Dynamics and Management of Our Local Groundwater Basins

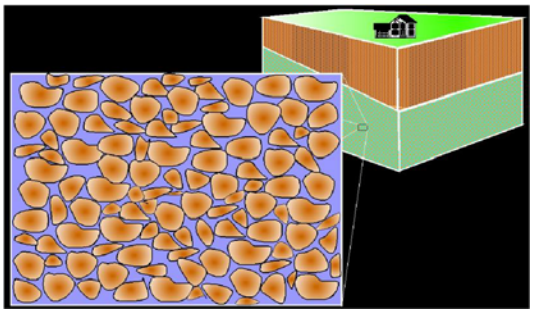
Thomas Harter
University of California

http://groundwater.ucdavis.edu

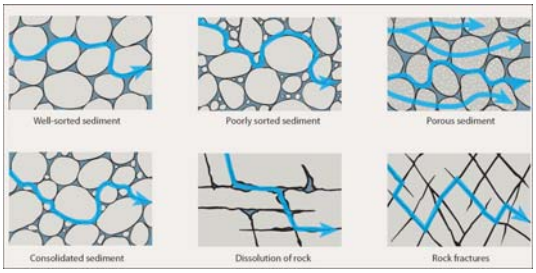
Overview

- What is groundwater?
  - How does it work?
  - How fast does it flow, how much?
  - How do we know?
- Groundwater in the Northern SJV
- Groundwater Management Options

Groundwater = Water completely filling Pores/Fractures

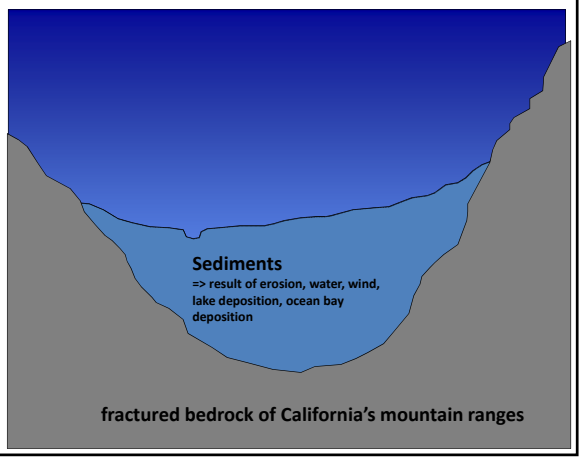


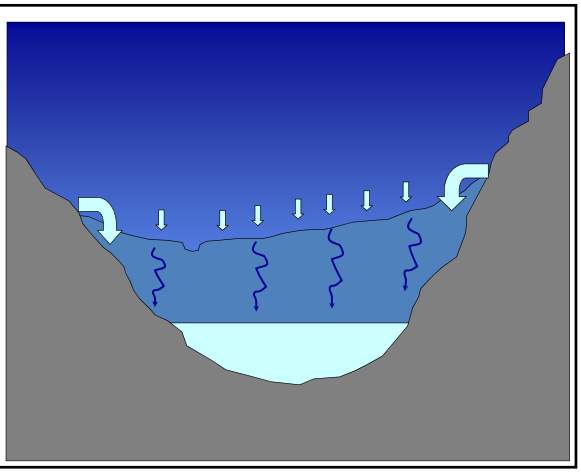
How much groundwater is in an aquifer?



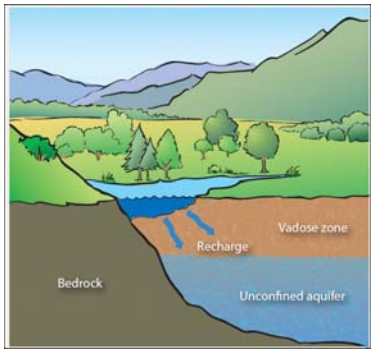
California Groundwater Basins

From: California Department of Water Resources



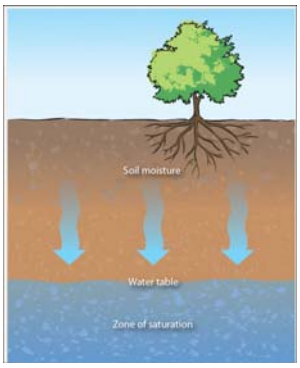


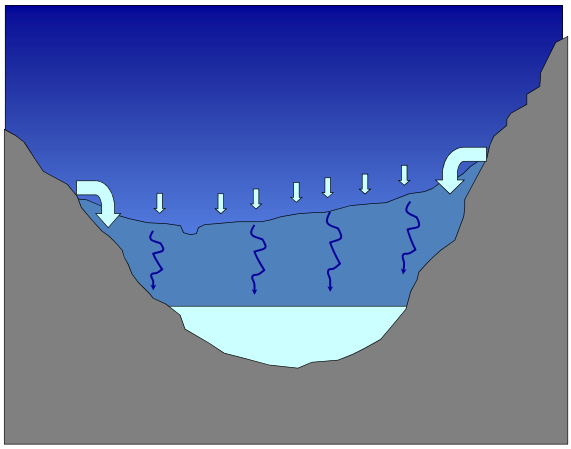
Unconfined Aquifer

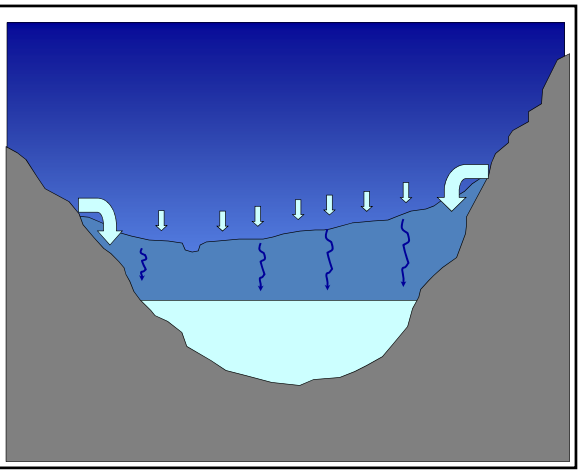


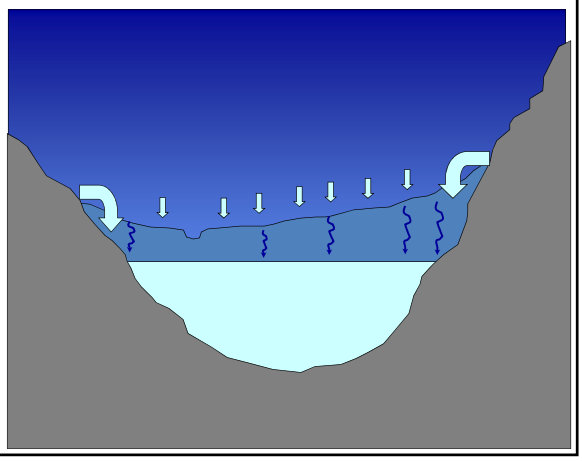
Losing stream

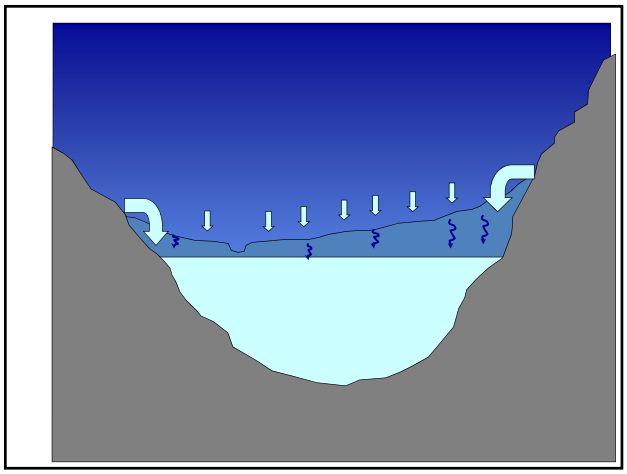
What is Groundwater?

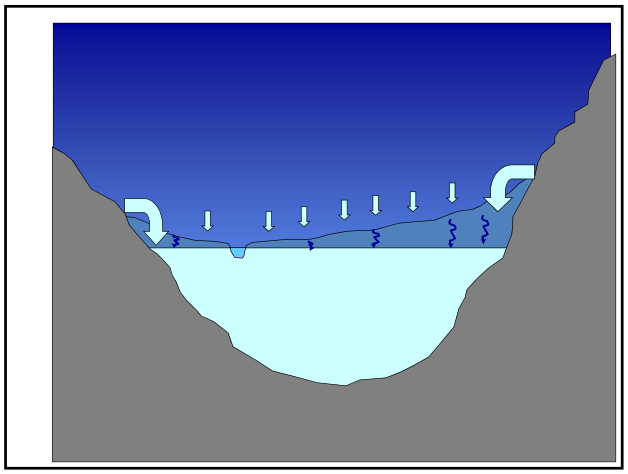


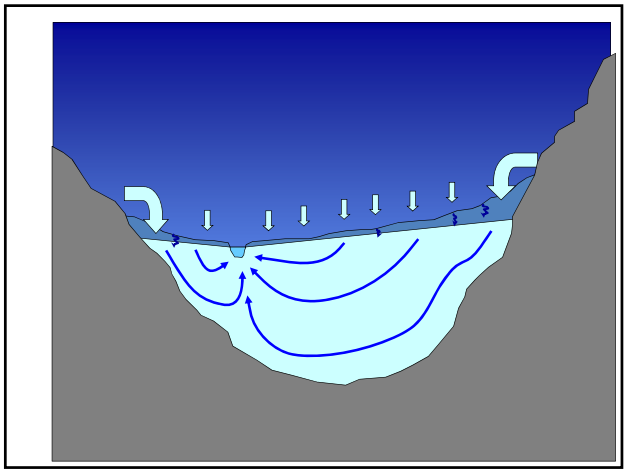


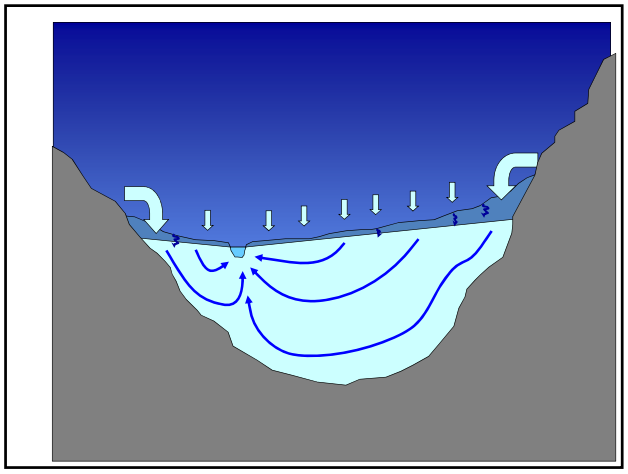




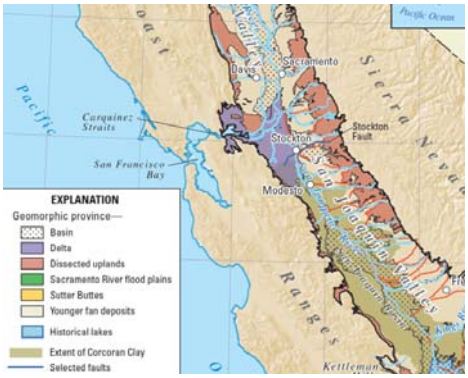






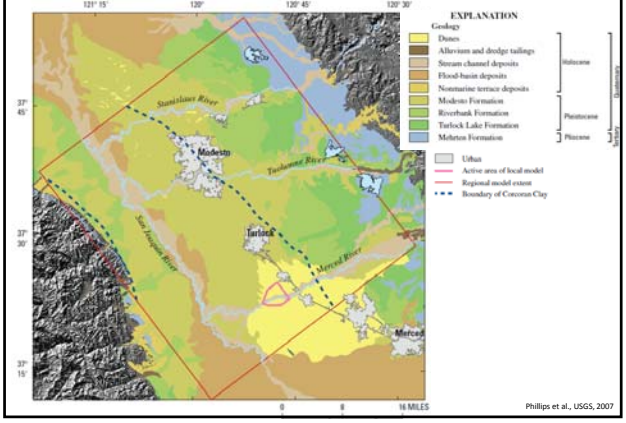


Central Valley Hydrogeology



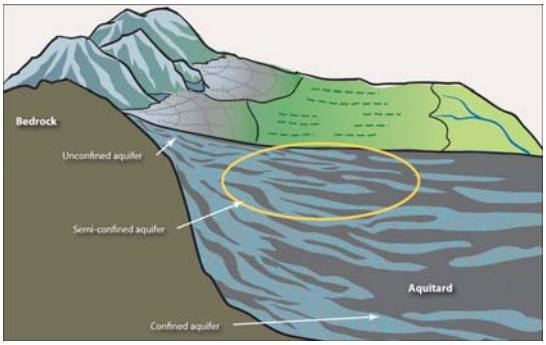
Faunt et al., USGS, 2009

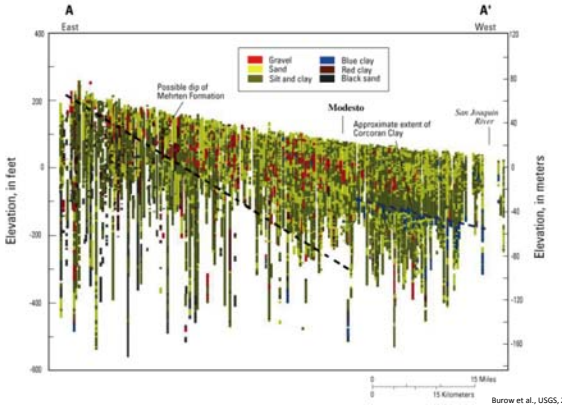
Geology of the Northern San Joaquin Valley



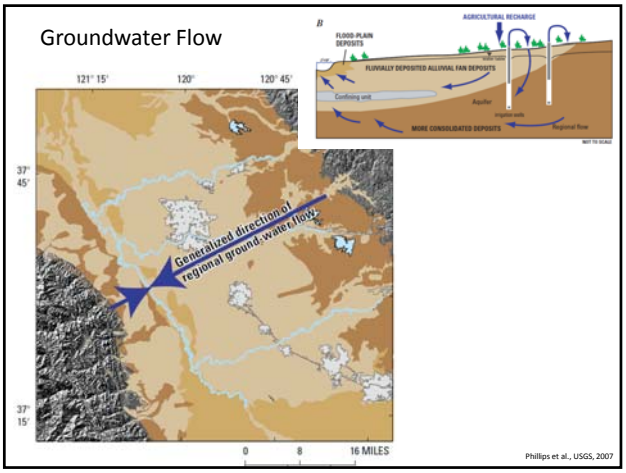
Phillips et al., USGS, 2007

(Semi-) Confined Aquifer

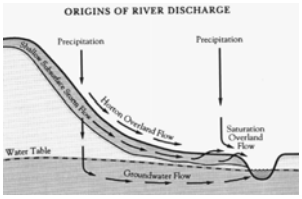




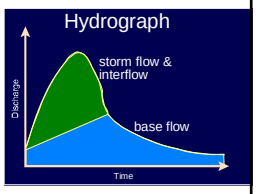
Groundwater Flow

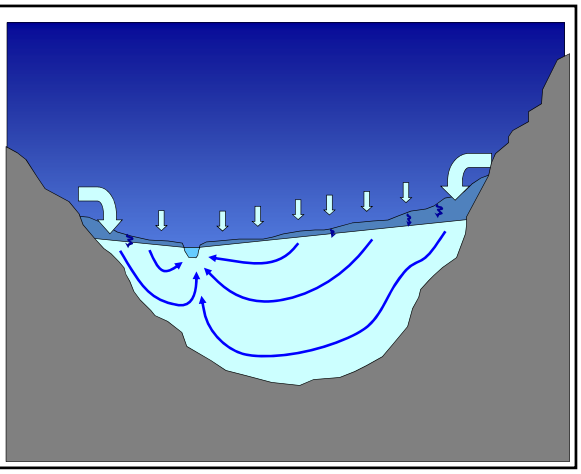


The Classic Hydrology View

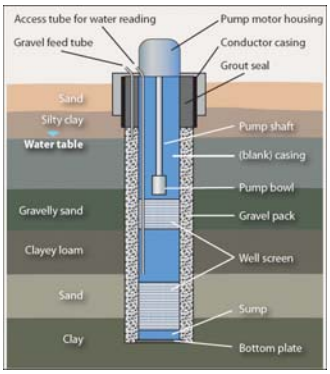


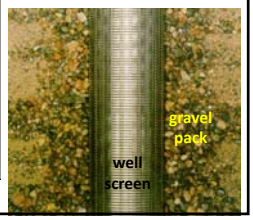
From: Jeff Mount "California Rivers and Streams"

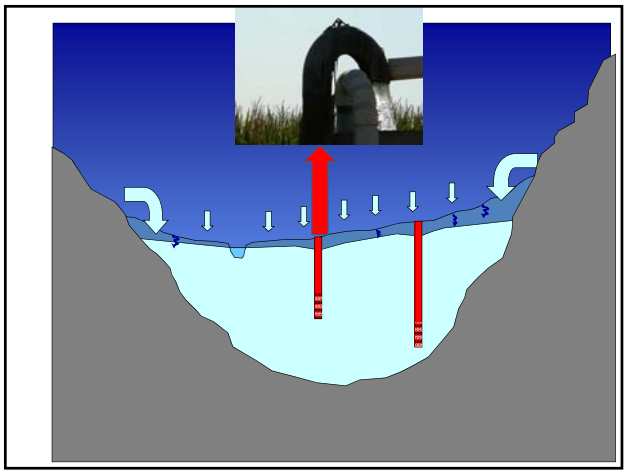




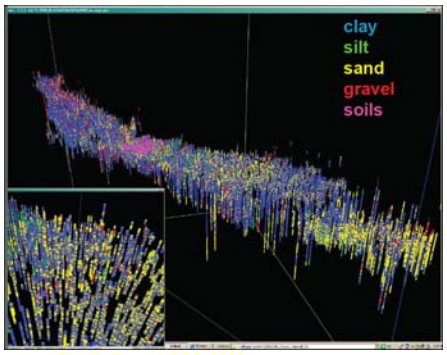
A Groundwater Well





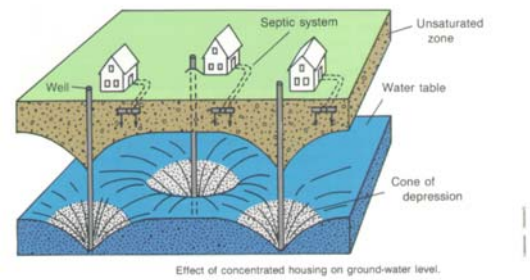


Hydraulic Conductivity from Borehole Logs (Estimated)

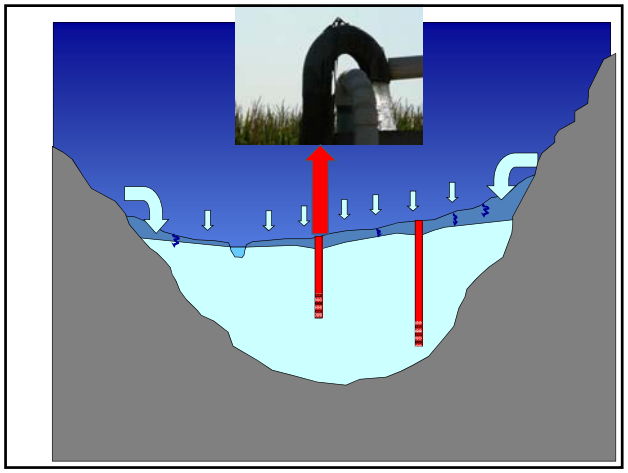


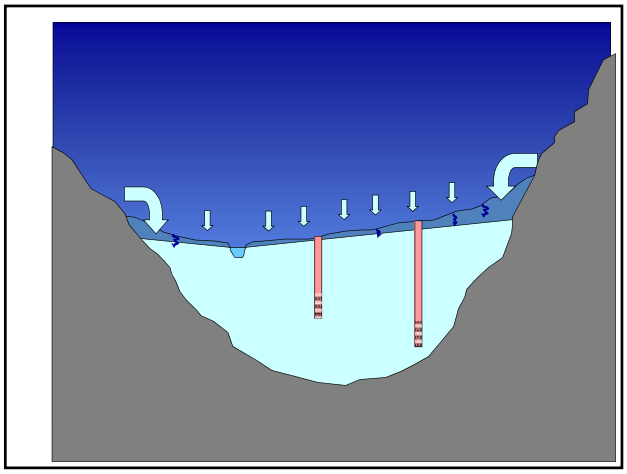
Courtesy, Claudia Fawn, USGS, 2008

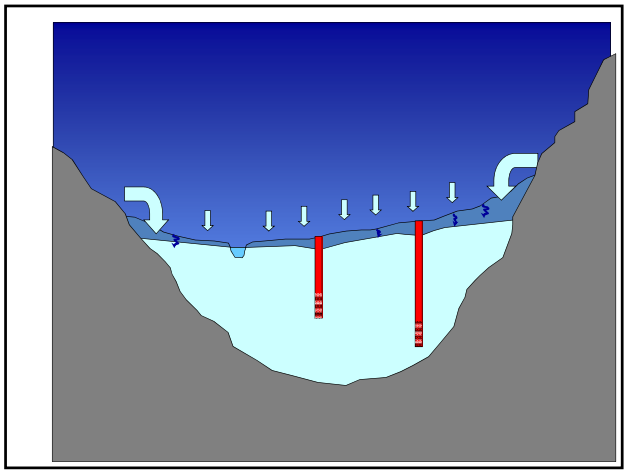
Cone of Depression near a Well

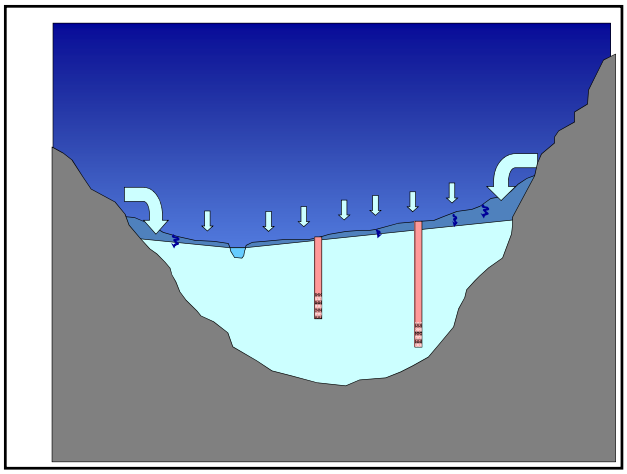


from: U.S. Geological Survey, 'Ground Water and the Rural Homeowner'

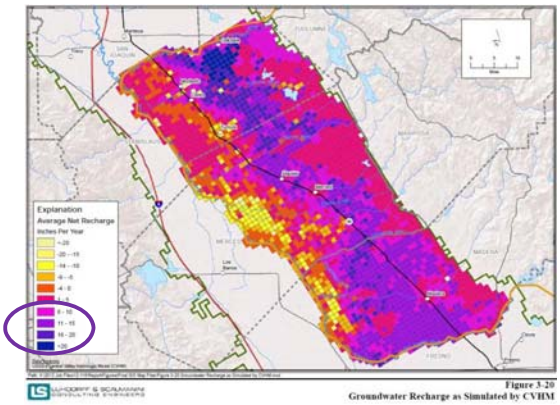






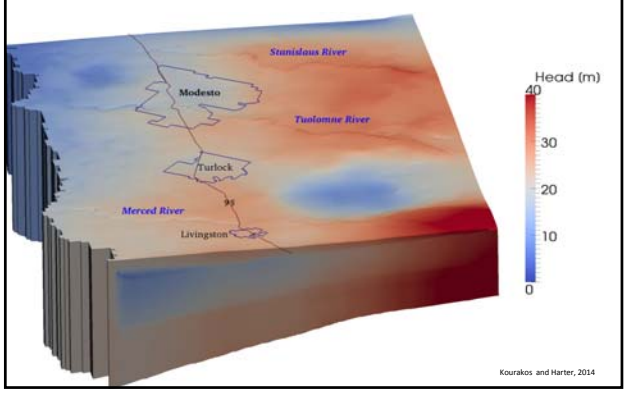


Recharge Rates, Eastern San Joaquin Valley

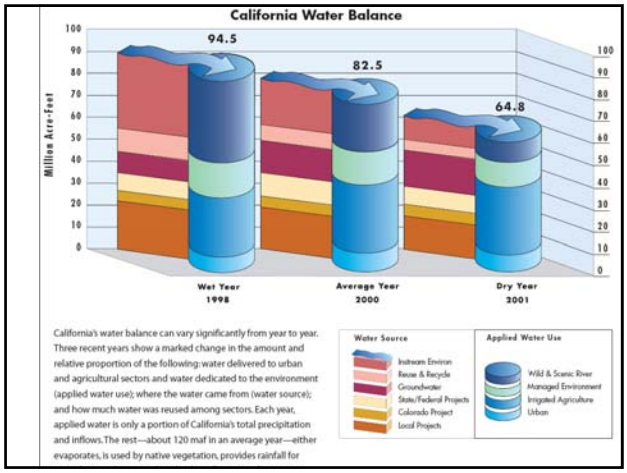


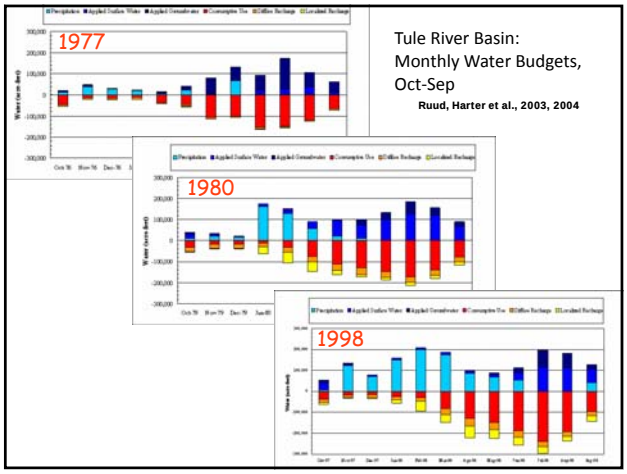
Eastern San Joaquin Valley GAR for ILRP, 2014

Simulated Water Table Surface, N San Joaquin Valley



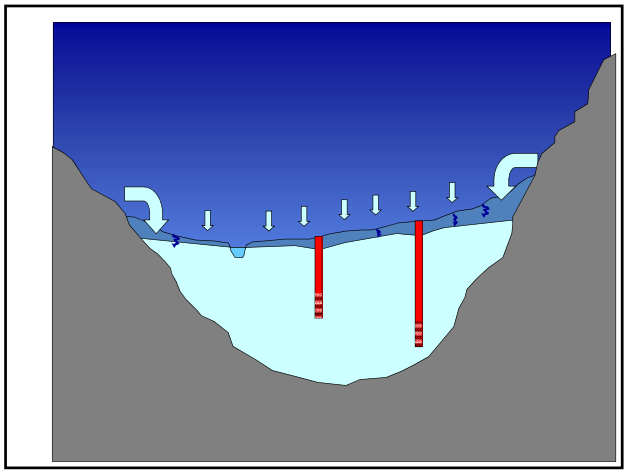
Kourakos and Harter, 2014

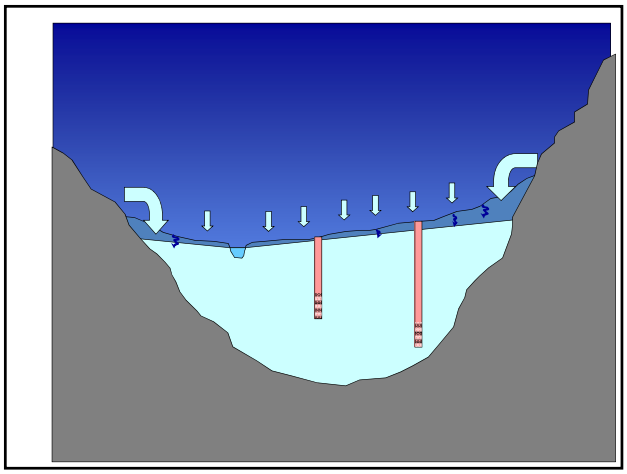


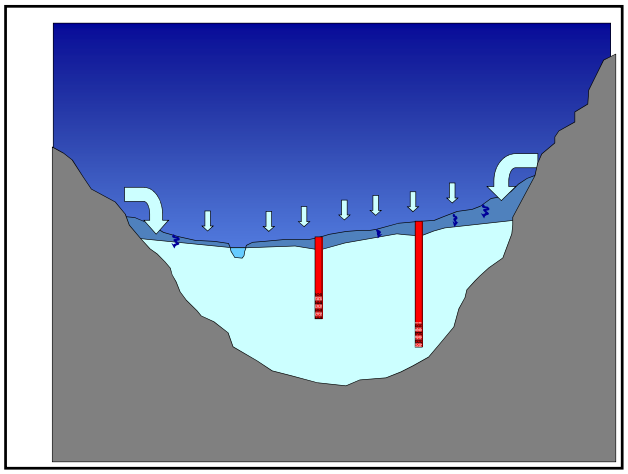


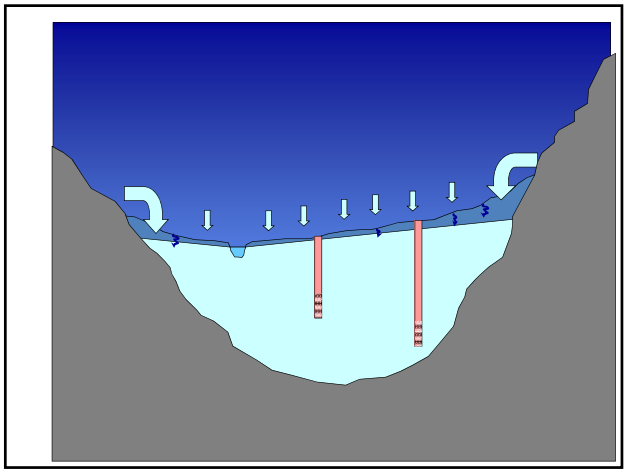
Tule River Basin:
Monthly Water Budgets,
Oct-Sep

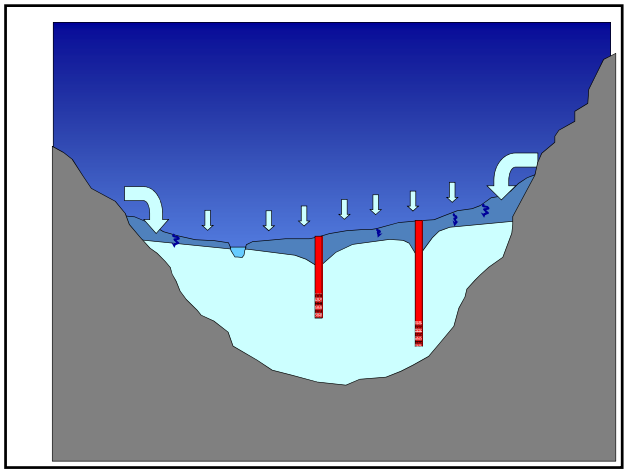
Ruud, Harter et al., 2003, 2004

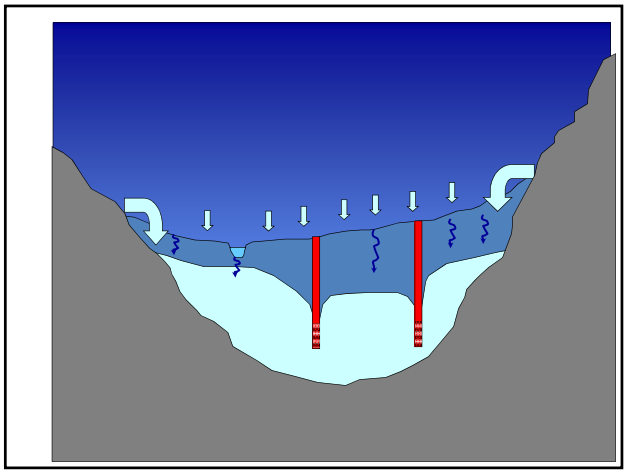


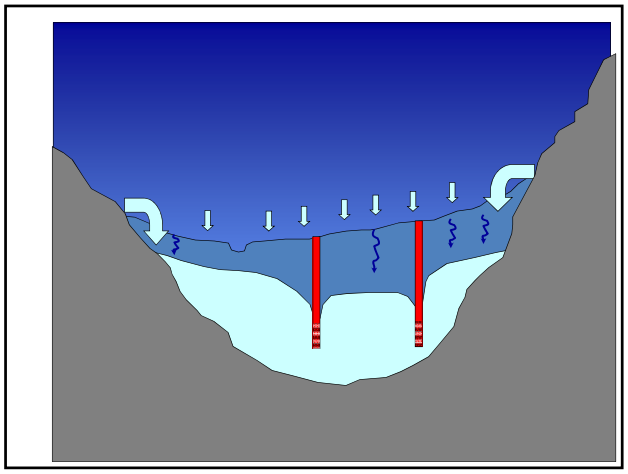






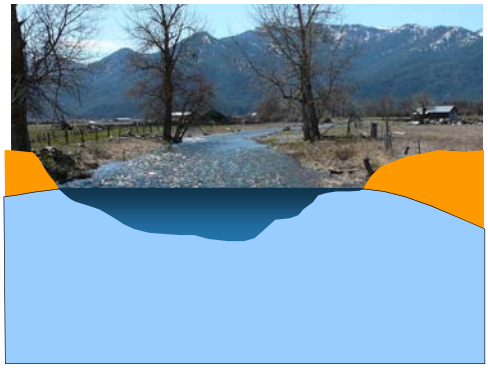




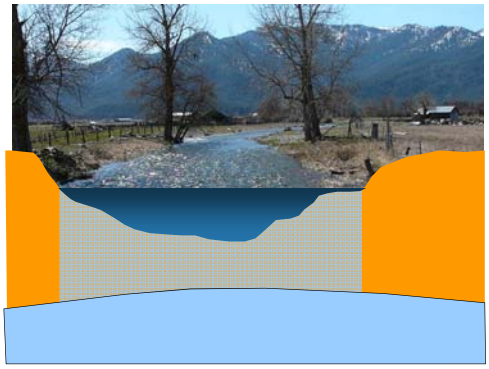


Gaining Stream

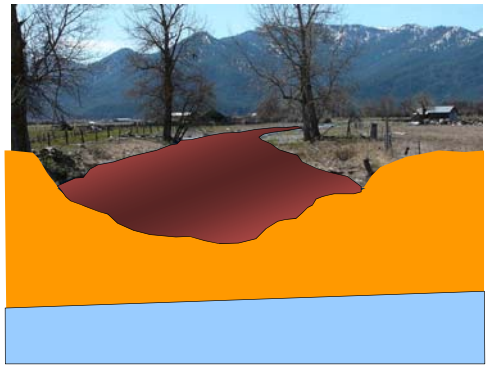
Losing Stream



Disconnected Stream



Dry Stream



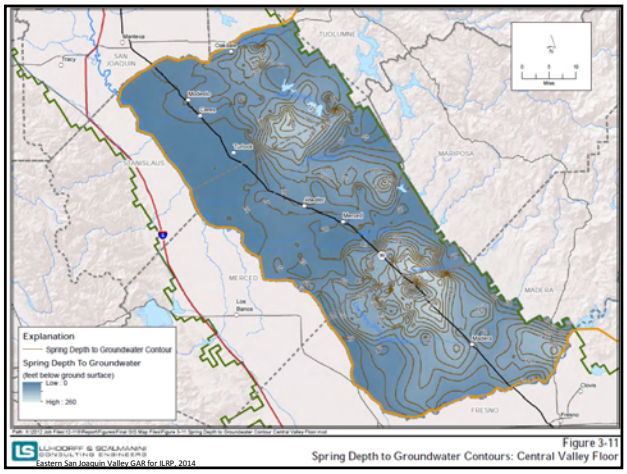
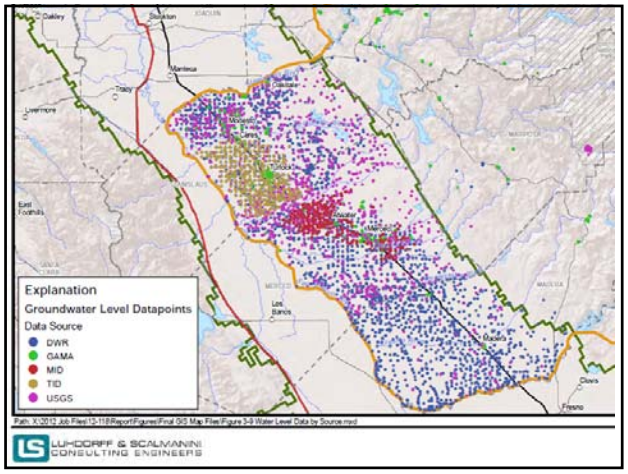
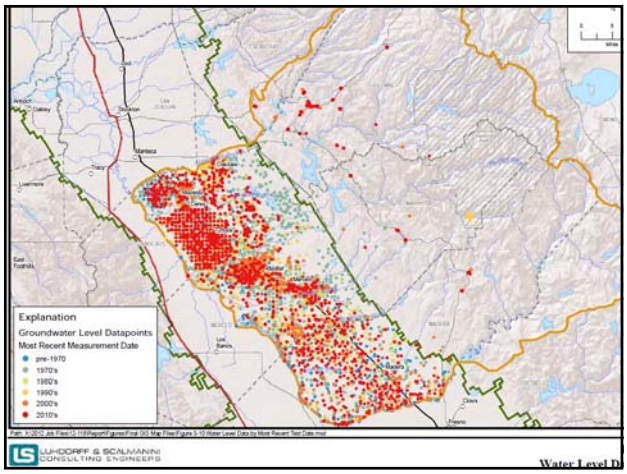
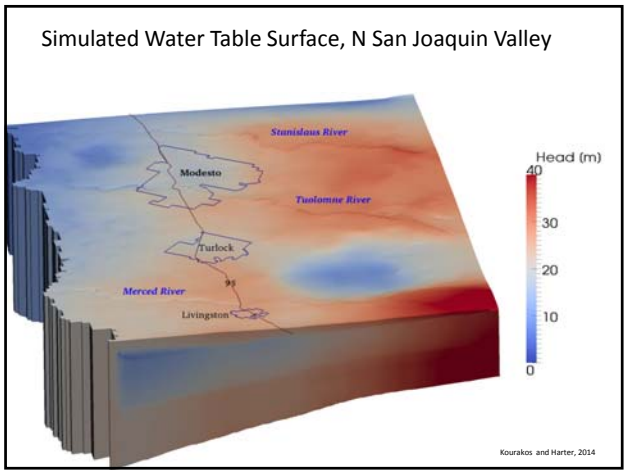
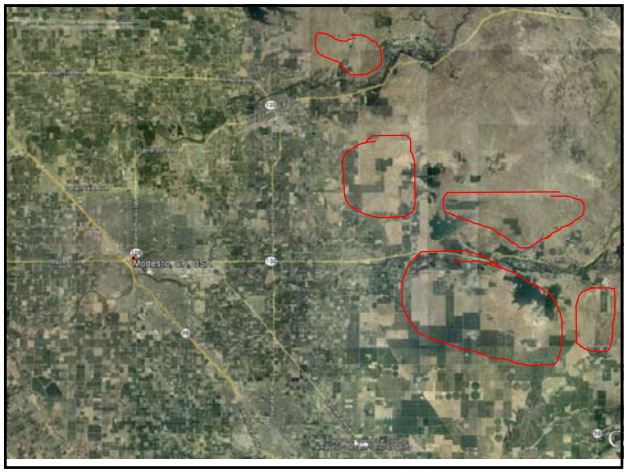


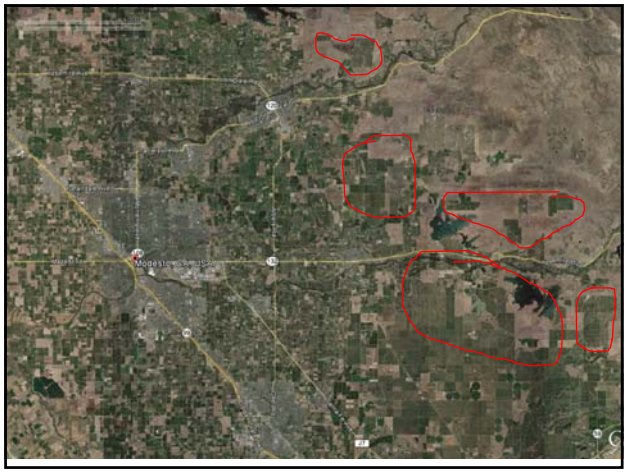
Figure 3-11
Spring Depth to Groundwater Contours: Central Valley Floor

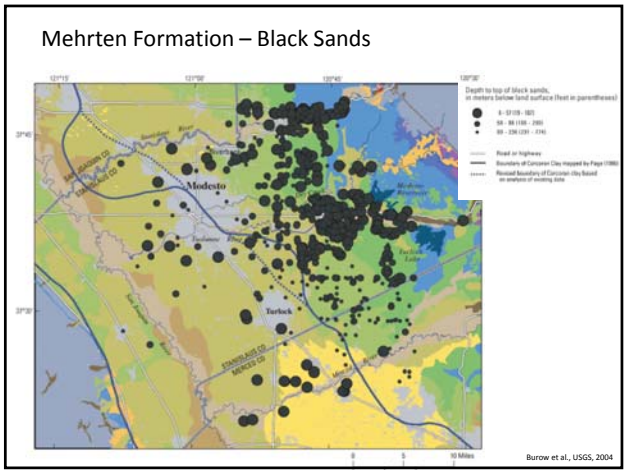


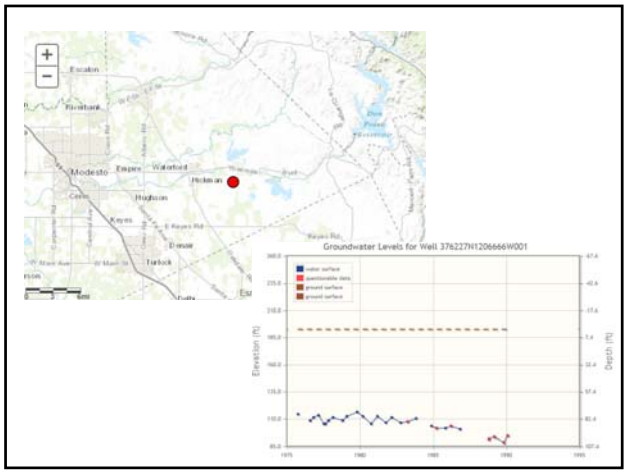


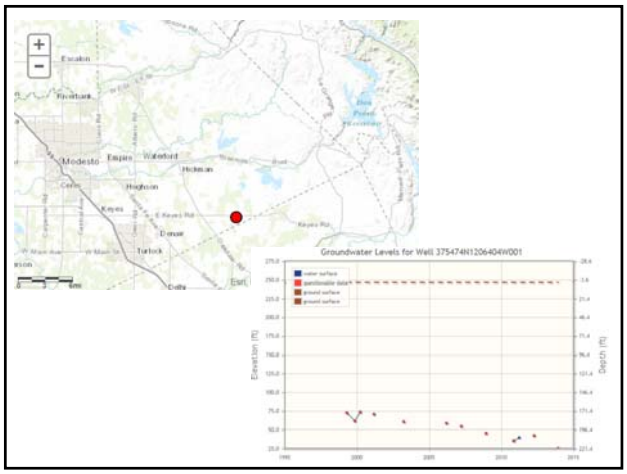


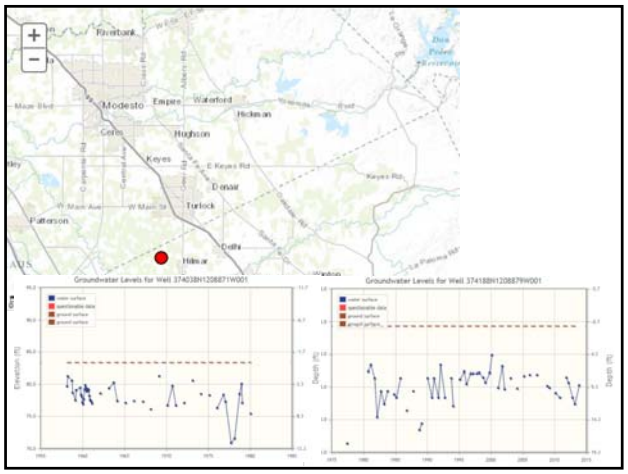




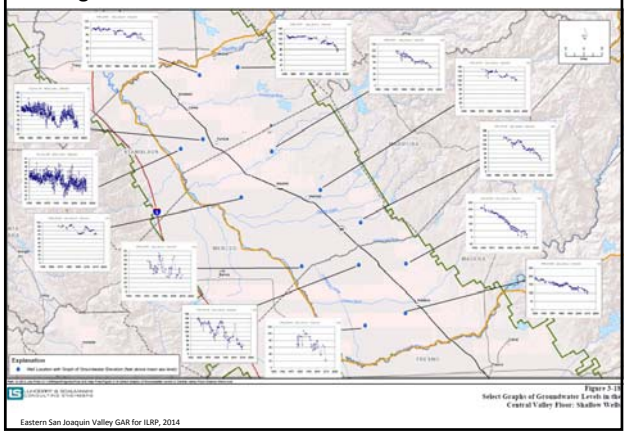








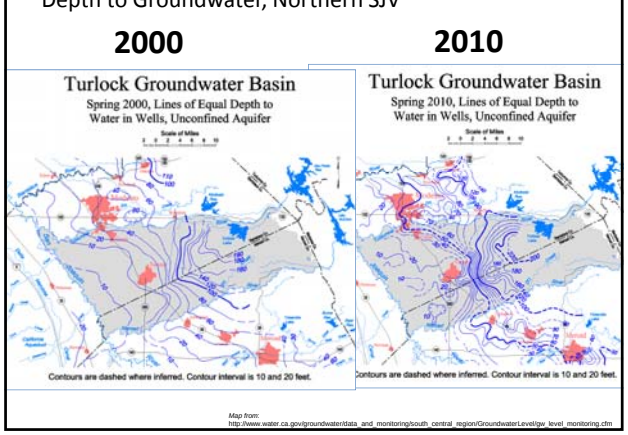
Long-term Water Level Fluctuations – Shallow Wells



Eastern San Joaquin Valley GAR for ILRP, 2014

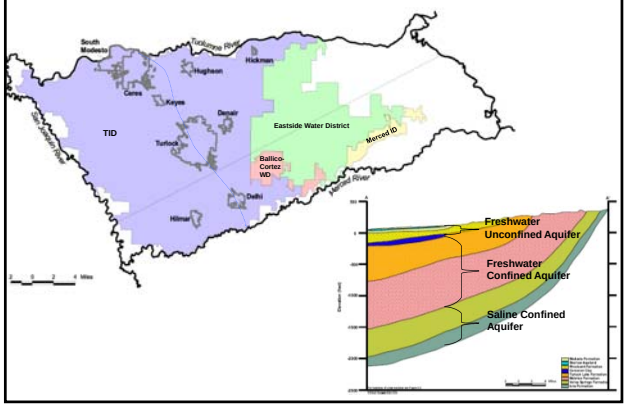
Depth to Groundwater, Northern SJV

2000 **2010**



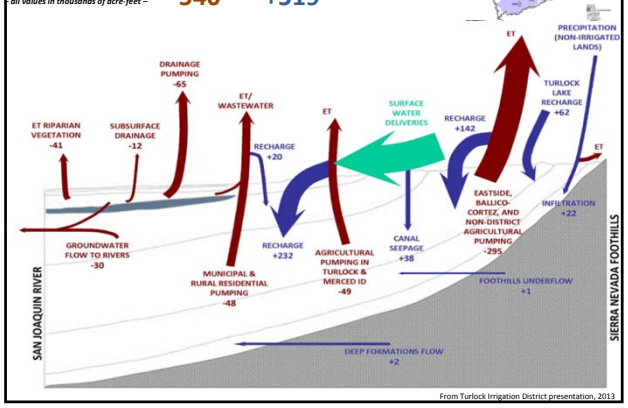
Map from:
http://www.water.ca.gov/groundwater/data_and_monitoring/south_central_region/GroundwaterLevel/gw_level_monitoring.cfm

Geology & Hydrogeology



1997-2006 Turlock Basin Water Budget

- all values in thousands of acre-feet – **-540** **+519**



From Turlock Irrigation District presentation, 2013

California Correlative Rights Doctrine:
Katz v.s Wilkinshaw, 1903

- Use of groundwater is a "usufructuary" right that is an appurtenance of the overlying land (not extinguished by non-use)
- Ownership lies with the state's people
- Use must be 'reasonable' relative to:
  - Use by others
  - Characteristics of the parcel
  - Characteristics of the aquifer
- In case of conflicts: no prescription, rather seek optimal solution (often through courts)

For California water law and groundwater governance, see Harter & Rollins, Chapter 3

California Groundwater Rights

- Correlative Rights Doctrine
- California constitutional mandate for beneficial use
- Special districts (20 different types, about 2,300 districts)
  - Water districts, irrigation districts, private water companies, reclamation districts, water conservation districts, water replenishment districts, water storage districts, etc.
- County police power – controls groundwater exports
  - Baldwin vs. Tehama County, 1994
- Basin adjudication / "physical solution" – controls extraction
  - City of Barstow vs. Mojave Water Agency, 2000:
    - Right of water users to negotiate physical "equitable, practical" solution, regardless of water rights
    - Individual water rights holders cannot be forced into a voluntary agreement
- State Water Resources Control Board
- The Courts

California Groundwater Management Policies, 1

- No statewide groundwater use permitting system
- Local Groundwater Management Act of 1992 (AB 3030)
  - Encourages local districts / counties to develop groundwater management plan
  - No specific guidelines
  - No enforcement required, but agencies are given enforcement authority
- Local Groundwater Management Assistance Act of 2000 (AB 303)
  - Sets financial incentives for local/regional agencies to develop groundwater management plan
  - Water project infrastructure only funded if groundwater management plan has been adopted
- Amendment to Land Use Laws 2001 (SB 221)
  - Ties landuse permits to availability of water
- Amendment to Urban Water Management Act 2001 (SB 610)
  - Requires urban water agencies to prepare urban water management plans
  - Sets specific minimum guidelines, much more rigorous than groundwater management plans

California Groundwater Management Policies, 2

- Groundwater Management Water Code Amendment 2002 (SB 1938)
  - Sets specific minimum guidelines for elements of groundwater management plan
    - Basin characterization
    - Management objectives
    - Management tools must be specified to meet objectives
    - Monitoring levels
    - Governance
  - Does NOT require enforcement
- Integrated Regional Water Management Act of 2002
  - Sets guidelines for governance
  - Encourages integration of surface water and groundwater management, water supply and water quality management, land use planning
- Groundwater Level Monitoring Act 2009 (SBX7 6)
  - Requires groundwater level monitoring in all California groundwater basins, starting 2012
  - Guidelines developed subsequently by state agency (Dept. Water Resources) require at least one monitoring well per 100 sq.miles (2.6 sq. km)
  - Annual groundwater level reporting
  - Local agencies may organize the monitoring program
  - Data are available through statewide public website

Groundwater Management Portfolio: Potential Elements

- Managing groundwater demand
- Managing different water sources conjunctively
- Protecting, and enhancing recharge
- Groundwater banking
- Protecting surface water flows
- Identifying and protecting groundwater-dependent ecosystems
- Maintaining / achieving economic/financial sustainability

Key Elements of (Local/regional) California Groundwater Management Plans

- Context / Basin Description
- Public and agency involvement
- Basin management objectives
- Monitoring
- Accountability and review

Currently Lacking:

- Enforcement mandate
- Empowerment for demand management (in addition to supply management)
- Integration with surface water management
- Integration with water quality management (source control, remediation, containment)
- State oversight / enforcement