Quality of the Nation's Groundwater 1991-2010

Western States Water Council

April 16, 2015

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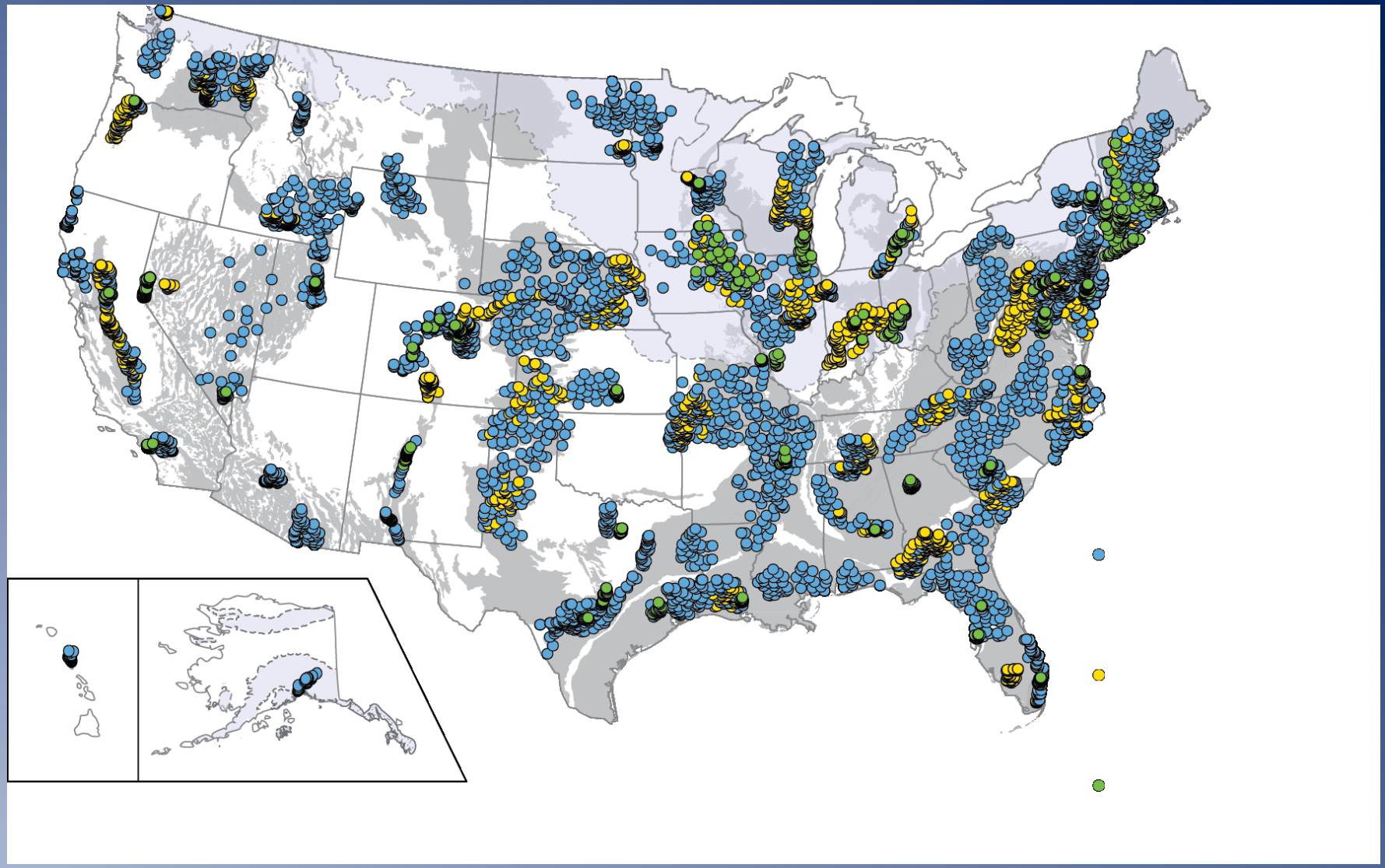
National Water-Quality Assessment Program

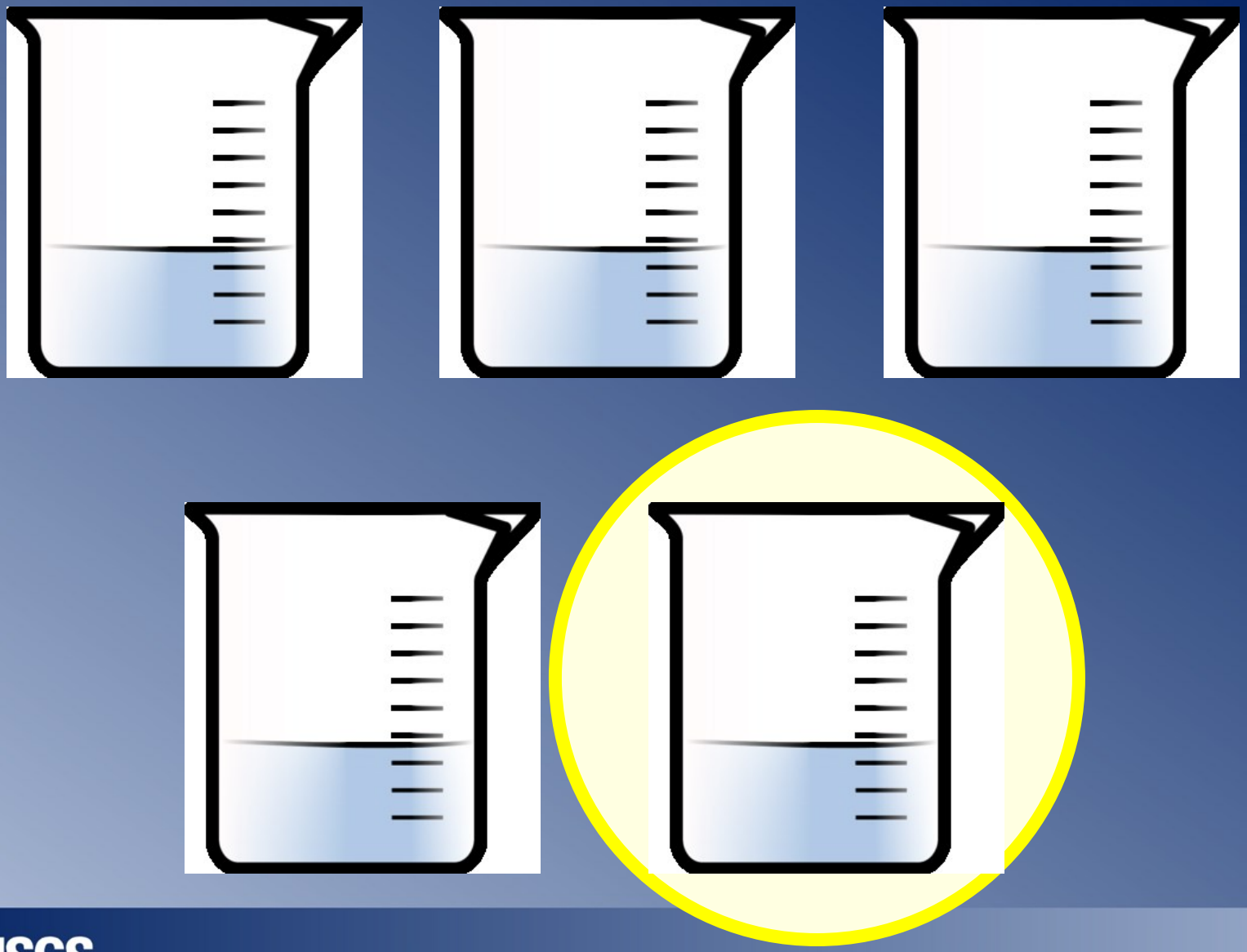
U.S. Department of the Interior

U.S. Geological Survey

- What contaminants are in groundwater?
- What chemical processes are occurring in the aquifer?
- How can water-resource managers use this information?

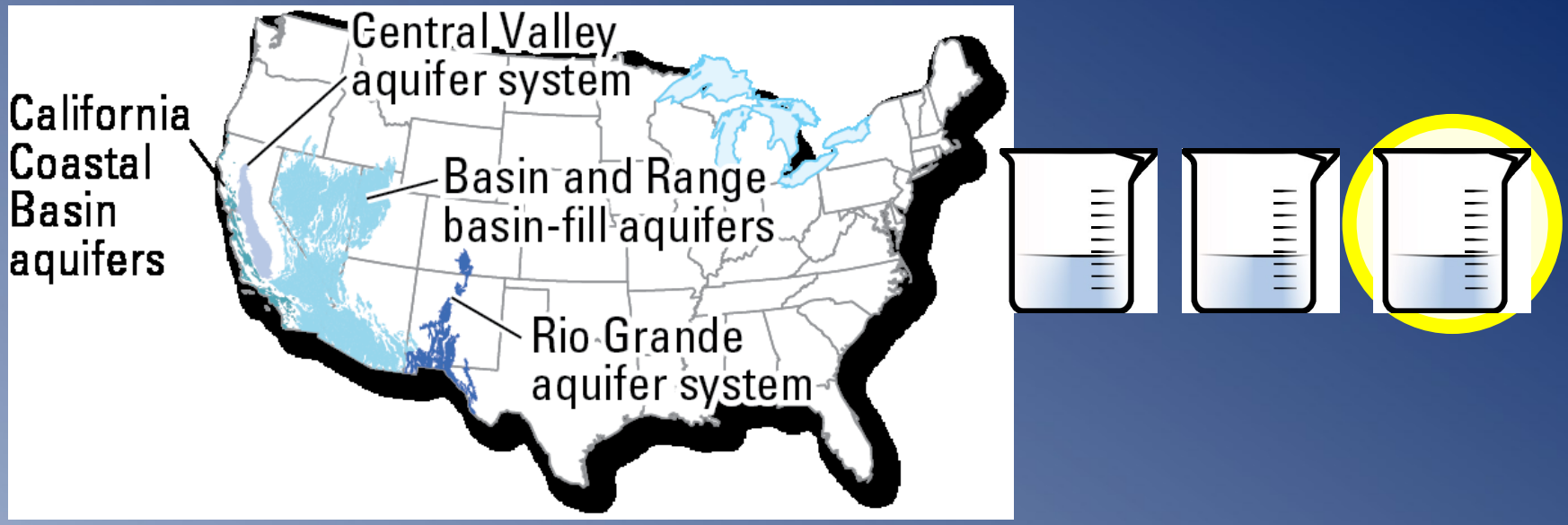
Groundwater study wells — 1991-2010



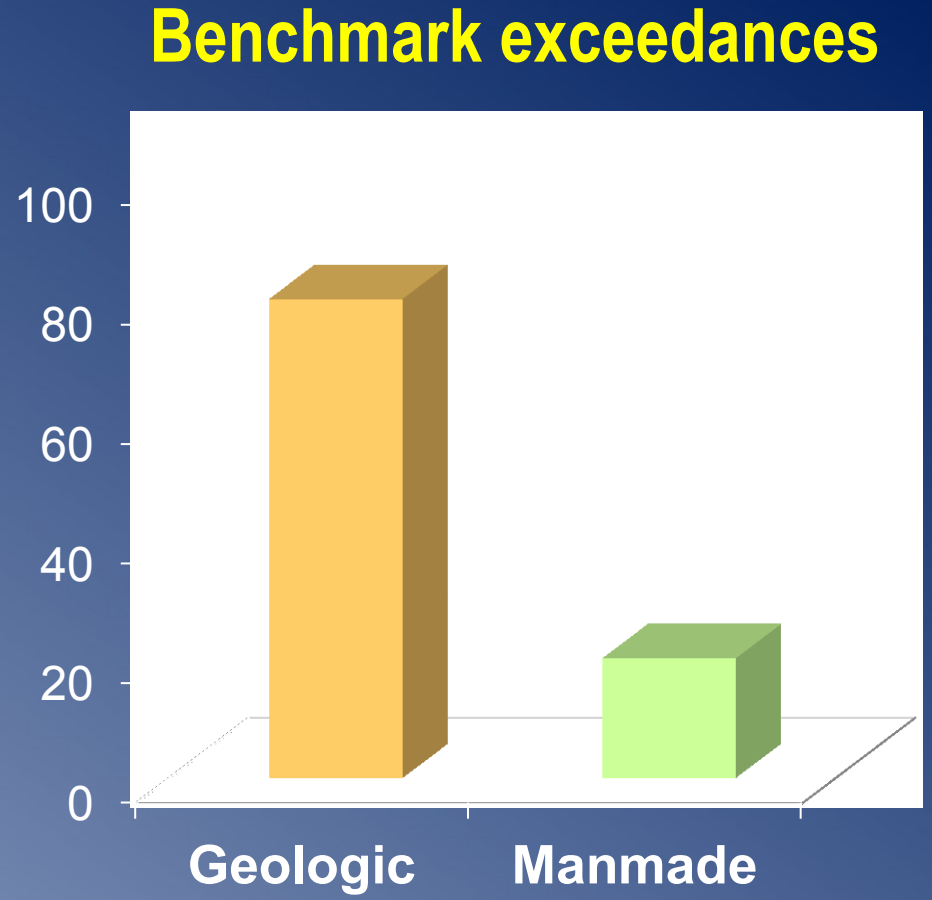


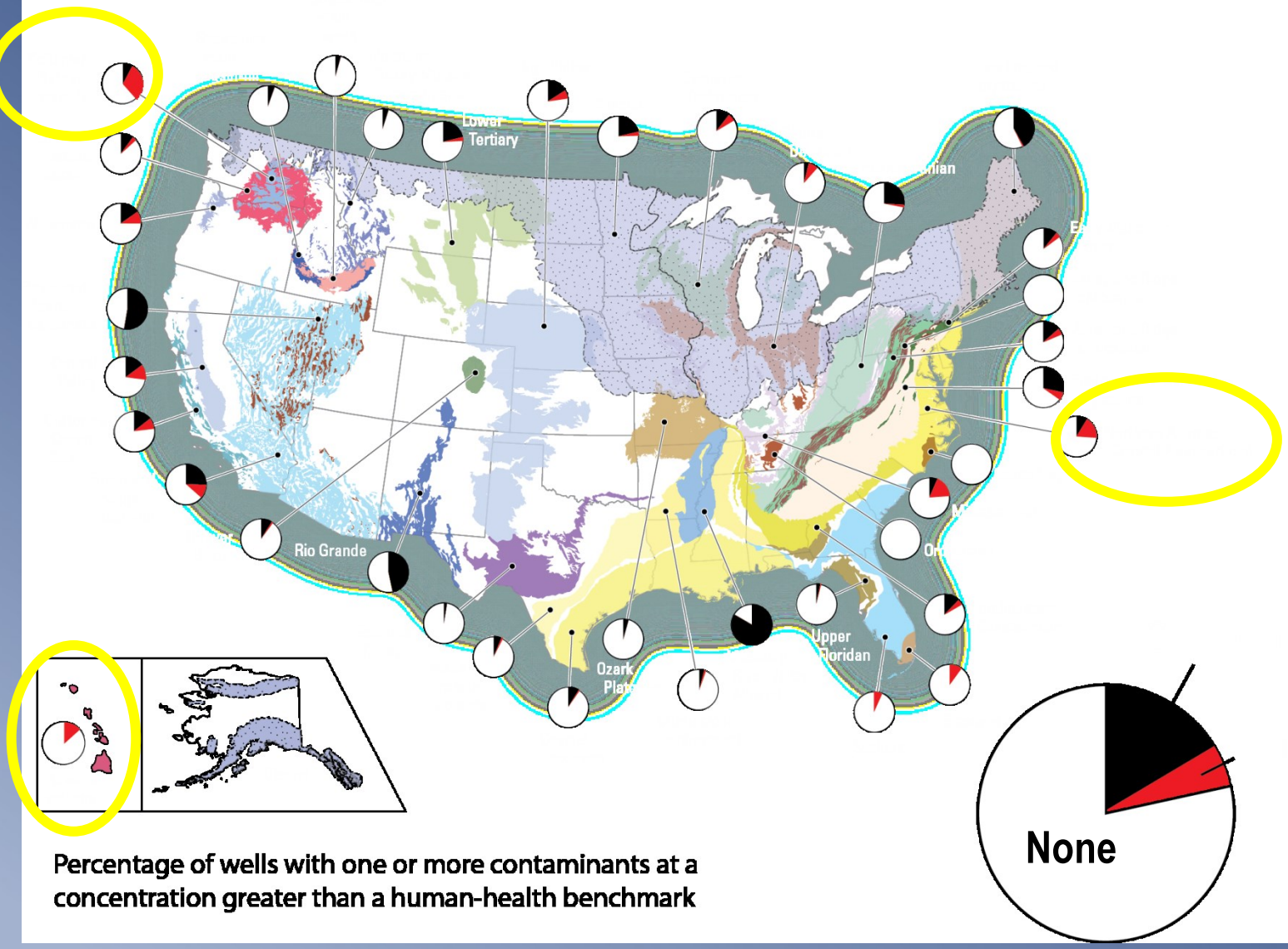
Radon: 3% of wells

Arsenic: 16% of wells



- Geologic source
  - Arsenic
  - Radon
  - Manganese
  - Uranium
- Manmade source
  - Nitrate
  - Pesticides
  - Solvents





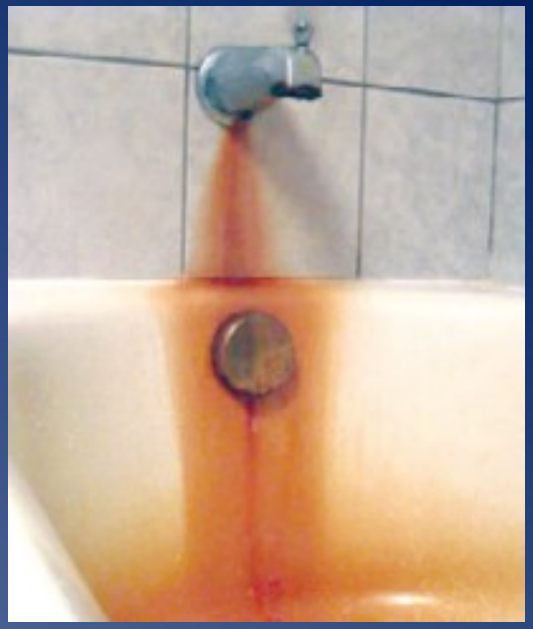
Percentage of wells with one or more contaminants at a concentration greater than a human-health benchmark

Percentage of wells with a benchmark exceedance

- Northern Atlantic Coastal Plain
  - **Dieldrin: 11.6%**
  - **Nitrate: 9.9%**
- Oahu
  - **Dieldrin 10%**
- Columbia Plateau
  - **Nitrate 17%**

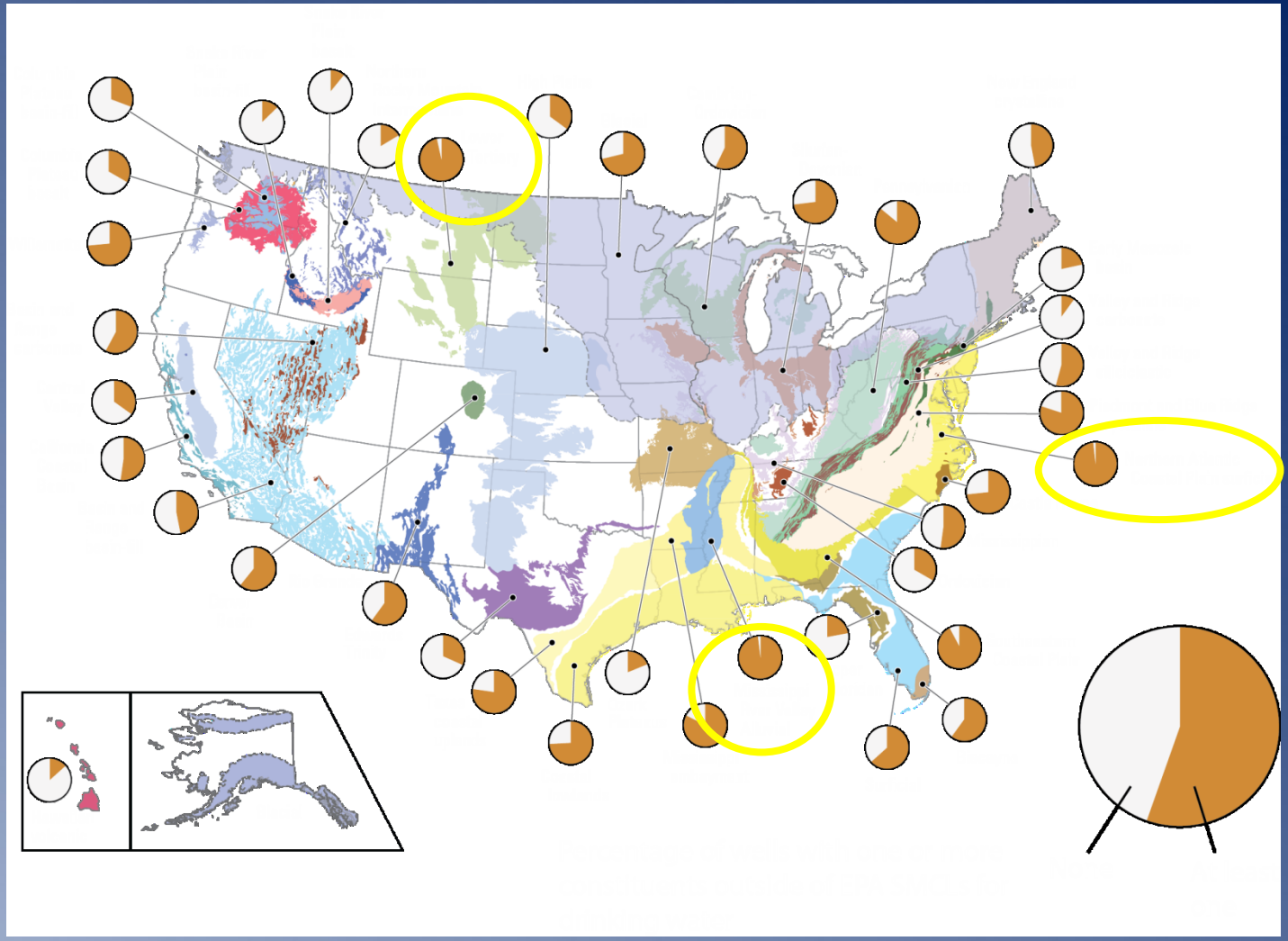
“Nuisance” constituents

- **Unpleasant taste, odor, or color**
- **Skin and tooth discoloration**
- **Corrosion or sedimentation**
- **Reduced effectiveness of water treatment**



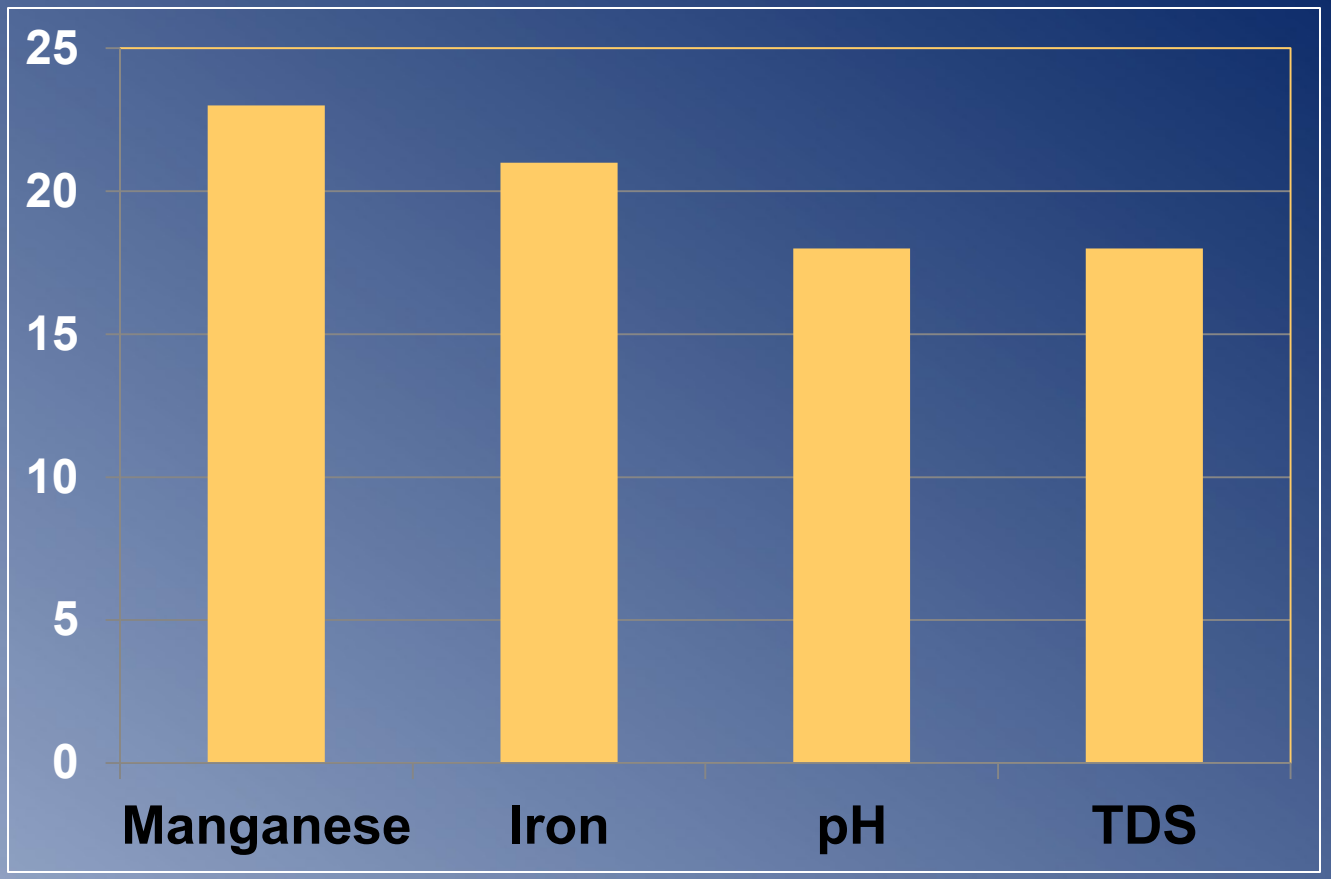
Secondary Maximum Contaminant Level (SMCL)

Exceedances of SMCLs (percentage of wells)



Western States: 19% 14% 11% 25%

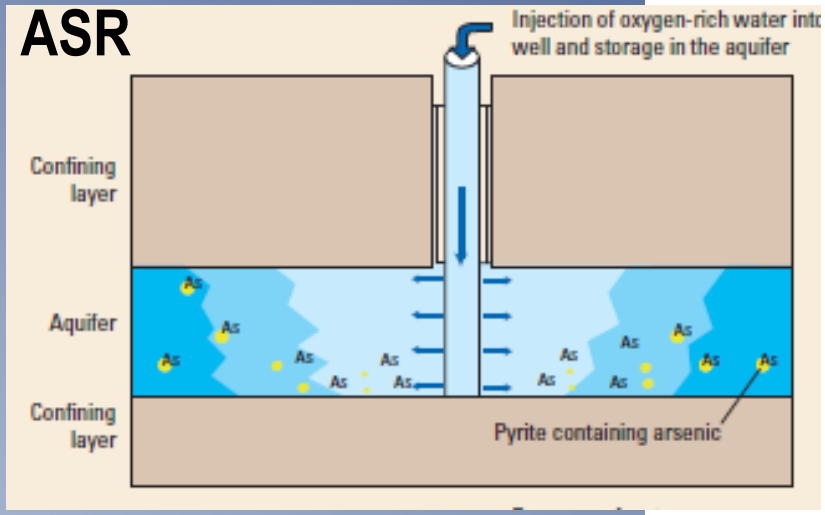
Percentage of wells exceeding SMCL

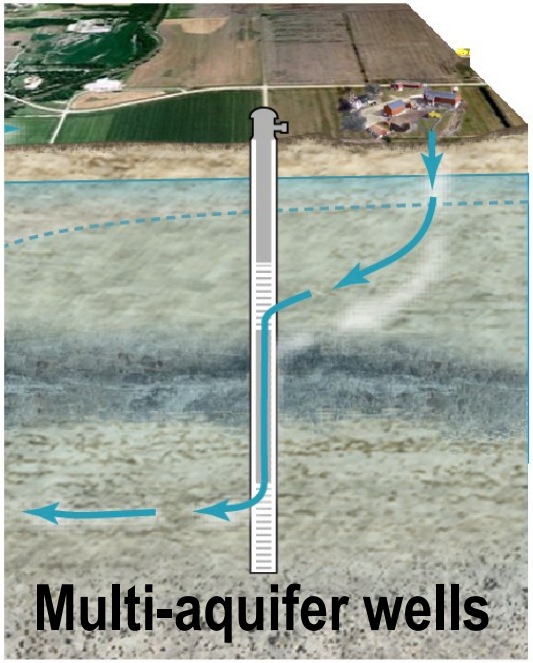


Artificial recharge

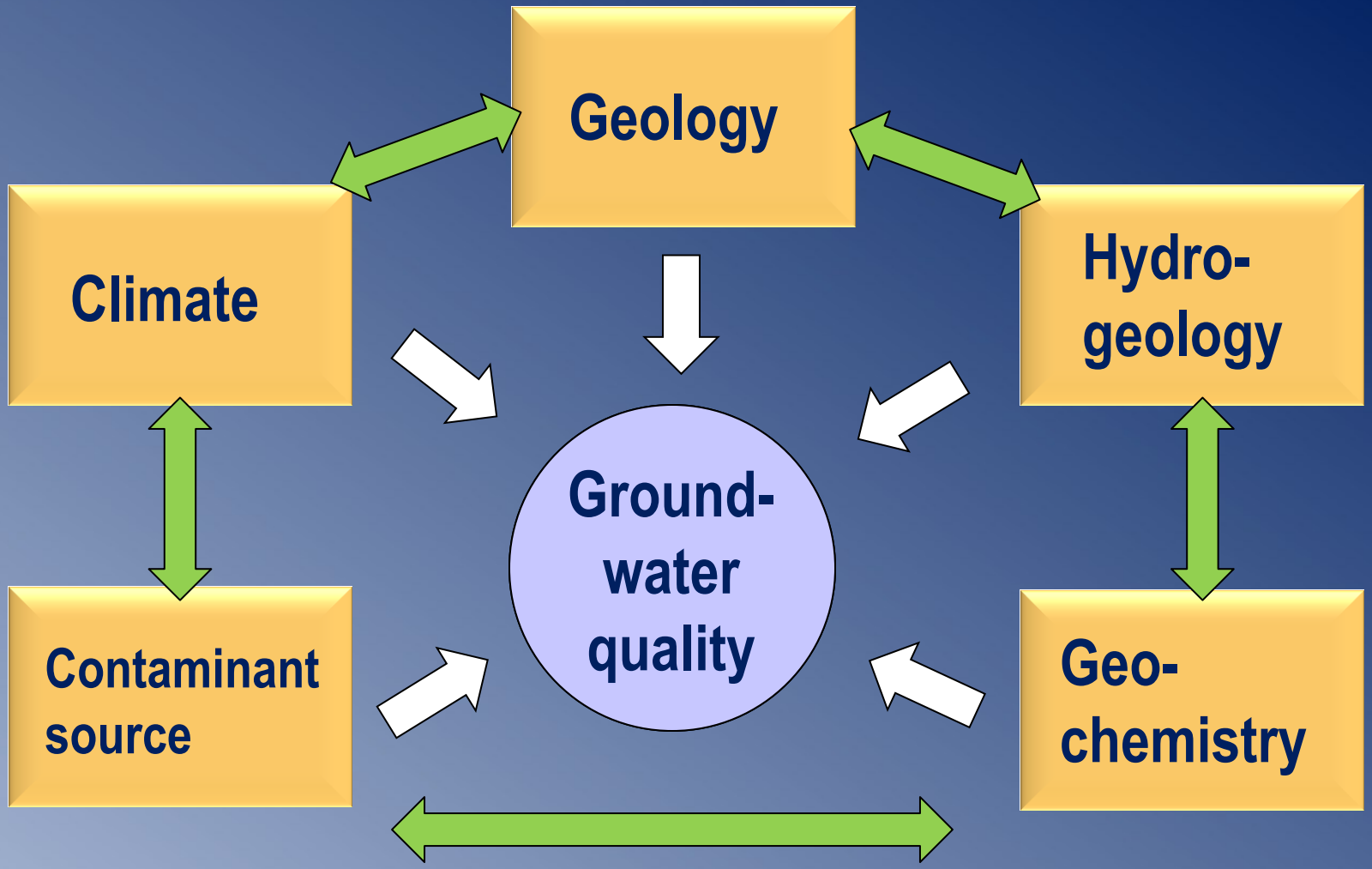
High volume pumping

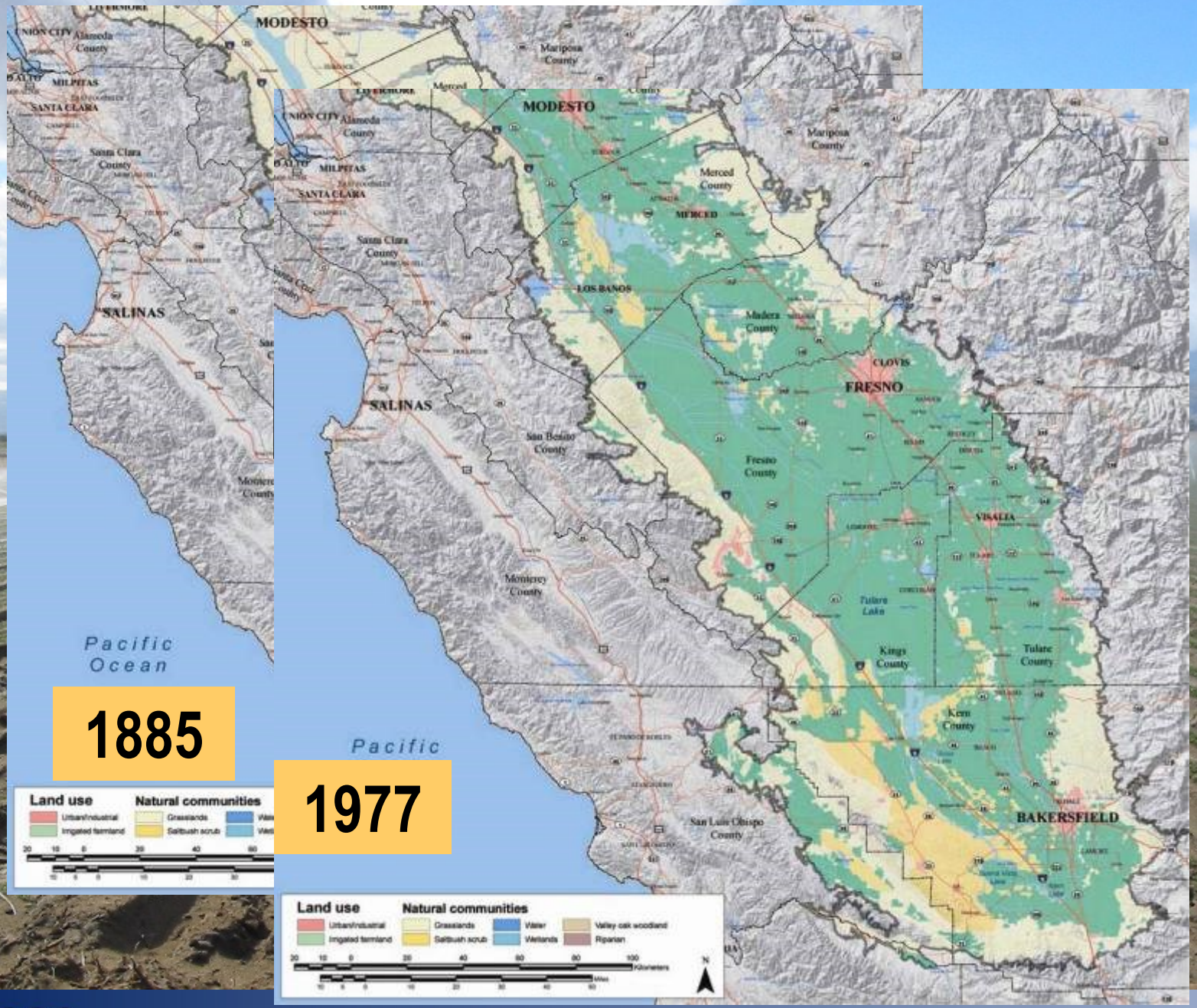
ASR

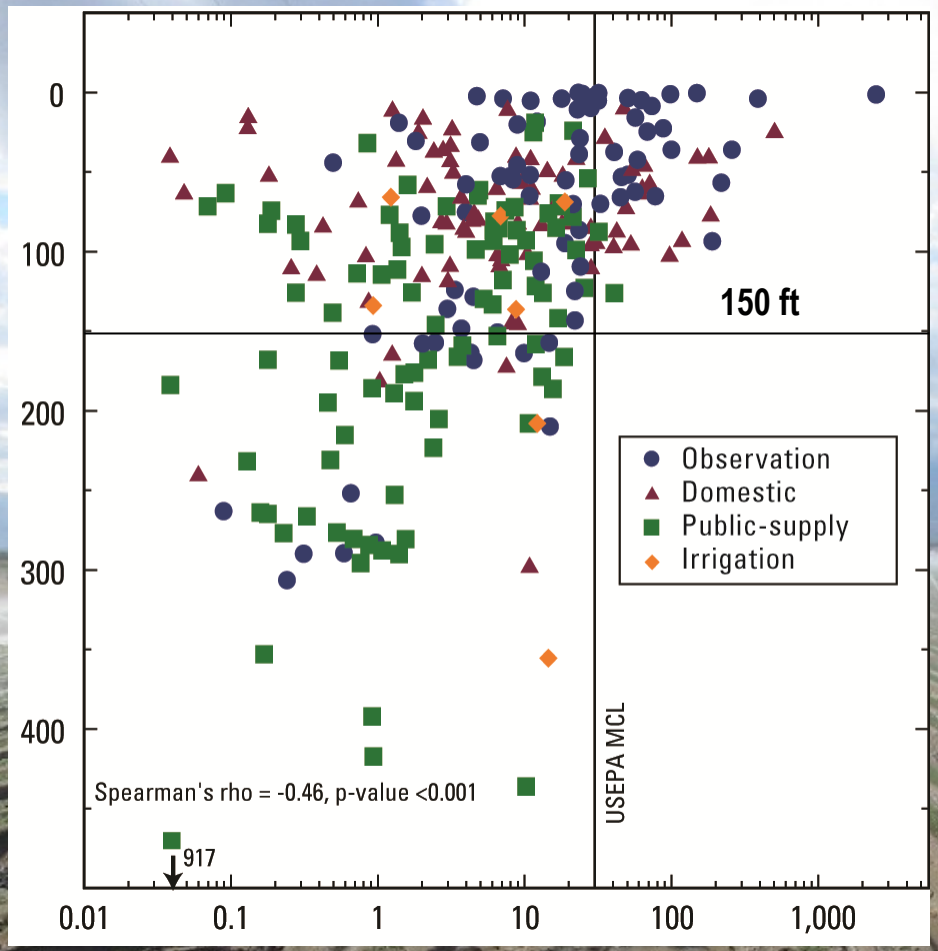




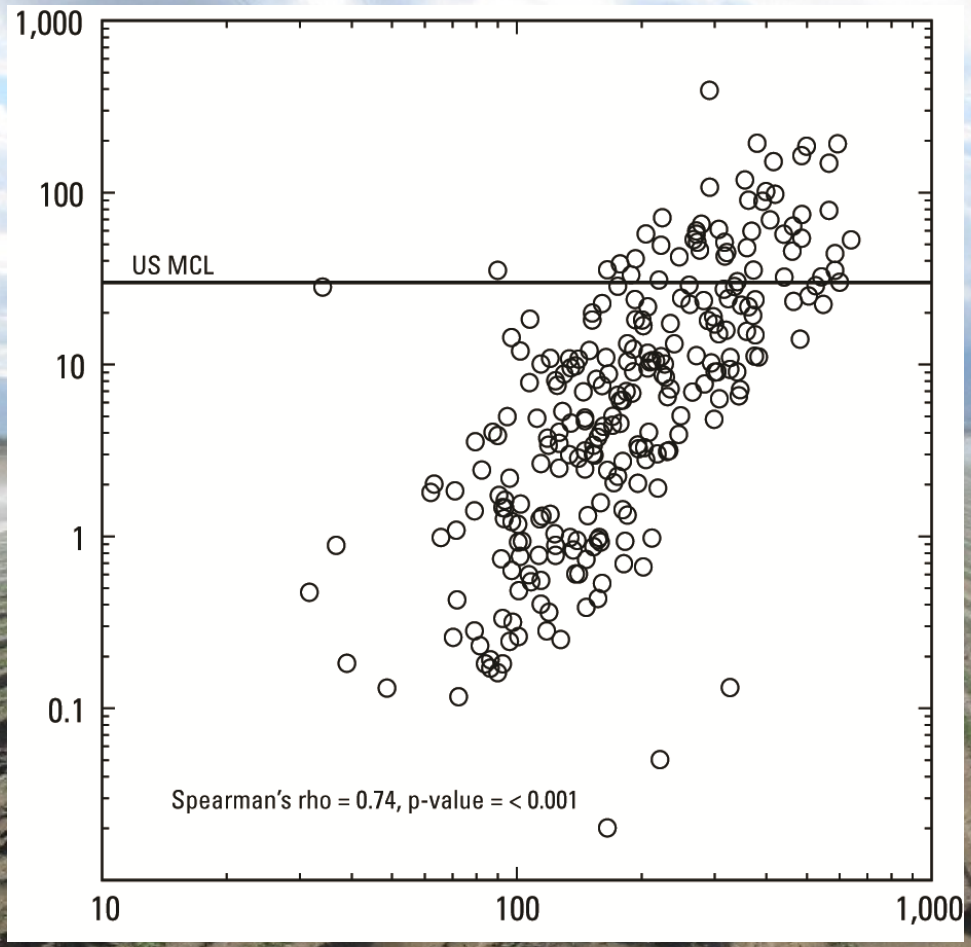
Multi-aquifer wells


Geology
Climate
Hydro-
geology
Ground-
water
quality
Contaminant
source
Geo-
chemistry


MODESTO
Alameda County
Santa Clara County
Merced County
Mariposa County
Madera County
Fresno County
San Benito County
Monterey County
Kings County
Tulare County
Kern County
San Luis Obispo County
SALINAS
LOS BANOS
CLOVIS
FRESNO
VISALIA
BAKERSFIELD
Tulare Lake
Pacific Ocean
Pacific
1885
1977
Land use
Natural communities
Urban/industrial
Irrigated farmland
Grasslands
Saltbush scrub
Water
Wetlands
Valley oak woodland
Riparian
Kilometers
Miles
N

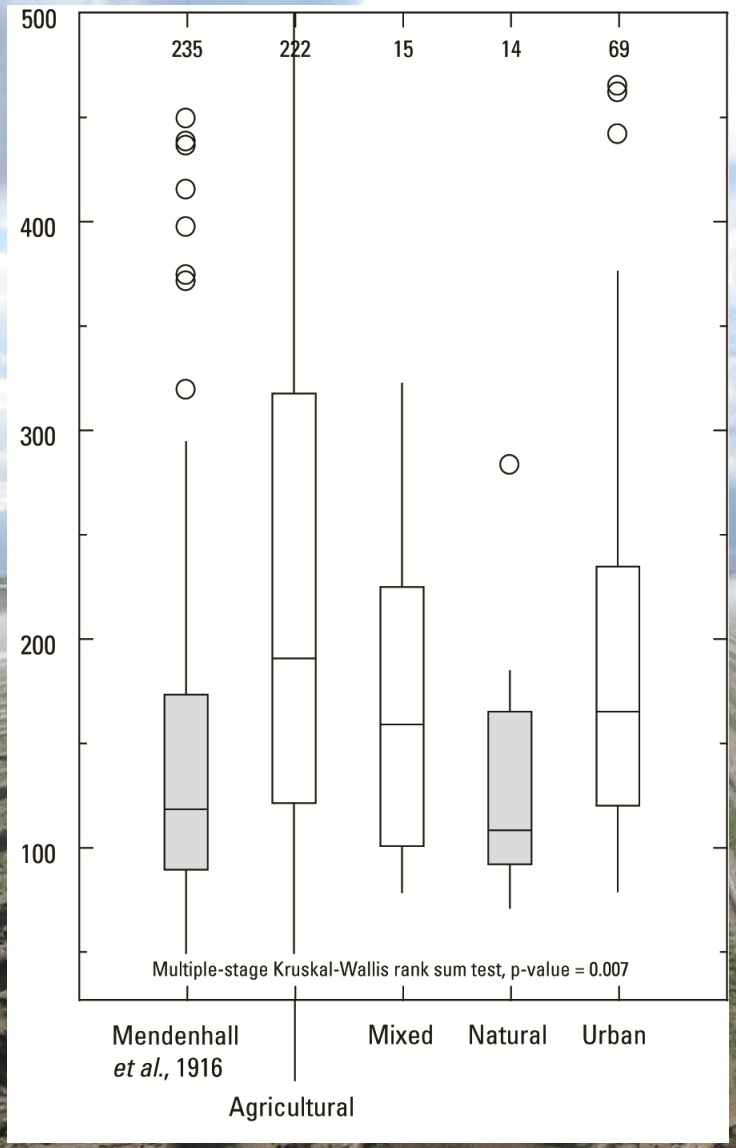


U concentrations greater than the MCL are found in shallow wells (<150 ft) that contain relatively young GW suggesting the overlying land use has affected groundwater quality



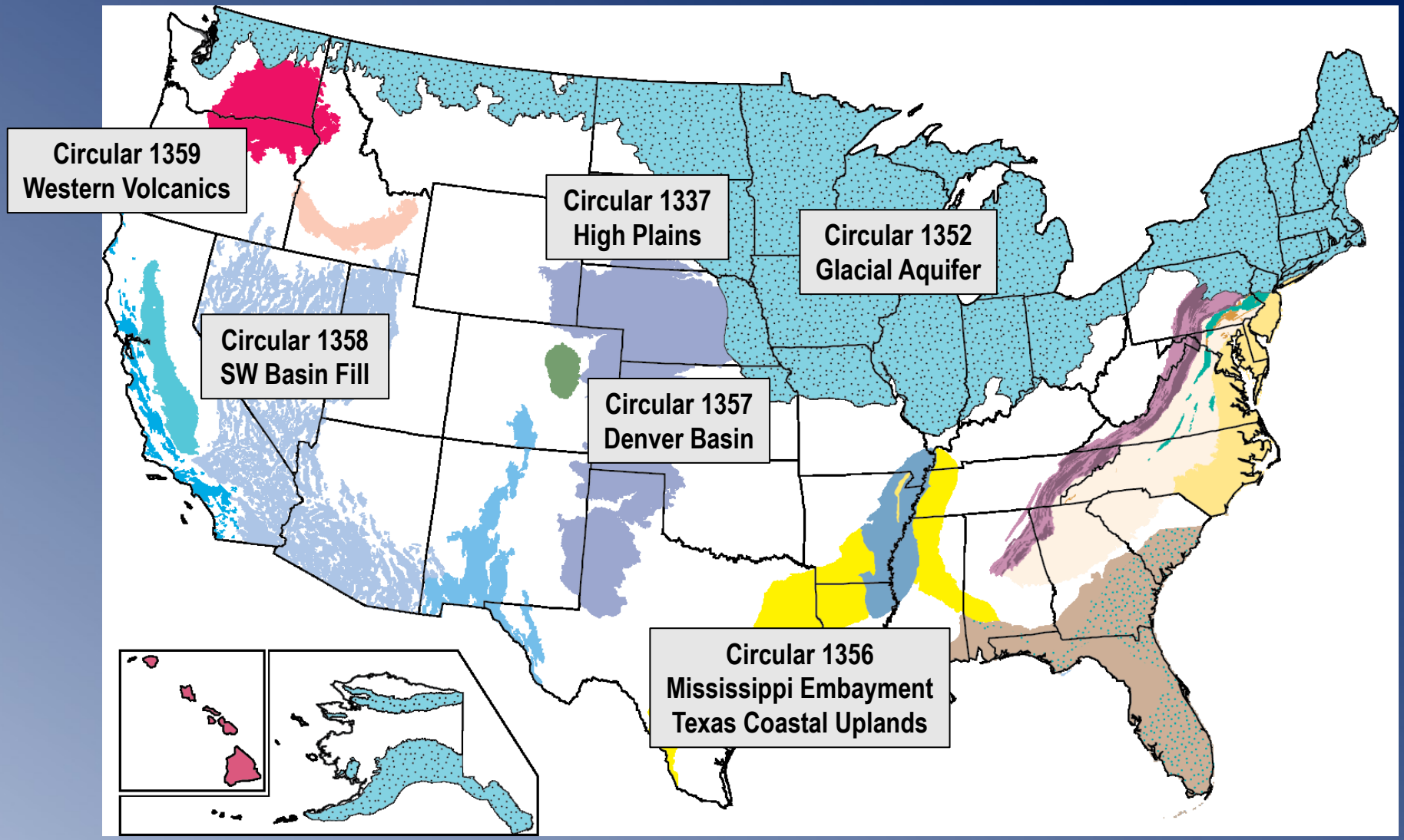
U concentrations display strong, positive correlation with groundwater alkalinity.

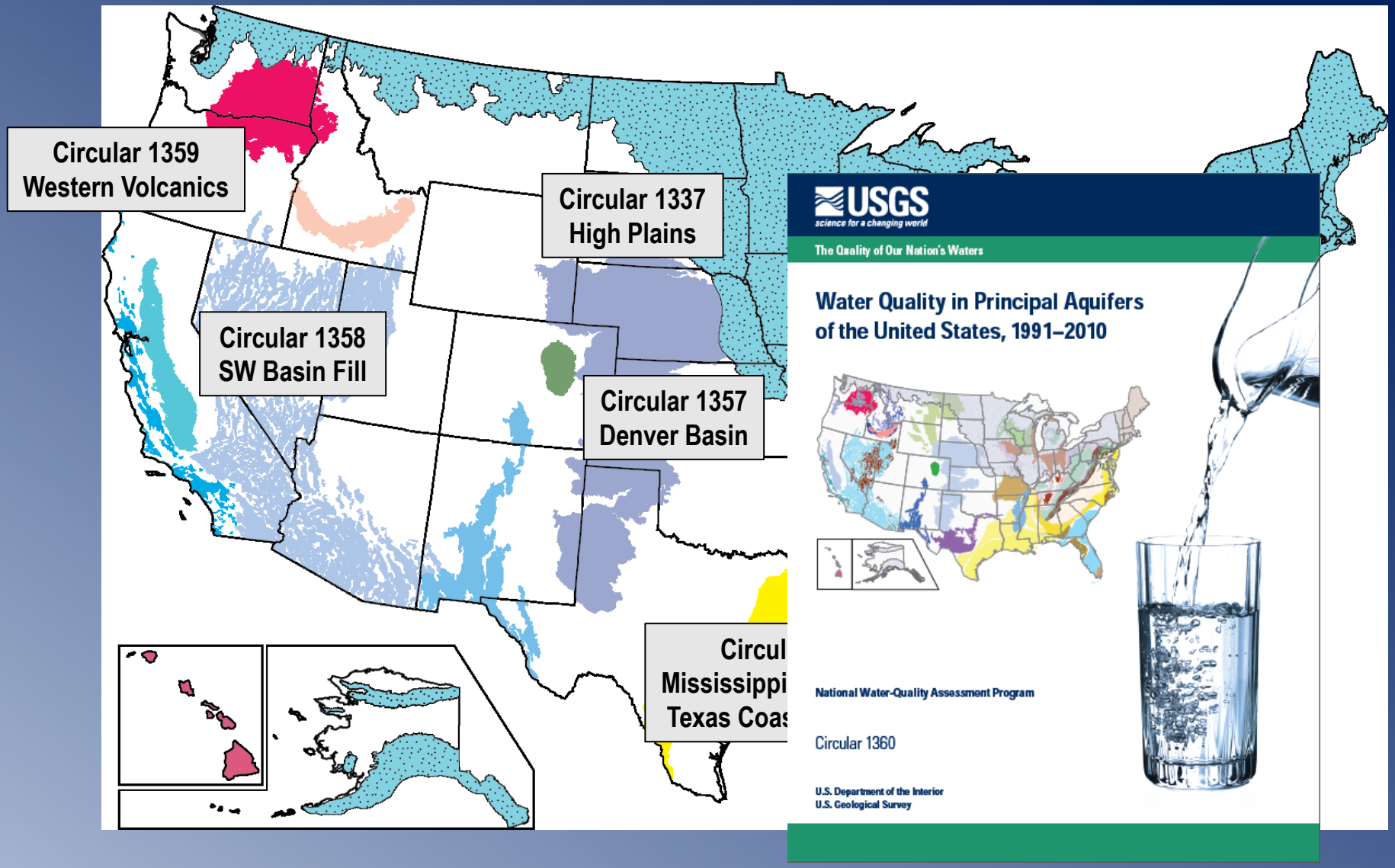
Bicarbonate, milligrams per liter



Land Use Classification

Alkalinity values have changed over time and today high alkalinities are associated with groundwater beneath agricultural, urban, and mixed-land use areas


Circular 1359
Western Volcanics
Circular 1337
High Plains
Circular 1352
Glacial Aquifer
Circular 1358
SW Basin Fill
Circular 1357
Denver Basin
Circular 1356
Mississippi Embayment
Texas Coastal Uplands


Circular 1359
Western Volcanics
Circular 1337
High Plains
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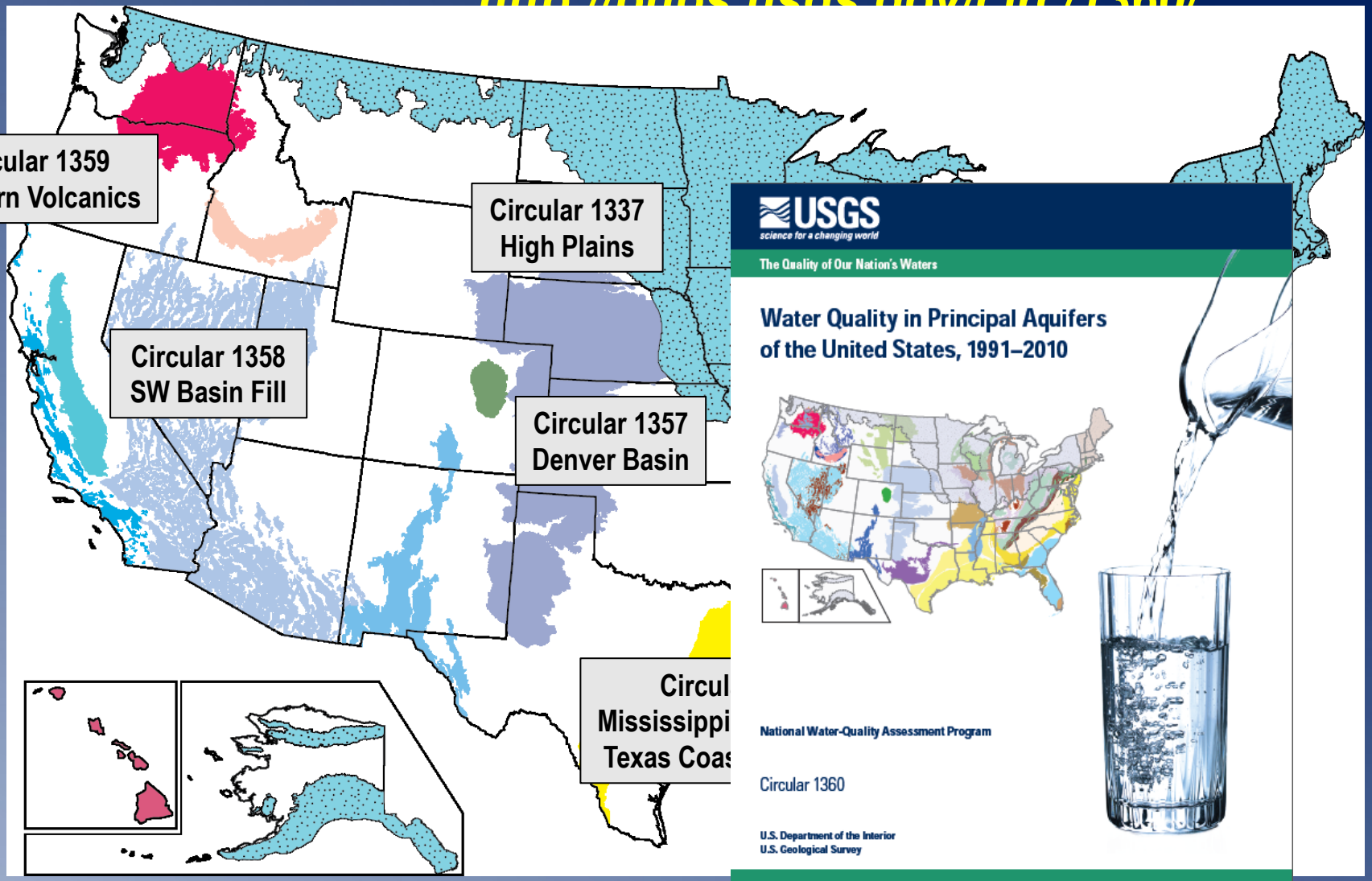
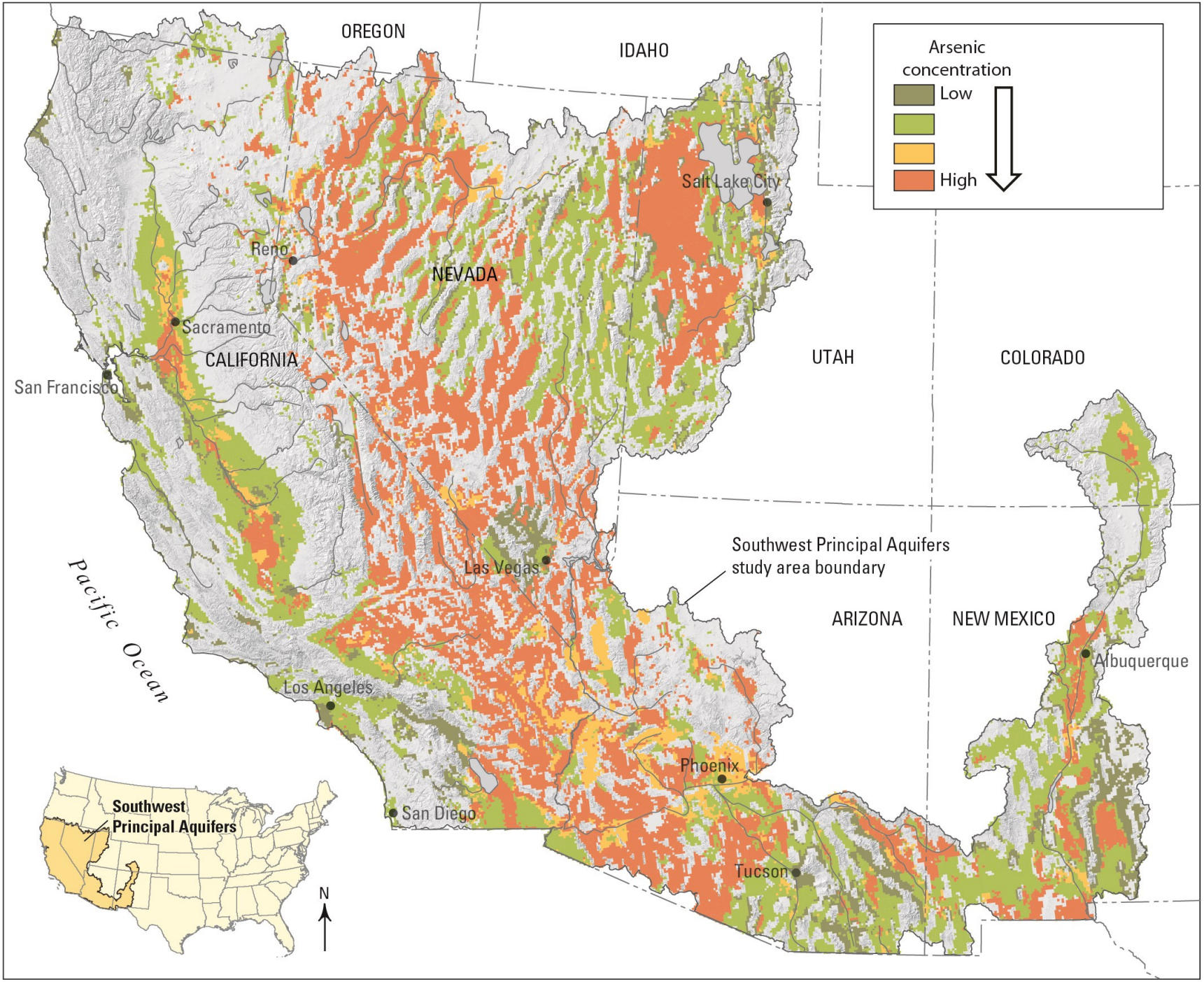
SW Basin Fill
Circular 1357
Denver Basin
Circul
Mississippi
Texas Coas
USGS
science for a changing world
The Quality of Our Nation's Waters
Water Quality in Principal Aquifers of the United States, 1991–2010
National Water-Quality Assessment Program
Circular 1360
U.S. Department of the Interior
U.S. Geological Survey

http://pubs.usgs.gov/circ/1360/




OREGON
IDAHO
Arsenic concentration
Low
High
Salt Lake City
Reno
NEVADA
Sacramento
CALIFORNIA
San Francisco
UTAH
COLORADO
Southwest Principal Aquifers study area boundary
Las Vegas
Pacific Ocean
ARIZONA
NEW MEXICO
Albuquerque
Los Angeles
Phoenix
San Diego
Tucson
Southwest Principal Aquifers
N

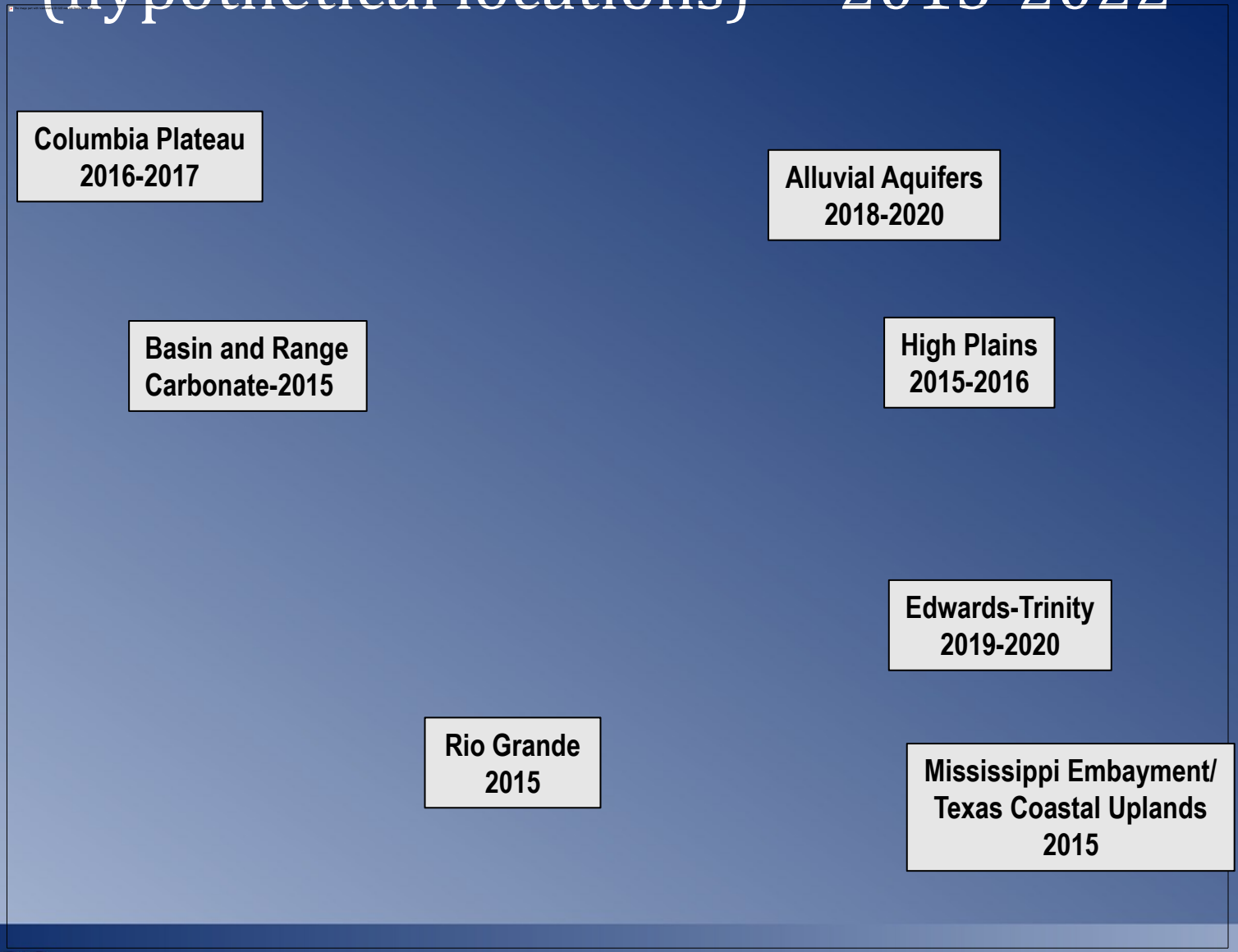
Assessing Groundwater Quality in 3-D

Trends in groundwater quality: What will the future bring?

Opportunities for Leveraging, Collaborating, and Providing Input on NAWQA GW-WQ Studies planned for 2015-2022

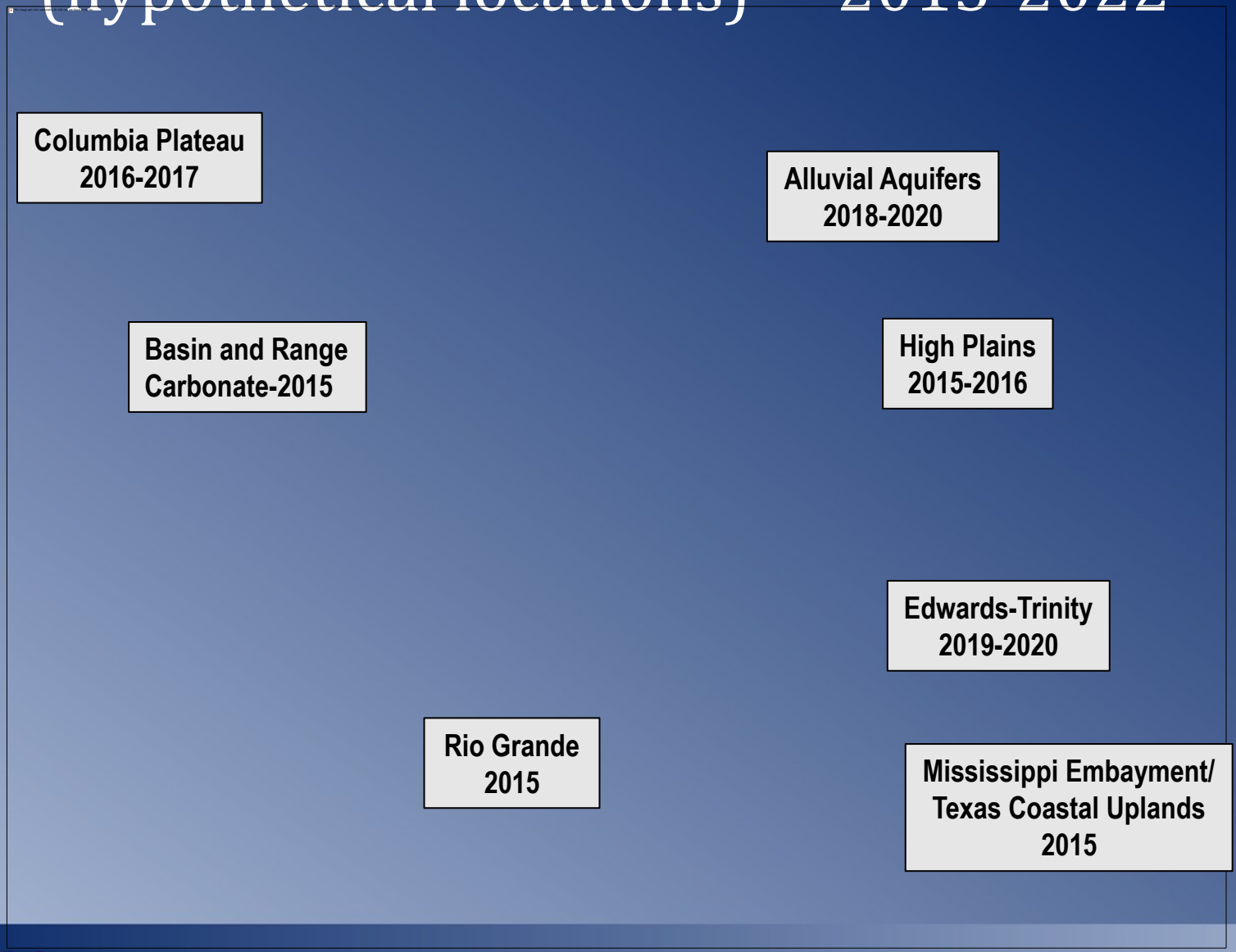
- **National Liaison Committee meeting**
  - Friday May 8 10-noon, Washington D.C.
- **Detailed briefing on when and where NAWQA monitoring and modeling studies are planned**
  - To WSWC Water Quality Committee per their schedule
  - Individual briefings with interested states
- **Direct correspondence**
  - Contact me at glrowe@usgs.gov

Principal Aquifer Study wells (hypothetical locations)— 2015-2022

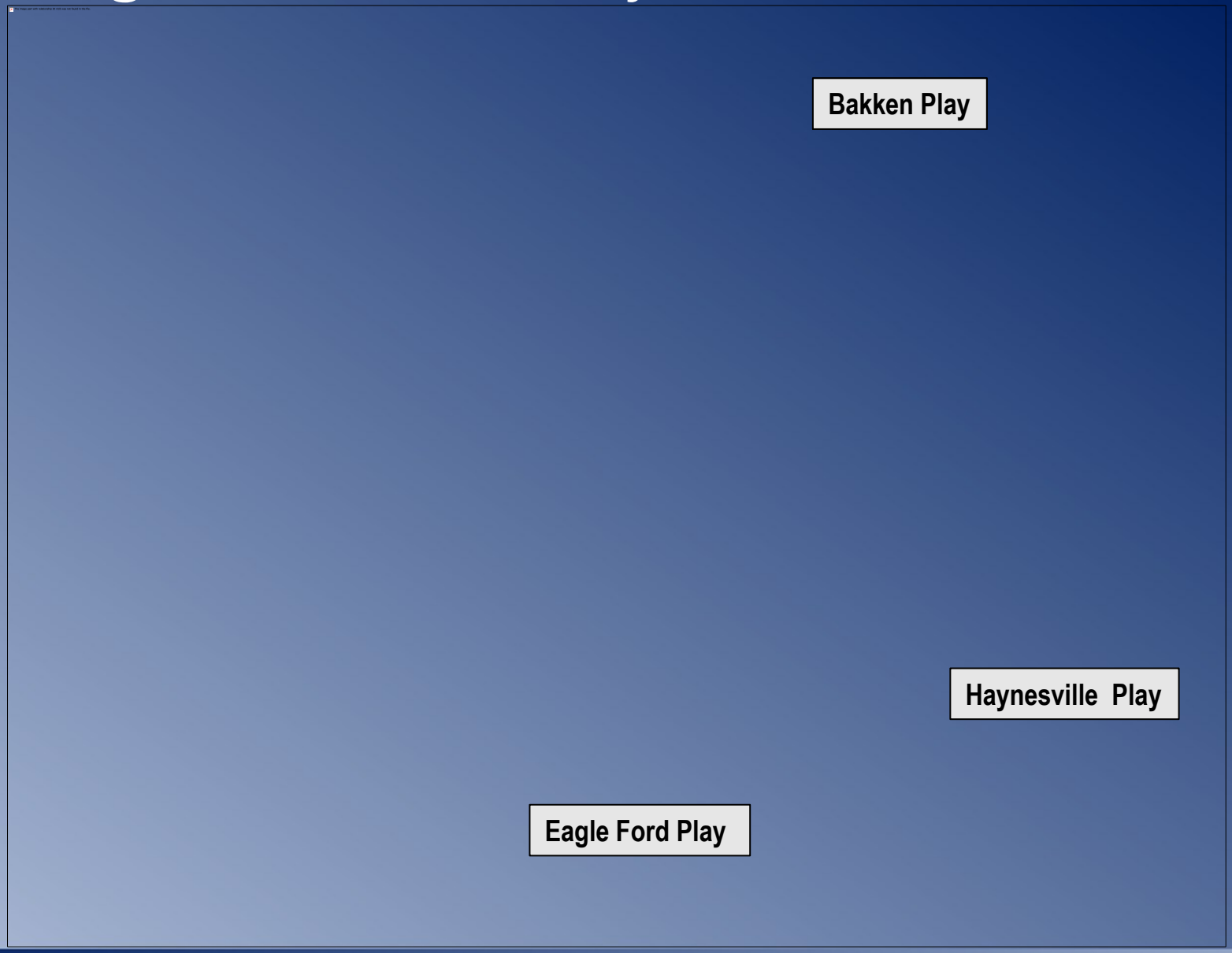


Decadal Trends wells — 2015-2022

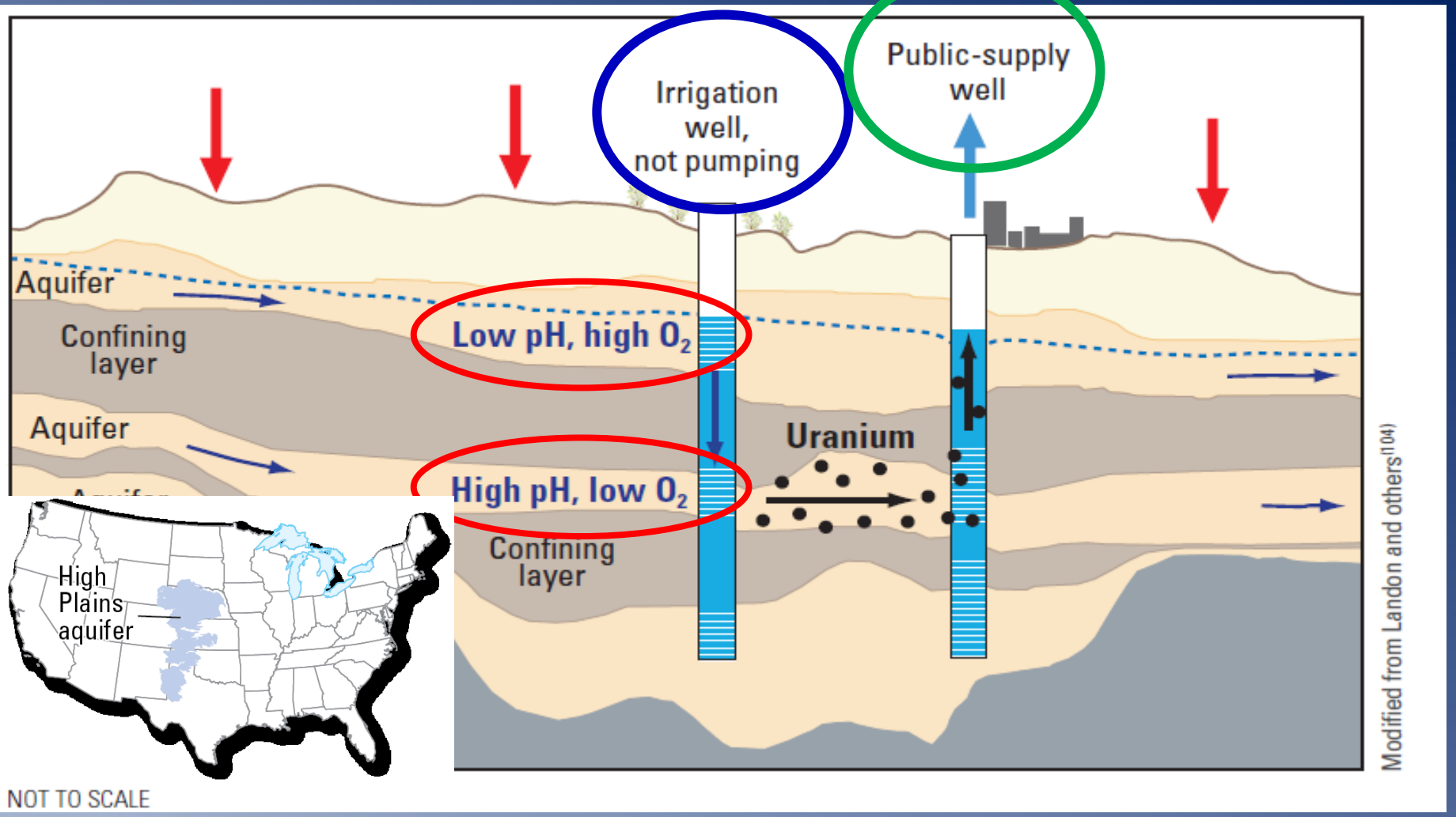
Principal Aquifer Study wells (hypothetical locations)— 2015-2022



Other groundwater study locations— 2015-2022



Contaminant source | Geology | Climate | Hydro-geology | Geo-chemistry



Years

Oxic

Decades

Anoxic

Centuries