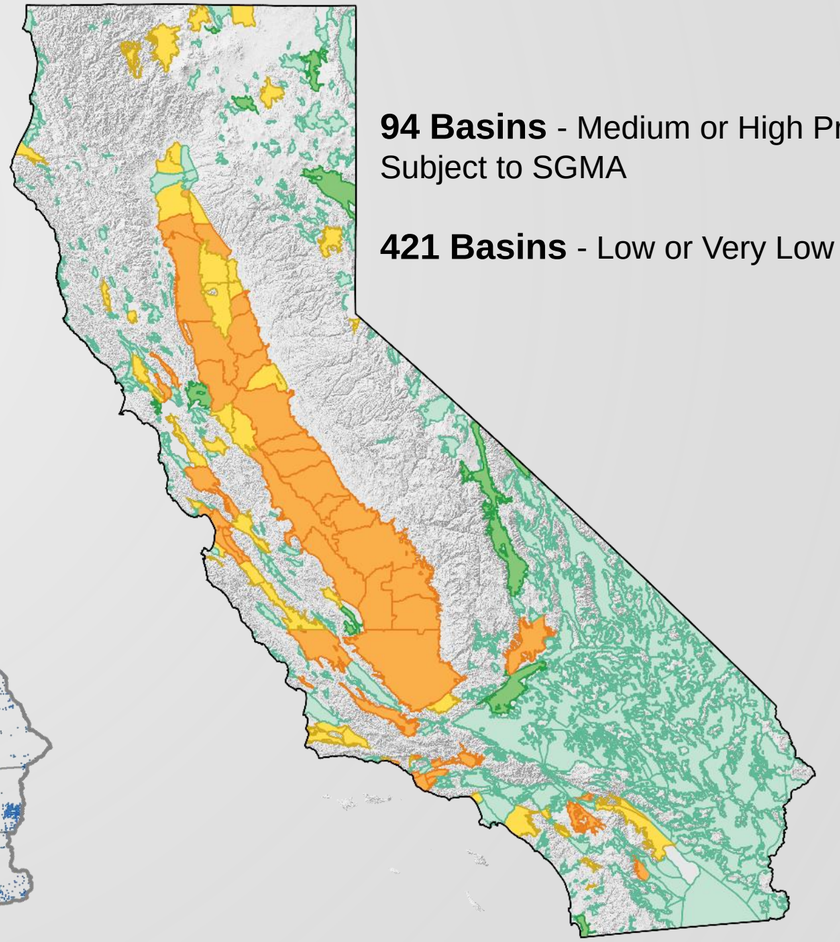
- GW Pumping: 20.5 MAF (94%)
- Population: 30.4 M (82%)
- Irrigated Acres: 7.5 M (97%)





Non Basin Areas (60% of CA)

- GW Pumping: 1.3 MAF (6%)
- Population: 6.8 M (18%) – 60% of S/DAC
- Domestic Wells: (53%)



94 Basins - Medium or High Priority
Subject to SGMA

421 Basins - Low or Very Low Priority

Statewide Groundwater Monitoring - Overview

DWR's Statewide Groundwater Monitoring

Maintain, Enhance, and Expand Groundwater Monitoring Networks - Statewide

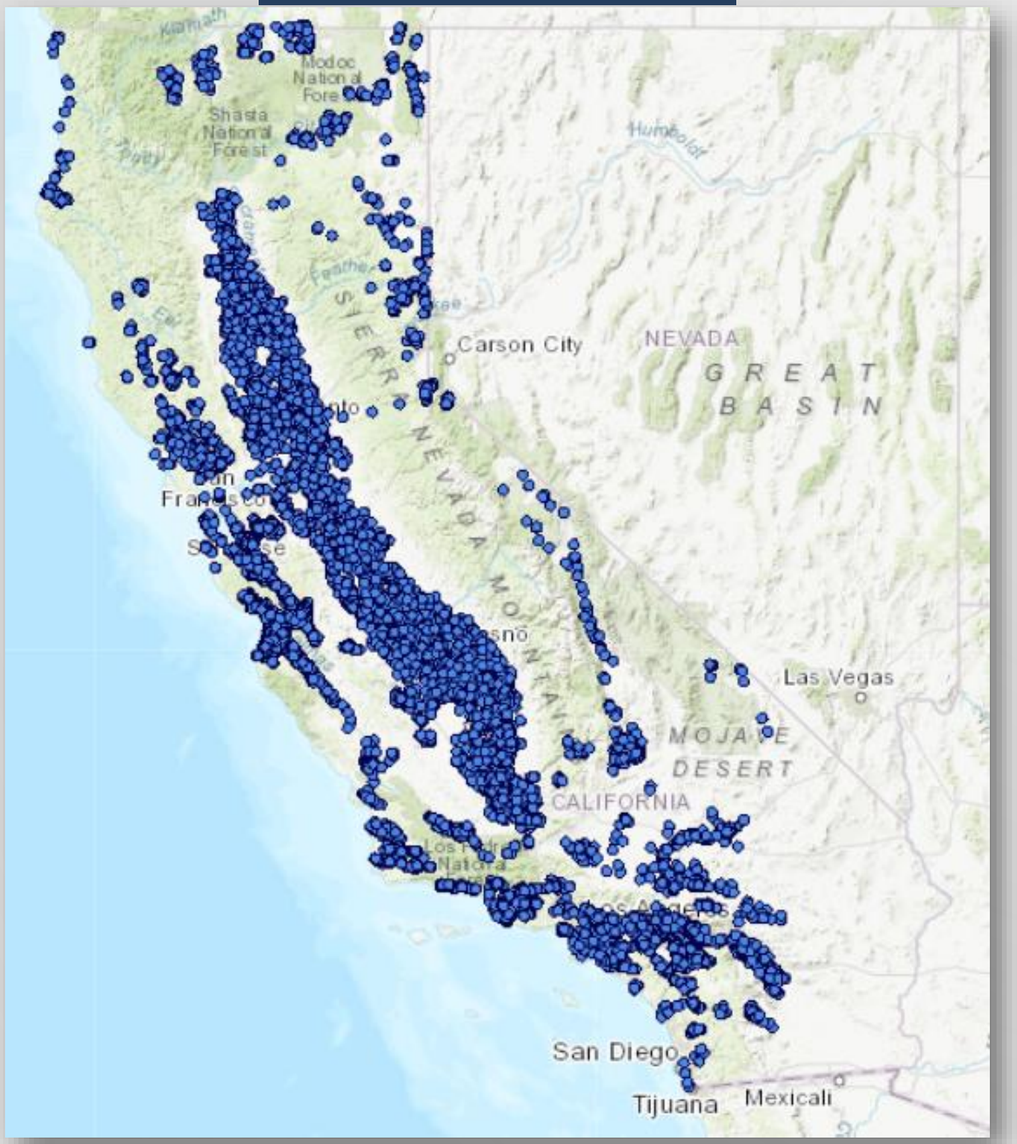
Groundwater Elevations

Land Subsidence

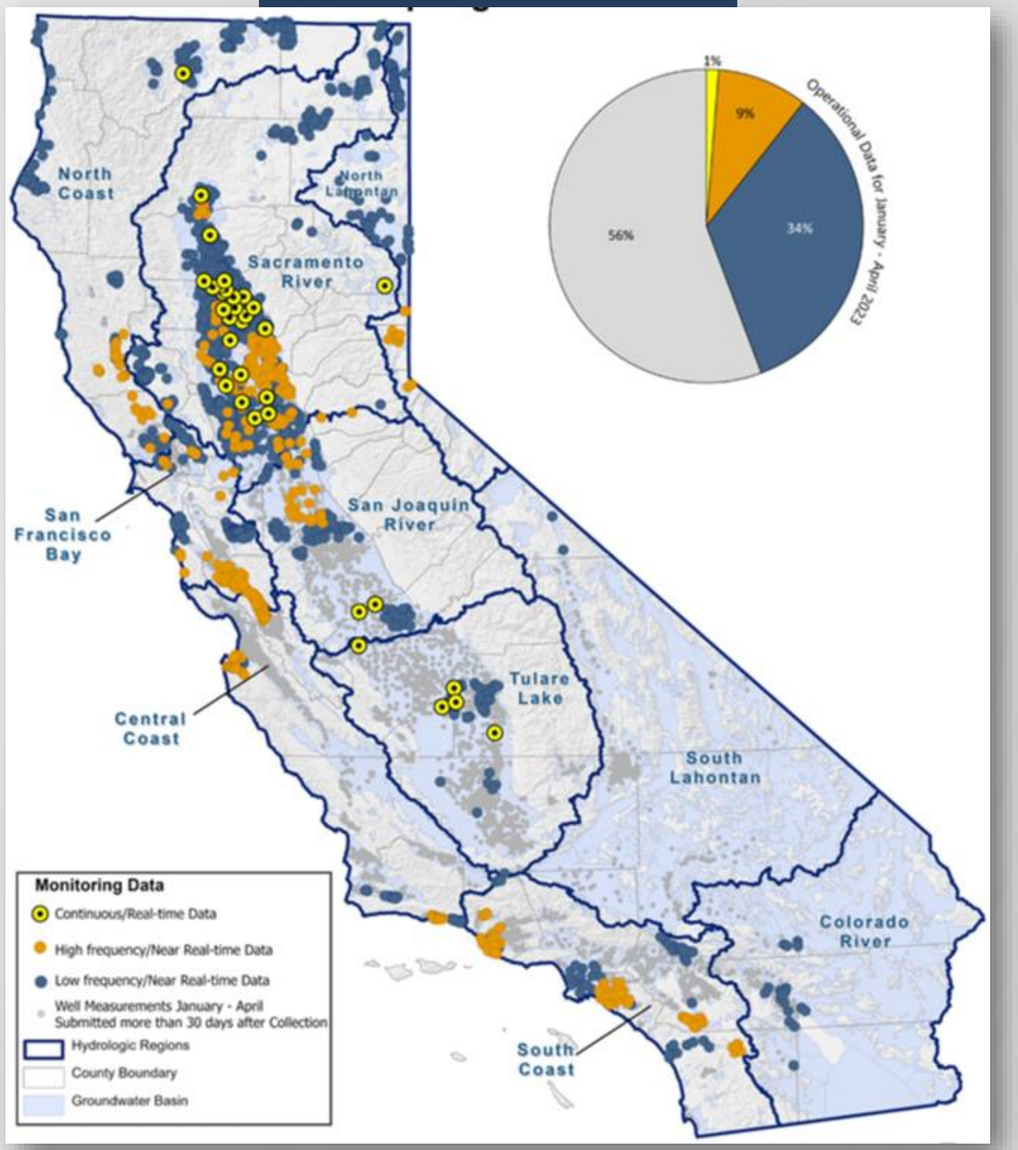
GW Quality and Other Sustainability Indicators

Statewide Groundwater Monitoring – Current GW Elevation Network

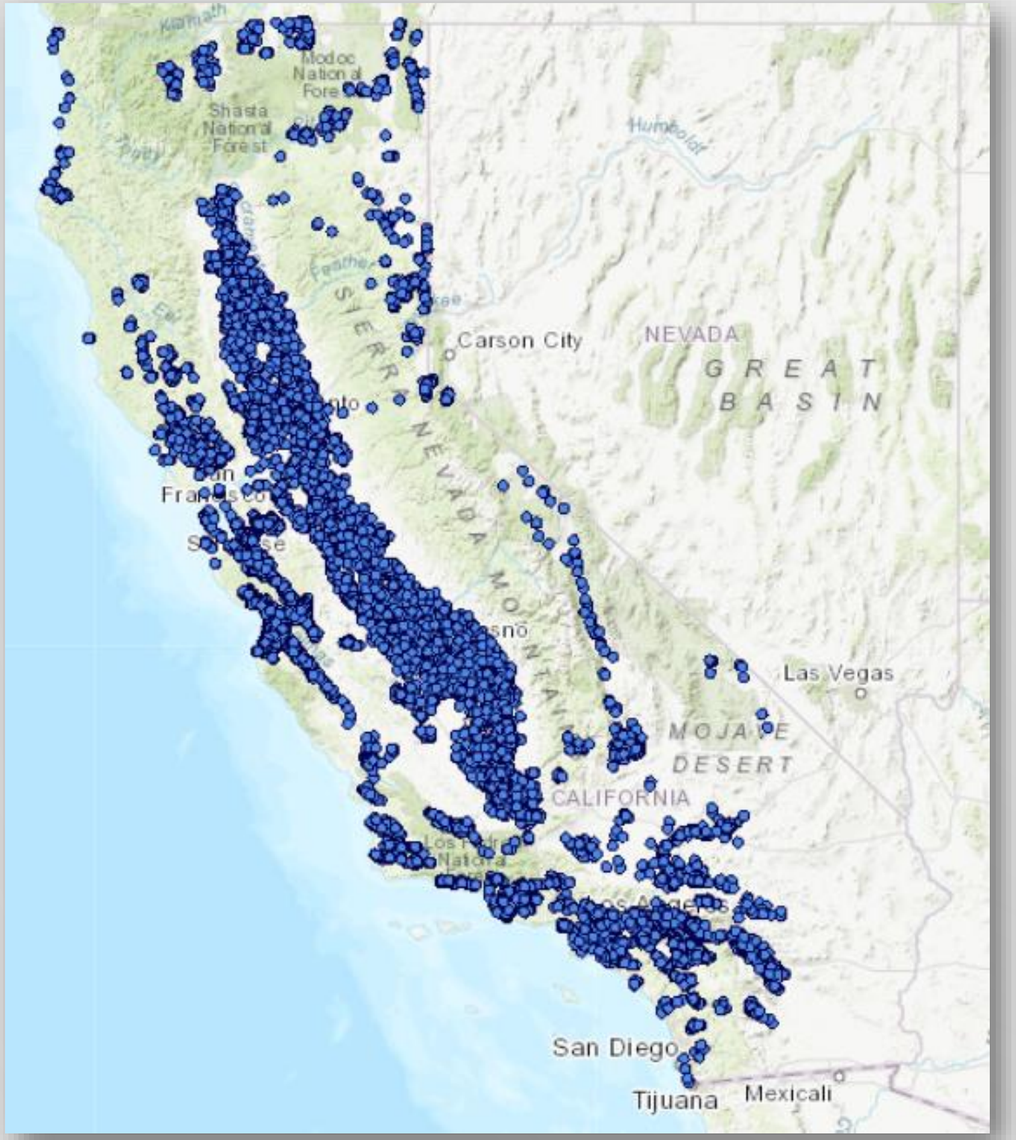
Current Density

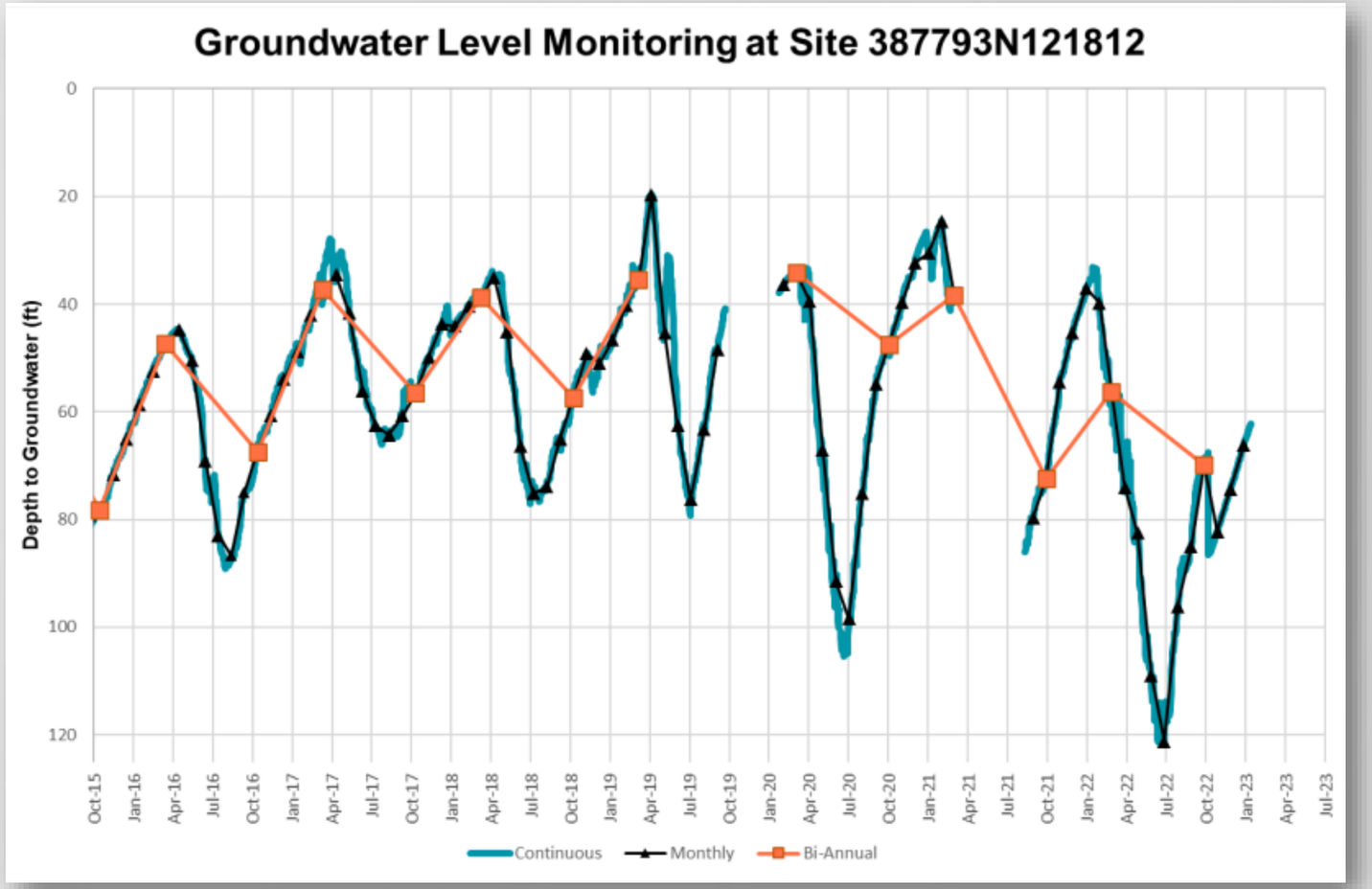


Current Frequency



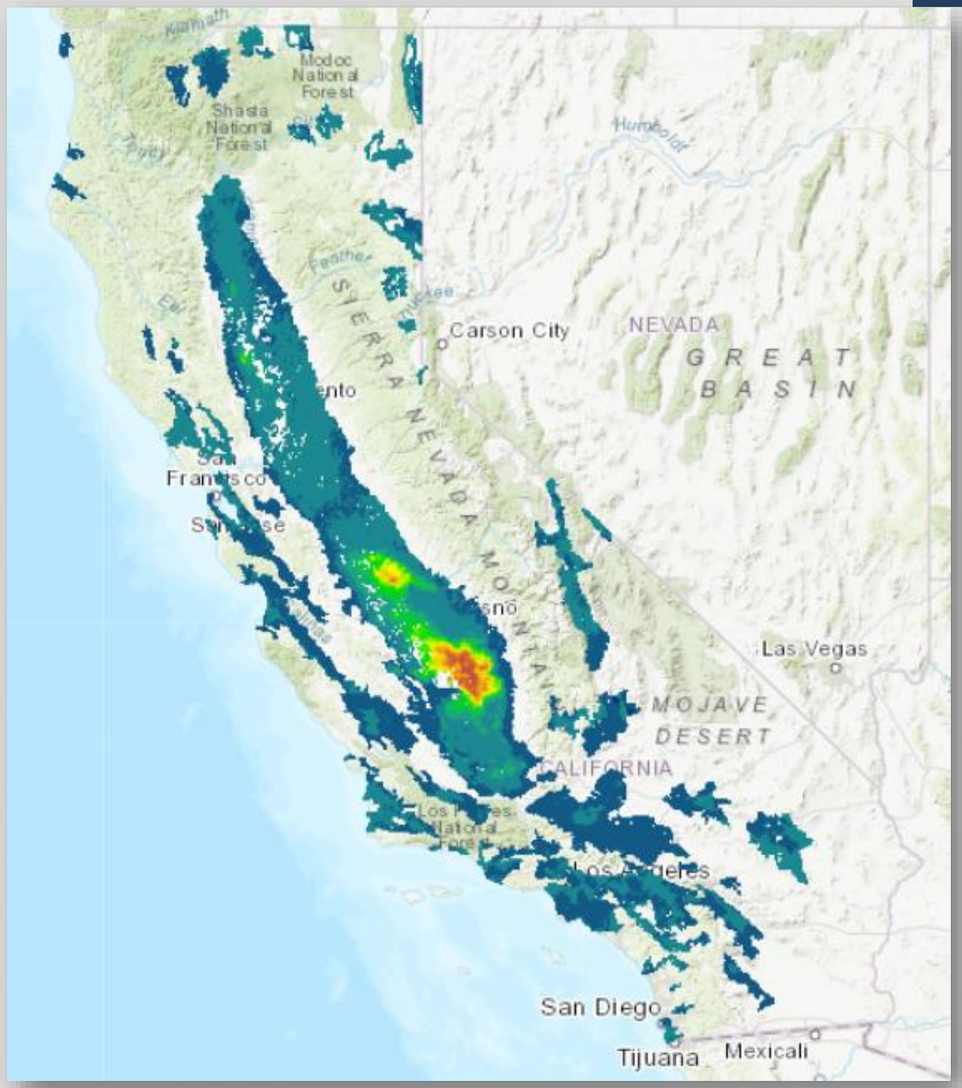
Statewide Groundwater Monitoring – Enhanced/Expanded Network

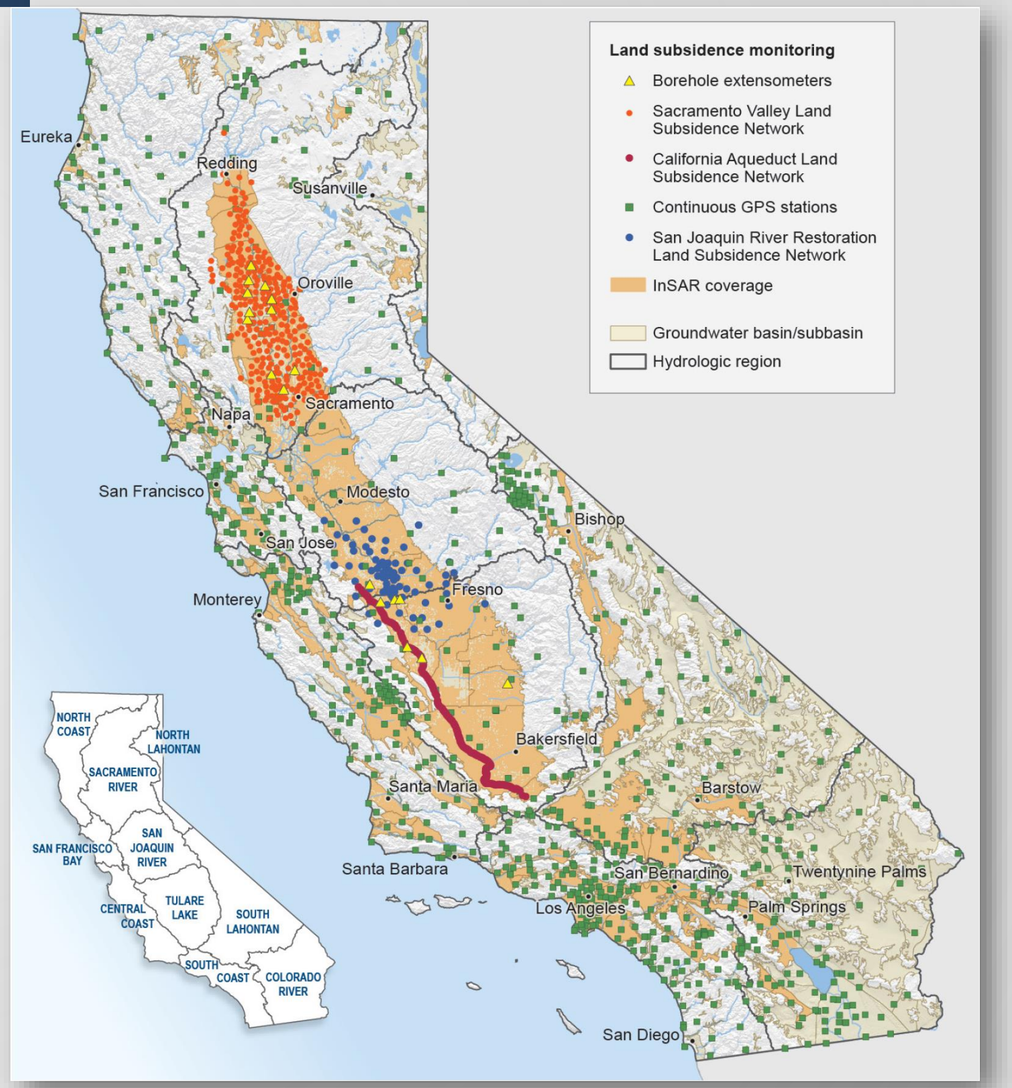




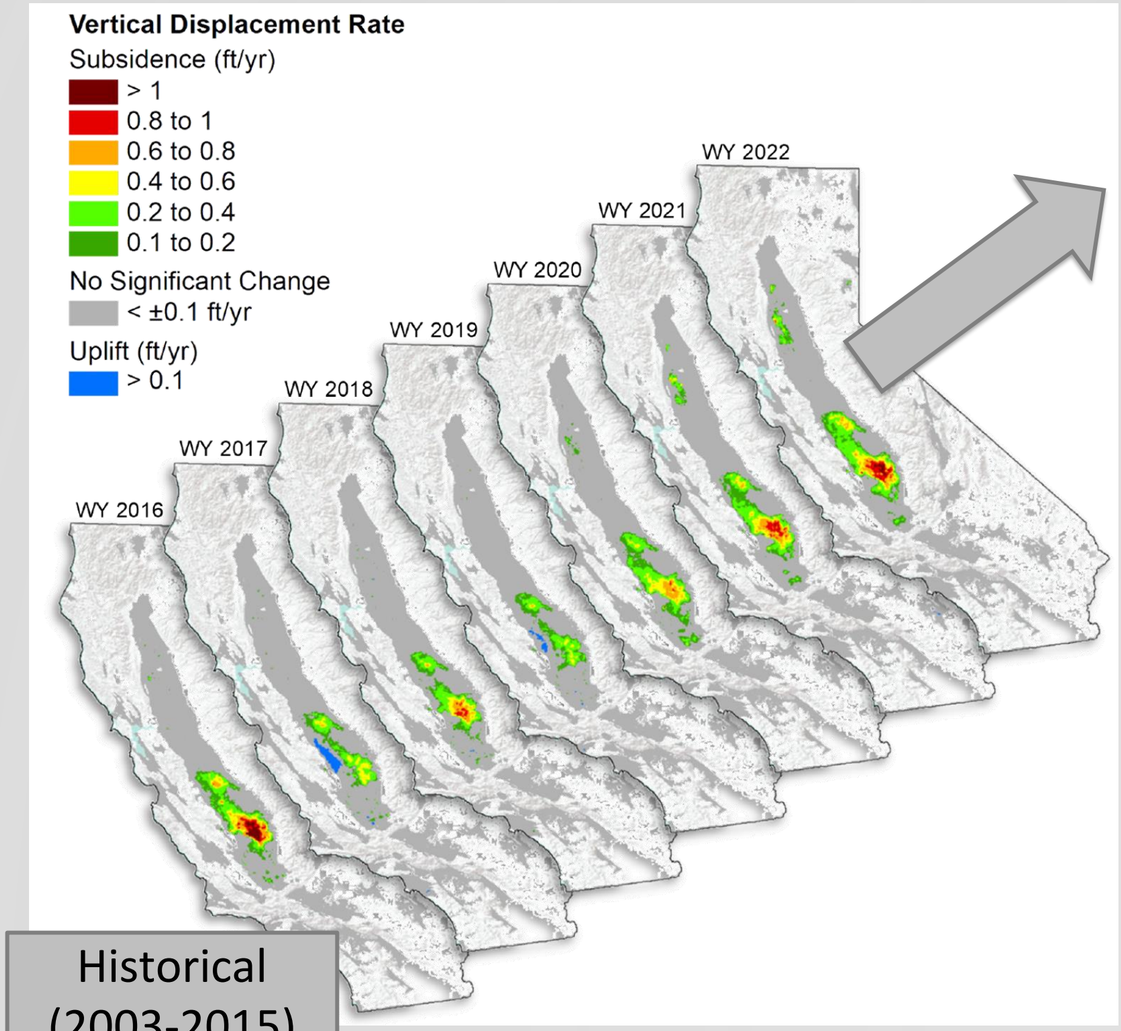
Statewide Groundwater Monitoring – Current Land Subsidence Network

Current Density

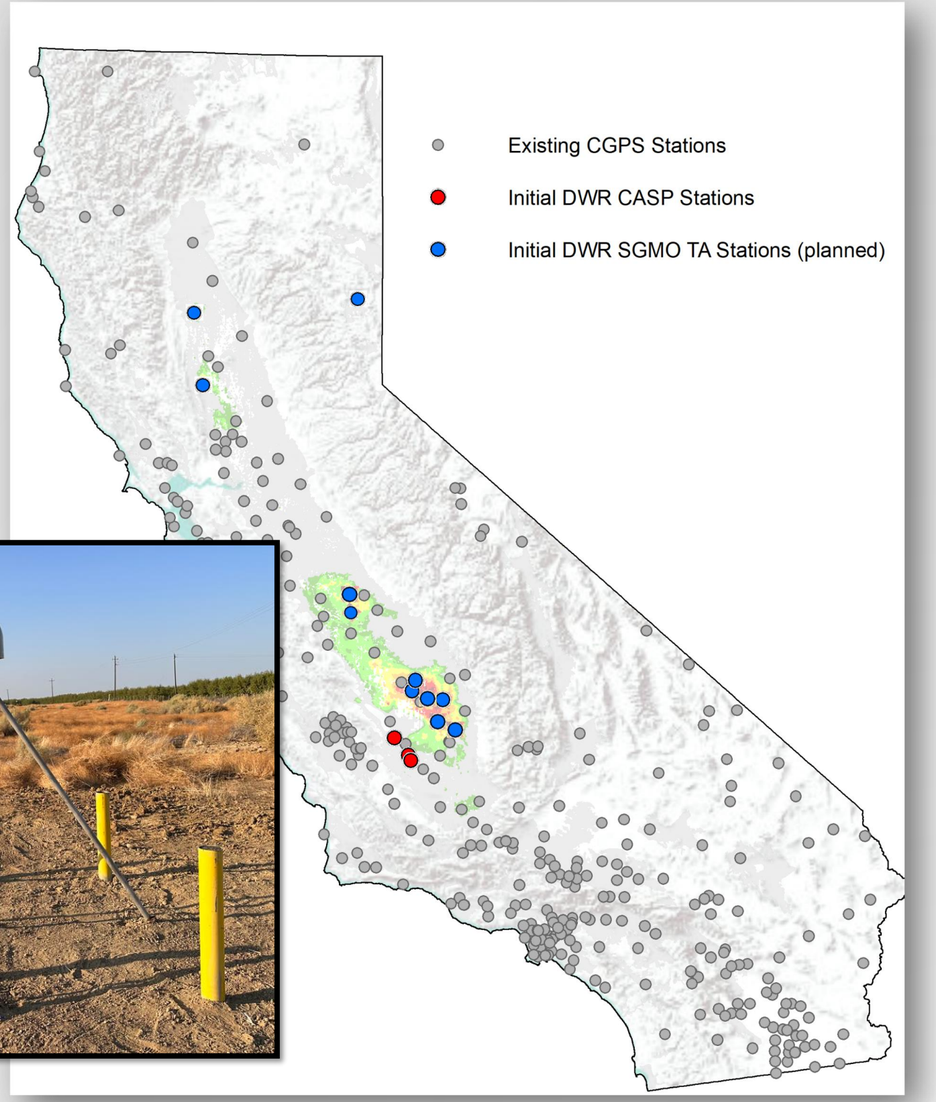




Statewide Groundwater Monitoring – Enhance/Expand Subsidence Network



Historical (2003-2015)



Statewide Groundwater Monitoring - Overview

DWR's Statewide Groundwater Monitoring

Maintain, Enhance, and Expand Groundwater Monitoring Networks - Statewide

Groundwater Elevations

Land Subsidence

GW Quality and Other Sustainability Indicators

Statewide Groundwater Monitoring – Resources

CASGEM Program Website:

https://water.ca.gov/programs/groundwater-management/groundwater-elevation-monitoring--casgem

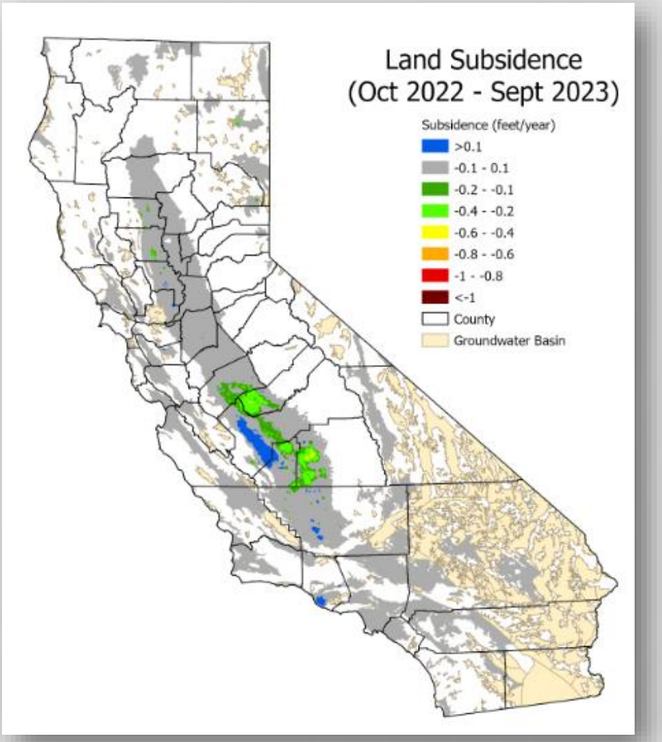
SGMA Data Viewer:

https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer#gwlevels

California Natural Resources Agency Open Data Portal for InSAR:

https://data.cnra.ca.gov/dataset/tre-altamira-insar-subsidence

Questions?: Tad.Bedegrew@water.ca.gov



Groundwater Modeling Tools

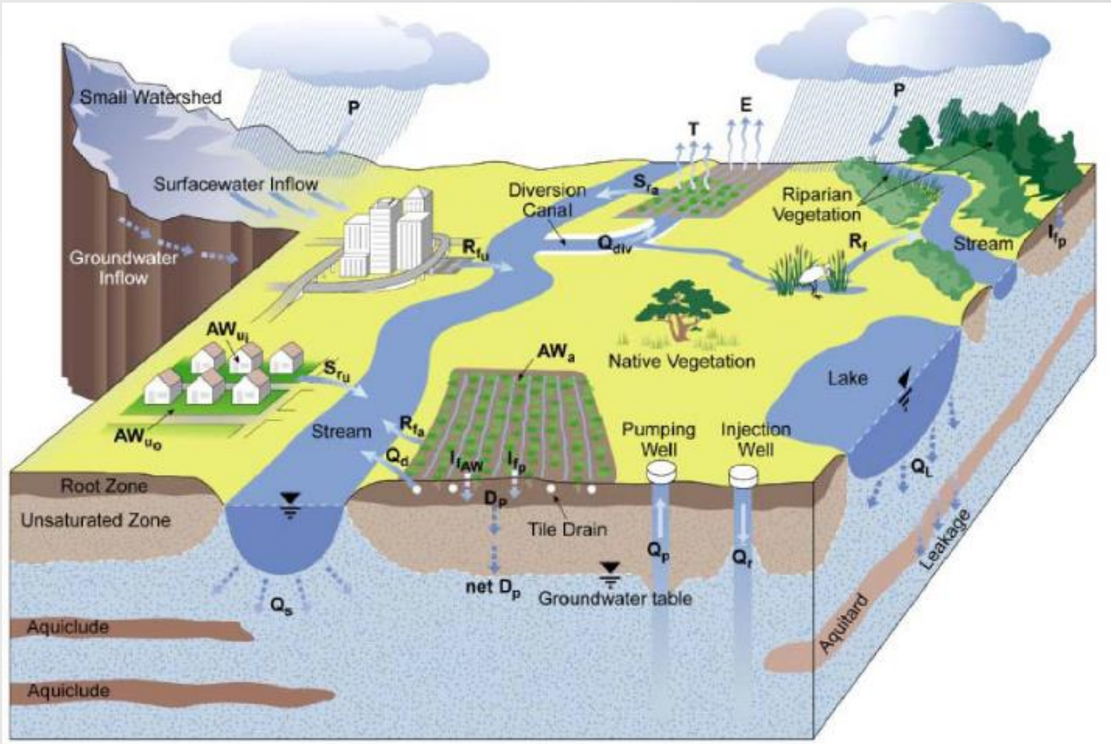
Craig Altare

DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

DWR Groundwater-Surface Water Model Codes

- Integrated Water Flow Model (**IWFM**)
- IWFM Demand Calculator (**IDC**)



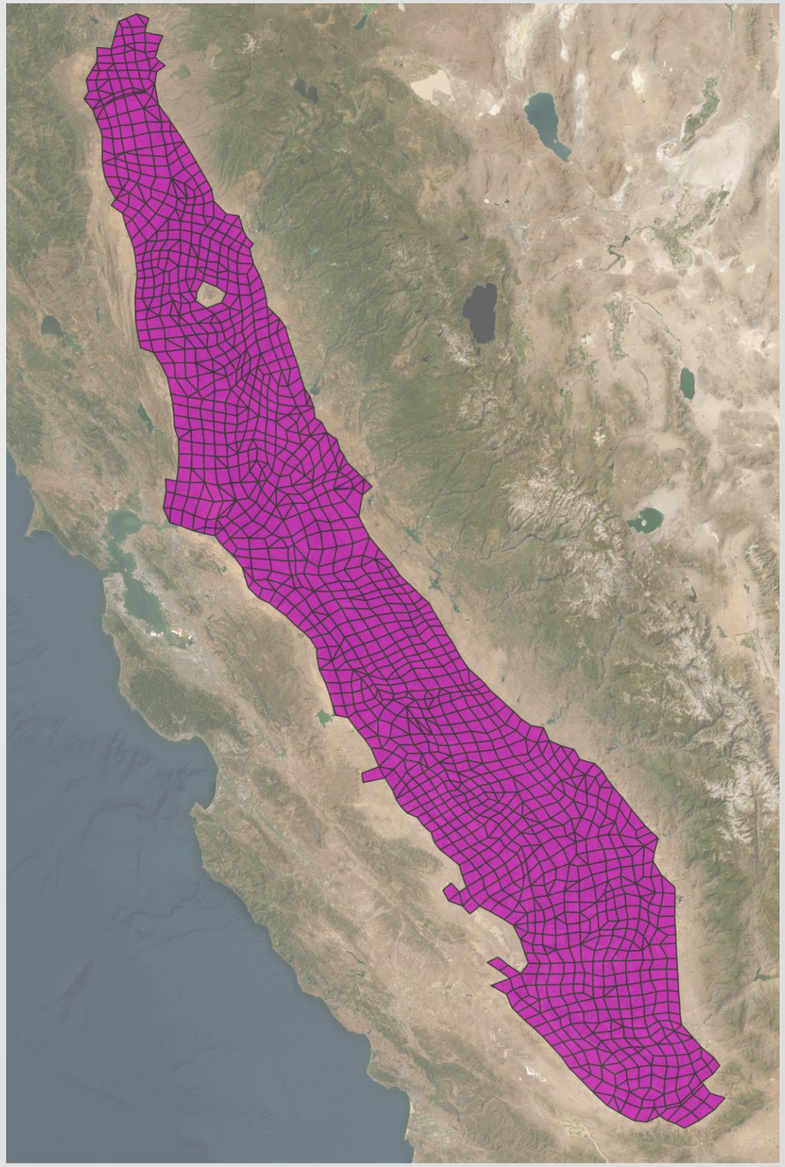
LEGEND

P	Precipitation	I_{fAW}	Infiltration of applied water	D_P	Deep percolation of water to the unsaturated zone
AW_a	Water applied to agricultural lands	Q_{div}	Surface water diversion	net D_p	Recharge to the groundwater aquifer
AW_{ui}	Water applied to indoor urban lands	S_{ra}	Agricultural runoff	Q_p	Pumping from groundwater aquifer
AW_{uo}	Water applied to outdoor urban lands	S_{ru}	Urban runoff	Q_r	Recharge to groundwater aquifer
E	Evaporation	R_f	Return flow	Q_s	Stream-groundwater interaction
T	Transpiration	R_{fa}	Agricultural return flow	Q_L	Lake-groundwater interaction
I_{fp}	Infiltration of precipitation	R_{fu}	Urban return flow	Q_d	Tile drainage flow

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

DWR Groundwater-Surface Water Model Applications

- California Central Valley Groundwater-Surface Water Simulation Model (C2VSim)
  - Coarse Grid



CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

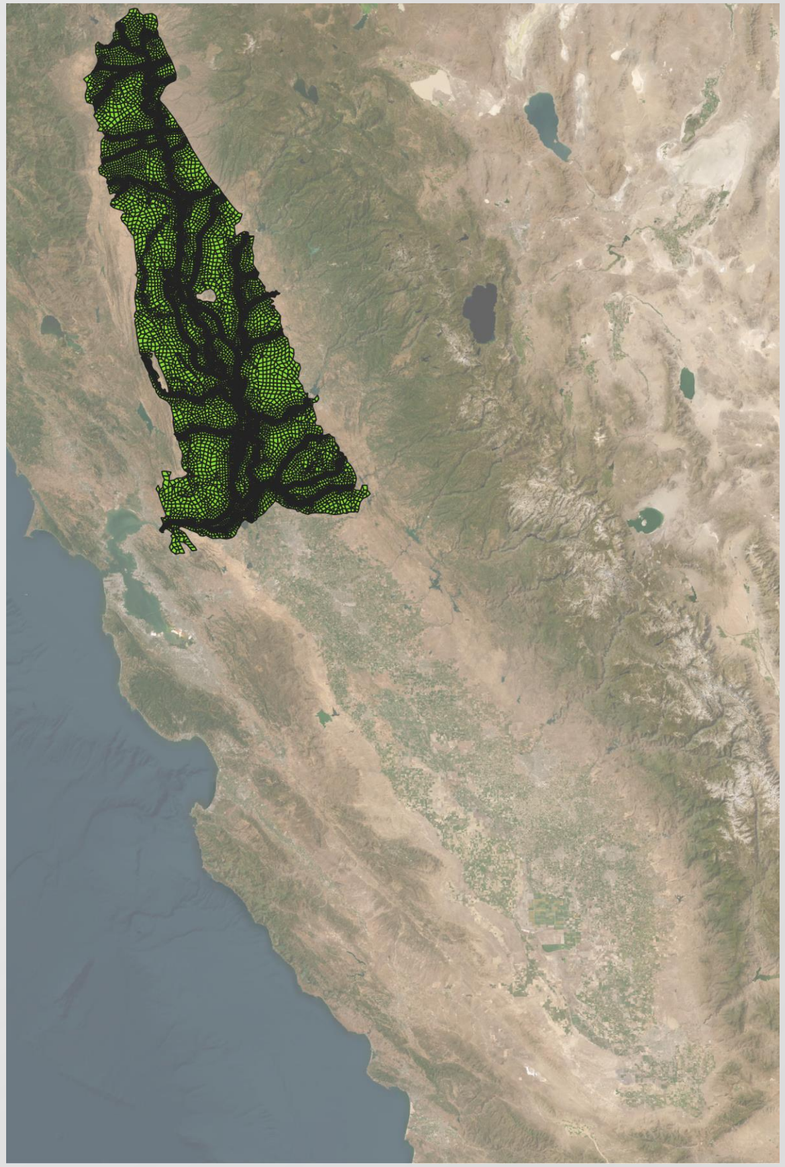
DWR Groundwater-Surface Water Model Applications

- California Central Valley Groundwater-Surface Water Simulation Model (C2VSim)
  - Coarse Grid
  - Fine Grid

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

DWR Groundwater-Surface Water Model Applications

- Sacramento Valley Groundwater-Surface Water Simulation Model (SVSim)



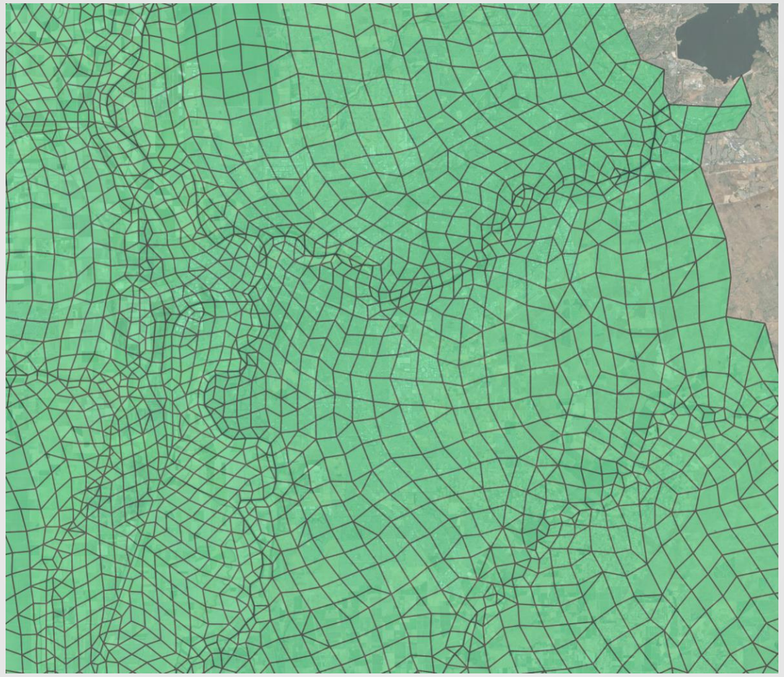
CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Resolution Comparison

C2VSim Coarse Grid

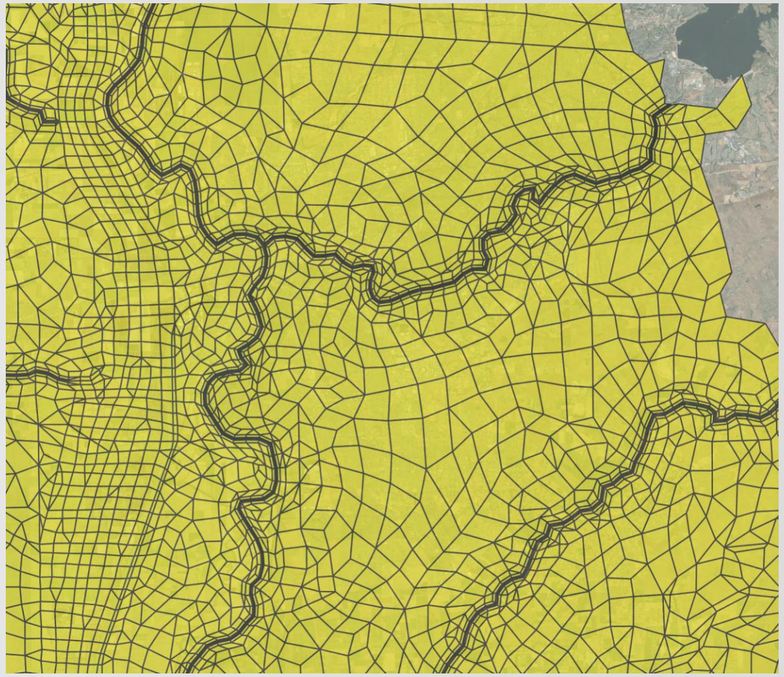
Average	9,190 acres
Min	1,366 acres
Max	21,379 acres
Count	1,392 (x 4 layers)

C2VSim Fine Grid



Average	407 acres
Min	4.0 acres
Max	1,771 acres
Count	32,537 (x 4 layers)

SVSim



Average	205 acres
Min	0.72 acres
Max	2,341 acres
Count	23,767 (x 9 layers)

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

C2VSim Fine Grid

- Current version (1.01) simulates Water Years 1974-2015
- Next version (1.5) as soon as Summer 2024
  - Updated to simulate through water year 2021
  - Limited calibration
- Future versions (2.0+) summer 2025 and beyond

C2VSim Fine Grid

Root Zone	Next Version (1.5)	Future Improvements
Simulation Period	Extended through Water Year 2021	Frequency of updates
Precipitation	Updated and bug fixes addressed	
Potential evapotranspiration (ET)	Updated for the entire model period in each subregion	Research use of new data (e.g., OpenET)
Soil parameters	Limited calibration to address known issues: high supply requirements, no groundwater uptake, groundwater above land surface	Further refine soil parameters with updated soil data and remotely sensed soil moisture estimates
Land Use	Updated land use data and added open water	Investigate new ways to estimate land use in gap areas/years (e.g., pesticide reports)
Urban Water Use	Updated estimates of population and per capita water use	

C2VSim Fine Grid

Surface Water	Next Version (1.5)	Future Improvements
Inflows	Updated based on USGS and CDEC; new scaling ratios for ungauged streams	Improve watershed delineation automation
Diversions/Bypasses	Updated based on CVP/SWP, eWRIMS, local model data, CalSim 3 historical data	Further refine diversion series using local data
Delivery Areas	Modified with local data; split by subbasins	Further refine delivery areas
Small Watersheds	New precipitation and ET data, limited calibration of parameters	
Stream Geometry	Fixed rating table discrepancies	
Flow/Stage Observations	Updated observation time series; new data at Cache Creek @ Rumsey, North Fork Honcut Creek	

C2VSim Fine Grid

Groundwater	Next Version (1.5)	Future Improvements
Specified Pumping	Added limited specified pumping from local data and models (water transfers, Kern)	Add more specified/measured pumping; Urban well production
Element Pumping	Remove some element pumping in Kern, Delta	Consider adding areas on known no-pumping conditions
Surface Water Bodies/Constrained Head Boundary Conditions	Updated reservoir storage data and stage-area rating: Thermalito Afterbay, Black Butte Lake, and Camanche Reservoir	Consider adding other water bodies within model domain
Observations	Updated and refined groundwater level (head) observations	Incorporate new GSP data; incorporate higher-order observations

C2VSim Fine Grid

Model Structure	Next Version (1.5)	Future Improvements
Grid Spacing and Layering		Considering enhancements to horizontal and vertical discretization to: • Better align with the latest understanding of the Central Valley conceptual model • Facilitate improved simulation of processes, including subsidence and depletion of interconnected surface water

DWR Groundwater Modeling Resources

Groundwater Modeling BMP: https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management/Best-Management-Practices-and-Guidance-Documents

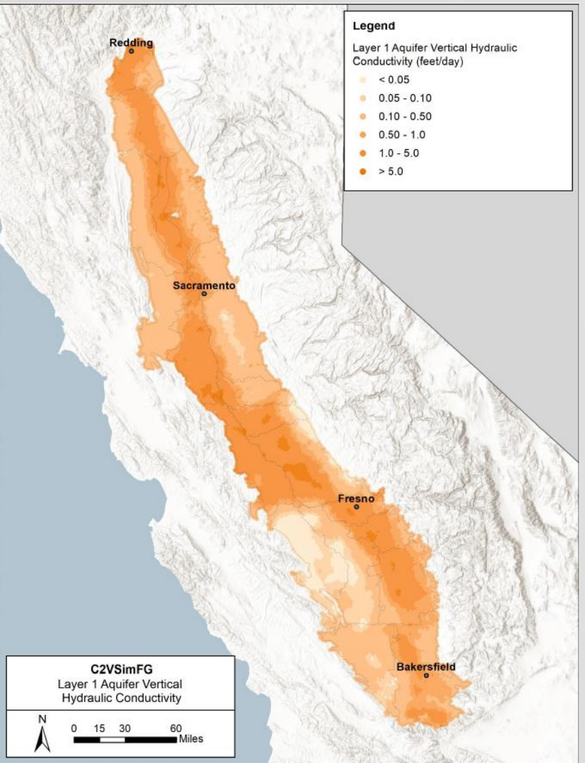
IWFM: https://data.cnra.ca.gov/dataset/iwfm-integrated-water-flow-model

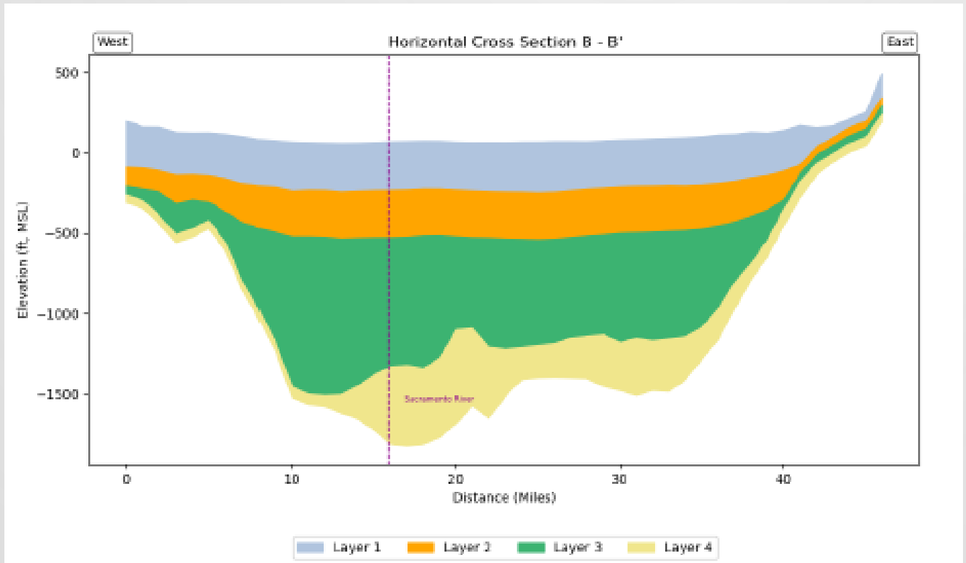
C2VSim Coarse Grid: https://data.cnra.ca.gov/dataset/c2vsimcg-v1-0

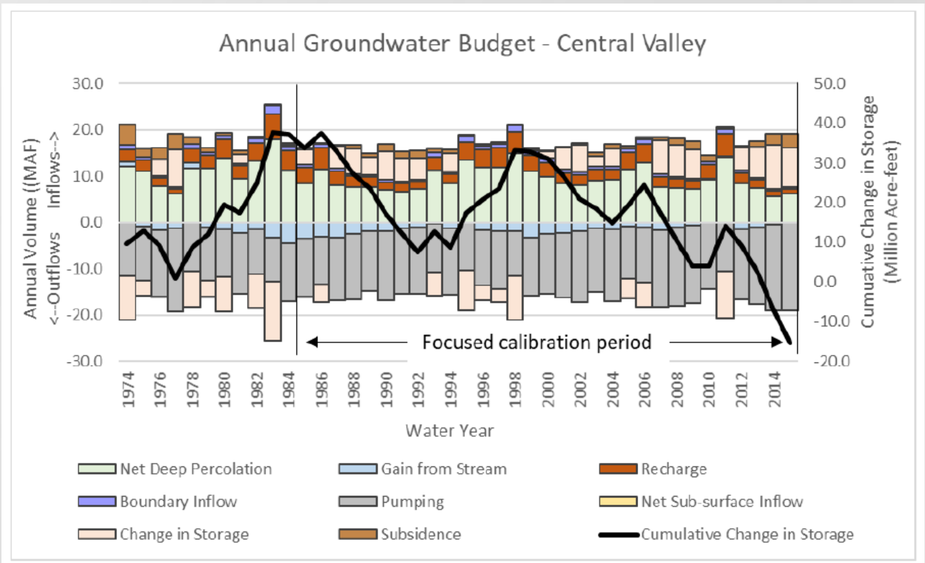
C2VSim Fine Grid: https://data.cnra.ca.gov/dataset/c2vsimfg

SVSim: https://data.cnra.ca.gov/dataset/svsim

Questions?: c2vsimtechsupport@water.ca.gov







Closing Remarks

Paul Gosselin

Deputy Director DWR, Sustainable Groundwater Management Office

CALIFORNIA DEPARTMENT OF WATER RESOURCES
SUSTAINABLE GROUNDWATER MANAGEMENT OFFICE

Looking Ahead

- **Well Permitting Observations & Analysis**
  Released Last Week
- **Funding Mechanisms Resources Report**
  Target: March 2024
- **Subsidence Best Management Practices**
  Target: Fall 2024
- **Depletion of Interconnected Surface Waters - Papers and Guidance Document**
  Target: Series of three Papers (Feb 2024 - Summer 2024) and Guidance (Fall 2024)
- **Groundwater Trading White Paper Follow-up (CWC, 2022)**

Spring 2024 GSA Forum

Thursday, May 23

Agenda and registration link will be shared once details are finalized

For questions or more information, email sgmps@water.ca.gov

10th Anniversary of SGMA Event – October 2024

THANK YOU