

Water Quality of the Nation's Groundwater 1991-2010

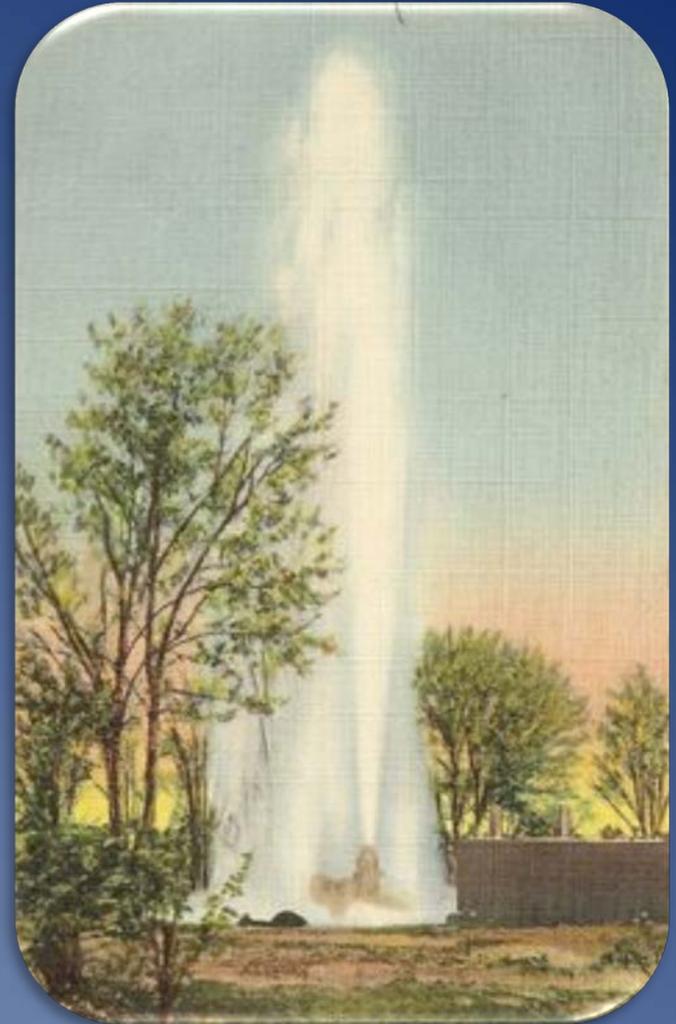
Barbara Mahler

17 June 2015

for

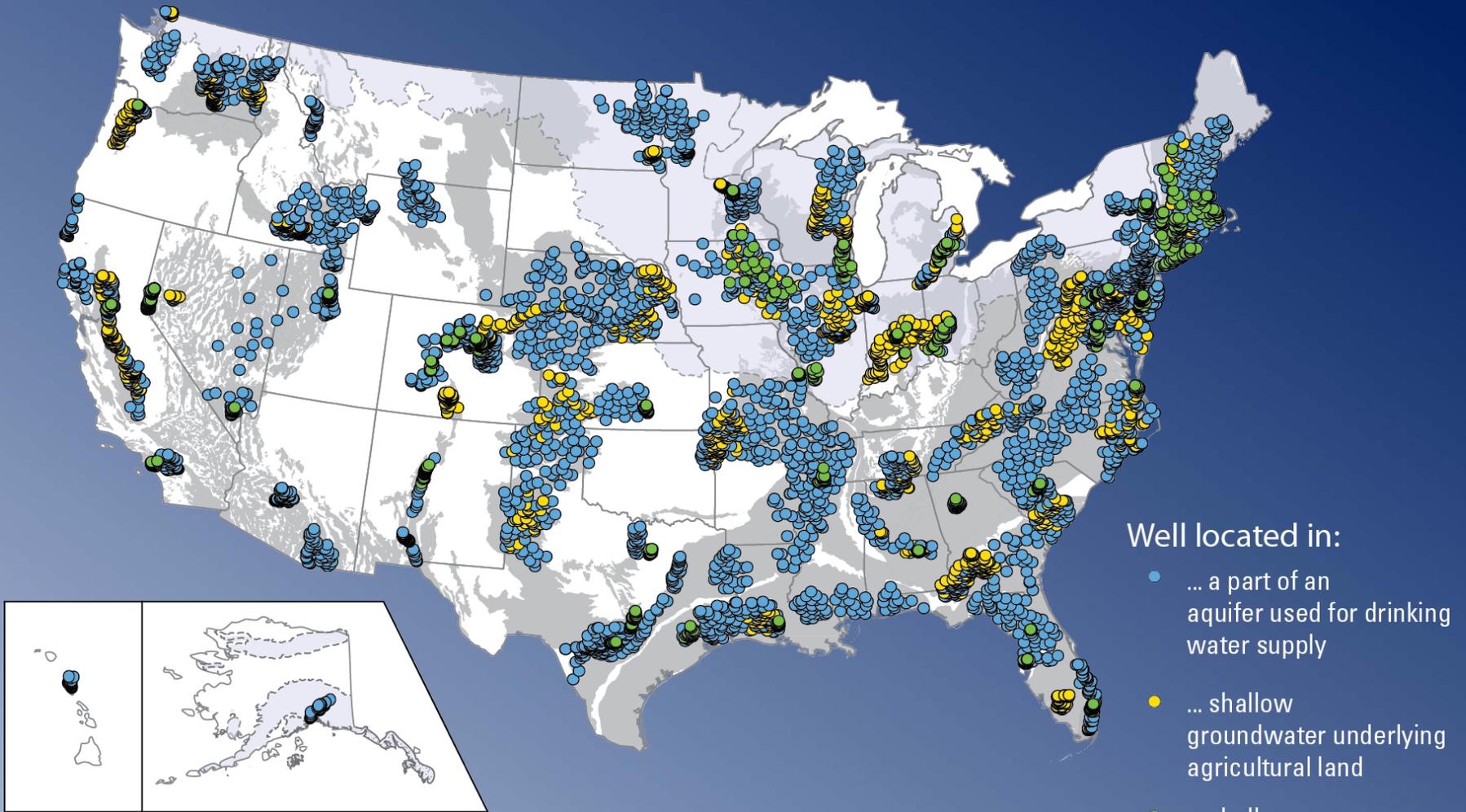
Association of Clean Water
Administrators

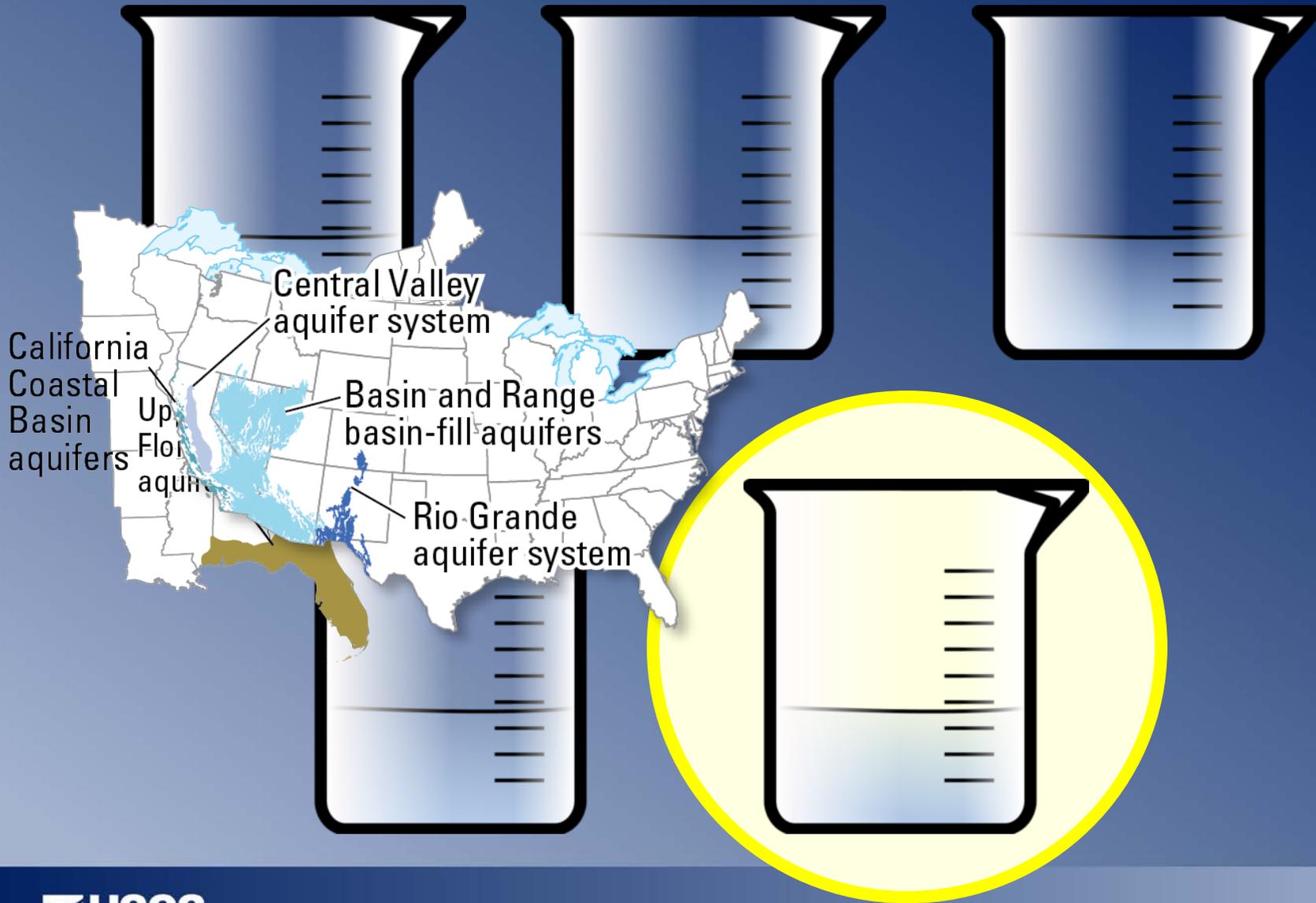
U.S. Department of the Interior
U.S. Geological Survey



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

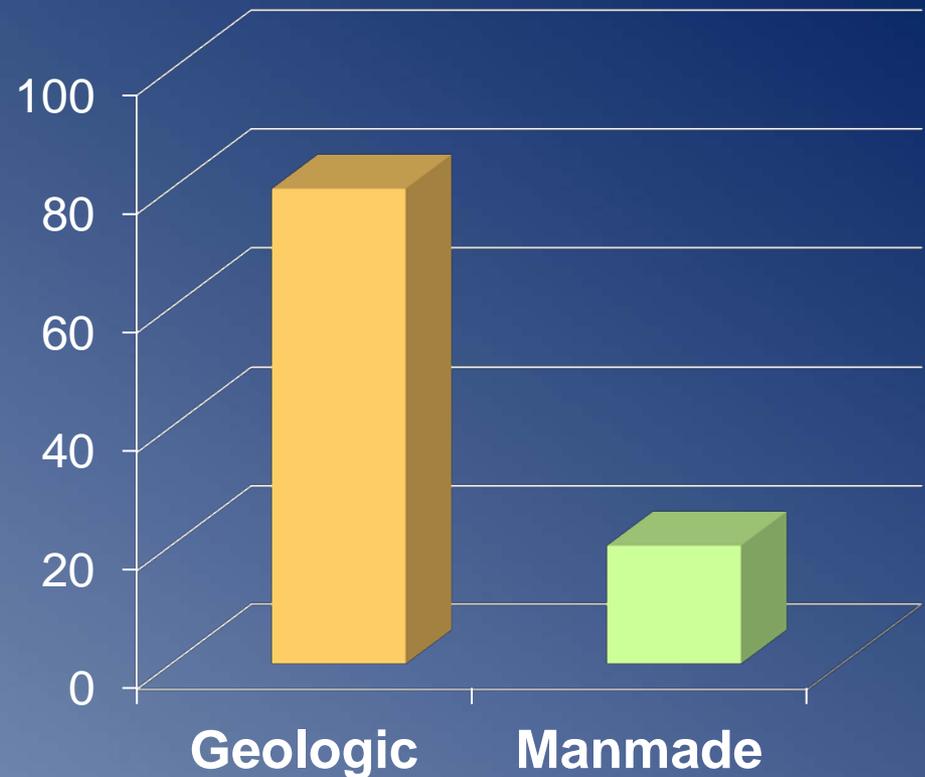
Groundwater study wells — 1991-2010

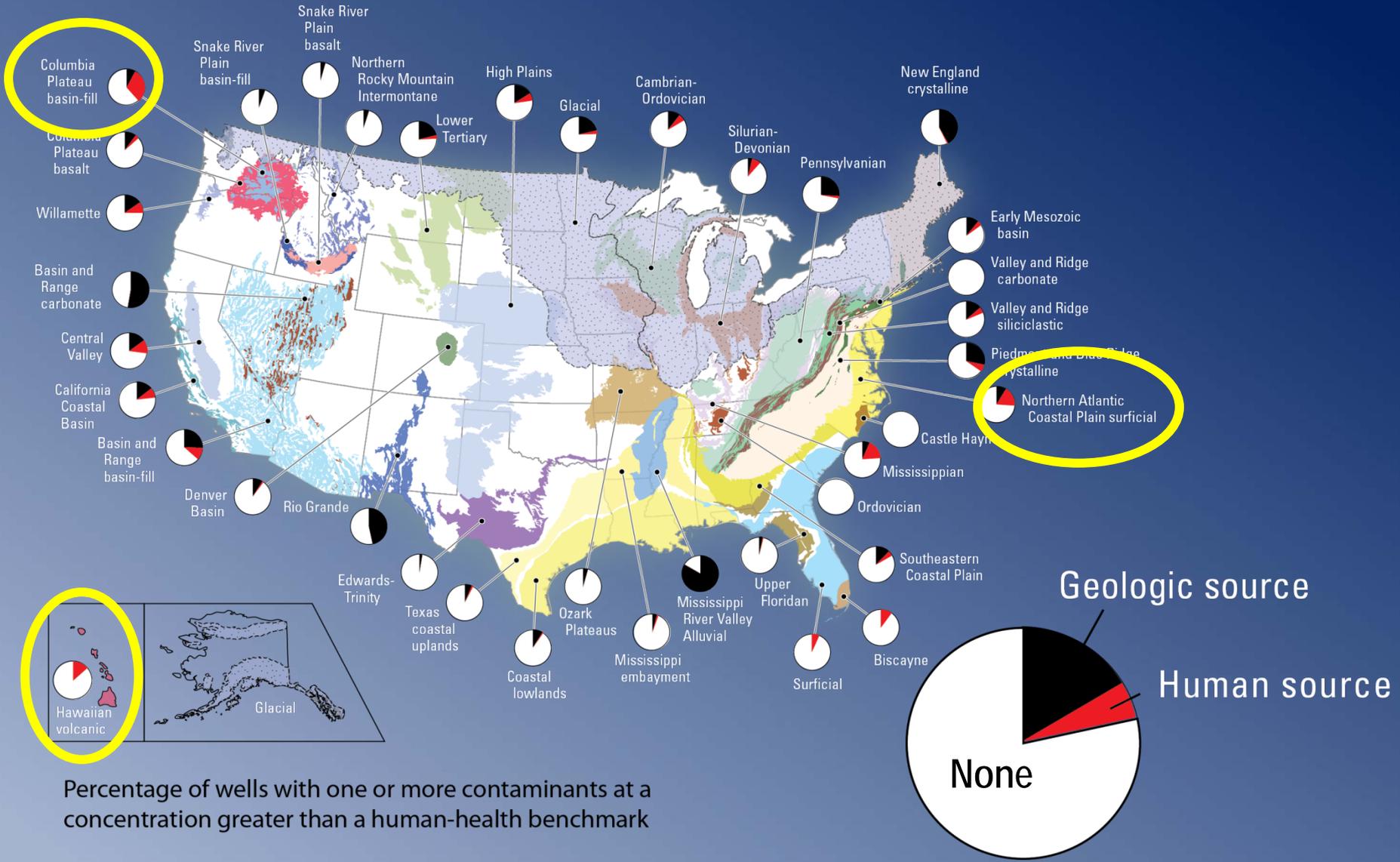


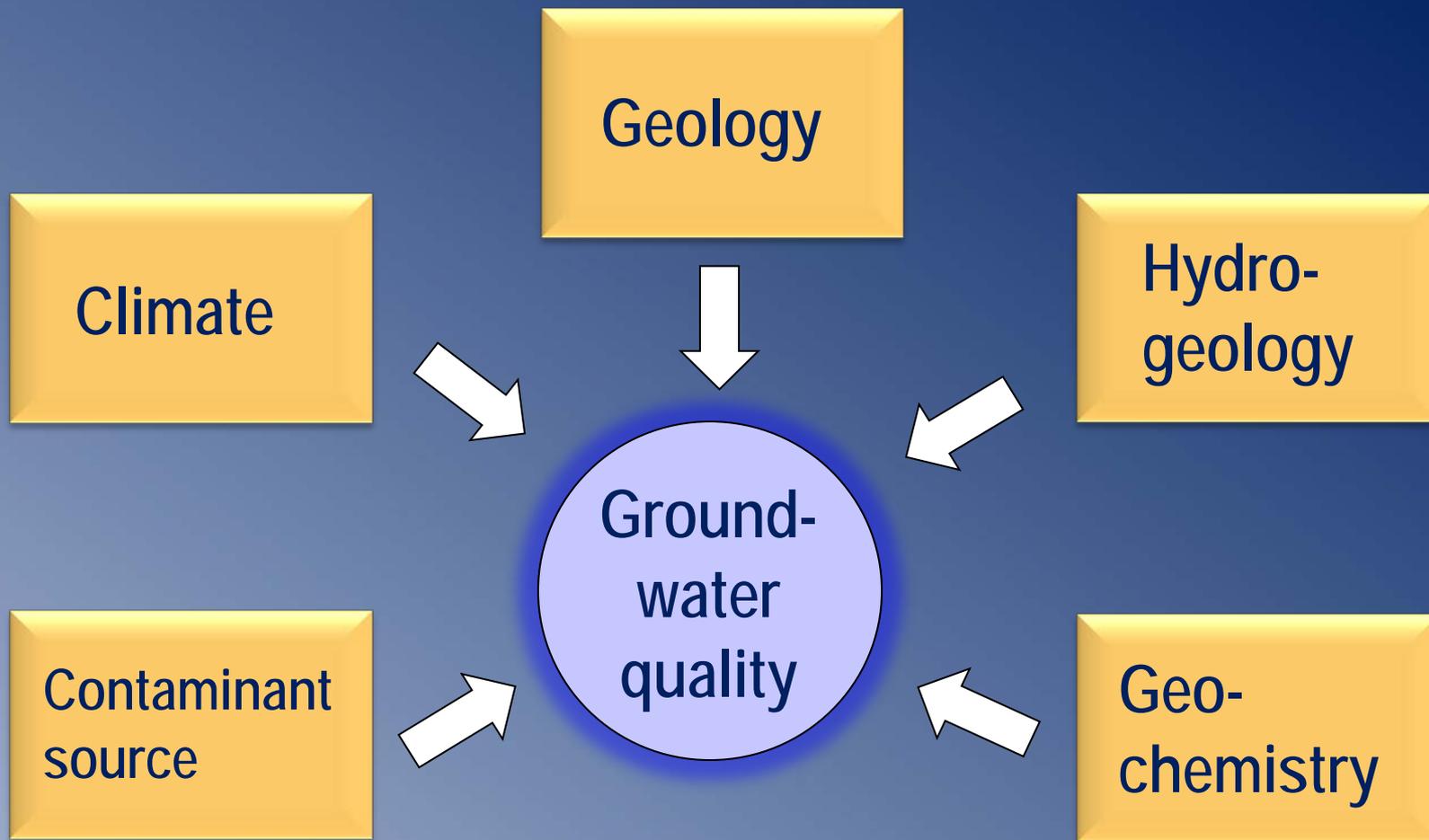


- Geologic source
 - Manganese
 - Arsenic
 - Radon
- Manmade source
 - Nitrate
 - Pesticides
 - Solvents

Benchmark exceedances







Contaminant source





Climate



Climate

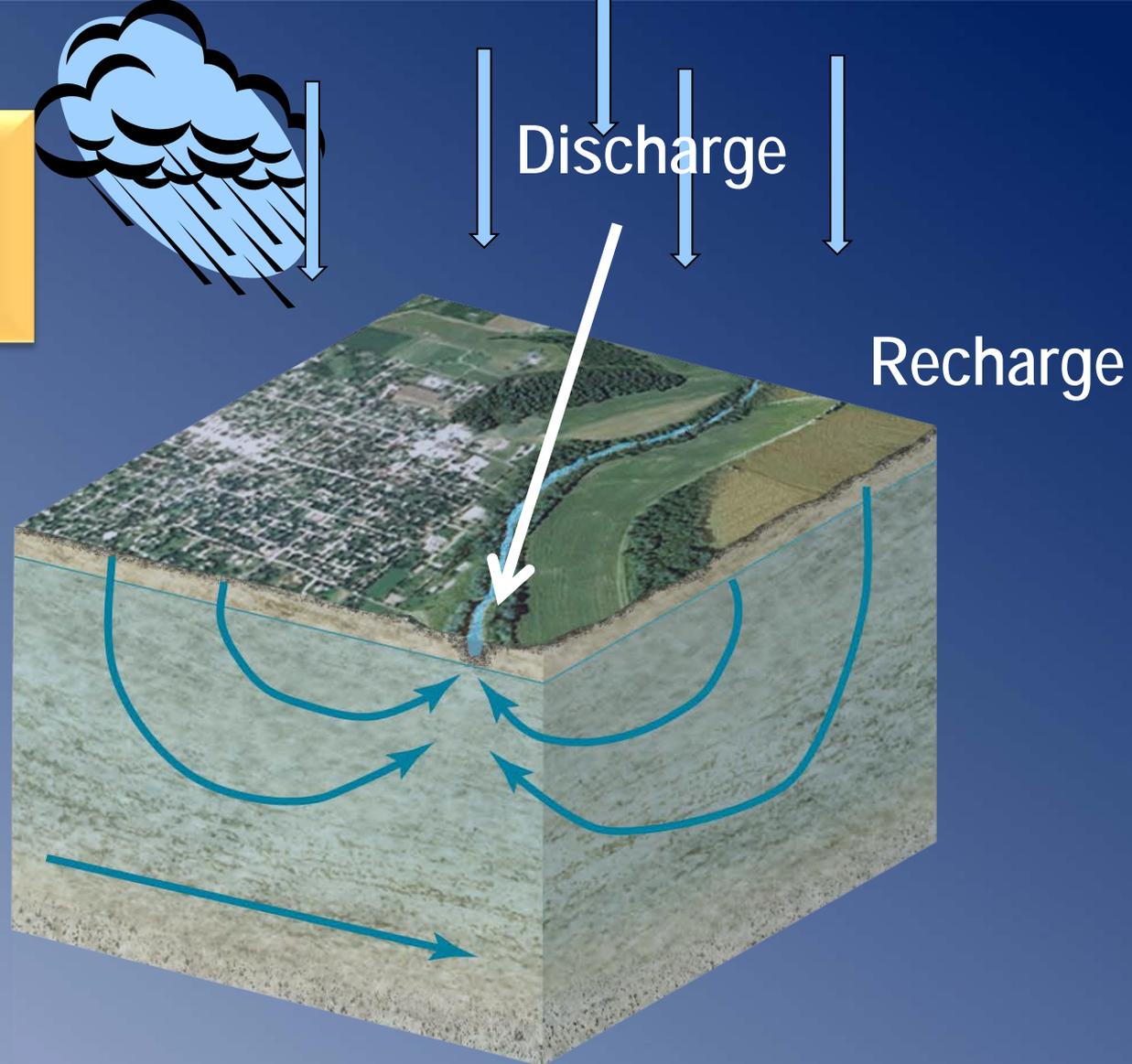


Geology



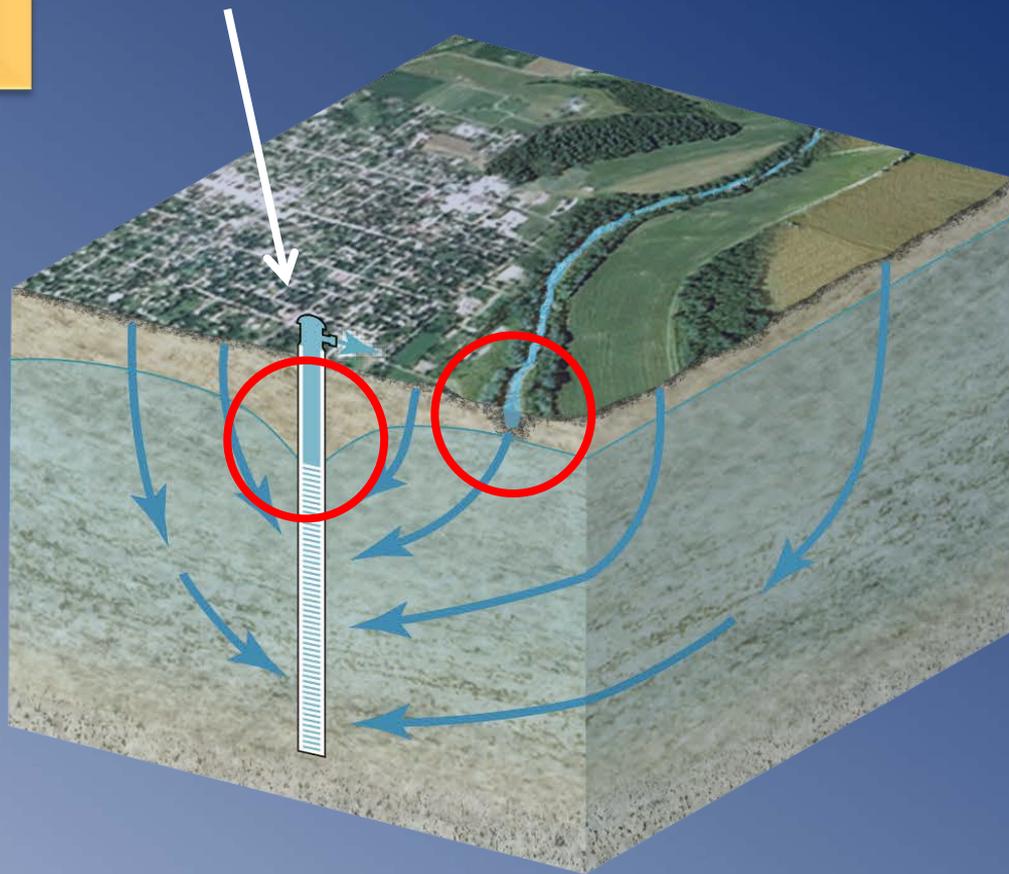
Upper Floridan aquifer

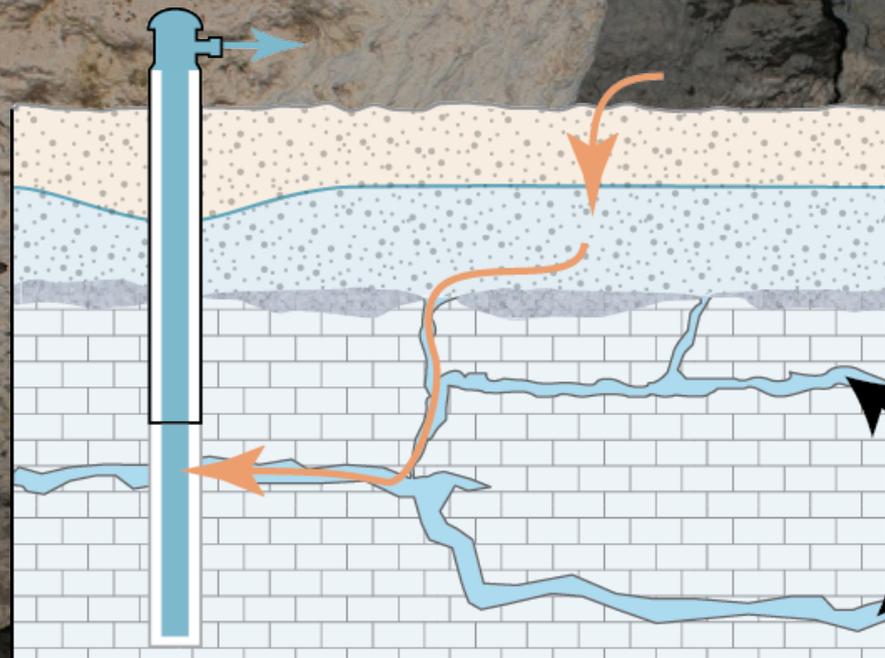
Hydro-geology



Hydro-geology

Discharge

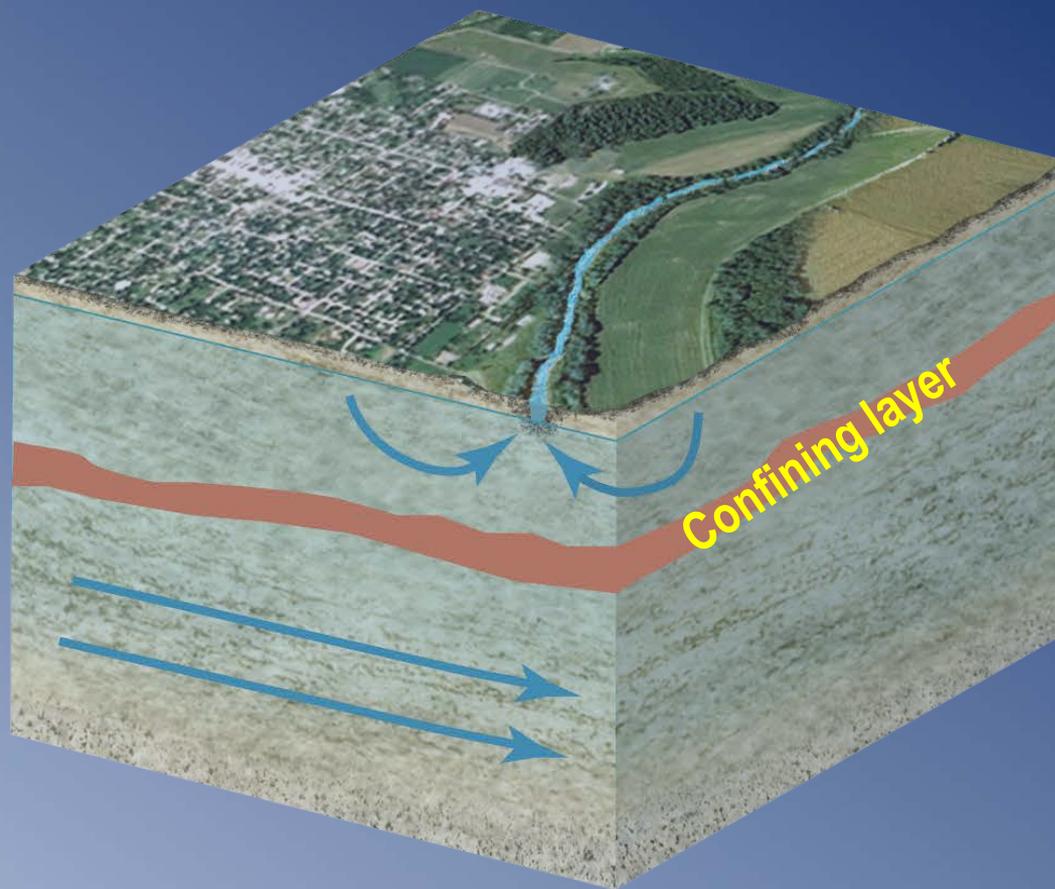




Preferential pathways



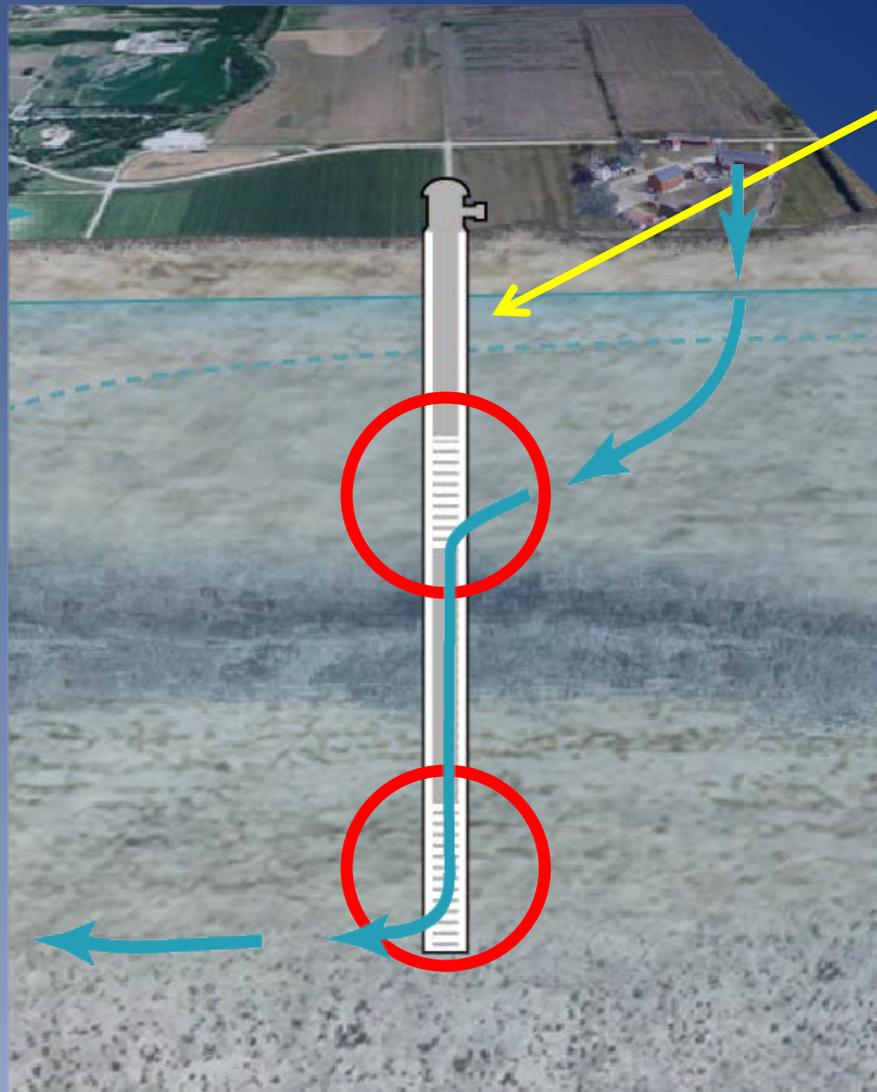
Hydro-geology



Unconfined
aquifer

Confined
aquifer

Hydro-geology



Multi-aquifer well

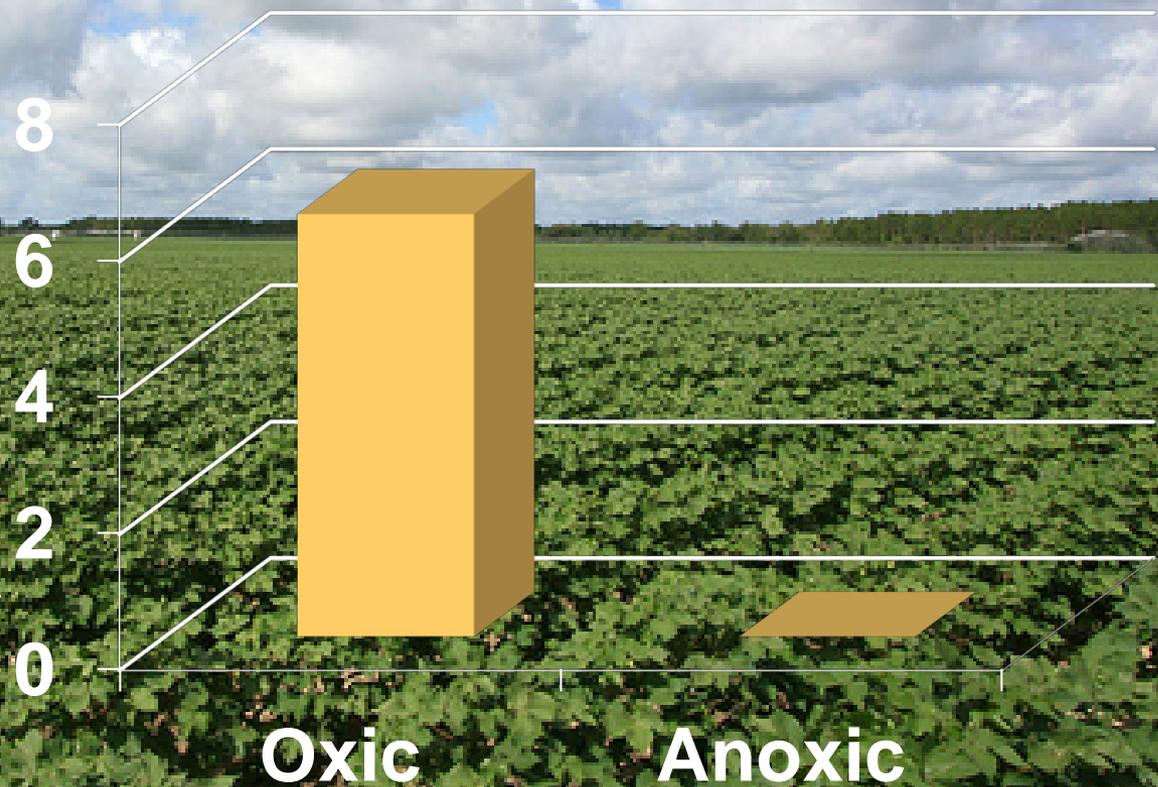
Unconfined aquifer

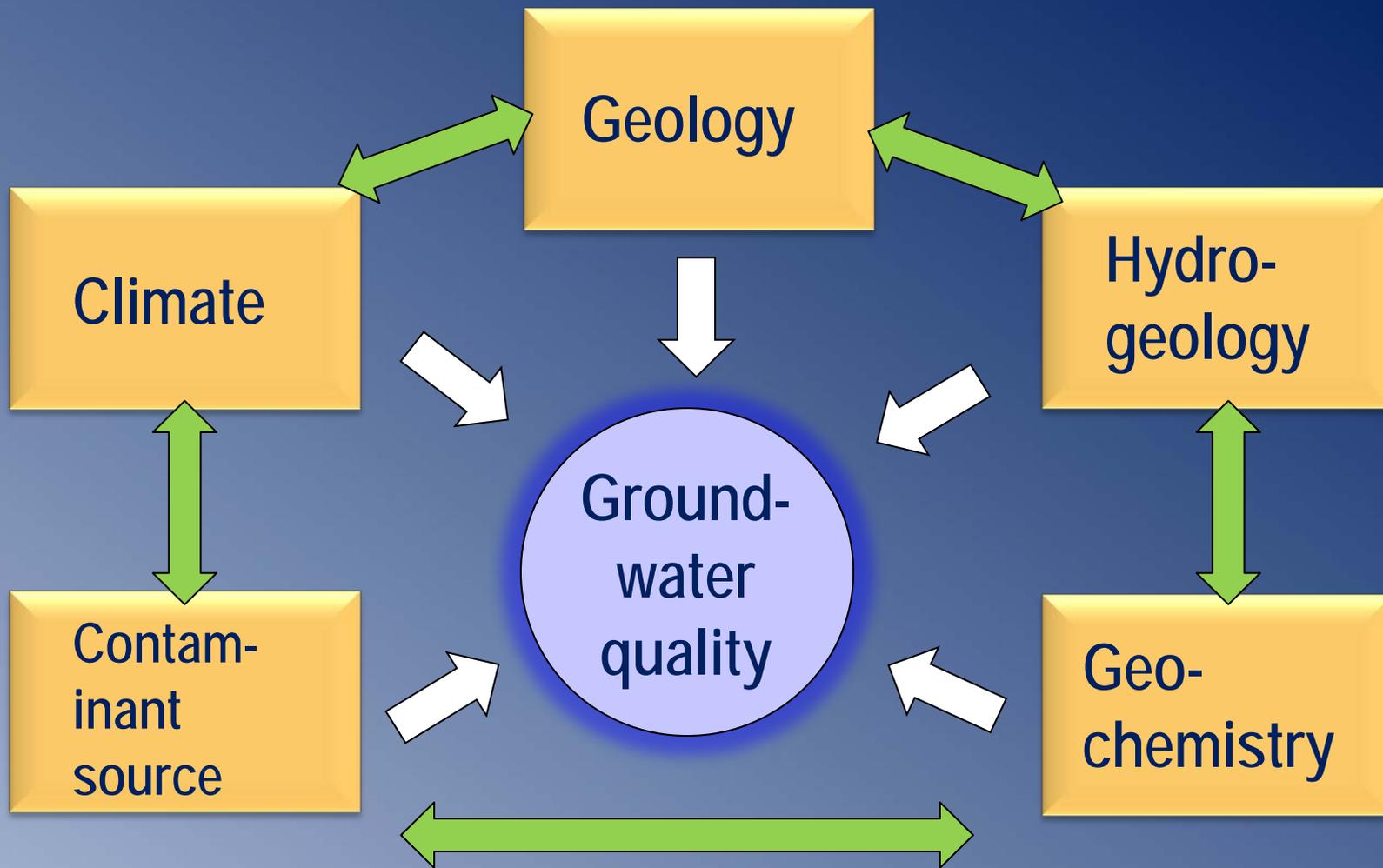
Confining layer

Confined aquifer

Geo-chemistry

Nitrate
Concentration
(mg/L as N)

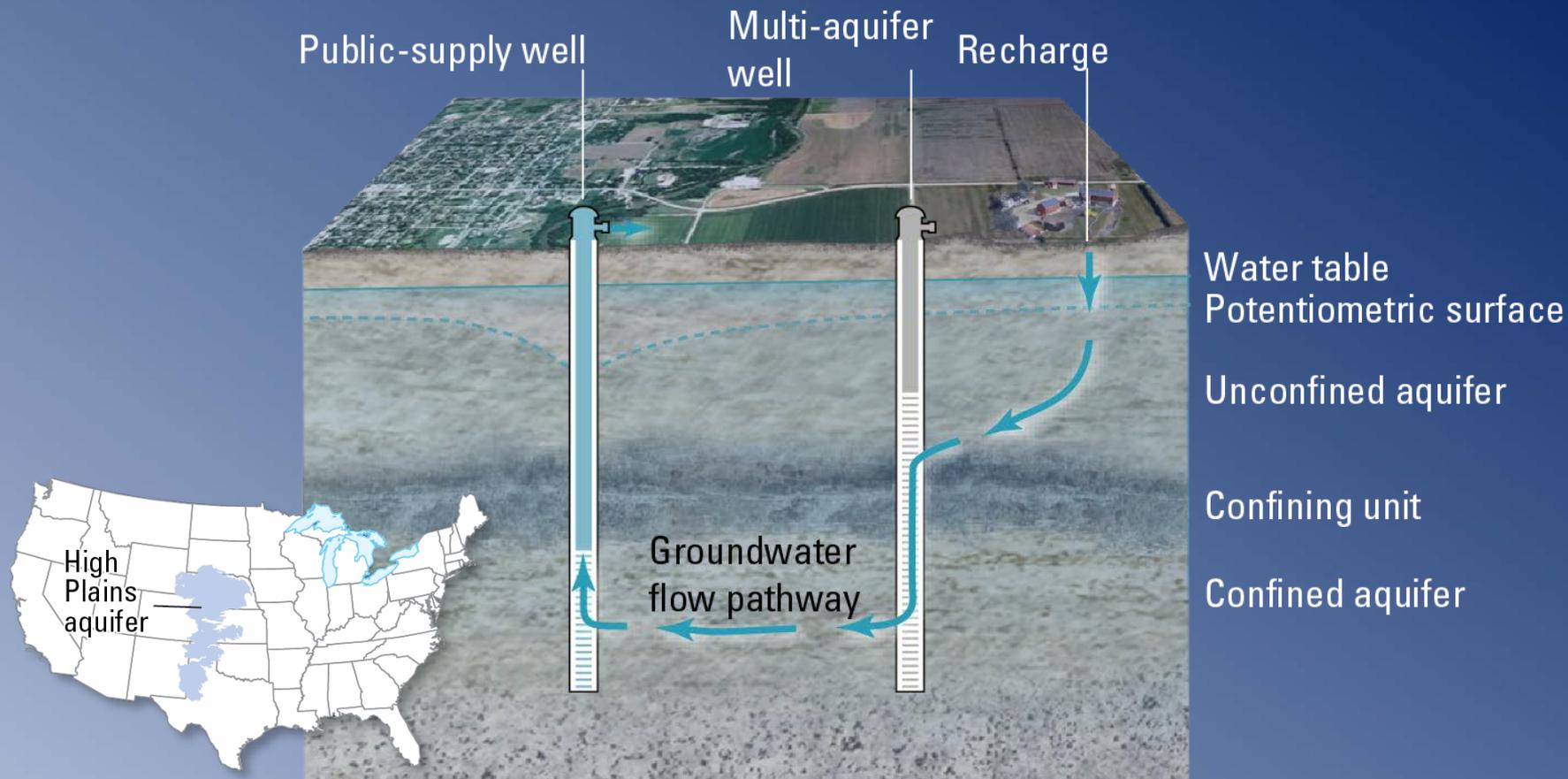




Geology

Hydro-geology

Geo-chemistry



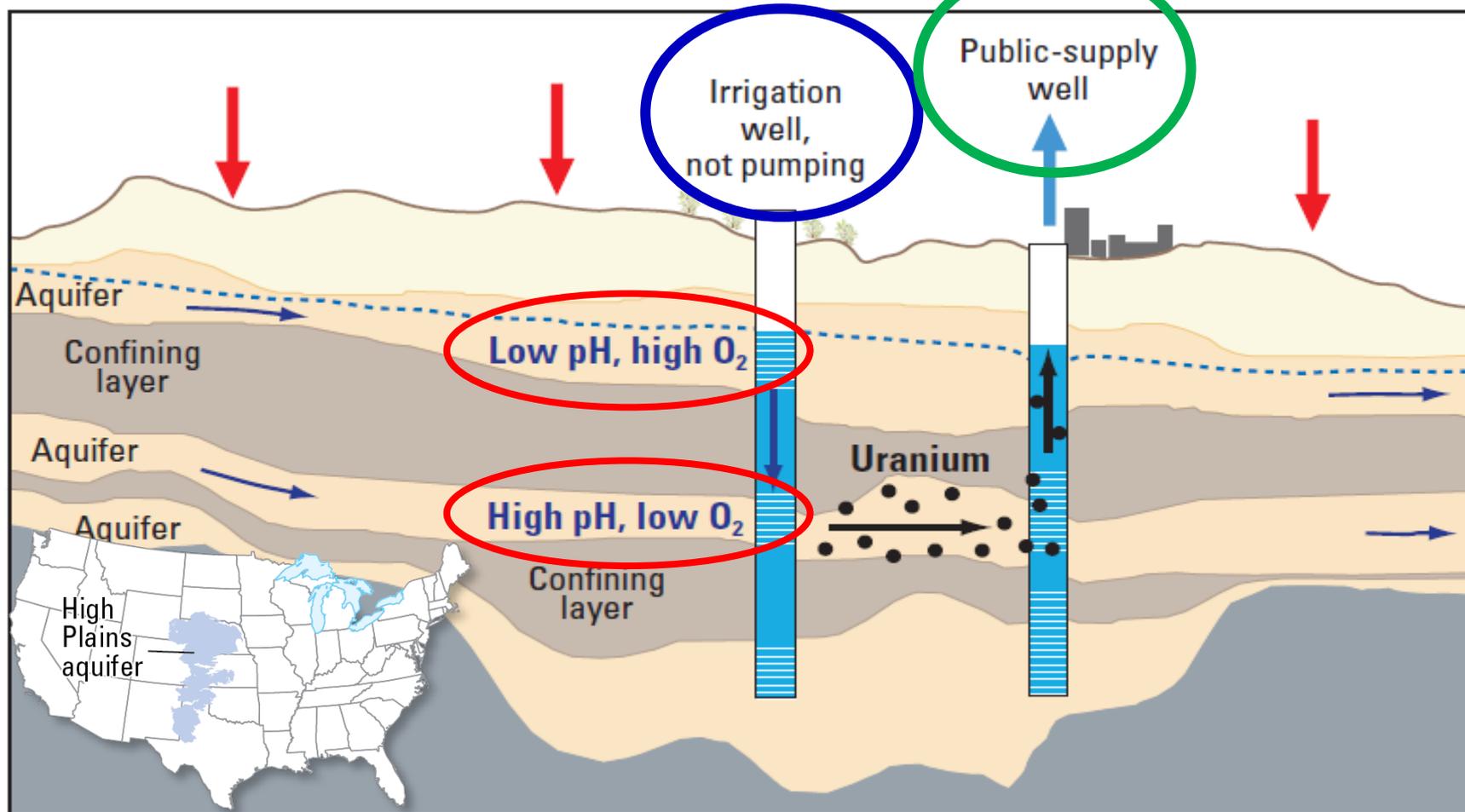
Contaminant source

Geology

Climate

Hydro-geology

Geo-chemistry



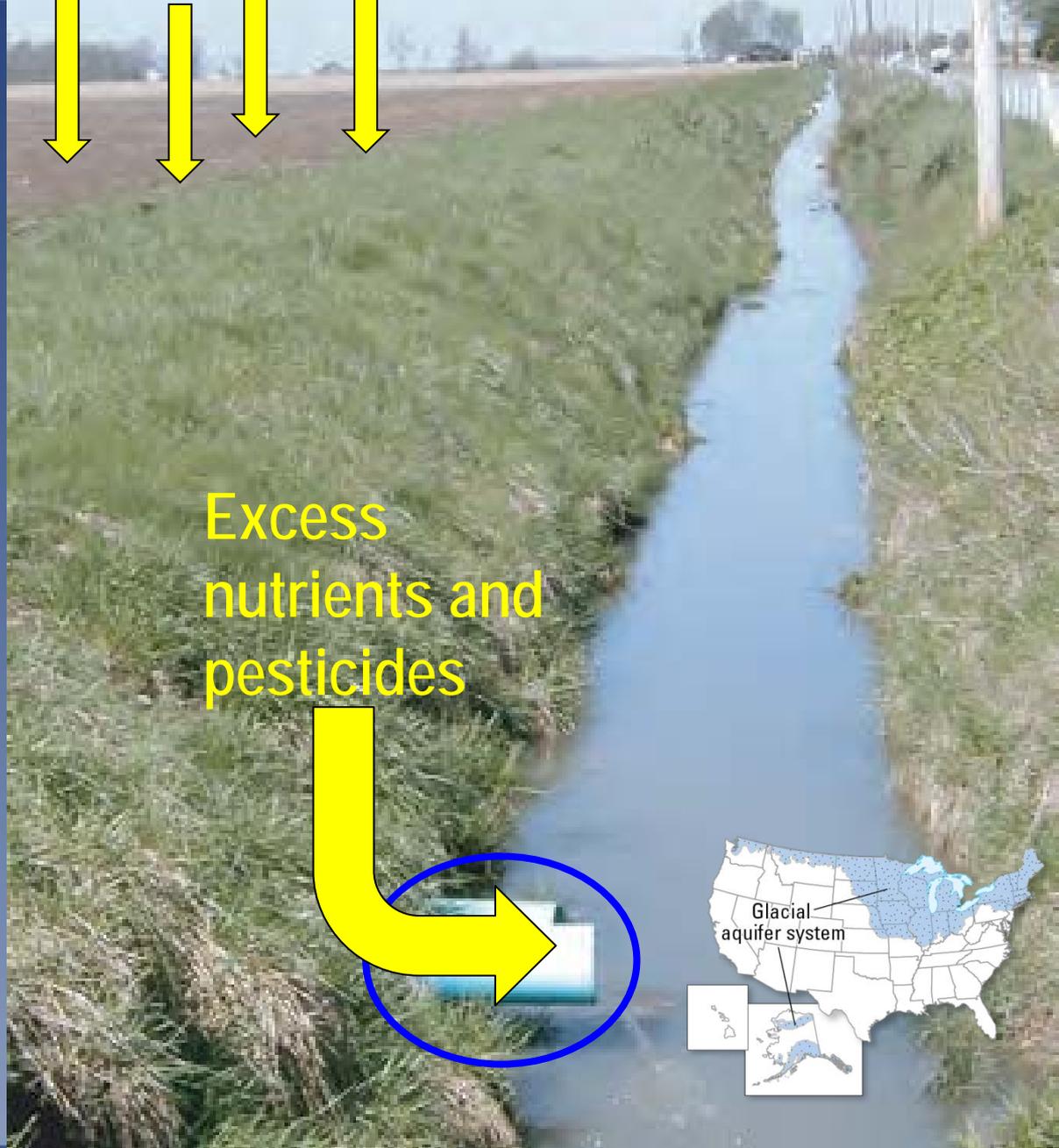
Modified from Landon and others (1994)

NOT TO SCALE

Geology

Contaminant source

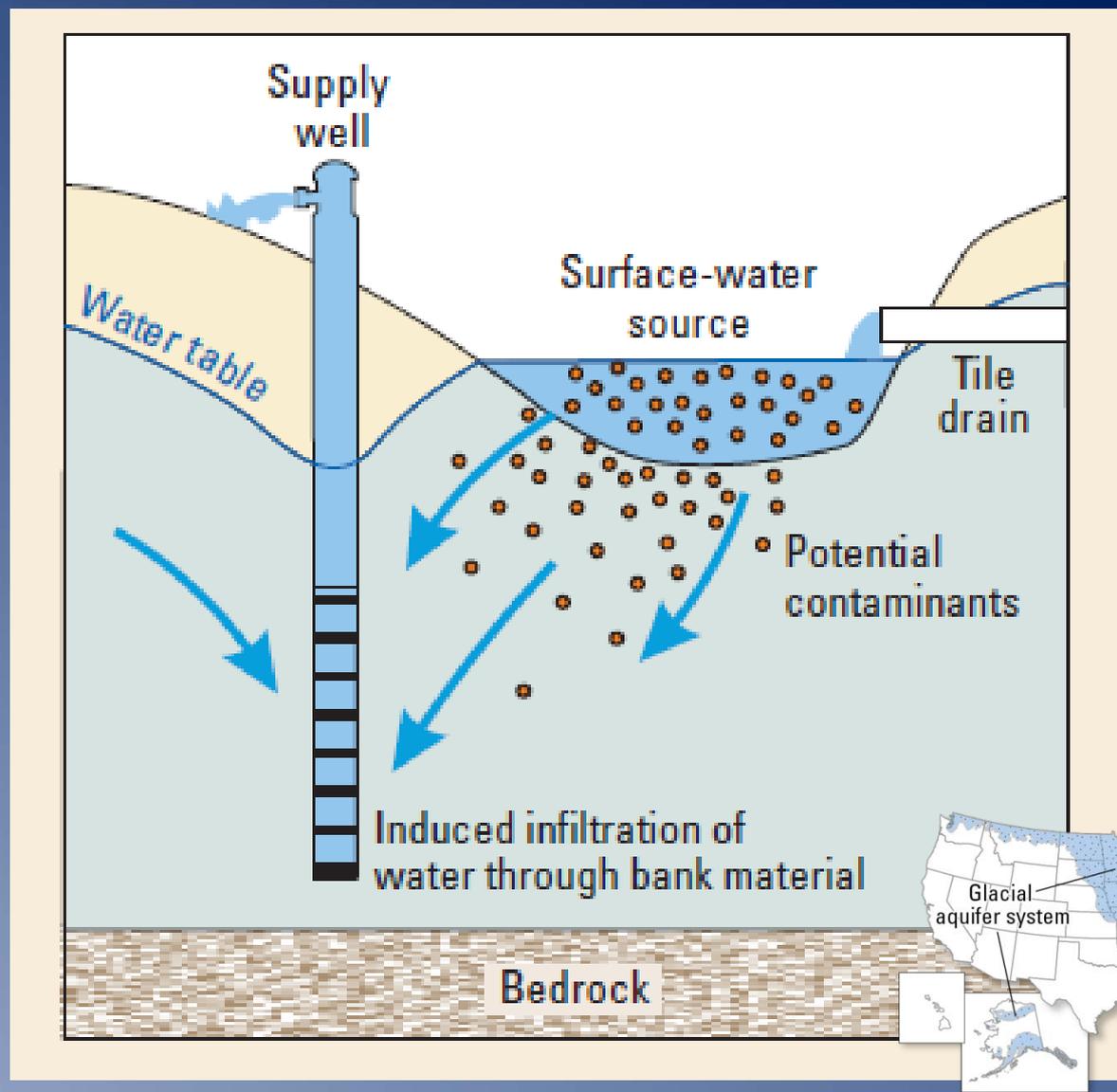
Hydro-geology



Geology

Contaminant source

Hydro-geology



Contaminant
source

Geology

Climate

Geo-
chemistry

Hydro-
geology

Selenium-containing salts



Denver Basin aquifer system

Contaminant source

Geology

Hydro-geology

Geo-chemistry

(weakly) acidic rainwater

Nitrogen-containing fertilizer

Ca^{2+}

Ca^{2+}

Mg^{2+}

Ca^{2+}

Ca^{2+}

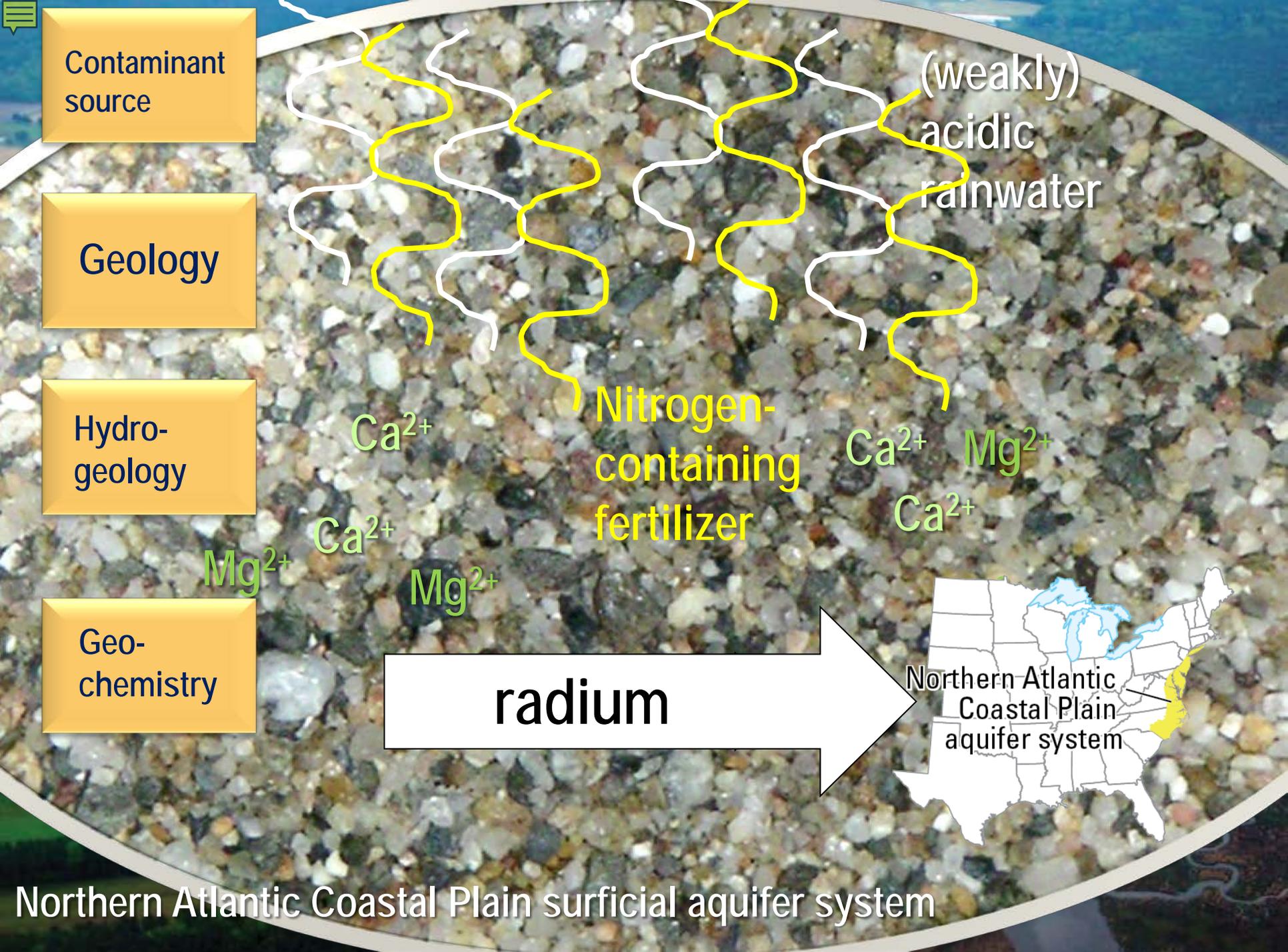
Mg^{2+}

Mg^{2+}

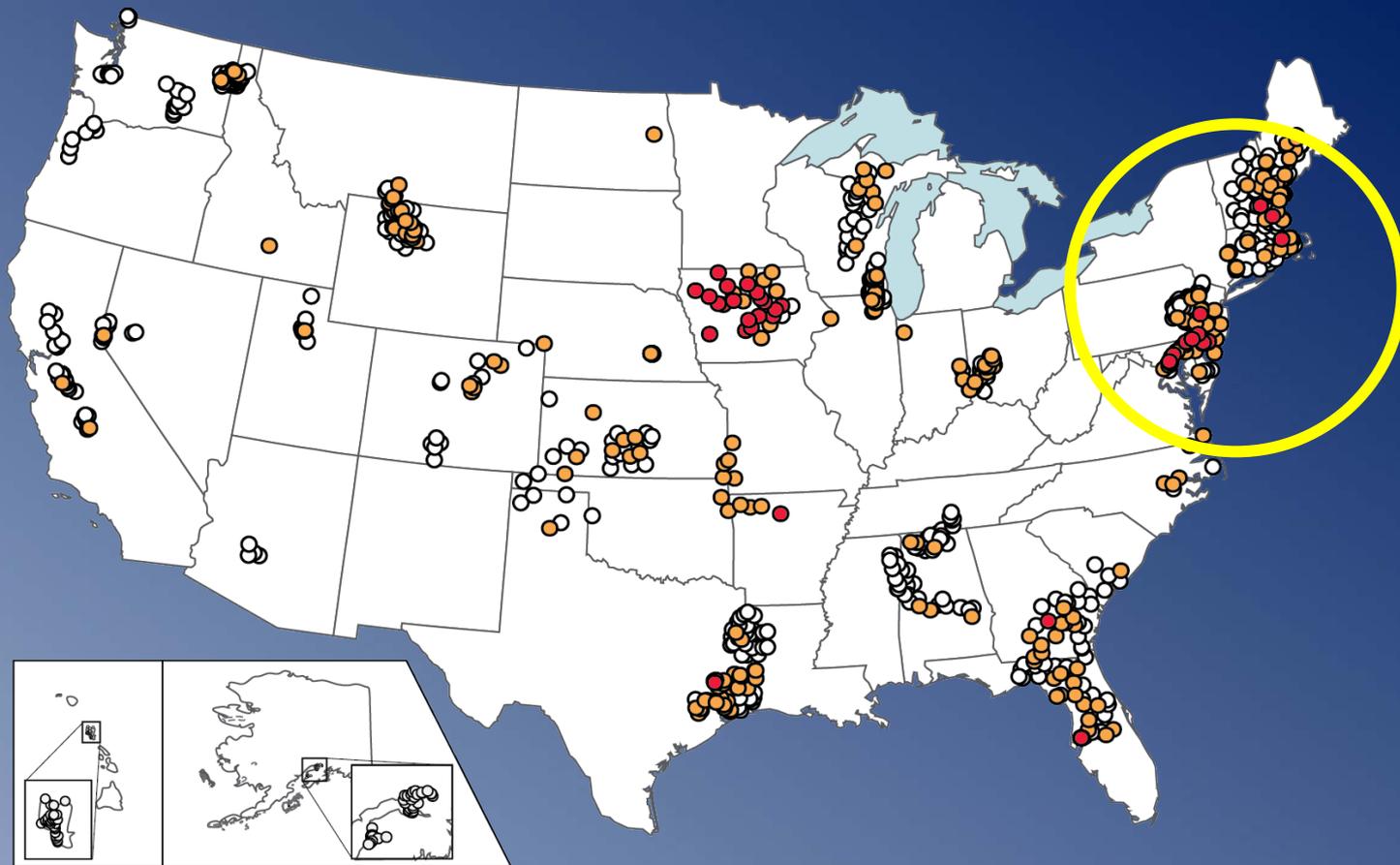
radium

Northern Atlantic Coastal Plain aquifer system

Northern Atlantic Coastal Plain surficial aquifer system

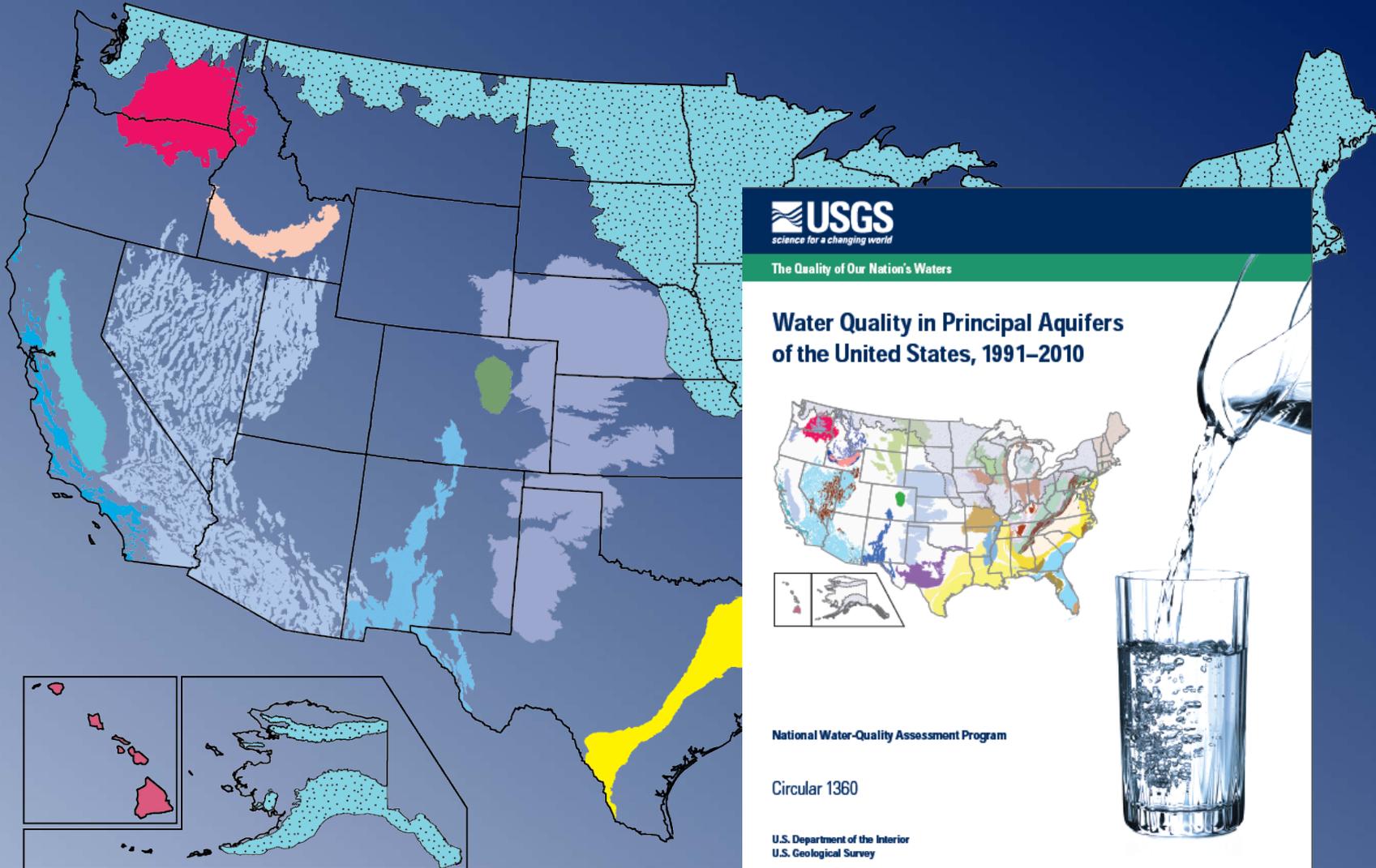


Radium in groundwater



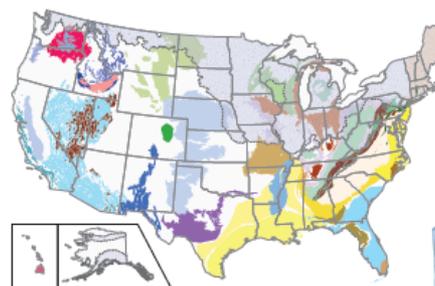
Radium concentration in sampled wells

- low
- medium
- high (exceeds human-health benchmark)



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

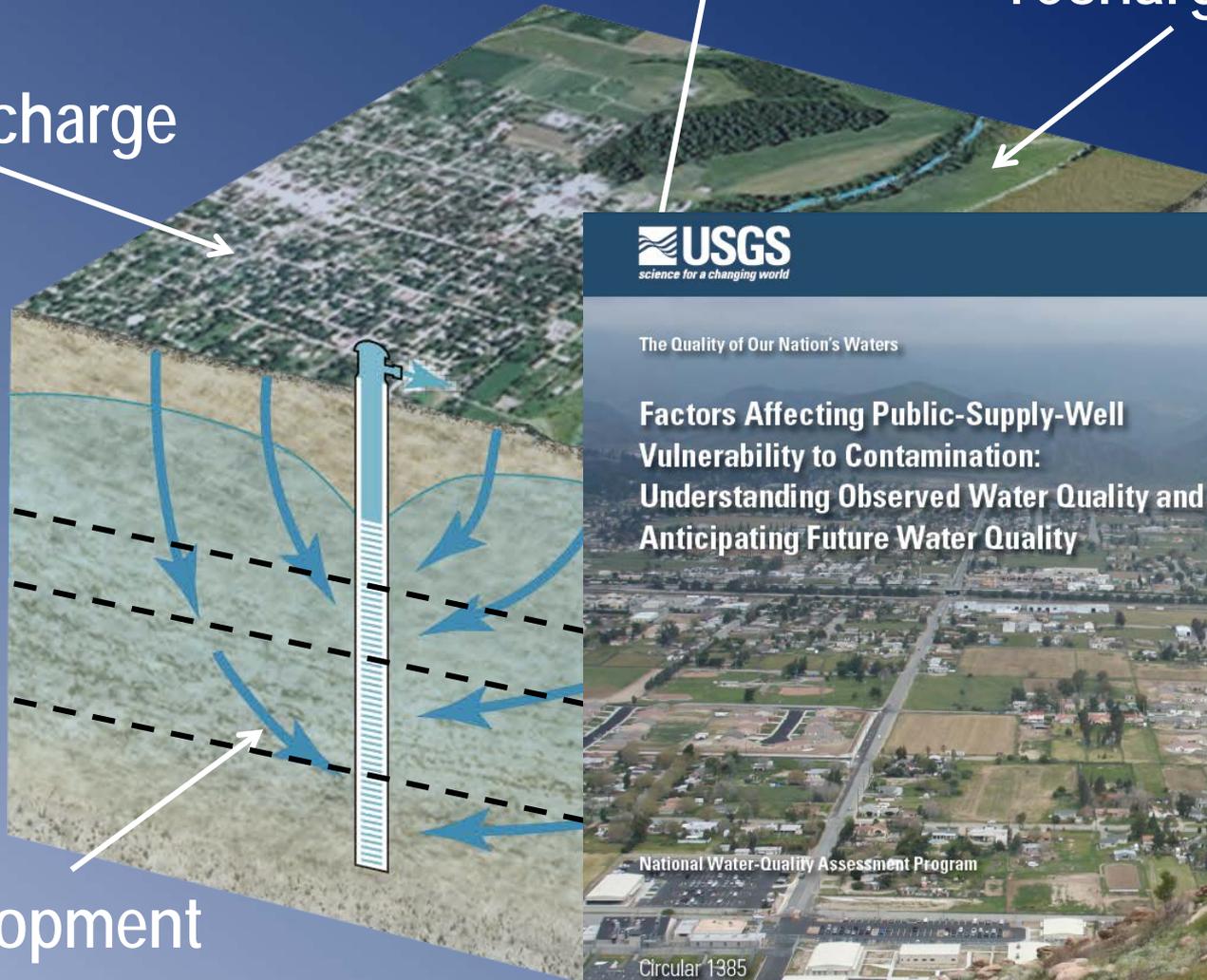
U.S. Department of the Interior
U.S. Geological Survey



Stream recharge

Agricultural recharge

Urban recharge



Years
Oxic

Decades

Anoxic
Centuries

Predevelopment water

USGS
science for a changing world

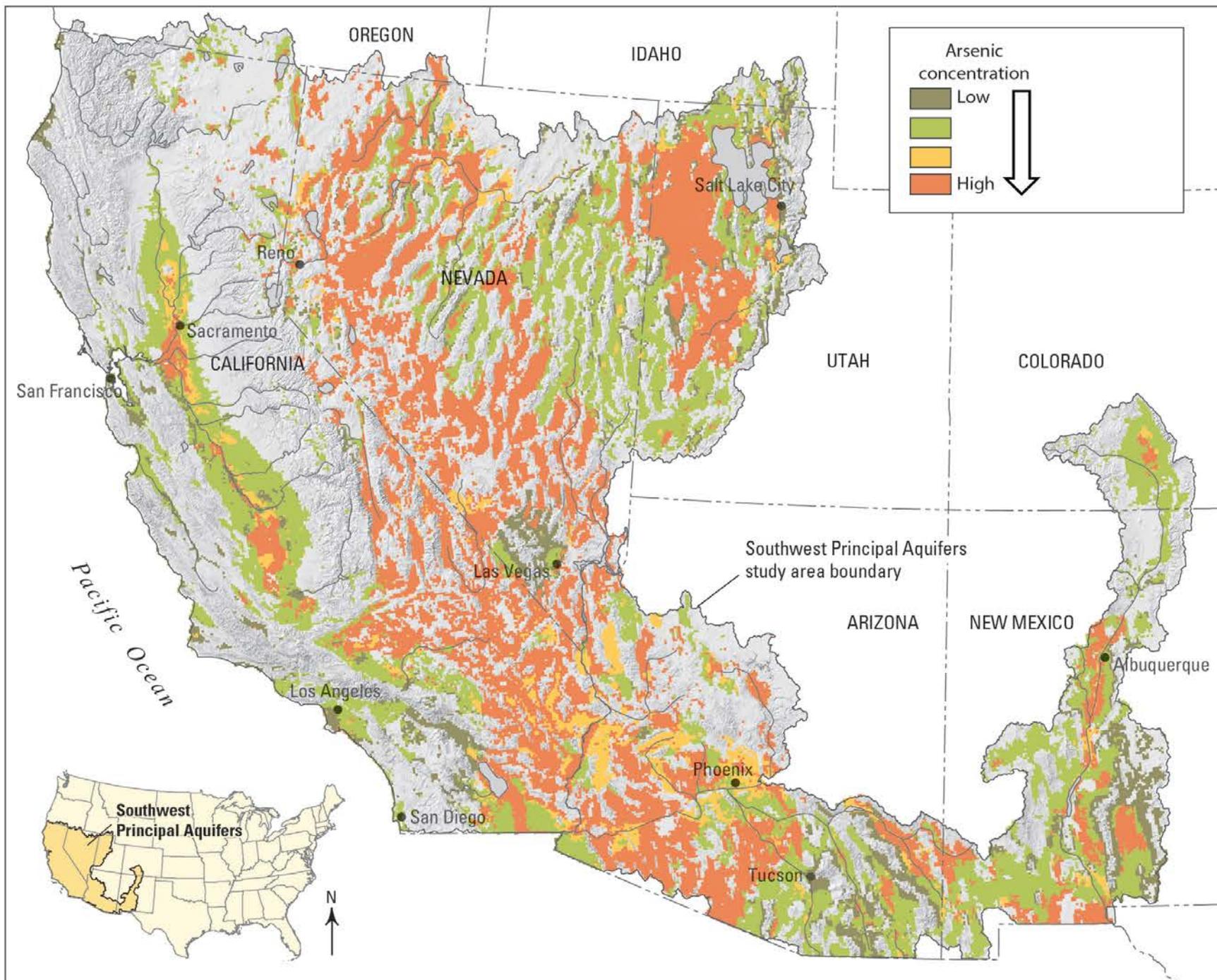
The Quality of Our Nation's Waters

Factors Affecting Public-Supply-Well Vulnerability to Contamination: Understanding Observed Water Quality and Anticipating Future Water Quality

National Water-Quality Assessment Program

Circular 1385

U.S. Department of the Interior
U.S. Geological Survey





The next decade: What will the future bring?



http://water.usgs.gov/nawqa/pubs/prin_aq/

