Overview of Water Resources including Groundwater/Surface Water Relationships

Presentation to the CIBO Focus Group
Water Impacts on Industrial Energy
March 5, 2013

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U.S. Geological Survey
Reston, VA

USGS

Presentation Outline

- Background on the USGS Water Mission Area
- USGS Water Mission Area Activities
  - Surface Water
  - Water Quality
  - Groundwater
  - Data Delivery
  - Water Use
- Drought
- GW/SW Interactions

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Water Resources Mission




To provide reliable, impartial, timely information that is needed to understand the Nation's water resources. The Water Mission Area actively promotes the use of this information by decision makers to –

- Minimize the loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement.
- Effectively manage groundwater and surface-water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

USGS

Why USGS?

Non-regulatory – With no regulatory or management responsibilities, USGS has been recognized since its inception in 1879 as the major national source of unbiased, consistent and rigorous science.

"*Even amidst cost concerns, USGS cooperators note that they need the quality and independence of USGS products; independent monitoring and data analyses are vital to provide unbiased input to their management programs and for "government performance and review*."

National Research Council of the National Academies in *Toward A Sustainable and Secure Water Future*, 2009

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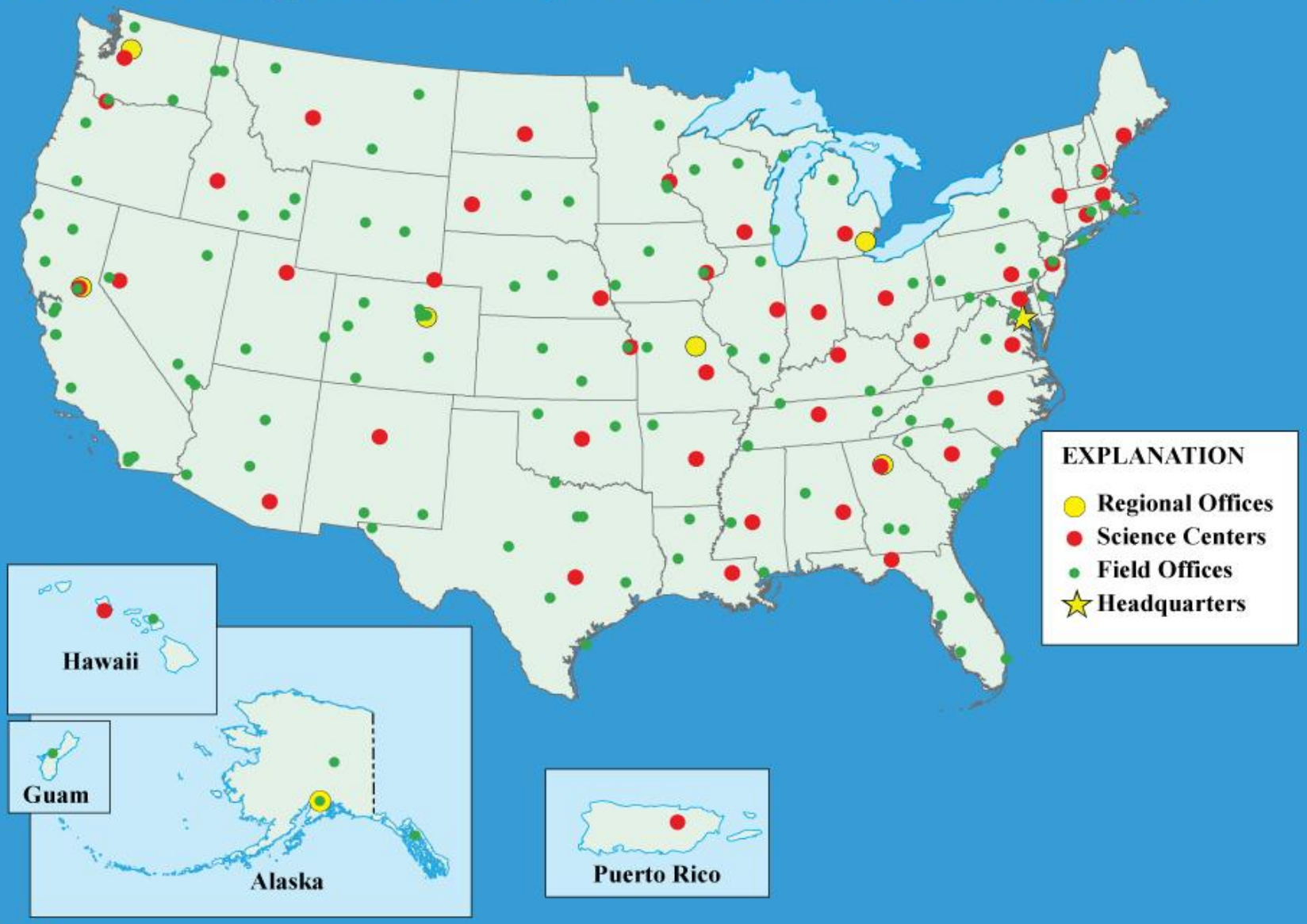
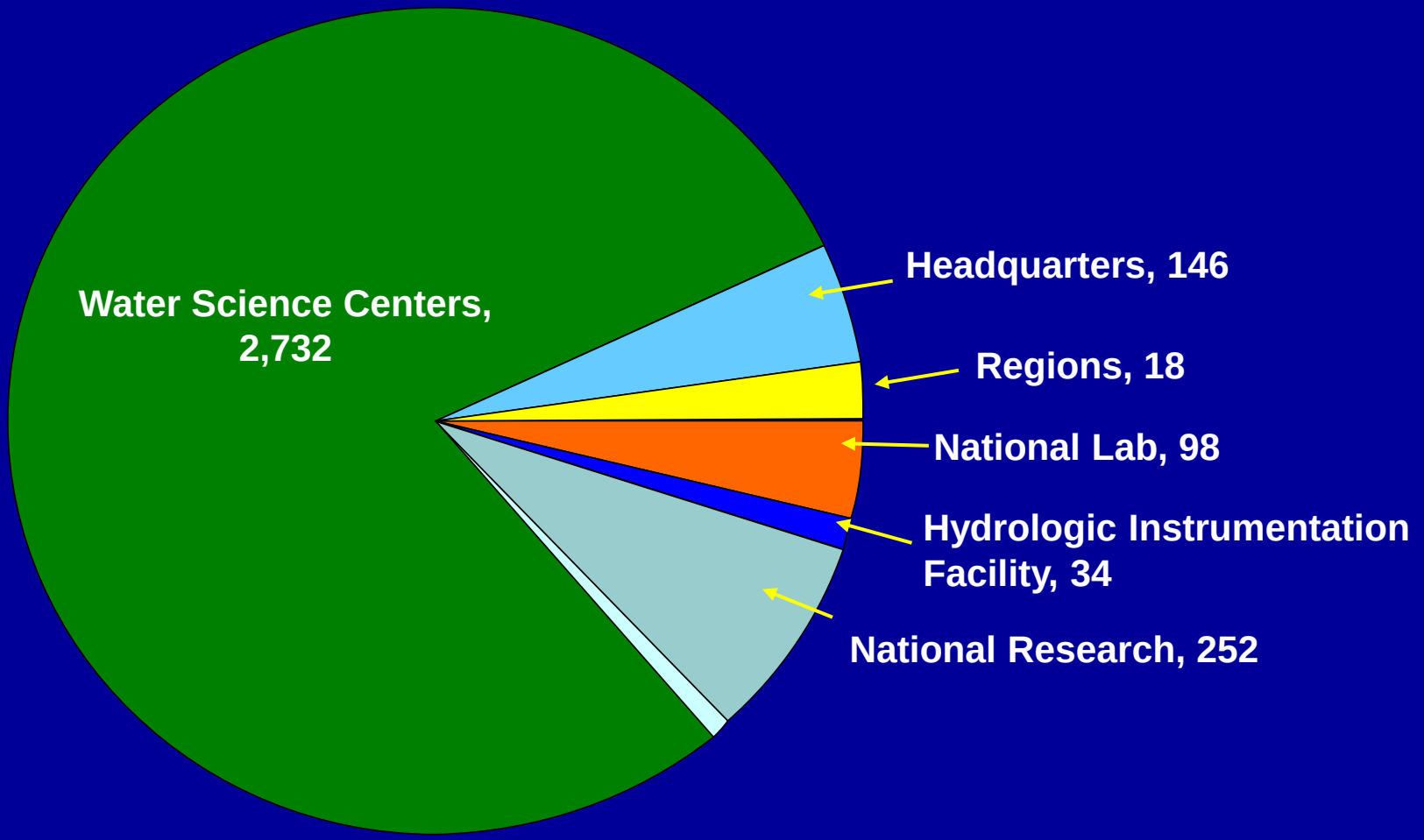
U.S. Geological Survey Water Resources Offices



USGS

FY1 2012

Water Staff by Location 2010 (3305 total)



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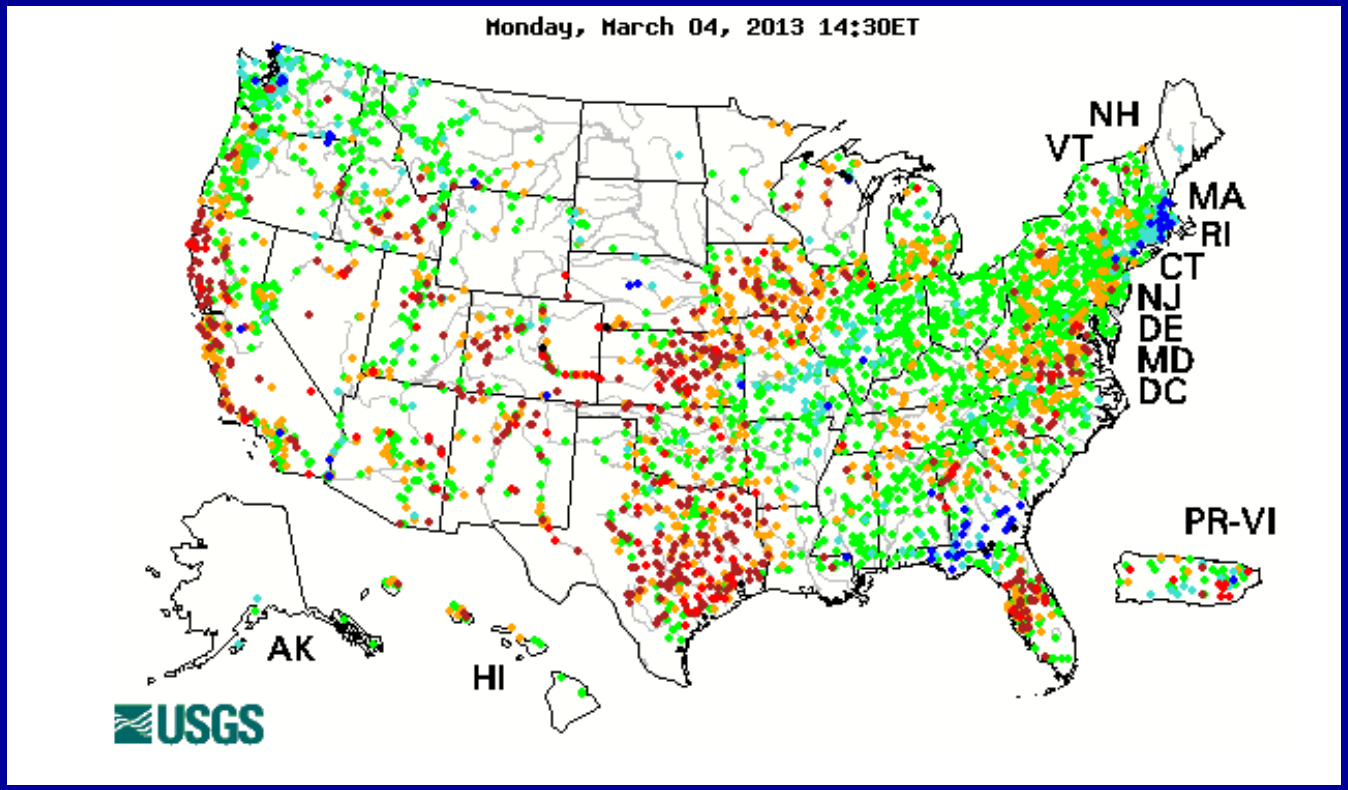
The USGS Streamgaging Network

Streamgages
8,000 gages
99 % real-time
All on web

850+ Partners



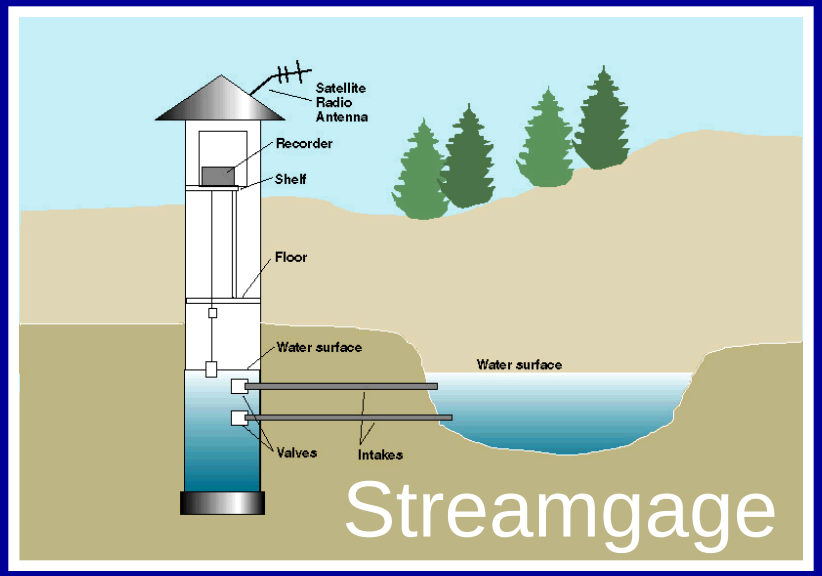
Funding Sources

State / Local Agencies	49%
Other Federal Agencies	18%
USGS Cooperative Program	16%
USGS National Streamflow Info Program	18%

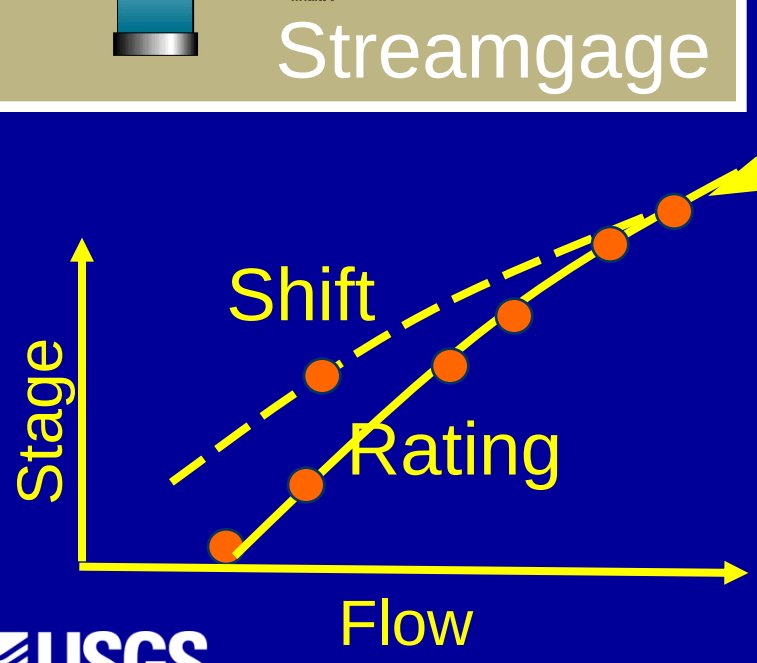
USGS

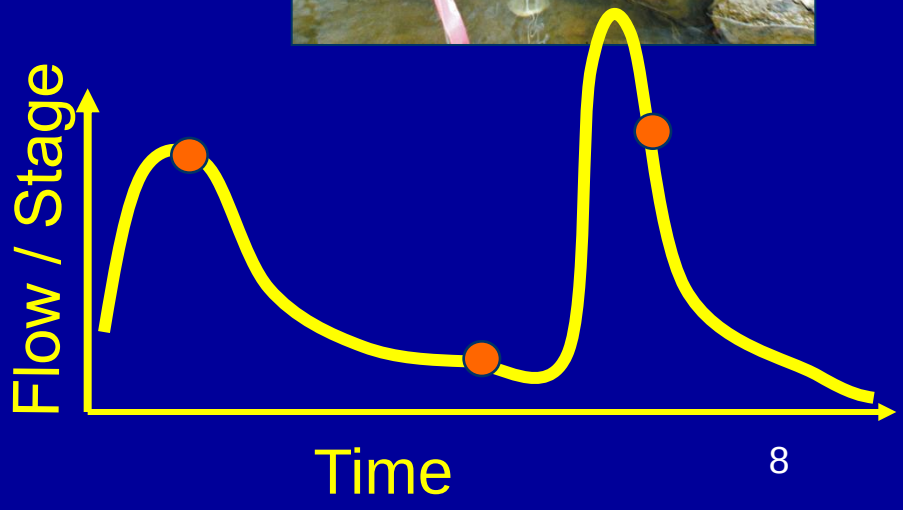
2011

The Streamgaging Process



Flow Measurements





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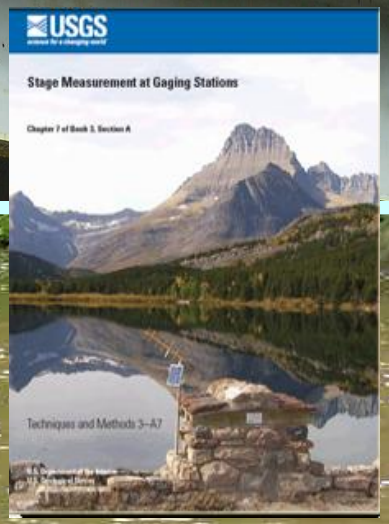
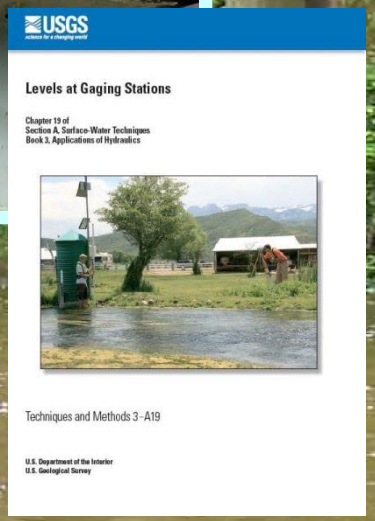
Monitoring Stage

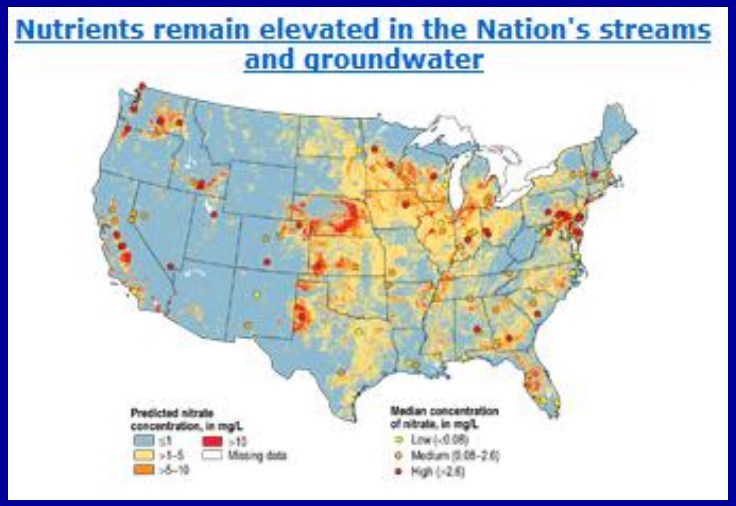


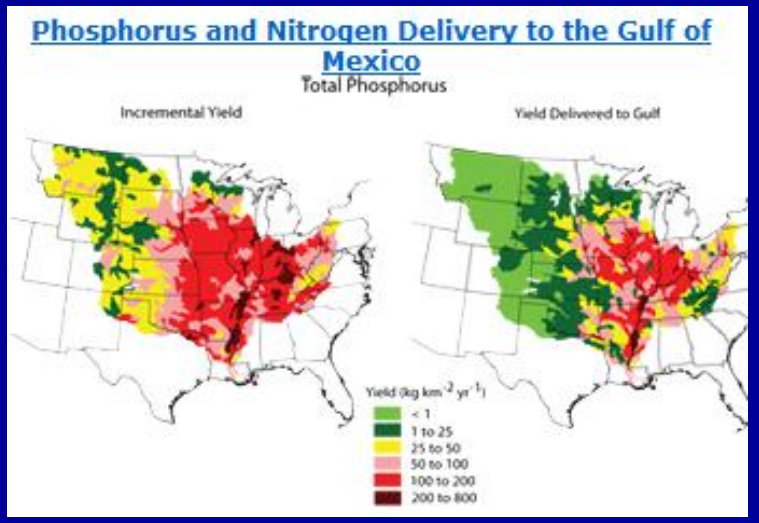


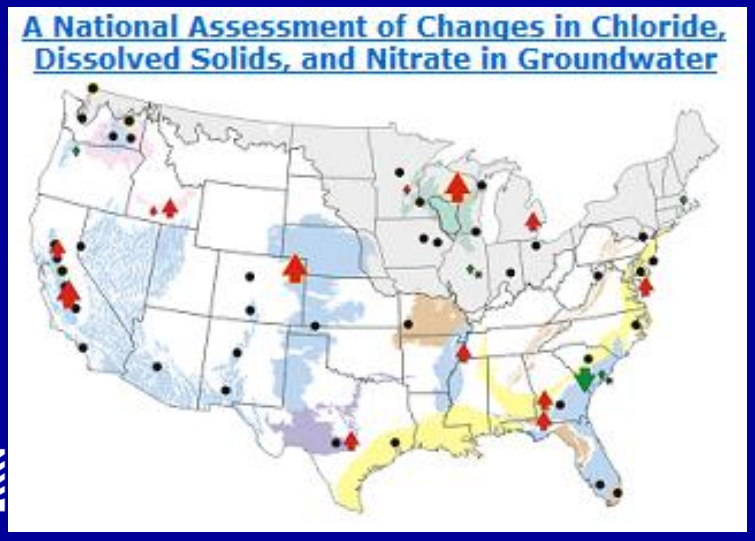
- +/- 0.02 ft. or 2% of range
- Verified by direct readings
- Record adjusted accordingly
- New technologies reduced costs

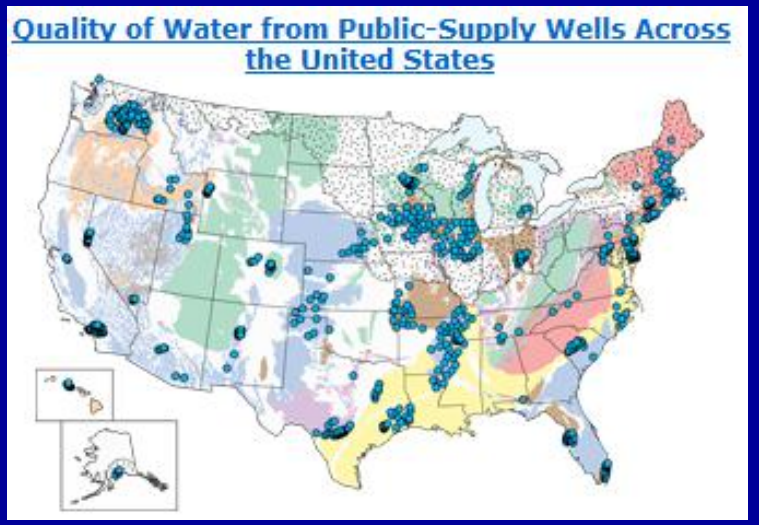
Products of the National Water Quality Assessment Program

National and Regional Assessments of Water Quality Conditions

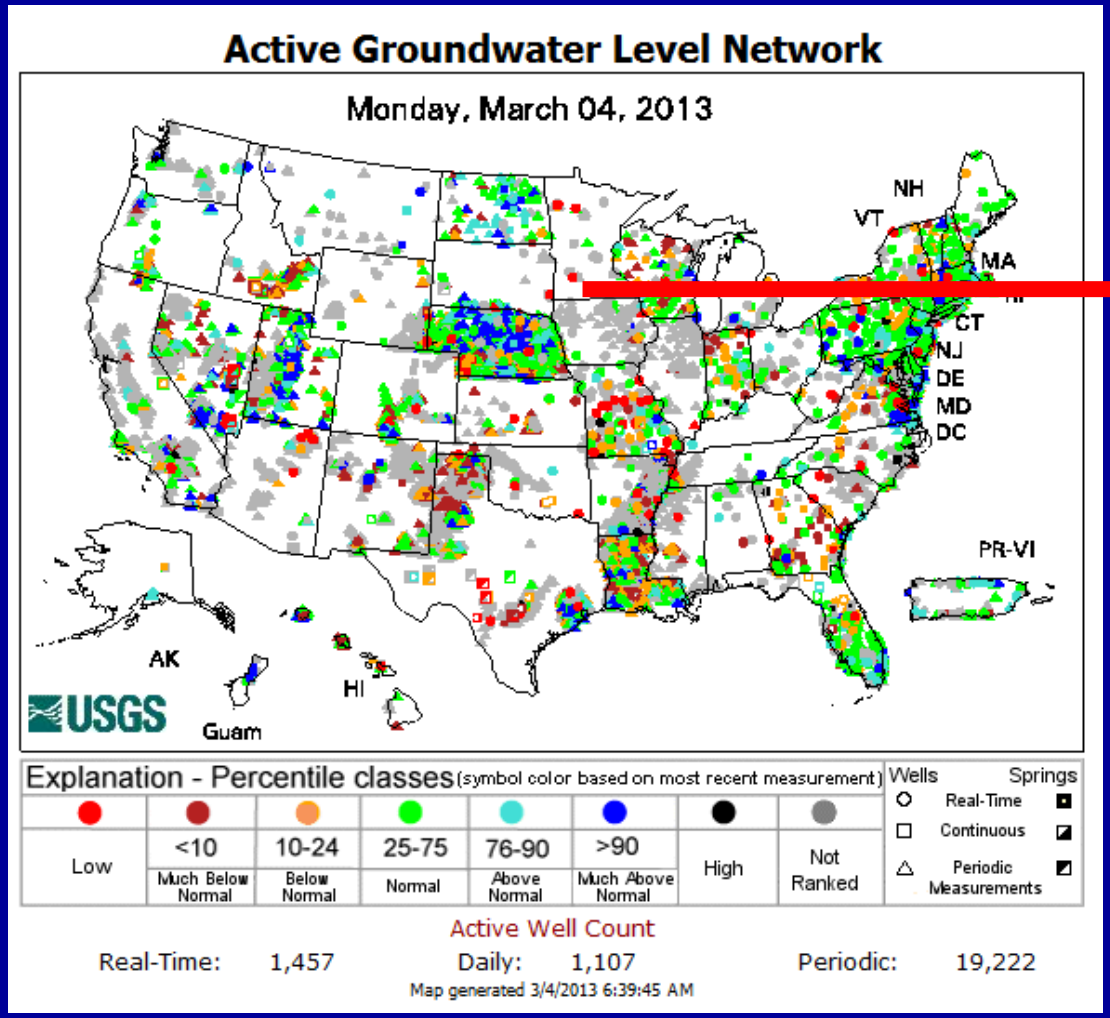


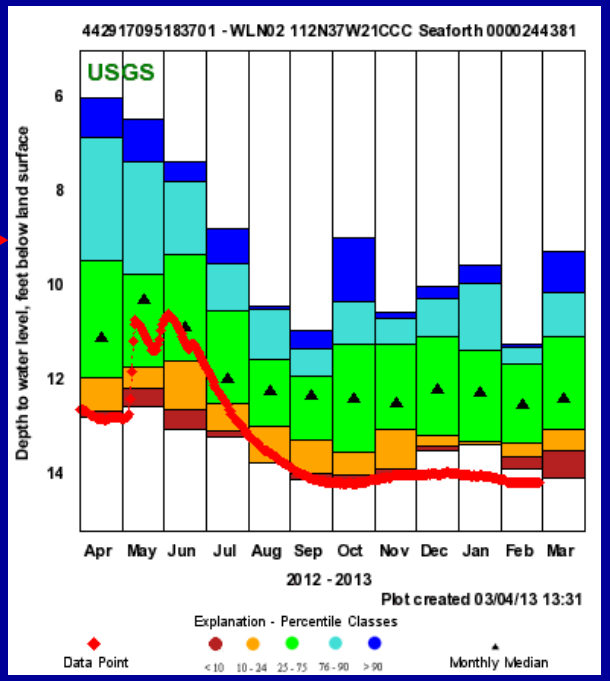






The USGS Groundwater Level Network

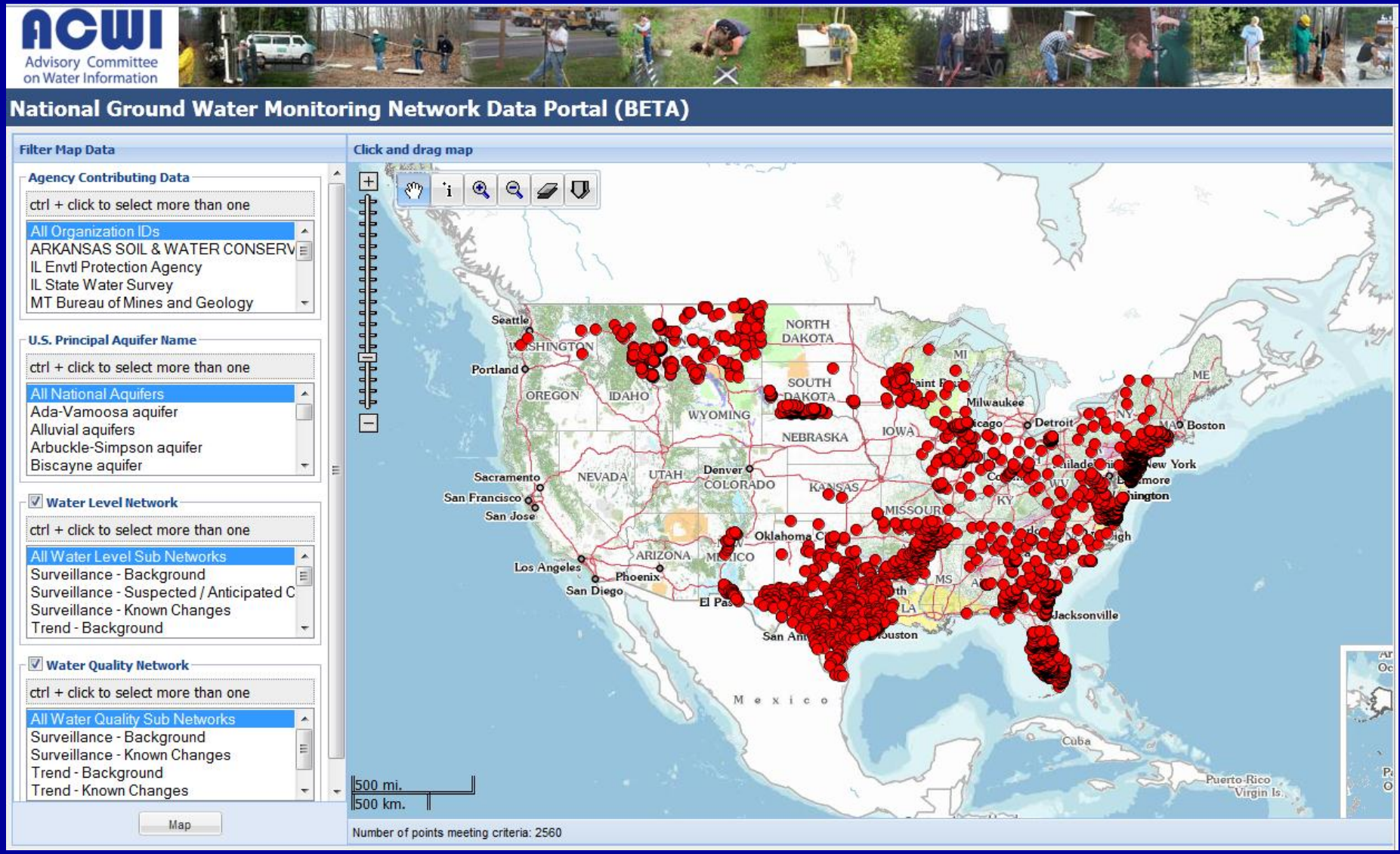




USGS

http://groundwaterwatch.usgs.gov/

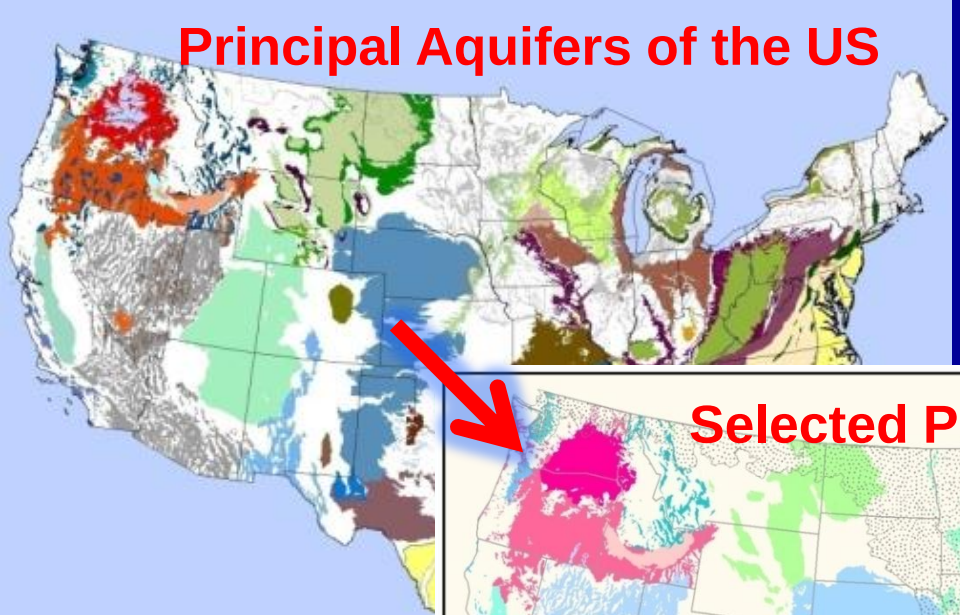
National GW Monitoring Network

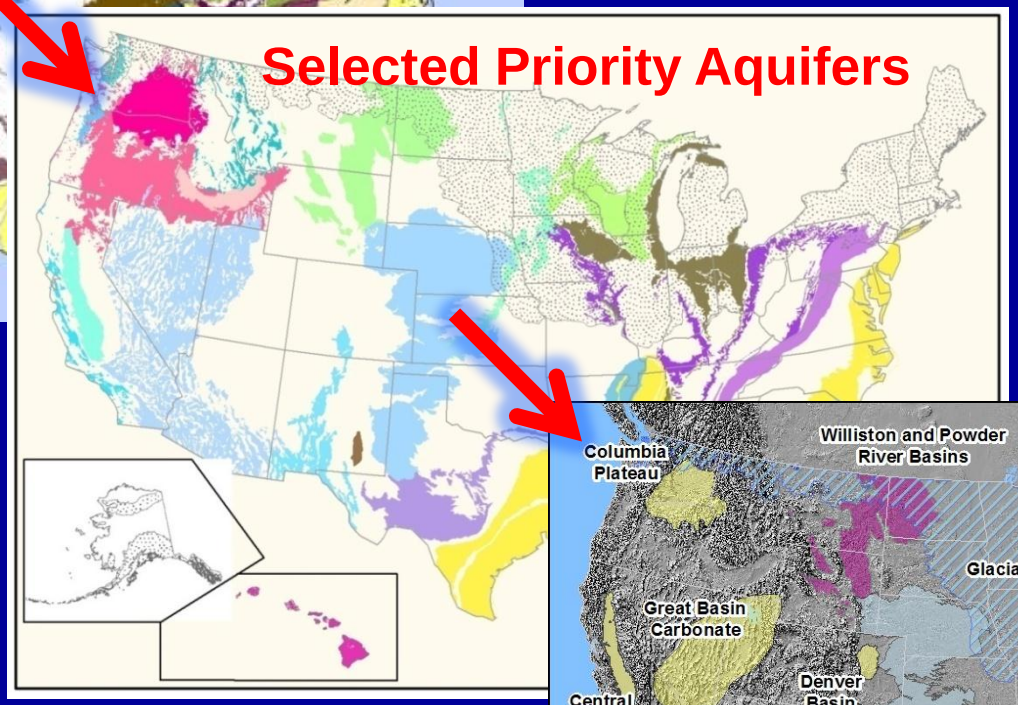


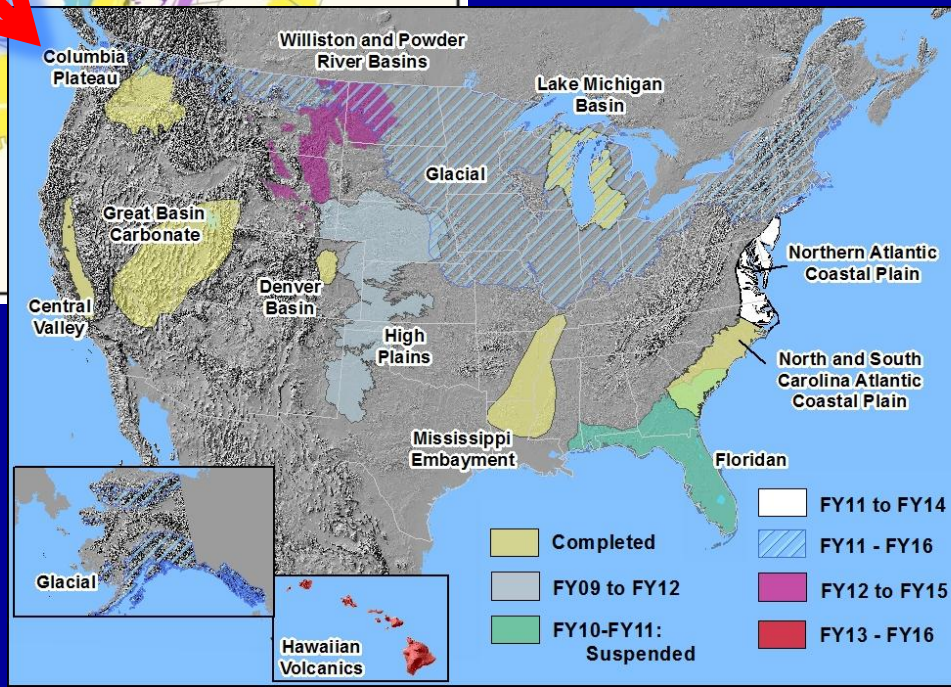
How Do We Make Water Level Measurements?

USGS

Groundwater Resources Program







Regional Groundwater Availability

USGS

Data Delivery: USGS NWISWeb

Total monitoring sites	1.57 million
Real-time sites	13,244
Real-time groundwater	1,810
Daily values	349 million
Groundwater levels	8.90 million
Water-quality samples	5.18 million
Water-quality analyses	97 million
Peak discharges (floods)	729,844

January 9, 2013

USGS

http://waterdata.usgs.gov

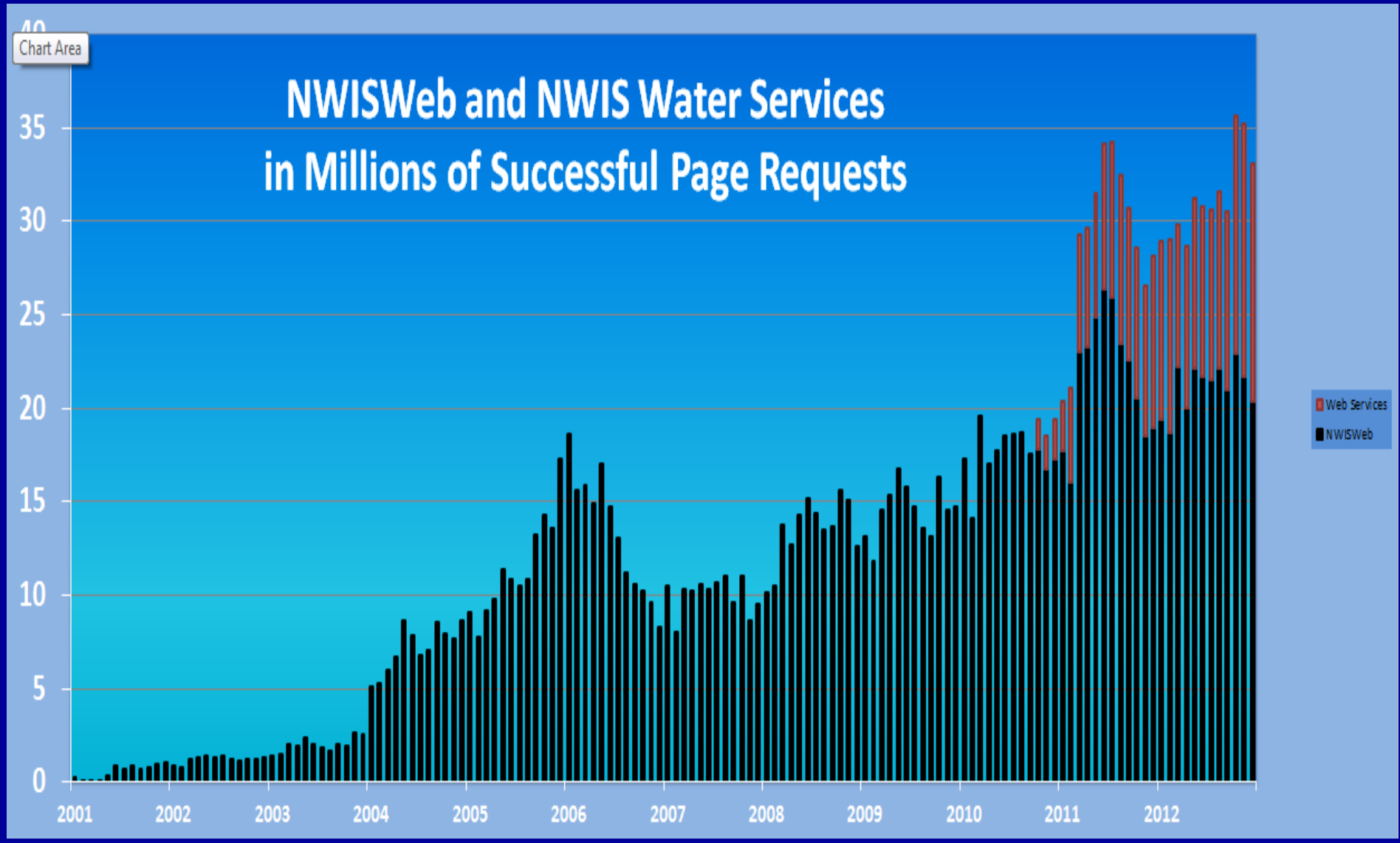
USGS NWISWeb Daily Values

Discharge	215.6 million
Stage	33.0 million
Water Levels in Wells	22.1 million
pH	3.2 million
Temperatures	19.7 million
Specific Conductance	9.1 million
Other	39.9 million

January 9, 2013

USGS

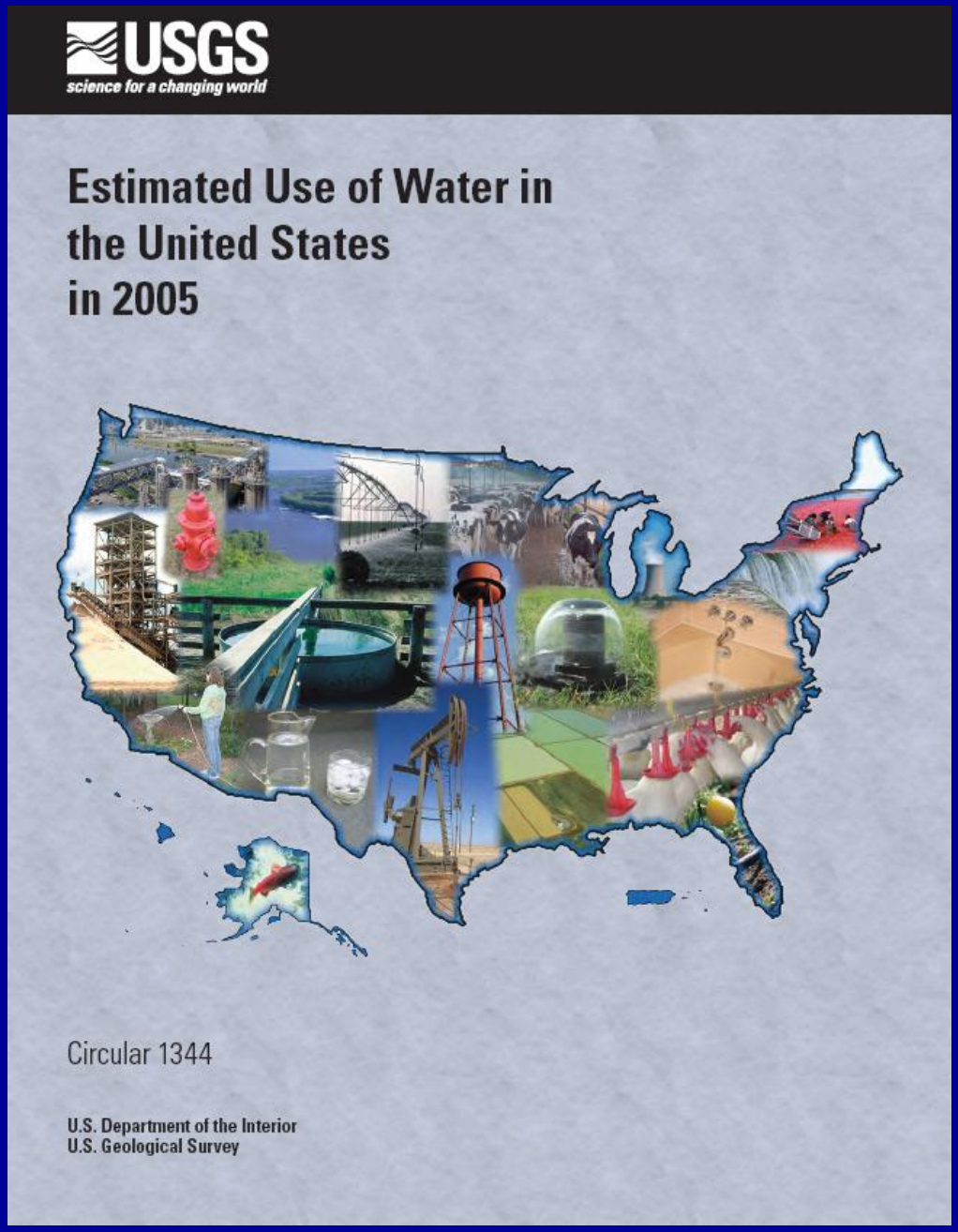
http://waterdata.usgs.gov



USGS

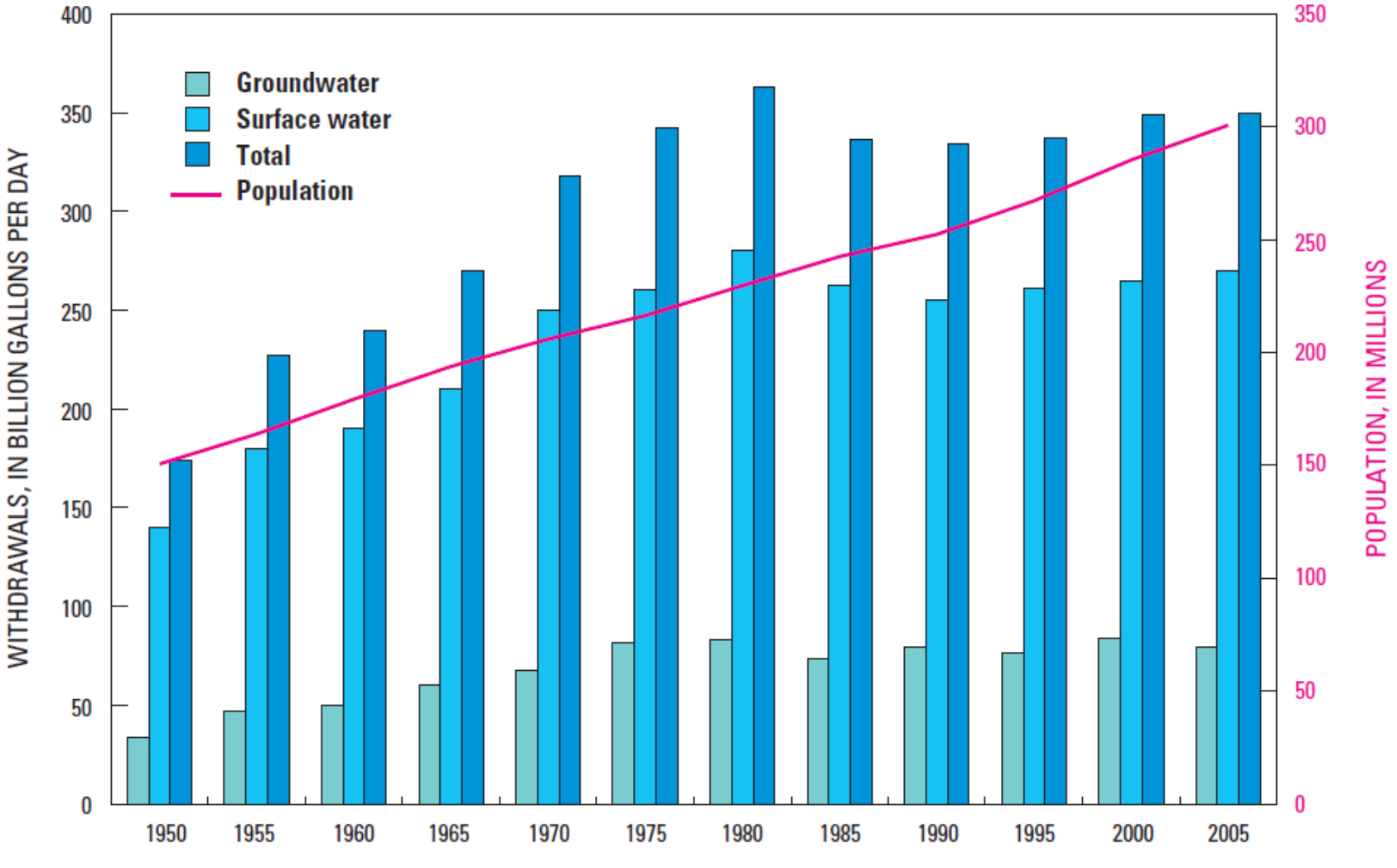
http://waterdata.usgs.gov

Water Use

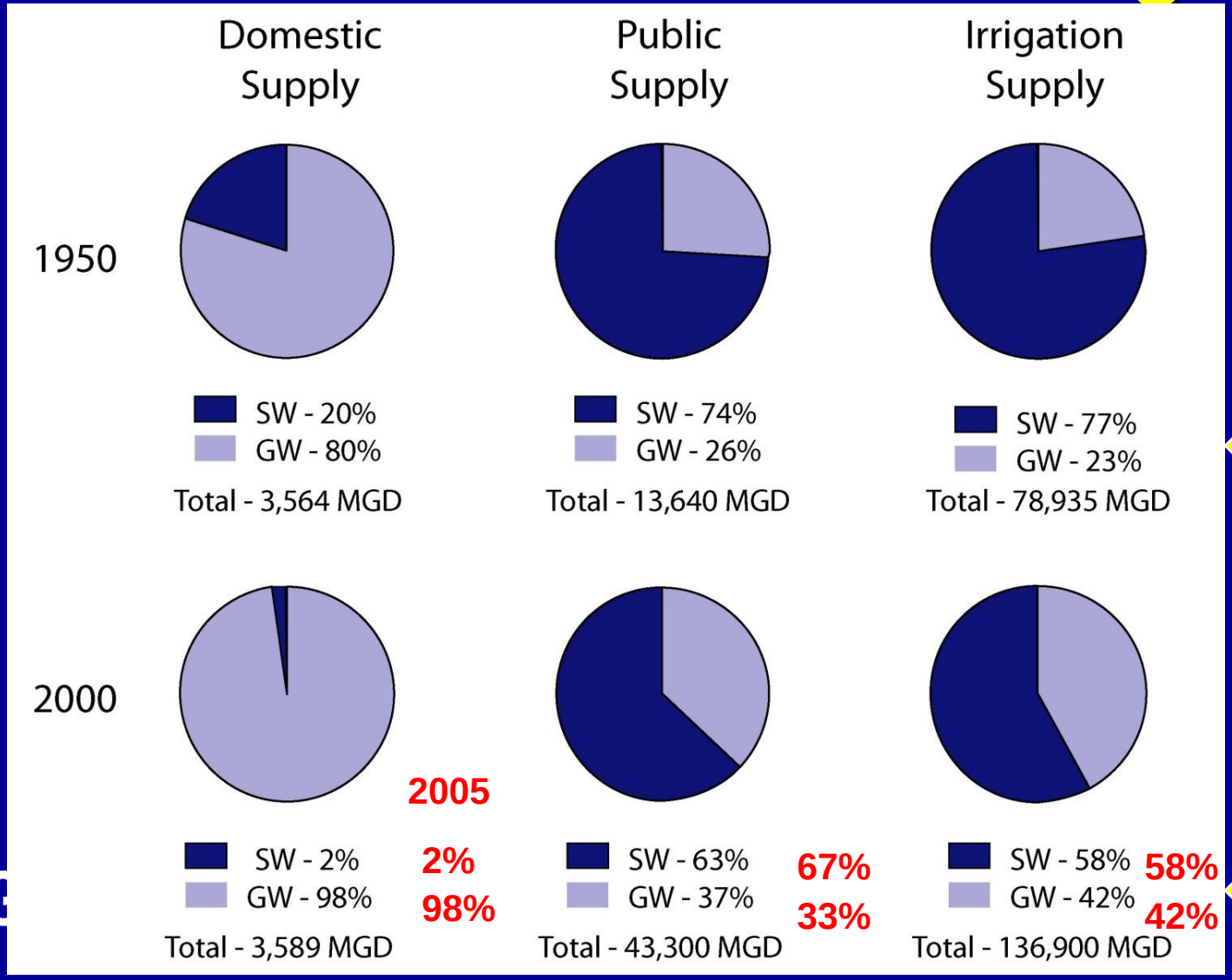


USGS

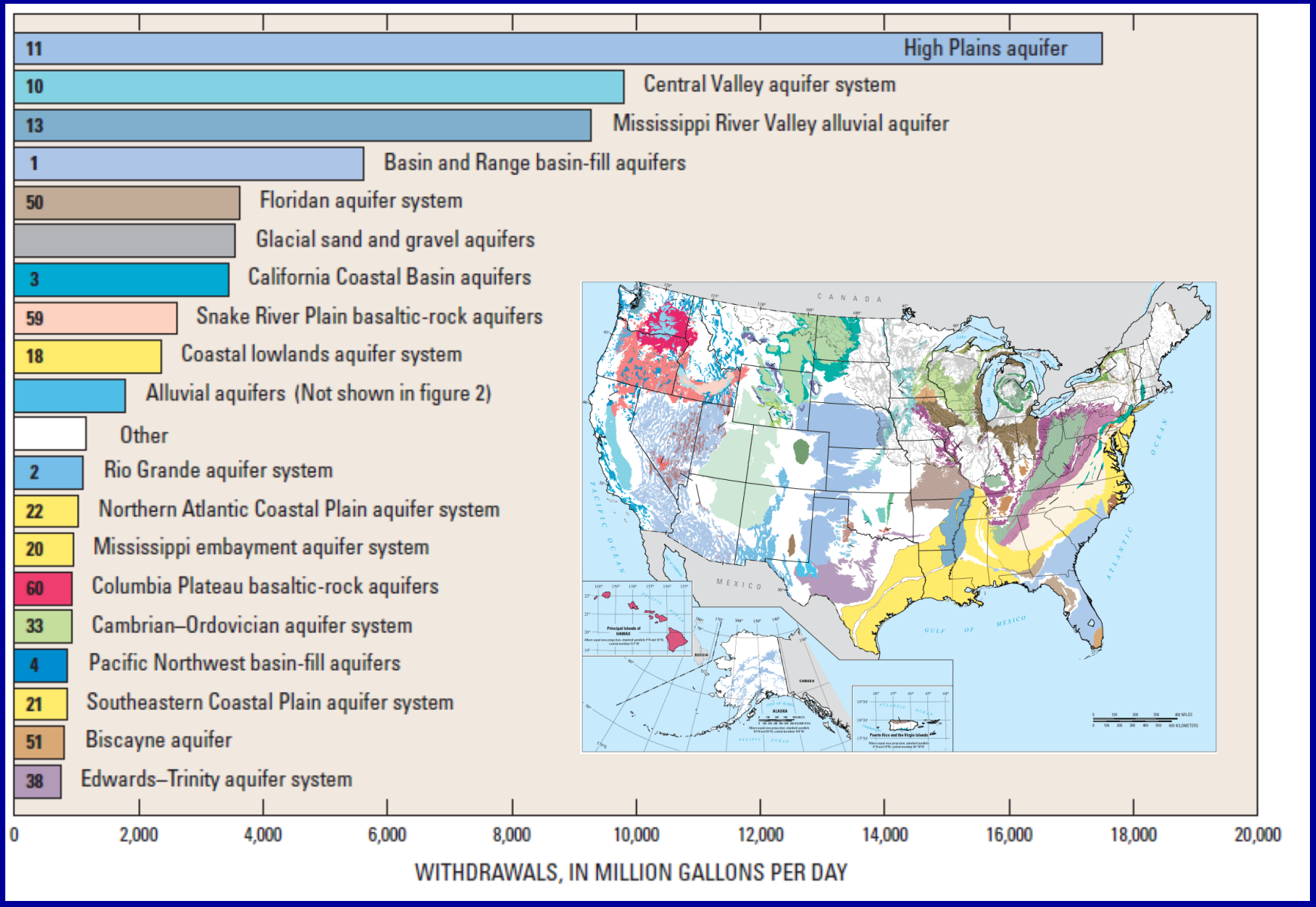
U.S. Water Use, 1950-2005

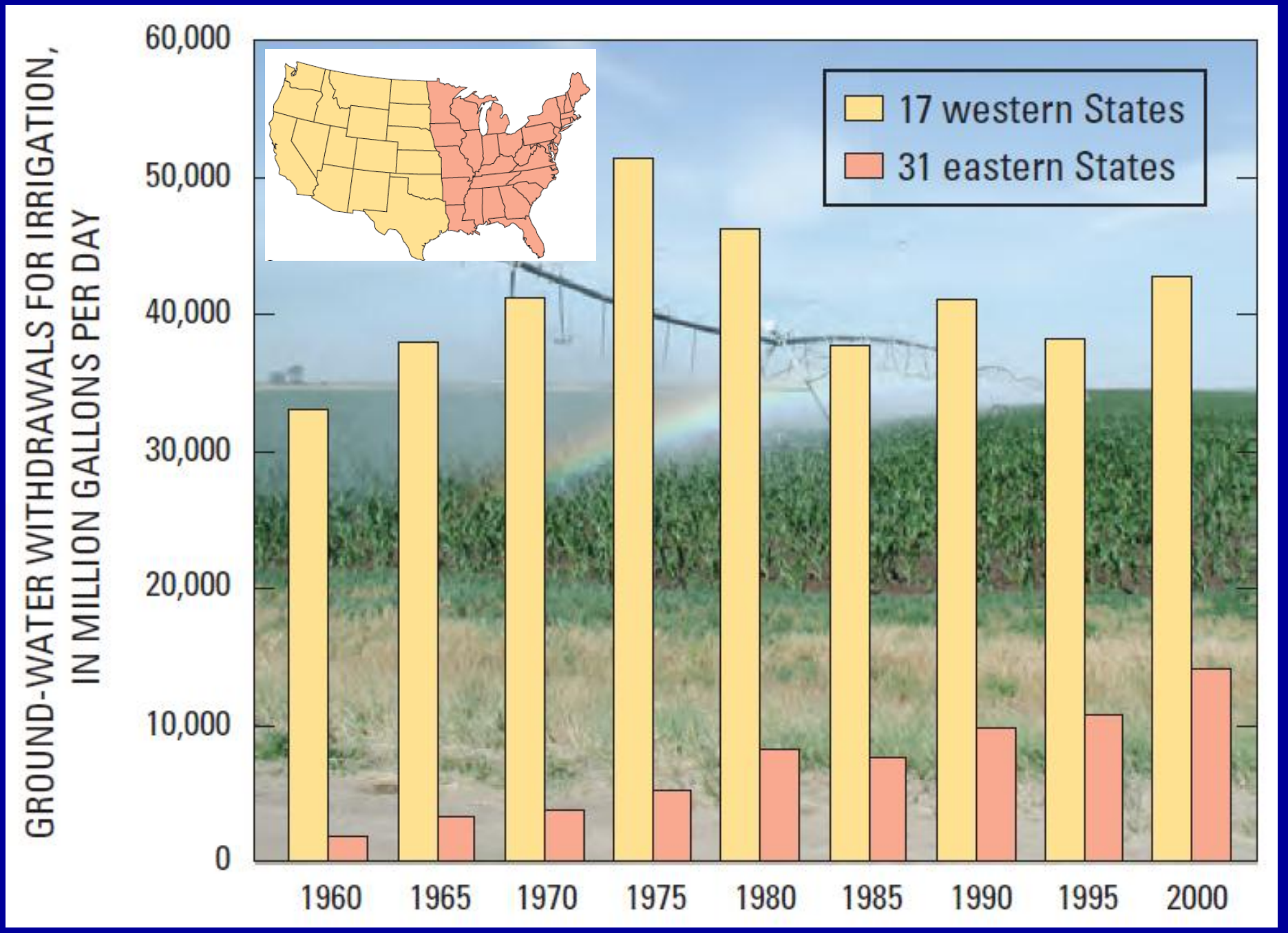


Percentage of Groundwater Withdrawals are Increasing

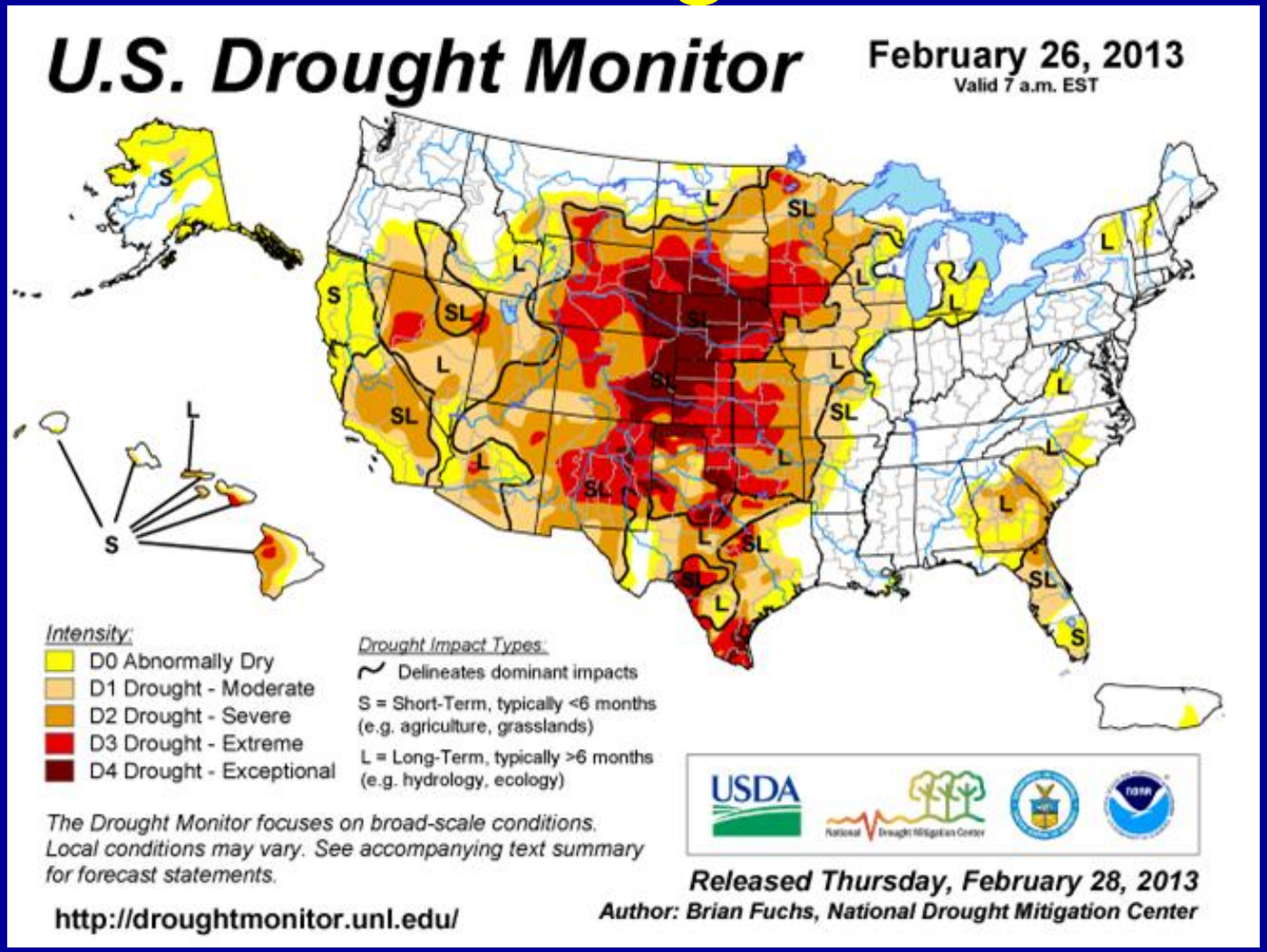


Groundwater Use, by Principal Aquifer




GROUND-WATER WITHDRAWALS FOR IRRIGATION, IN MILLION GALLONS PER DAY
60,000
50,000
40,000
30,000
20,000
10,000
0
17 western States
31 eastern States
1960
1965
1970
1975
1980
1985
1990
1995
2000

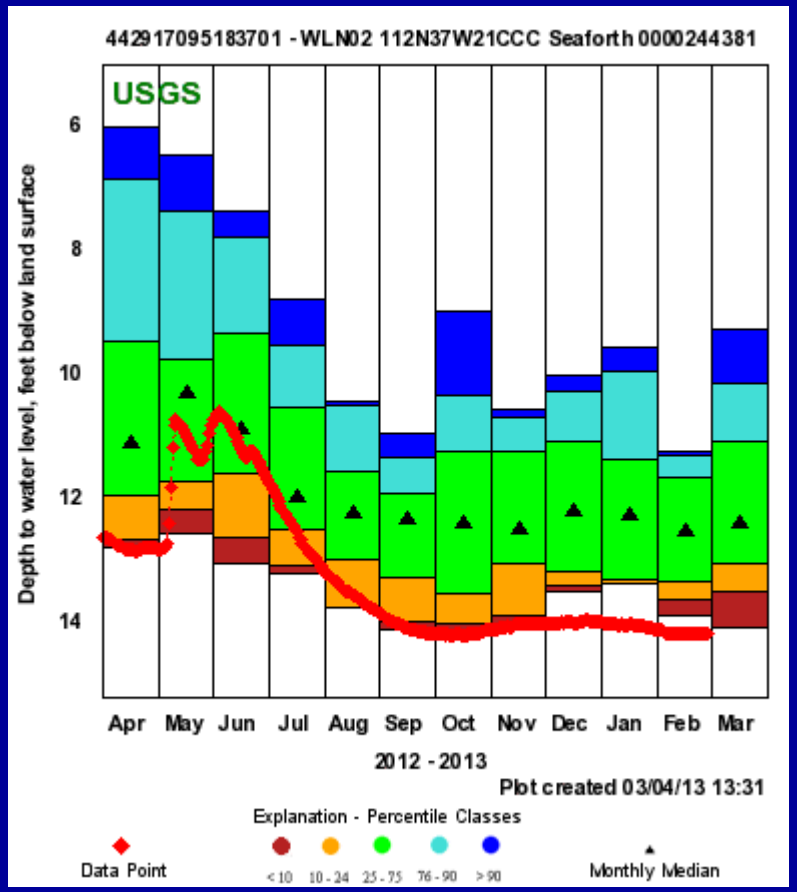
Drought



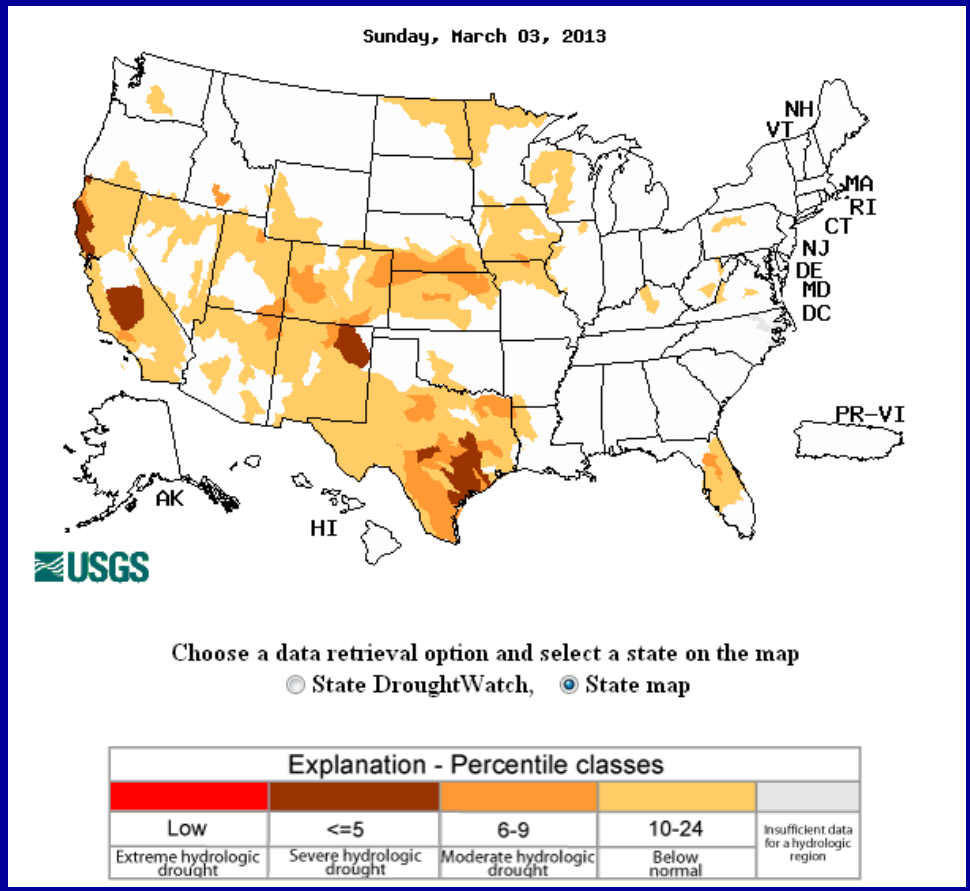
USGS

Drought Impacts: USGS Tools

Water Table in Minnesota



Ranking of 7-day Streamflow



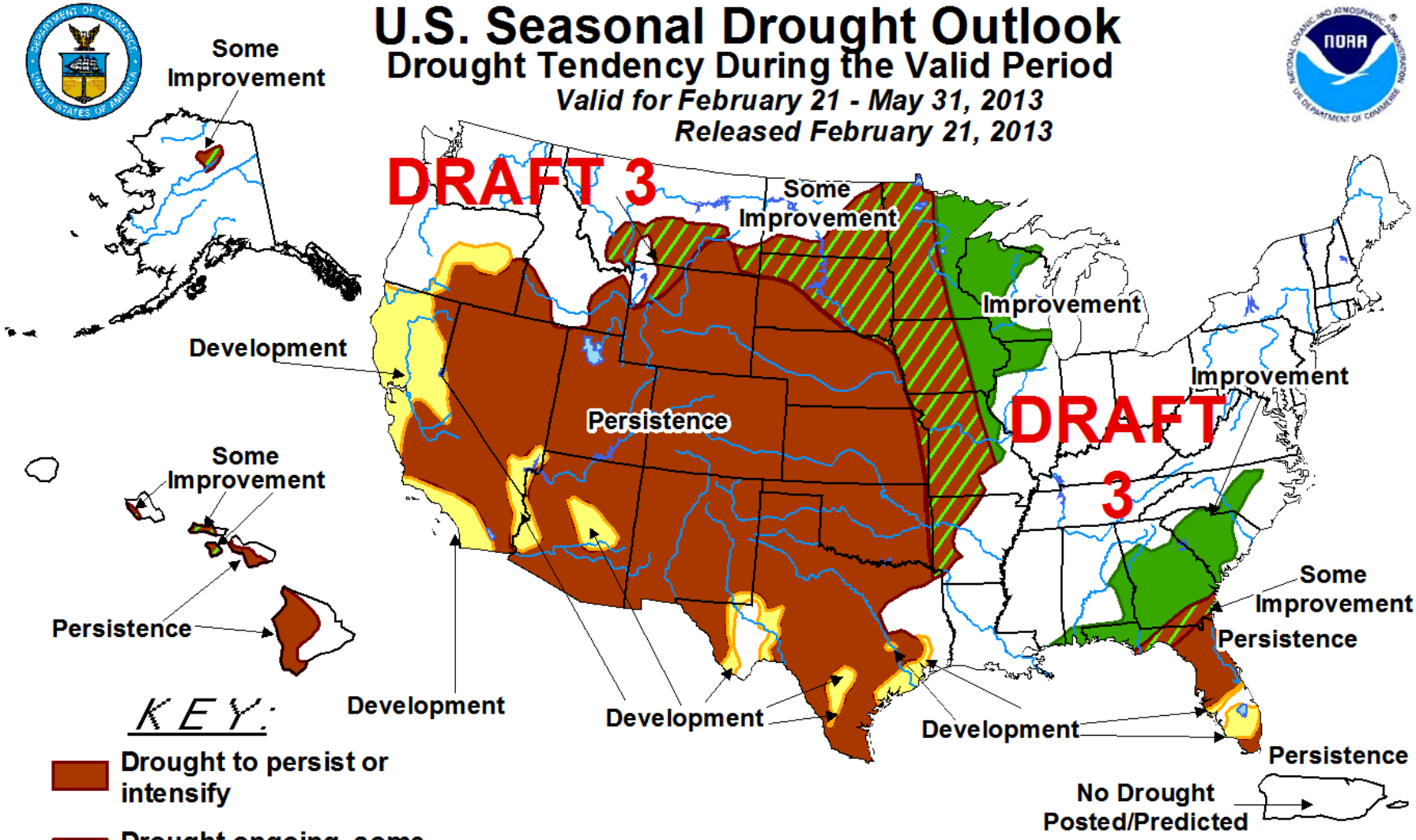
USGS

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for February 21 - May 31, 2013

Released February 21, 2013



Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Short-term events -- such as individual storms -- cannot be accurately forecast more than a few days in advance. Use caution for applications -- such as crops -- that can be affected by such events. "Ongoing" drought areas are approximated from the Drought Monitor (D1 to D4 intensity). For weekly drought updates, see the latest U.S. Drought Monitor. NOTE: the green improvement areas imply at least a 1-category improvement in the Drought Monitor intensity levels, but do not necessarily imply drought elimination.

Colorado River Basin Water Supply

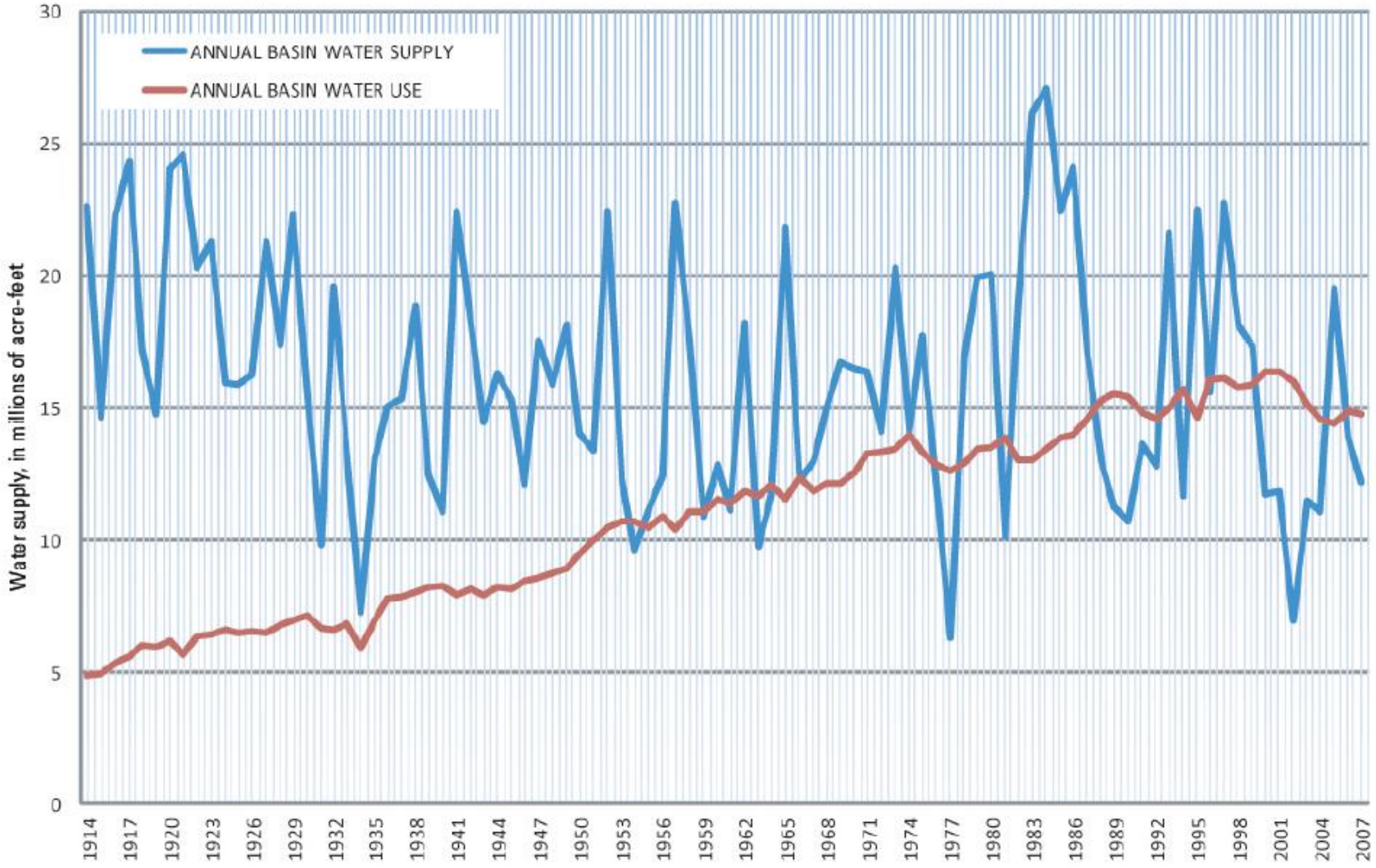
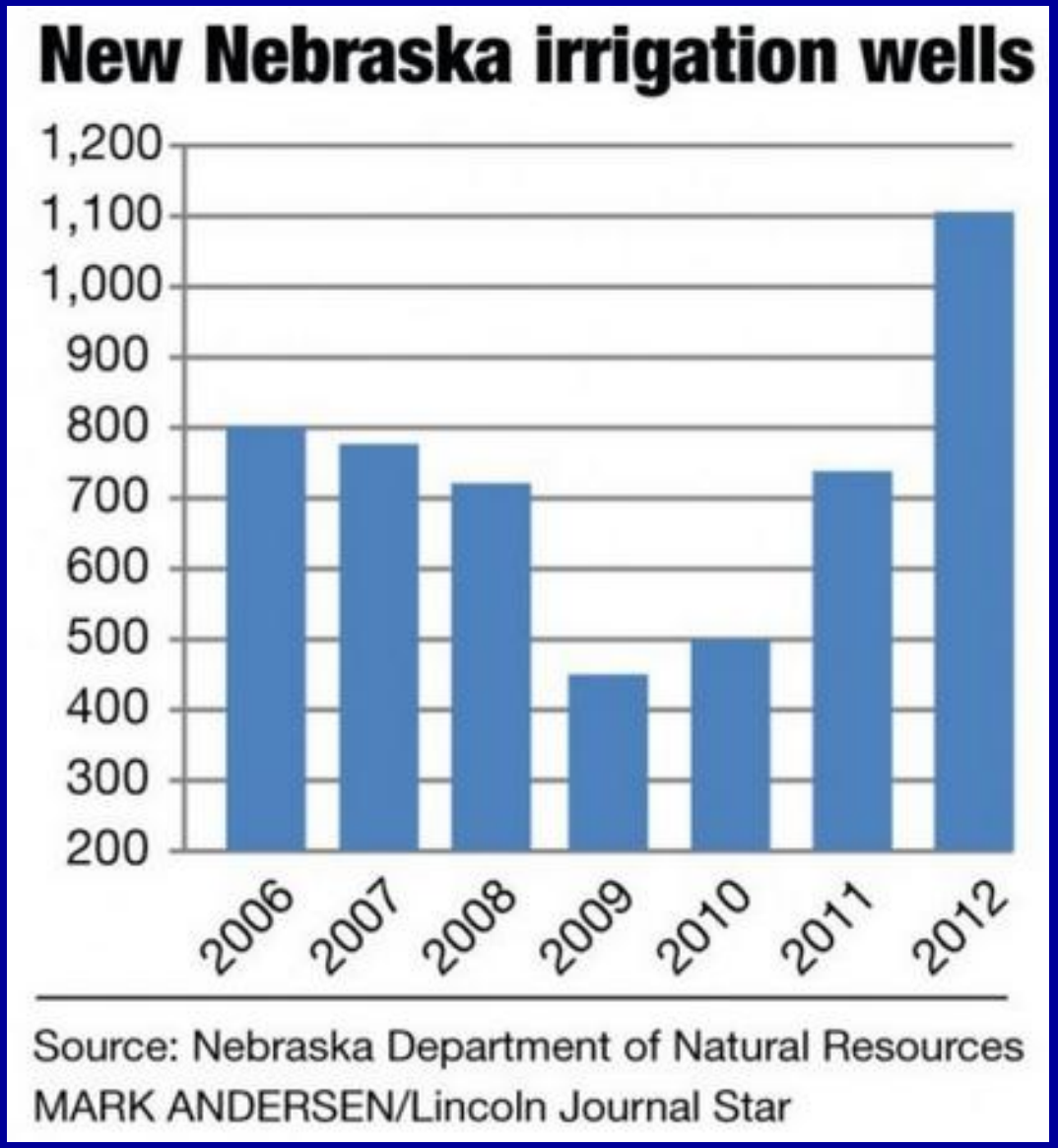


Figure 1. Colorado River Basin water supply, 1914–2007 (Bureau of Reclamation, 2011).

Other Drought Impacts



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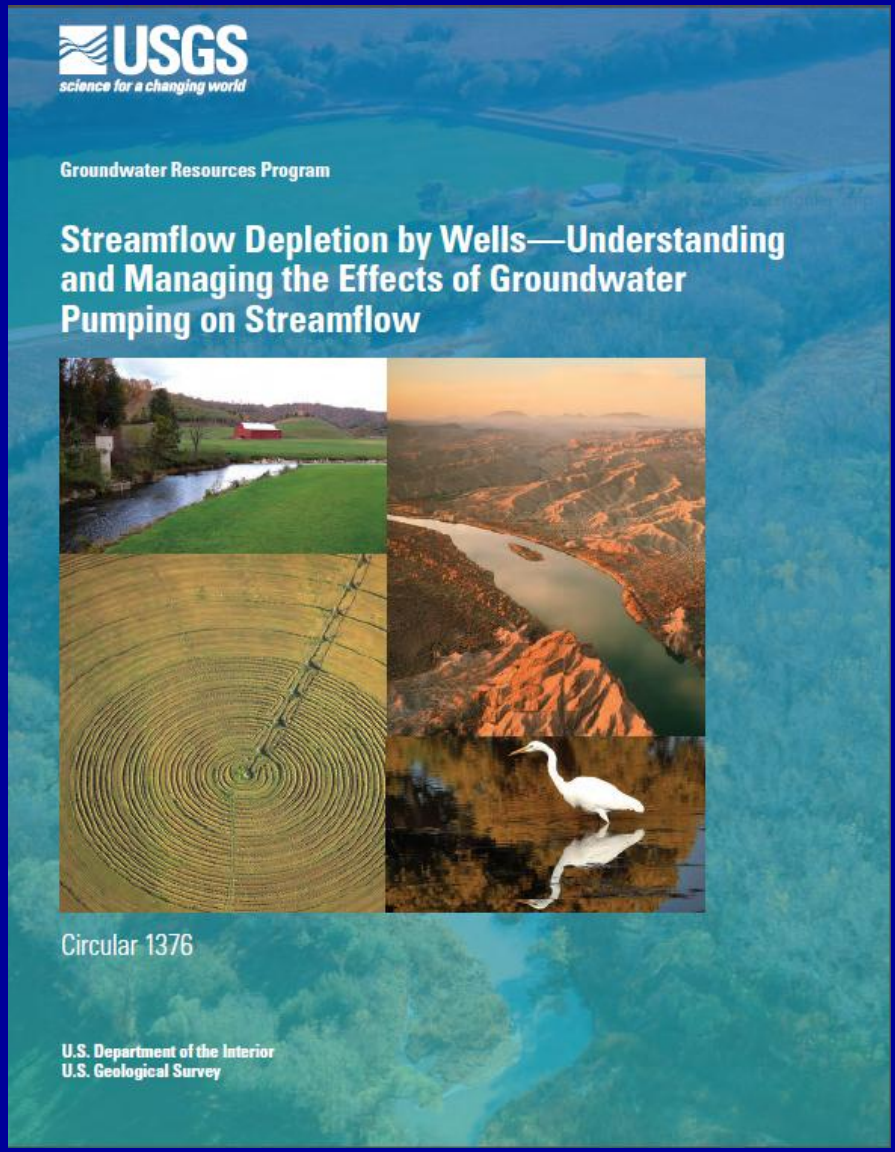
GW/SW Interactions

- Groundwater and surface are a single resource
- New USGS Circular on streamflow depletion by wells



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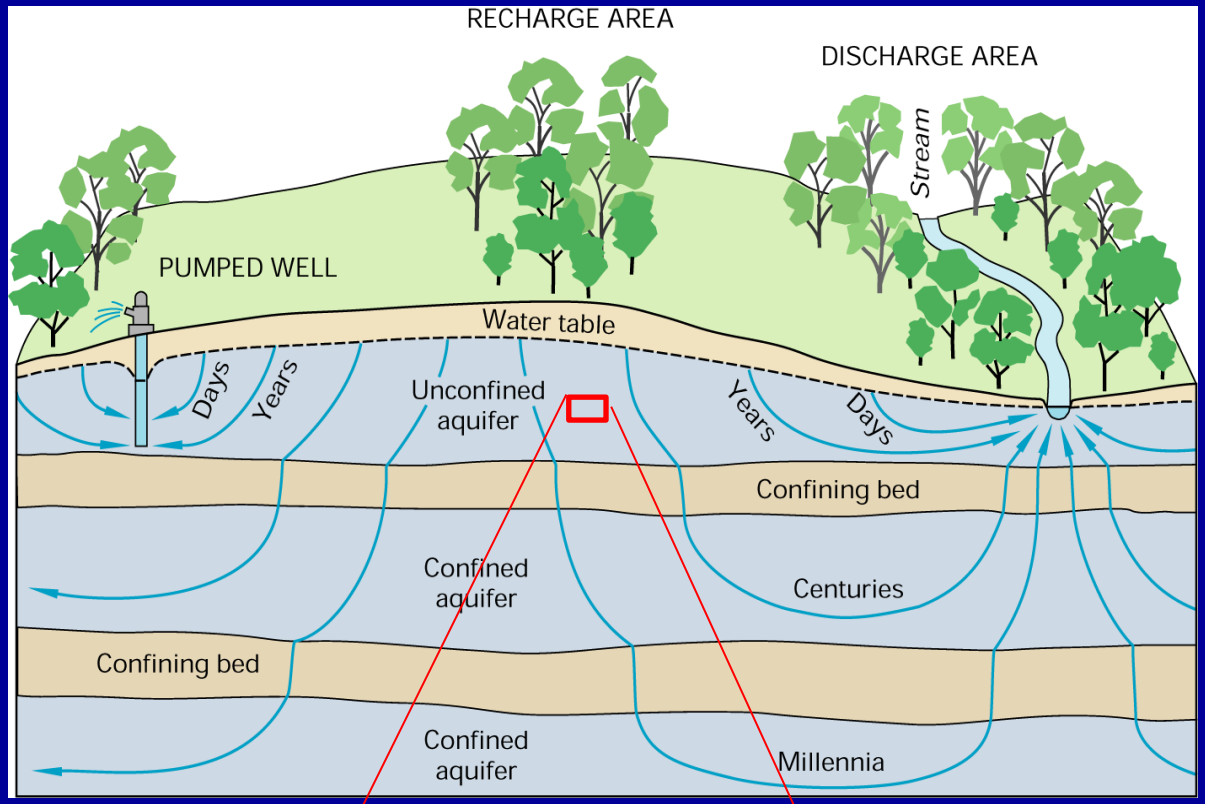
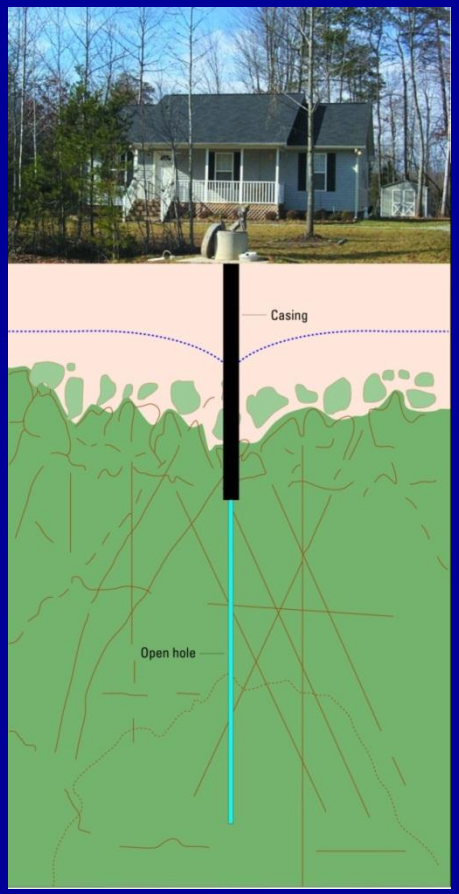
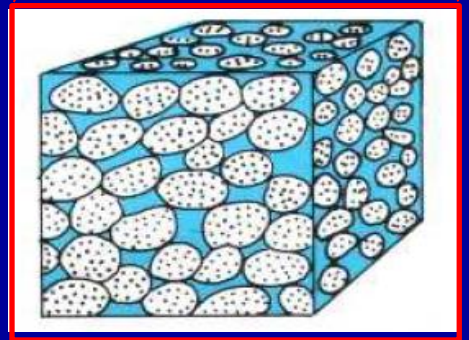
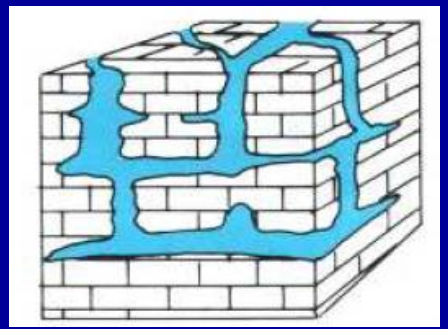
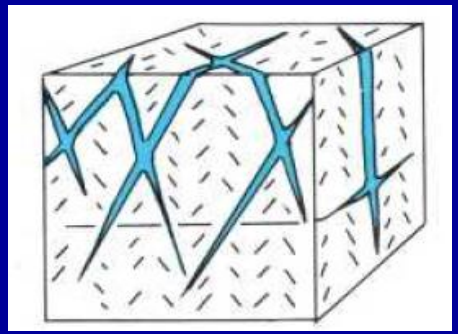
Groundwater Flow





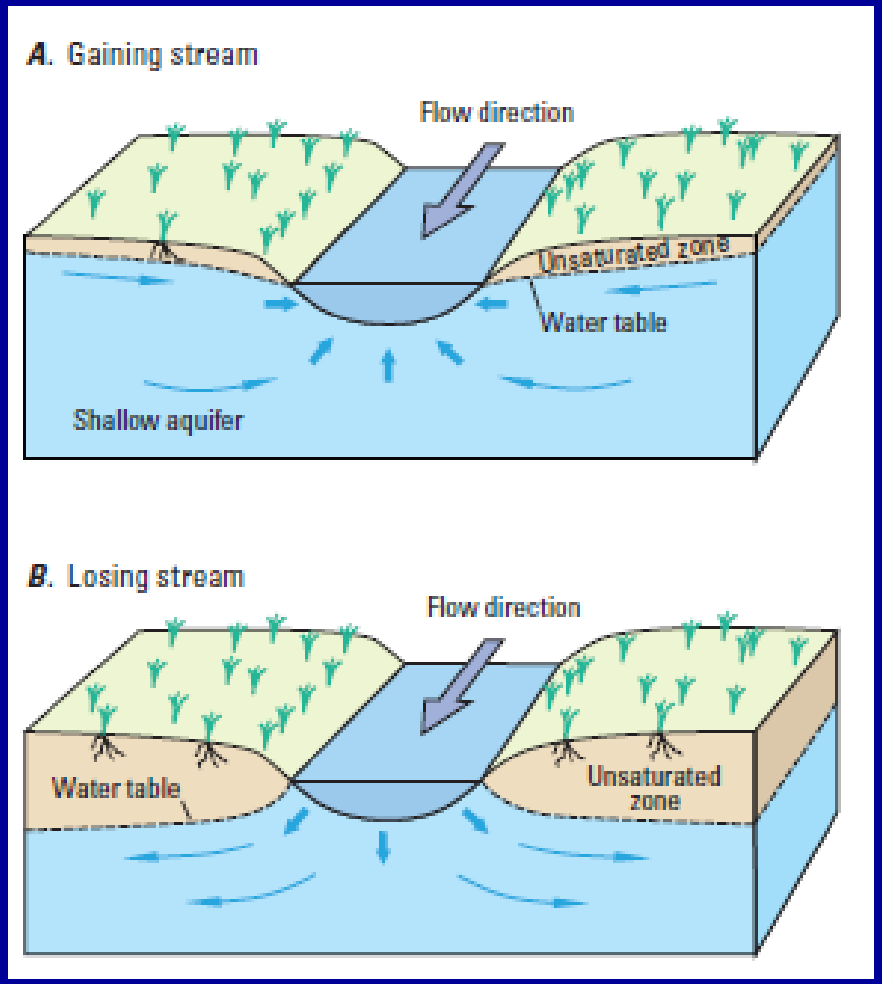


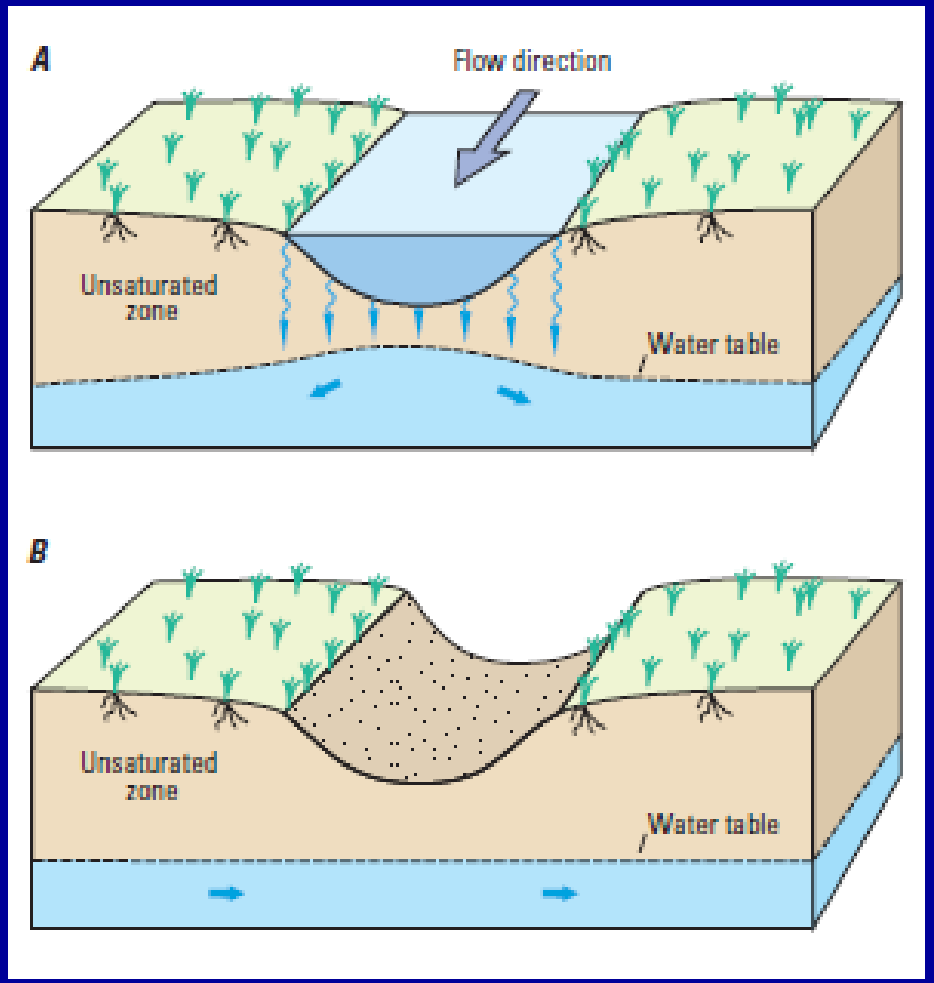


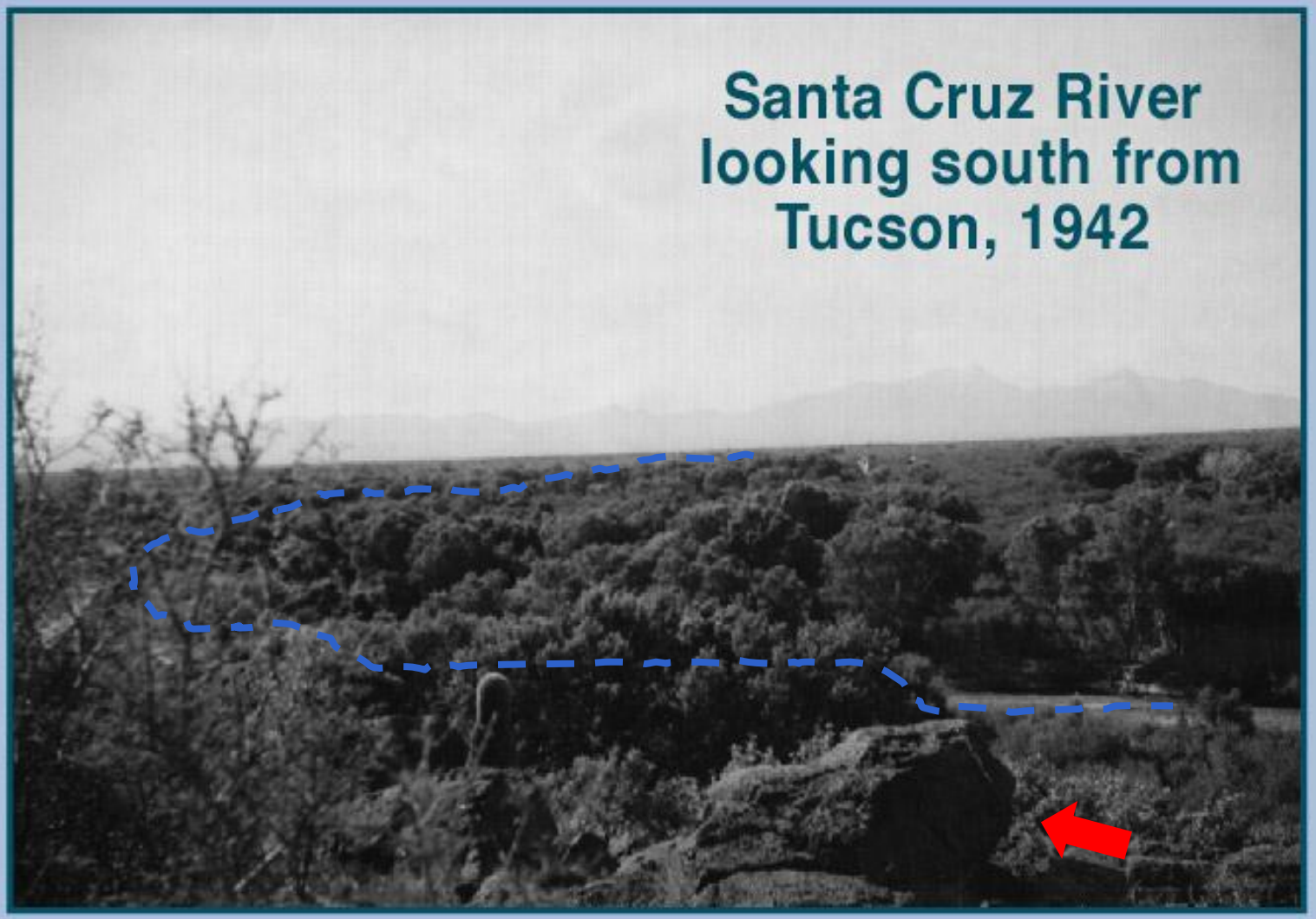


USGS

Gaining, Losing, and Disconnected Streams







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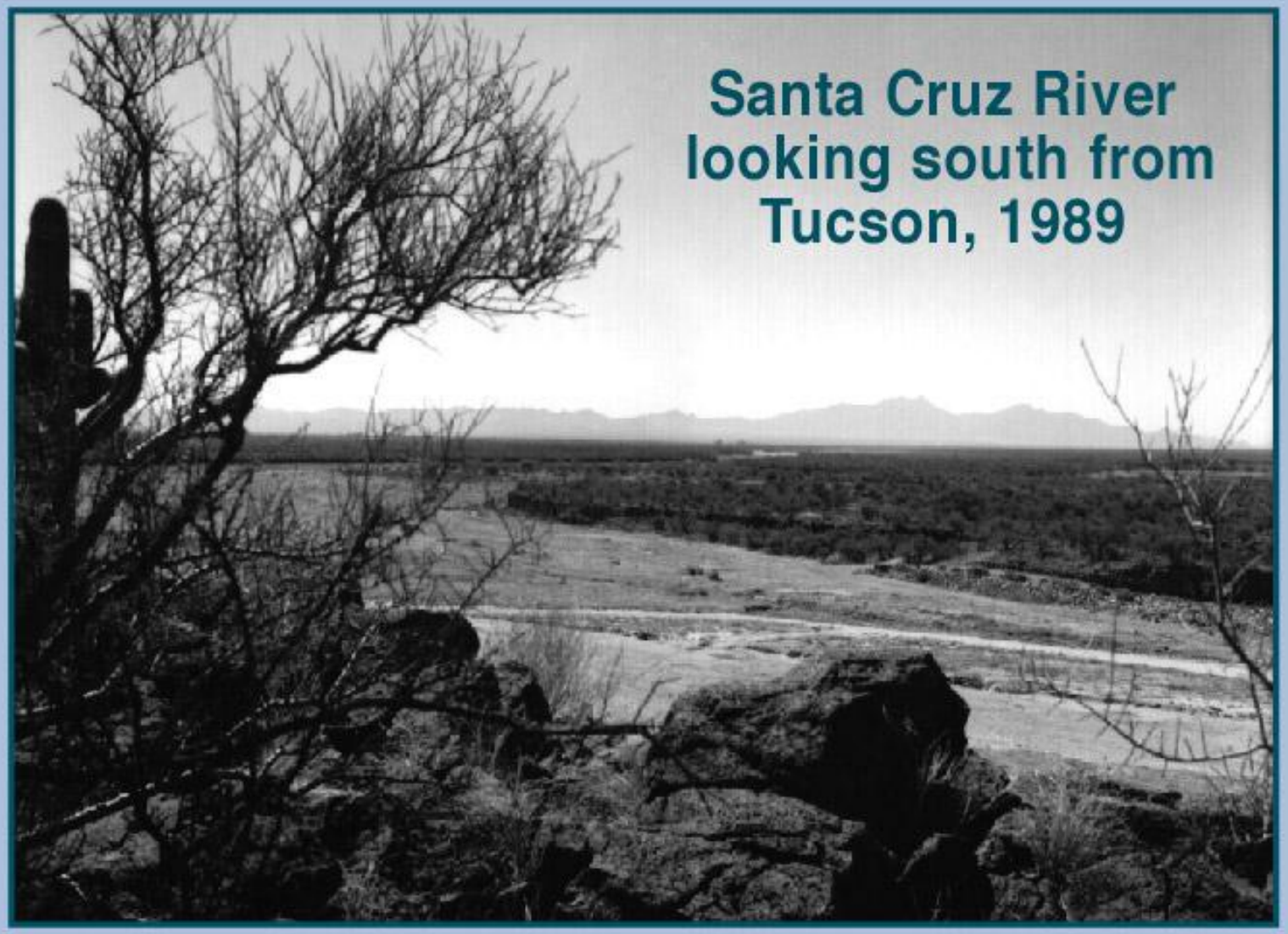

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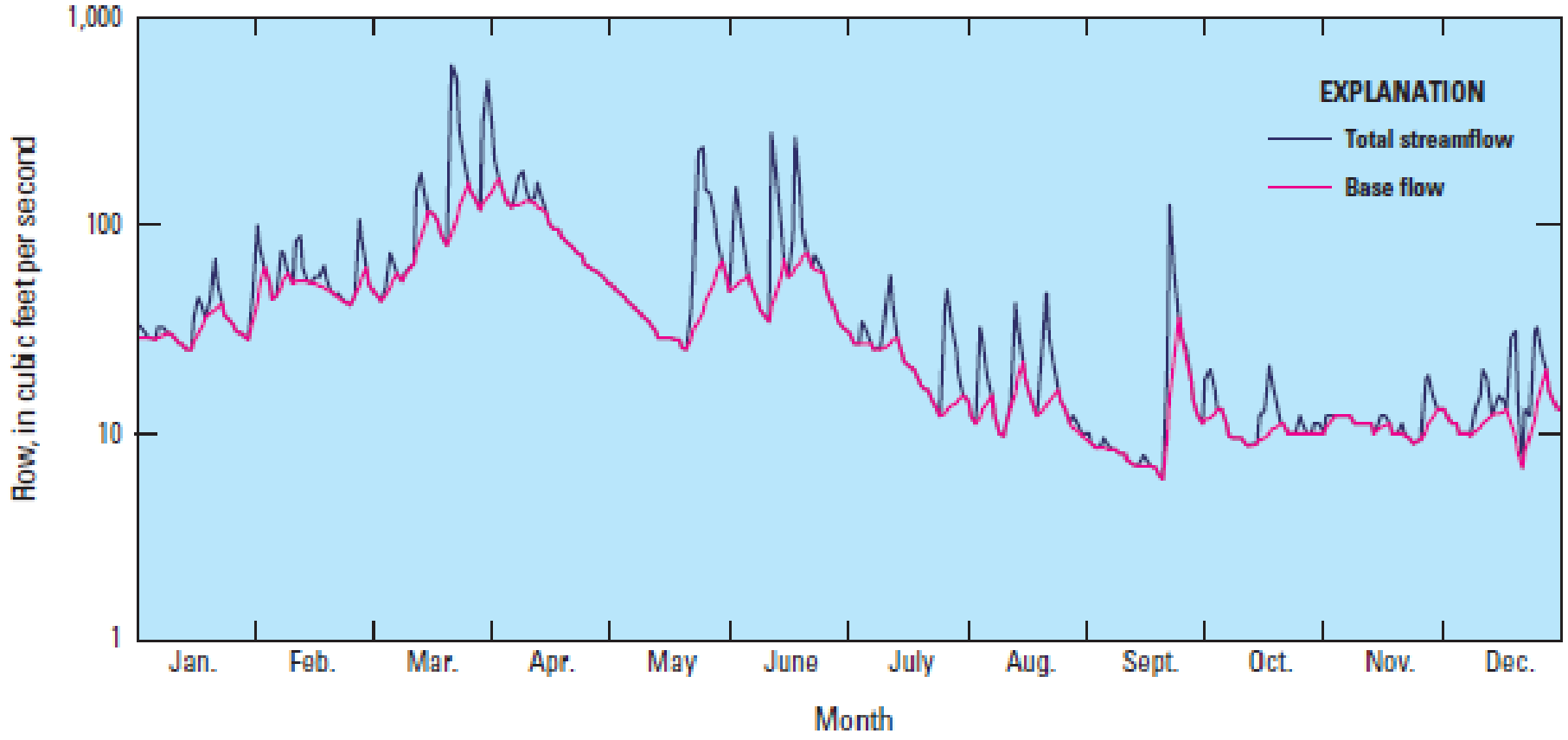
Groundwater is an Important Component of Streamflow



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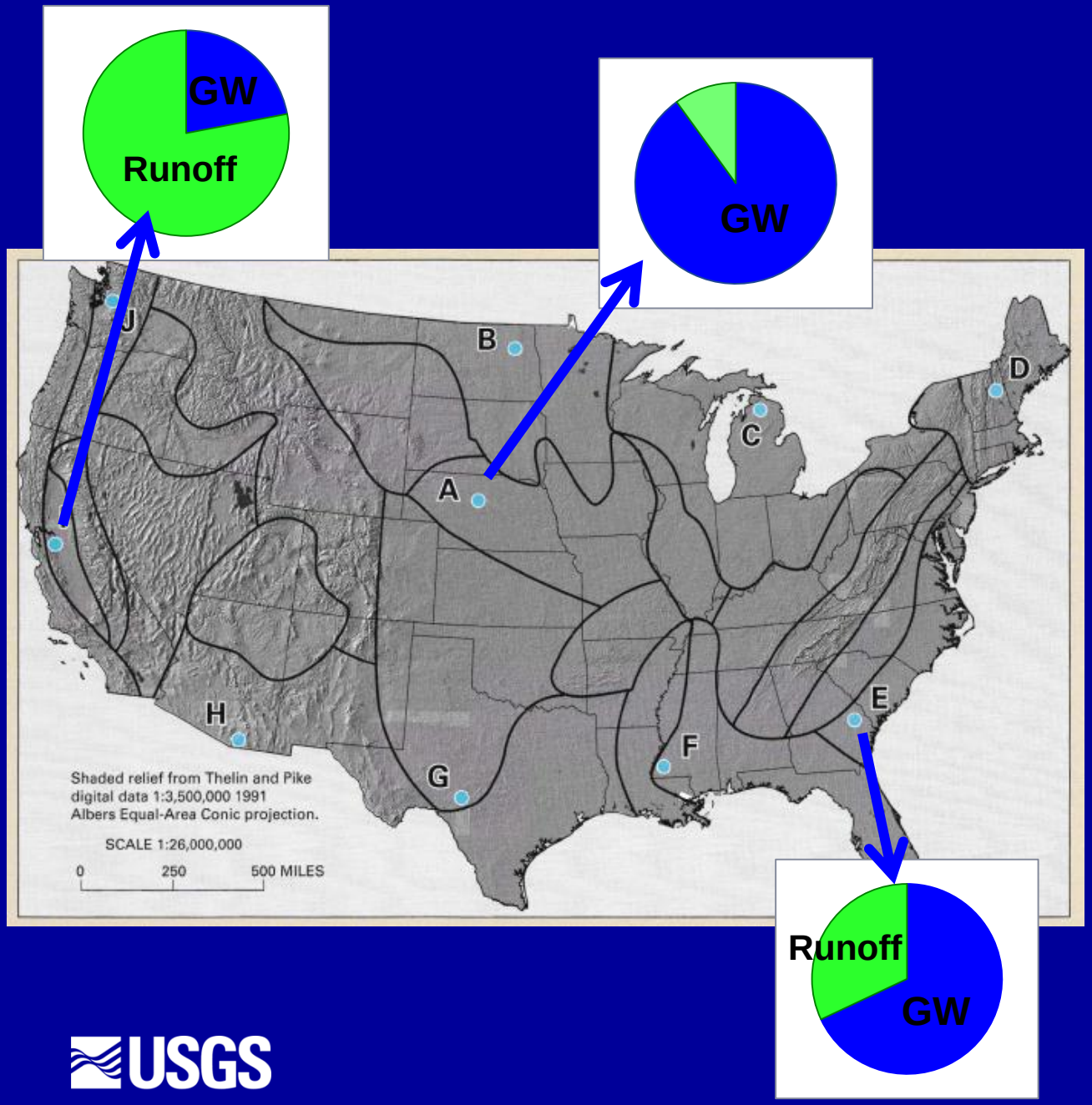
Contribution to Streamflow

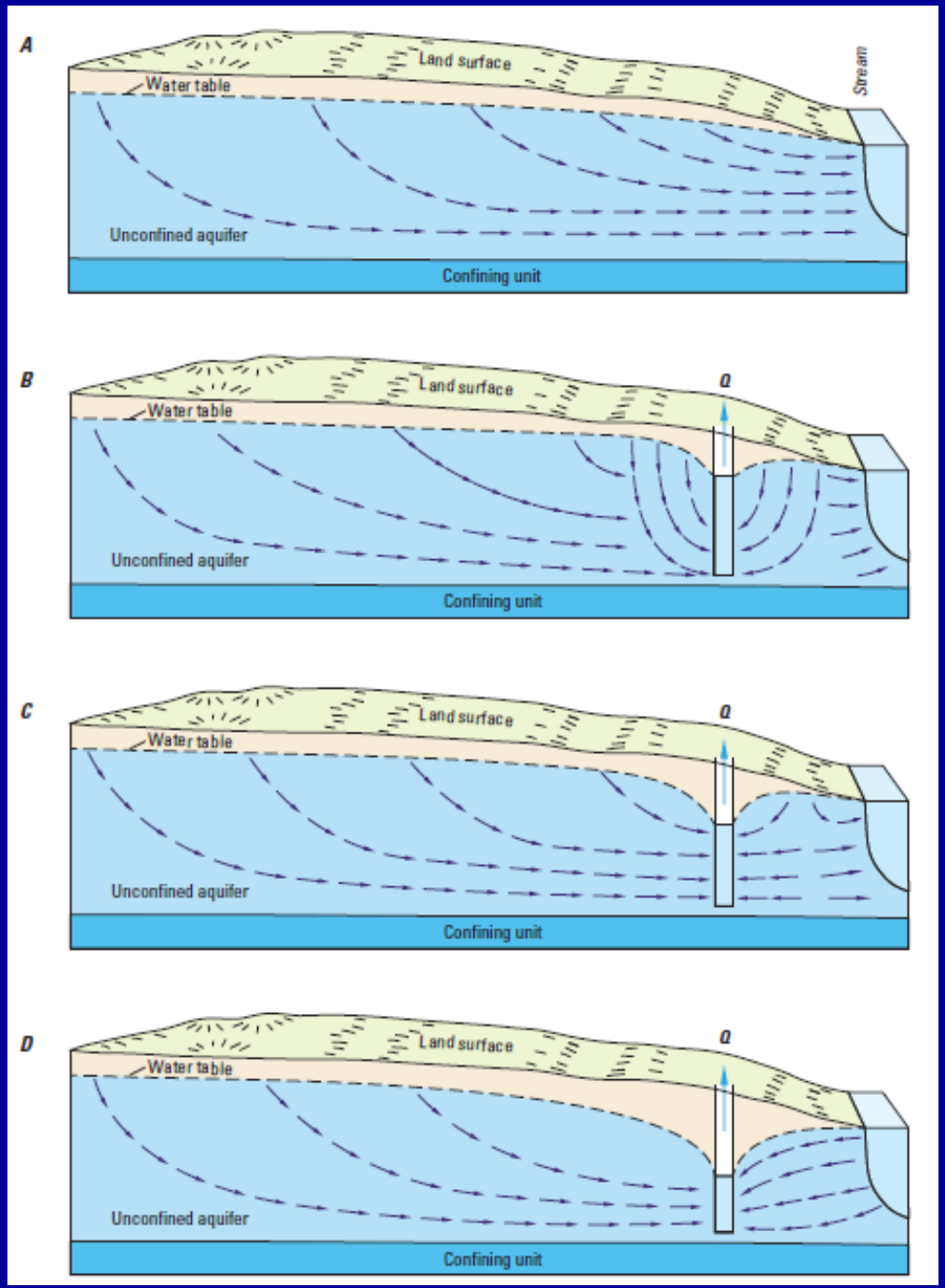


54 Streams
Range 14-90%
Average 52%

- Geology
- Physiography
- Climate

USGS

Pumping Effects on Streamflow



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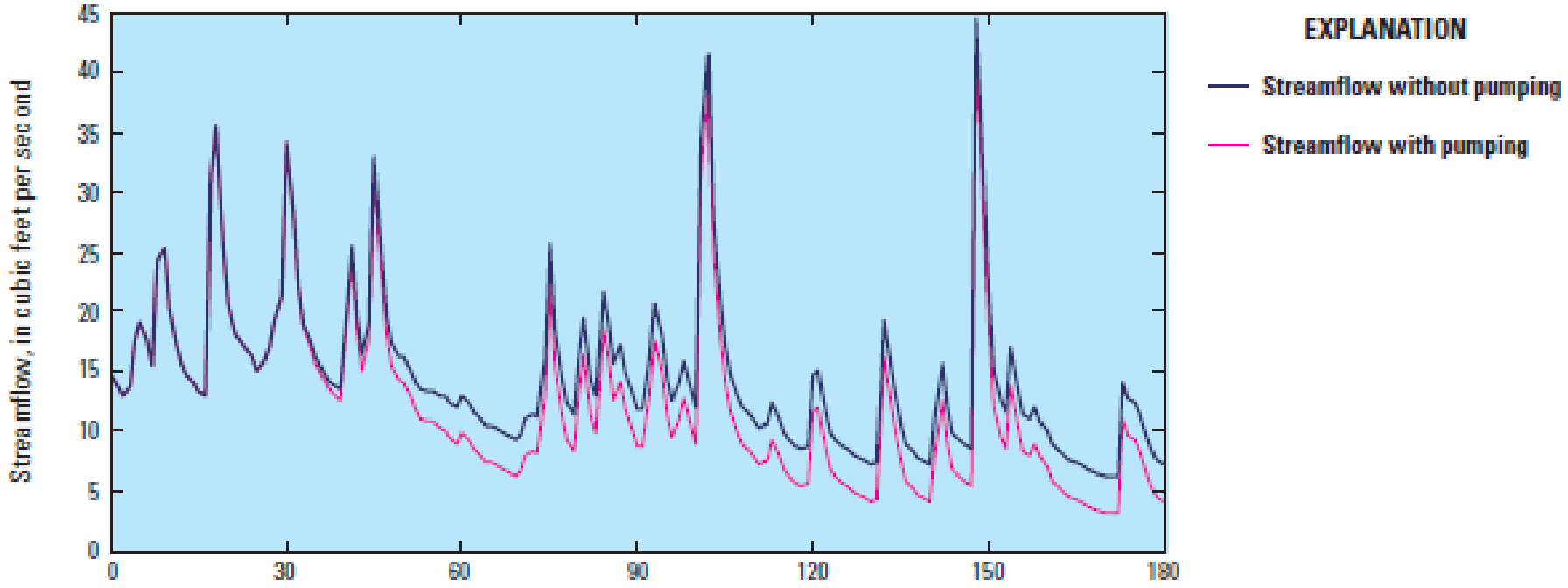
Pumping Effects on Streamflow



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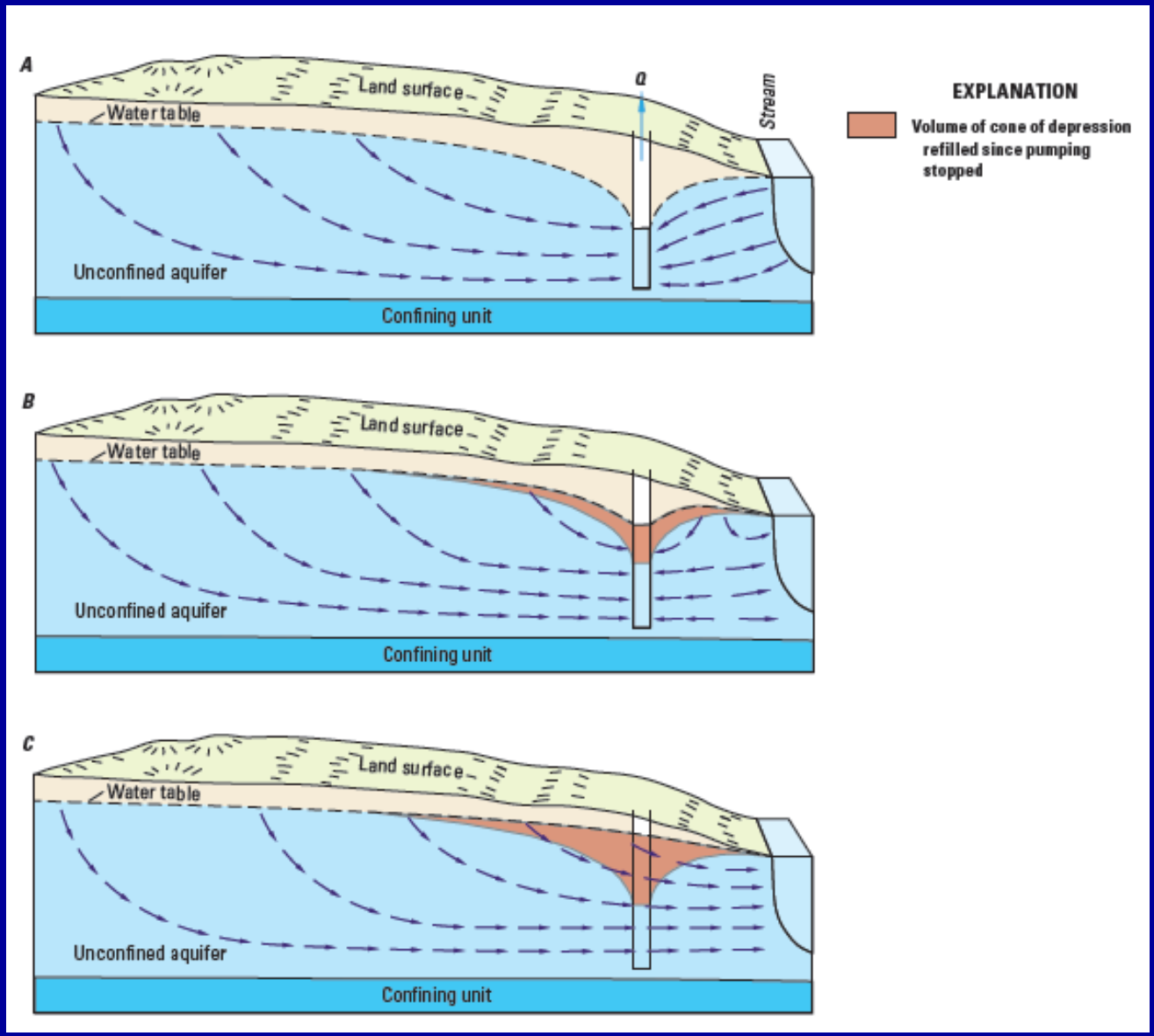
Streamflow Depletion after Pumping Stops



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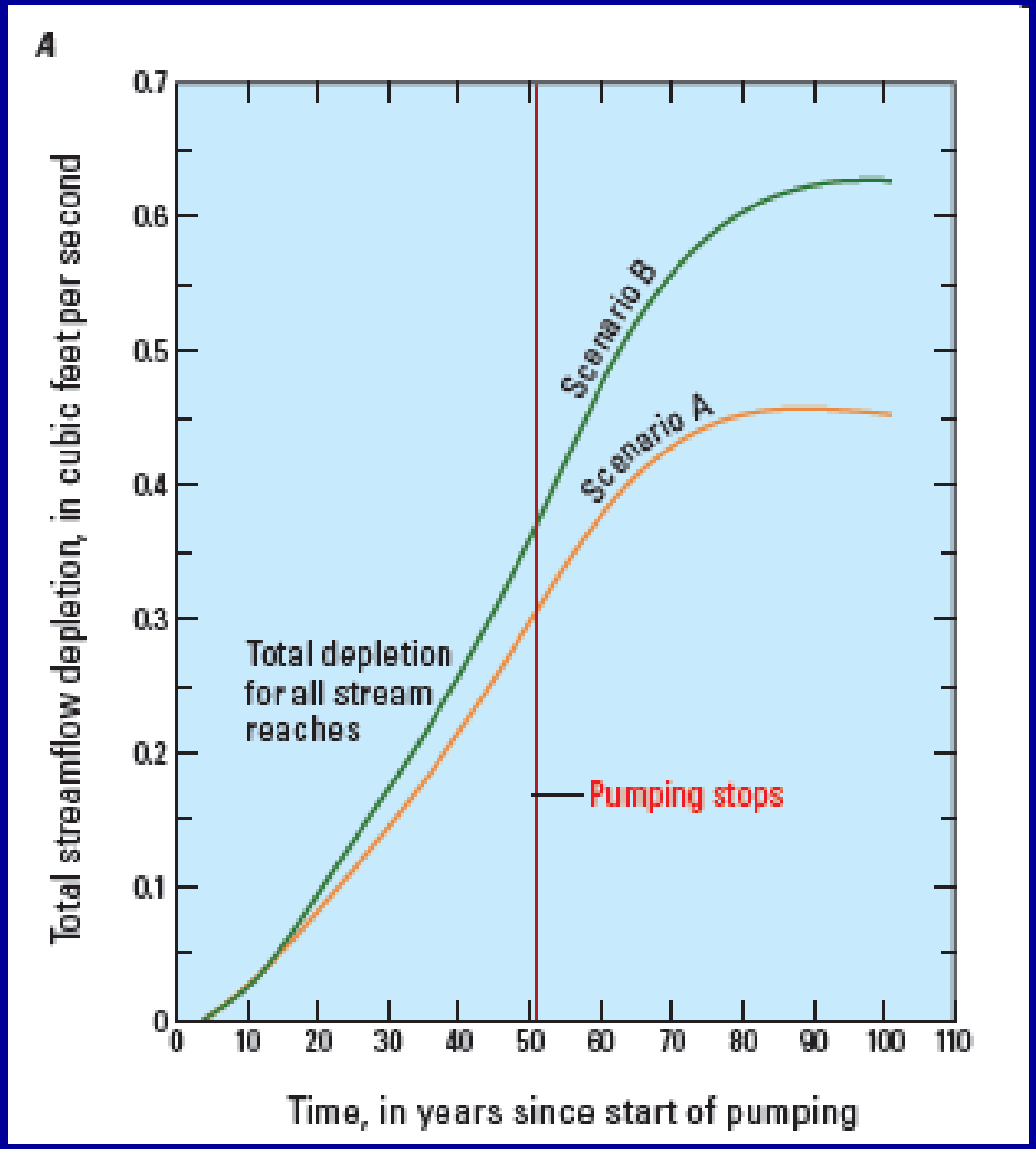
Depletion Timing: Arizona Example



USGS

Questions?

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