Sustainable Groundwater Management

In 2014, the State of California adopted historic legislation to help manage its groundwater, the Sustainable Groundwater Management Act (SGMA)

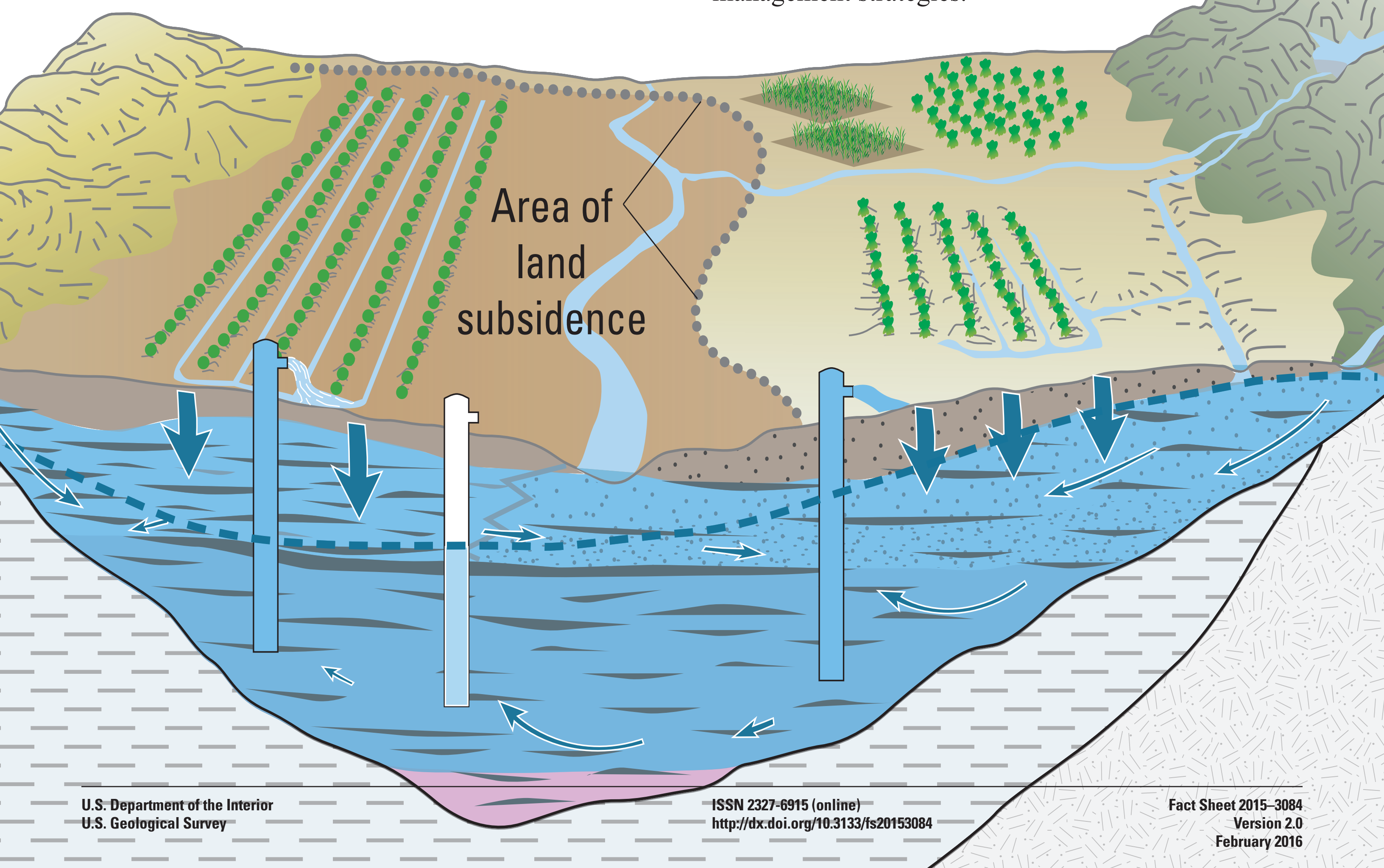
Overview

According to the act, local agencies must develop and implement groundwater-sustainability plans for managing and using groundwater without causing "undesirable results" related to the following:

- Groundwater-level declines.
- Groundwater-storage reductions.
- Seawater intrusion.
- Water-quality degradation.
- Land subsidence.
- Interconnected surface-water depletions.

Science for Sustainable Groundwater Planning and Management

The U.S. Geological Survey (USGS) uses data collection, modeling tools, and scientific analysis to help water managers plan for, and assess, hydrologic issues that can cause "undesirable results" associated with groundwater use. This information helps managers understand trends and investigate and predict effects of different groundwater-management strategies.



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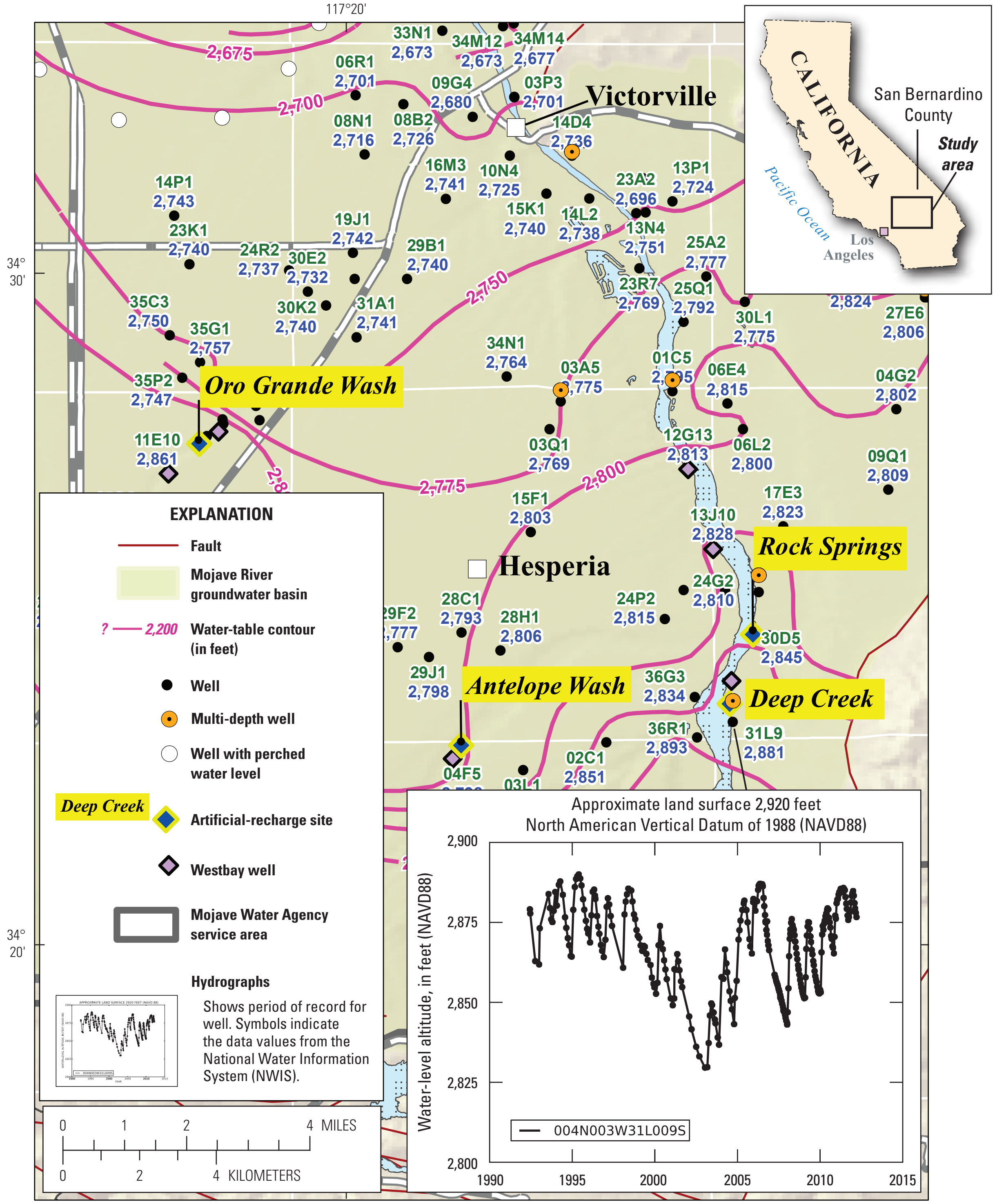
Groundwater Levels



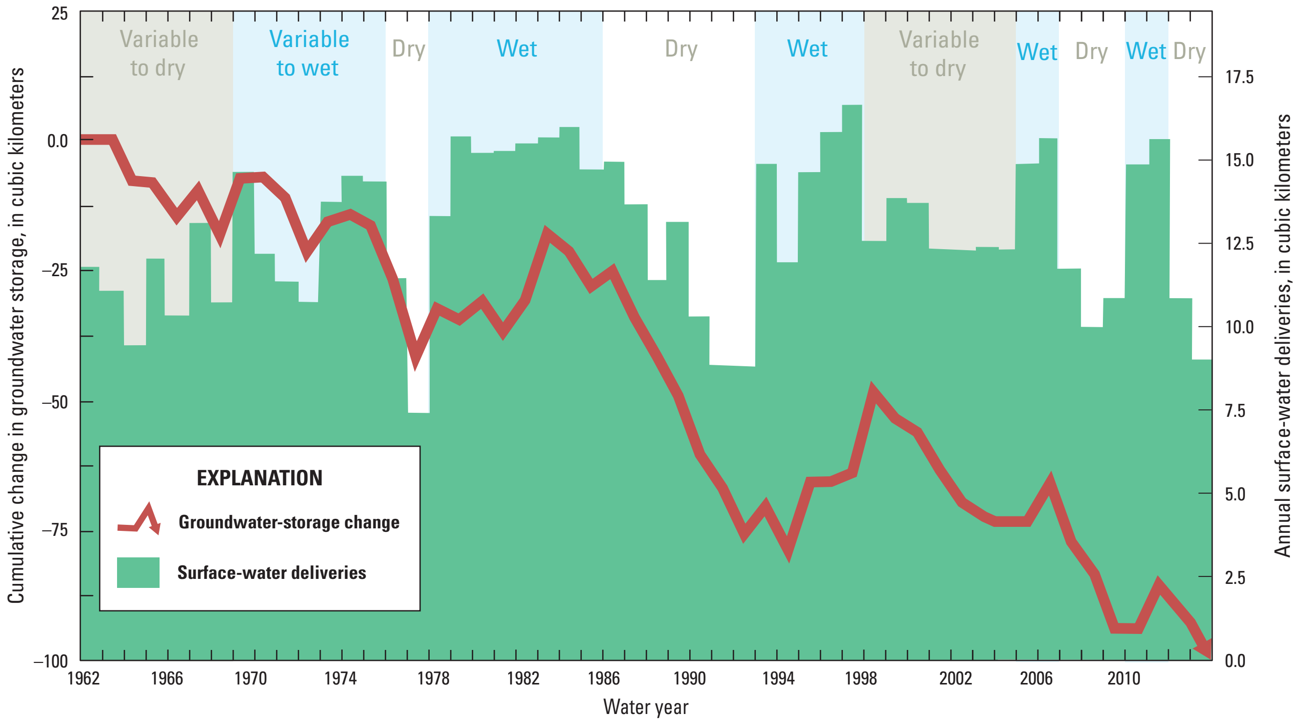
Measurements of water levels in wells are fundamental indicators of the status of groundwater. These measurements are critical to meaningful evaluations of the quantity and movement of groundwater.

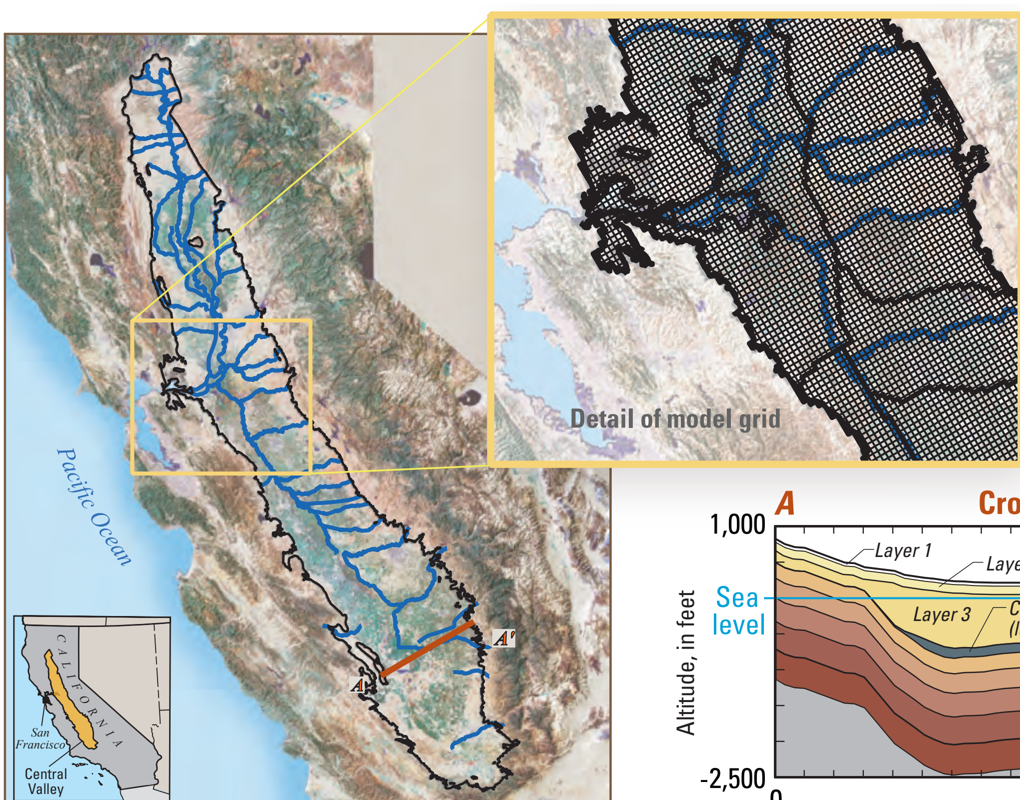
Since 1992, the USGS, in cooperation with the Mojave Water Agency, has maintained an extensive groundwater-monitoring network and has constructed a series of regional water-table maps in the Mojave River and Morongo groundwater basins. The data, hydrographs, and interactive maps are provided on this website: http://ca.water.usgs.gov/mojave/wl_studies/wlmap.html

Groundwater Storage

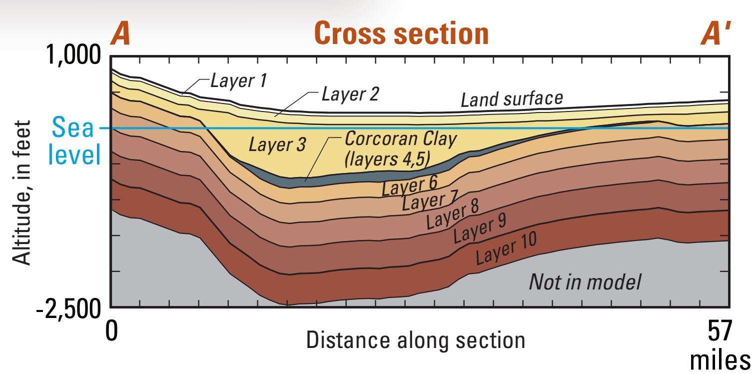
Changes in groundwater storage can be estimated by using direct measurements, such as measuring groundwater levels, and indirect measurements, such as remote sensing, coupled with modeling tools.

The Central Valley Hydrologic Model has been used to quantify the large decreases in groundwater storage in the Central Valley since 1962, http://ca.water.usgs.gov/projects/central-valley/central-valley-hydrologic-model.html

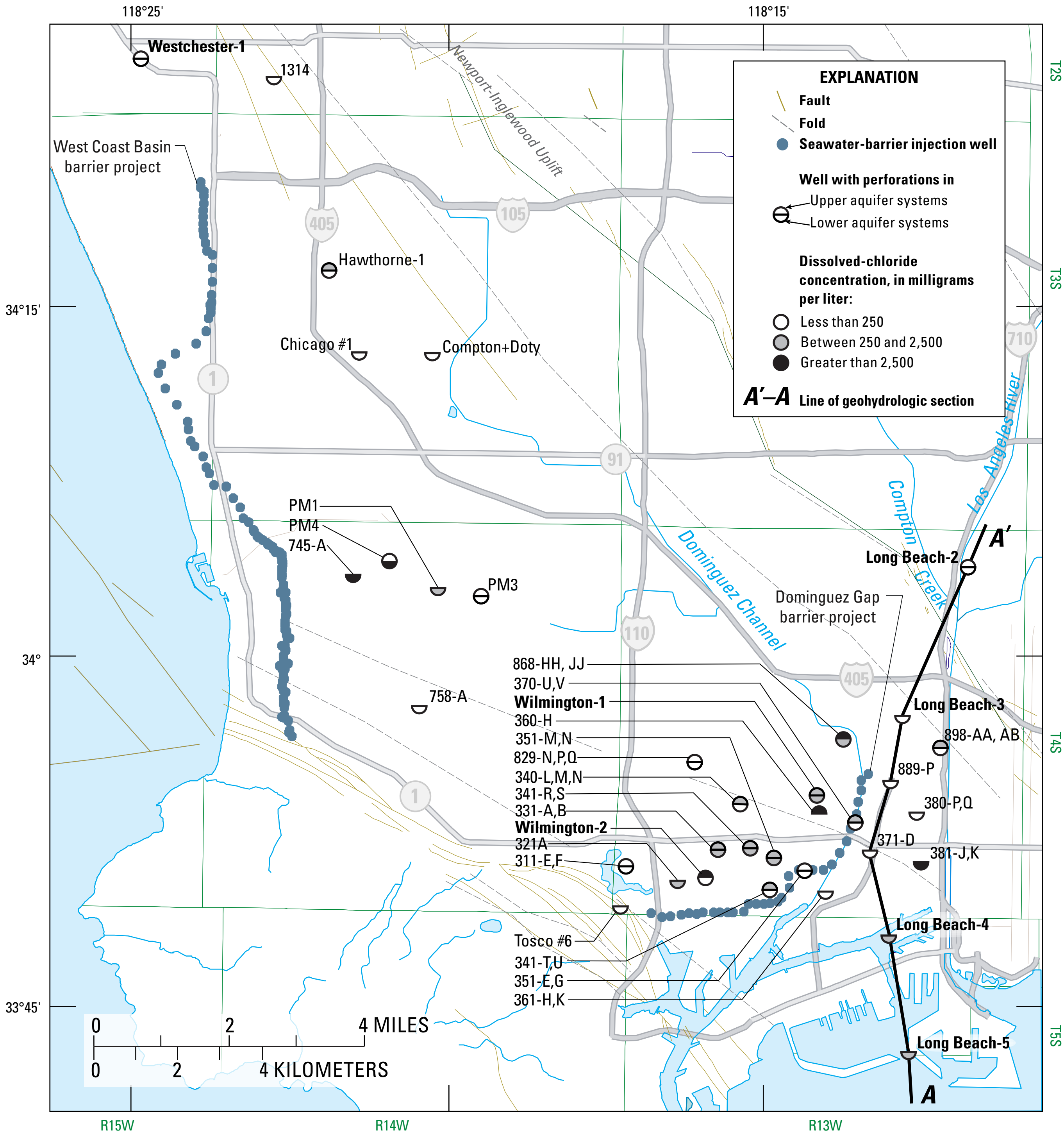




To have enough detail to be practical for water-management decisions, the aquifer was divided spatially into 20,000 model cells of 1-square mile each and vertically into 10 layers ranging in thickness from 50 to 750 feet.



Seawater Intrusion



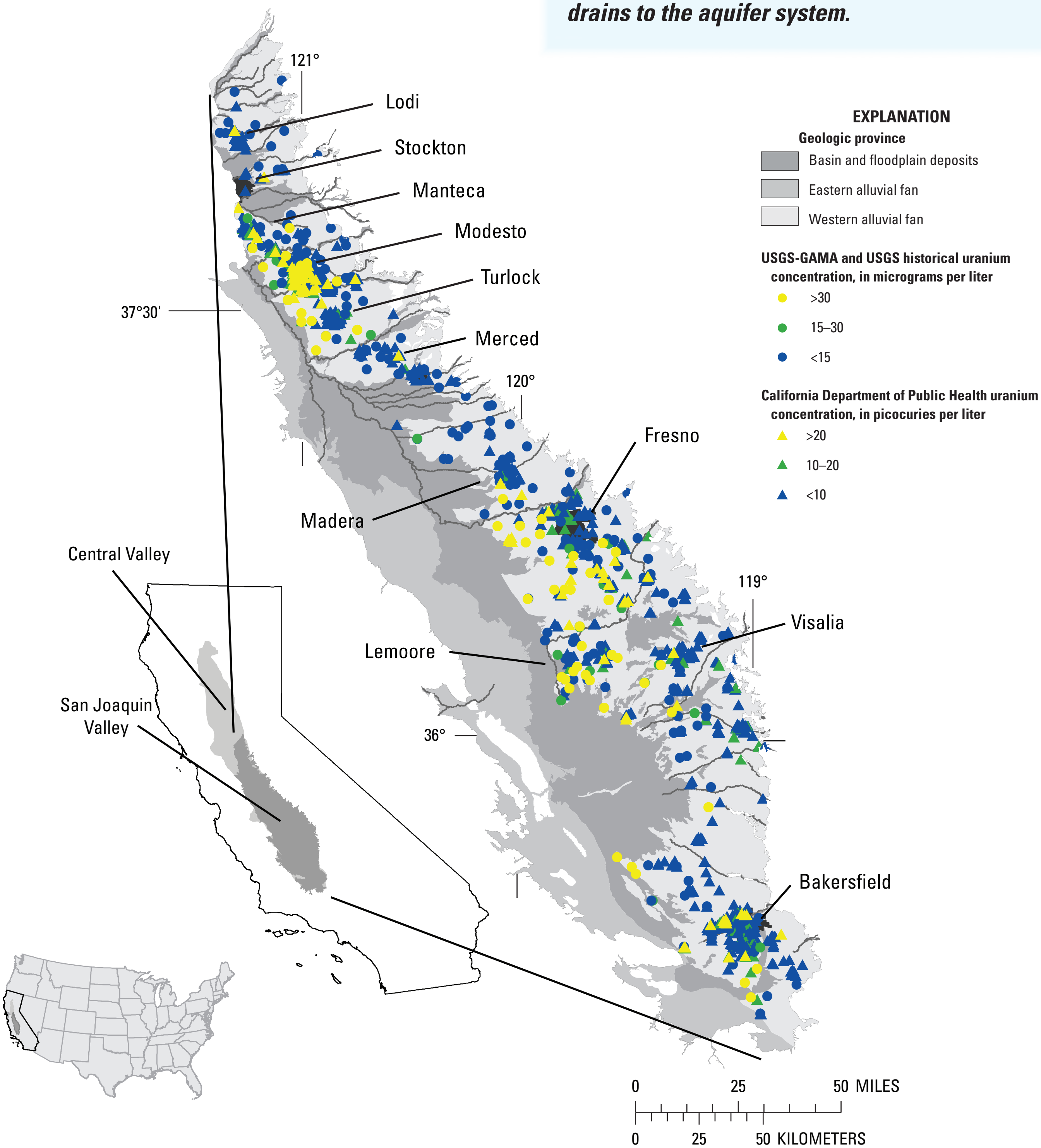
Seawater intrusion associated with lowering of groundwater levels is an important issue in many of California's coastal groundwater basins. Quantifying the rate and extent of seawater intrusion involves understanding the aquifer–ocean interconnection and distinguishing among multiple sources of saline water.

In the Los Angeles West Coast Basin, the USGS has done detailed analyses of chloride, as well as other constituents, to characterize the three-dimensional extent of seawater intrusion and the effectiveness of injection barrier operations, http://ca.water.usgs.gov/projects/projects00/ca512.html

Water Quality

Determining changes in groundwater quality over time involves systematic monitoring of constituents of concern, coupled with understanding of the dynamics of the groundwater-flow system.

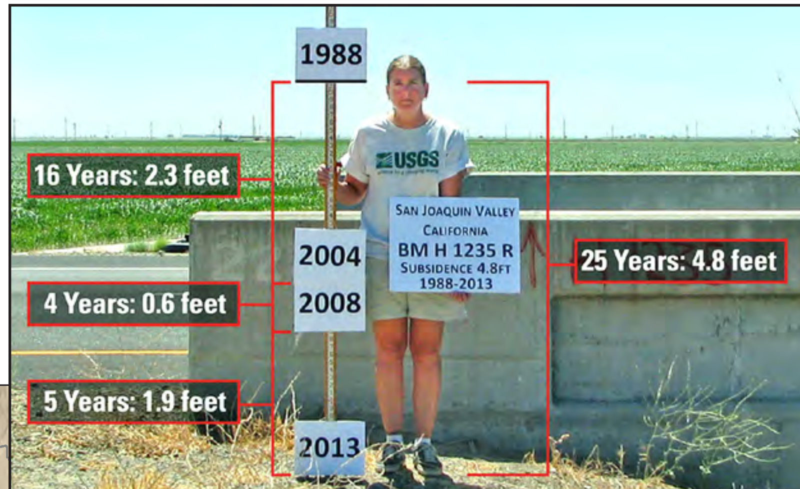
Scientists used data collected by USGS as part of the Groundwater Ambient Monitoring and Assessment (GAMA) program, a comprehensive assessment of statewide groundwater quality, along with data from the California Department of Public Health. Results from this study showed that uranium from natural sources was mobilized in the groundwater system by human activities, in particular, from excess irrigation water that drains to the aquifer system.

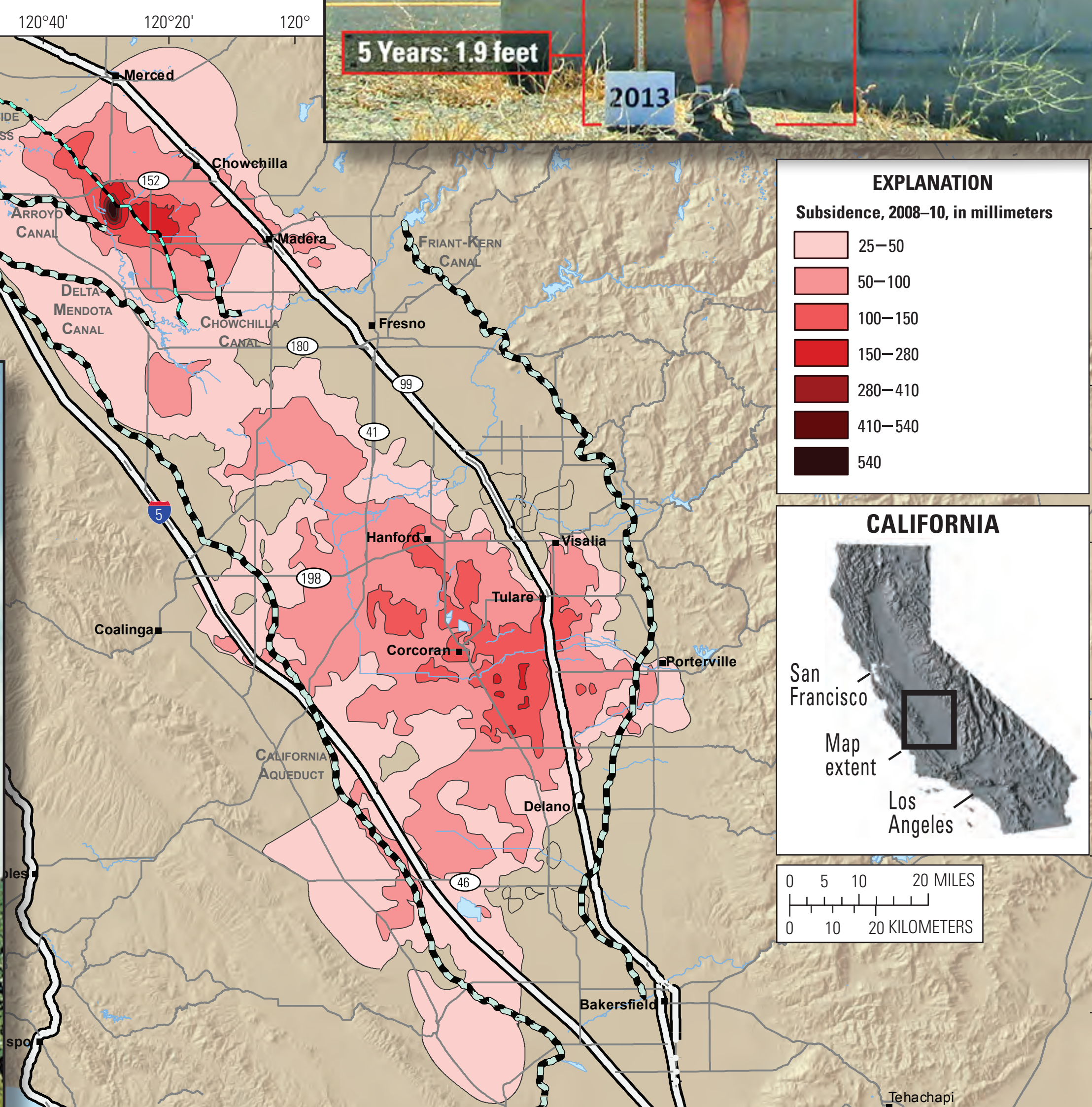


Land Subsidence

The USGS uses an integrated set of scientific tools, including satellite imagery, continuous GPS, extensometers, and modeling, to assess rates, extent, and potential solutions for the extensive subsidence in the San Joaquin Valley, http://ca.water.usgs.gov/land_subsidence/

Extensive groundwater withdrawals from aquifer systems have caused land subsidence throughout California. Land subsidence can damage structures, such as wells, buildings, and highways, and creates problems in the design and operation of facilities for drainage, flood protection, and water conveyance. Groundwater-level and land-subsidence monitoring are important to mitigating subsidence and managing future effects.

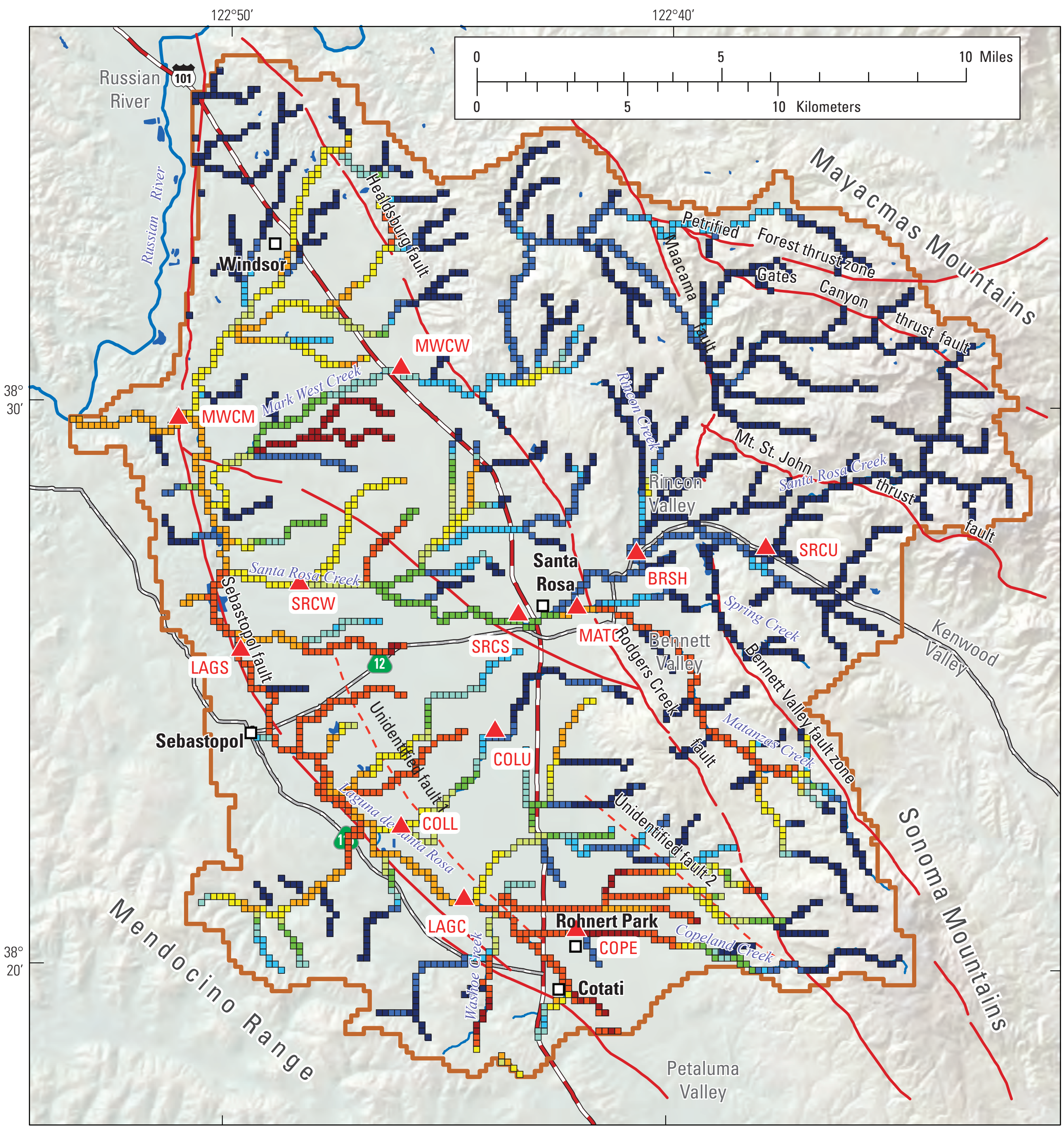




Interconnected Surface-Water Depletion

Groundwater and surface water are interconnected resources. Much of the flow in streams, and the water in lakes and wetlands, is sustained by the discharge of groundwater, particularly during dry periods. Coordinated measurement and modeling of surface- and groundwater conditions are needed to estimate surface-water changes that result from groundwater development.

The percentage of change in average streamflow due to pumping from 1976 to 2010 was simulated by using the GSFLOW model for the Santa Rosa Plain, Sonoma County, http://pubs.usgs.gov/sir/2014/5052/



EXPLANATION

Percentage decrease in average streamflow due to pumping

- <1.0
- 1.1 to 2.0
- 2.1 to 3.0
- 3.1 to 4.0
- 4.1 to 5.0
- 5.1 to 6.0
- 6.1 to 8.0
- 8.1 to 10
- 11 to 15
- 16 to 56

Streamflow-routing cell

Santa Rosa Plain watershed (SRPW) and hydrologic-model boundary

Fault

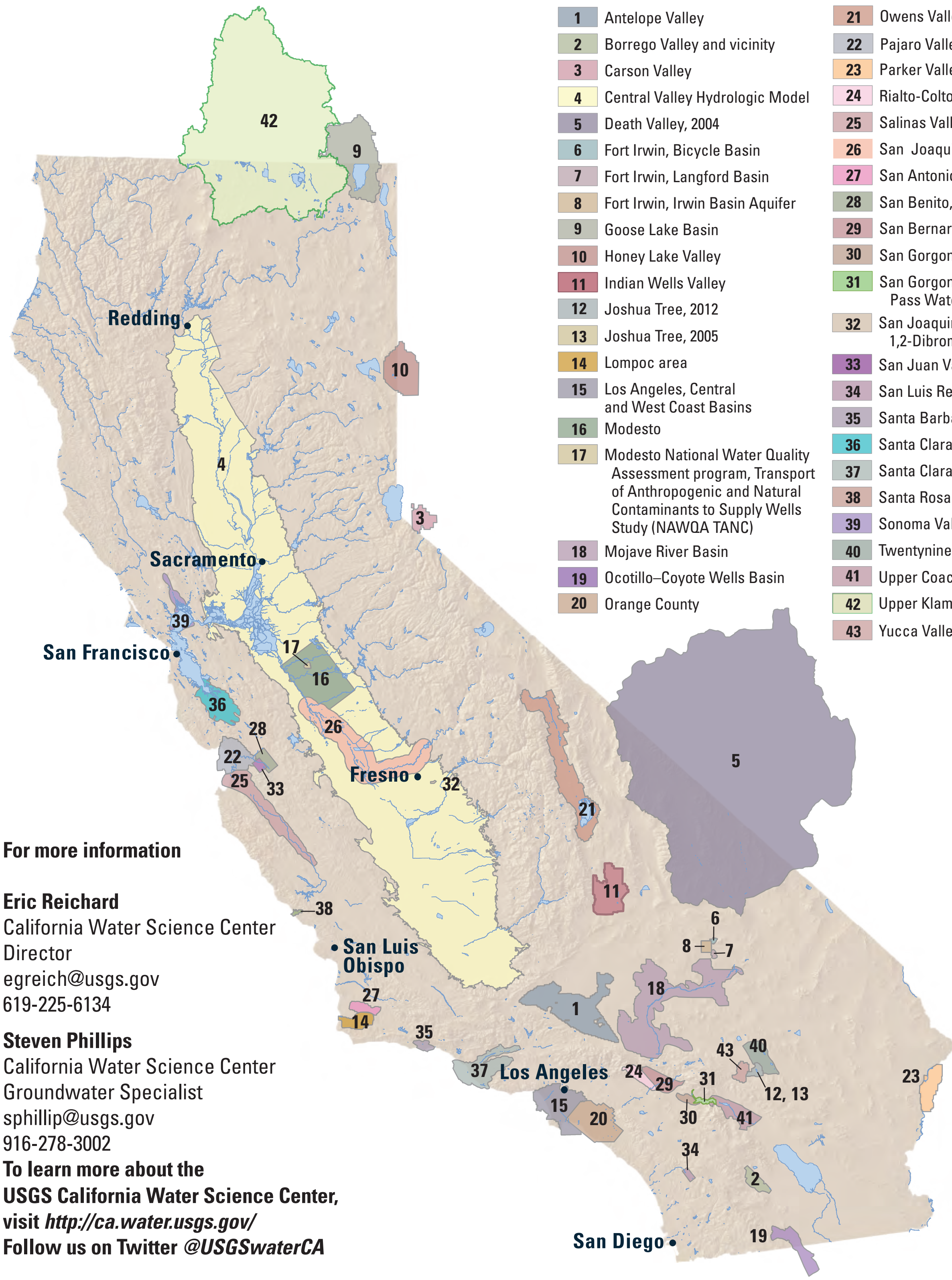
Inferred fault

SRCU **USGS streamgage and SRPW gage code**

Modeling

The USGS has developed a variety of models to assist in groundwater-management planning. These include MODFLOW and MODFLOW-based integrated groundwater/surface-water models, such as GSFLOW and MODFLOW-OWHM, as well as recharge/runoff models, such as the Basin Characterization Model (BCM) and Precipitation Runoff Modeling System (PRMS).

USGS MODFLOW-based Groundwater Models



1 Antelope Valley
2 Borrego Valley and vicinity
3 Carson Valley
4 Central Valley Hydrologic Model
5 Death Valley, 2004
6 Fort Irwin, Bicycle Basin
7 Fort Irwin, Langford Basin
8 Fort Irwin, Irwin Basin Aquifer
9 Goose Lake Basin
10 Honey Lake Valley
11 Indian Wells Valley
12 Joshua Tree, 2012
13 Joshua Tree, 2005
14 Lompoc area
15 Los Angeles, Central and West Coast Basins
16 Modesto
17 Modesto National Water Quality Assessment program, Transport of Anthropogenic and Natural Contaminants to Supply Wells Study (NAWQA TANC)
18 Mojave River Basin
19 Ocotillo–Coyote Wells Basin
20 Orange County
21 Owens Valley
22 Pajaro Valley aquifer system
23 Parker Valley
24 Rialto-Colton Basin
25 Salinas Valley Basin
26 San Joaquin River Restoration Program
27 San Antonio Creek Valley
28 San Benito, West Bolsa Basin
29 San Bernardino
30 San Gorgonio Pass
31 San Gorgonio, Cabazon (San Gorgonio Pass Water Agency)
32 San Joaquin Valley, eastern, fate of 1,2-Dibromo-3-chloropropane (DBCP)
33 San Juan Valley Basin
34 San Luis Rey River Valley, lower
35 Santa Barbara
36 Santa Clara Valley
37 Santa Clara–Calleguas Basins
38 Santa Rosa and San Simeon Creek Basins
39 Sonoma Valley
40 Twentynine Palms
41 Upper Coachella Valley
42 Upper Klamath Basin
43 Yucca Valley, Warren subbasin

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