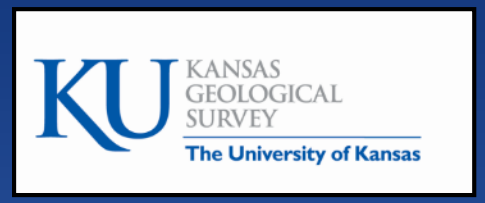
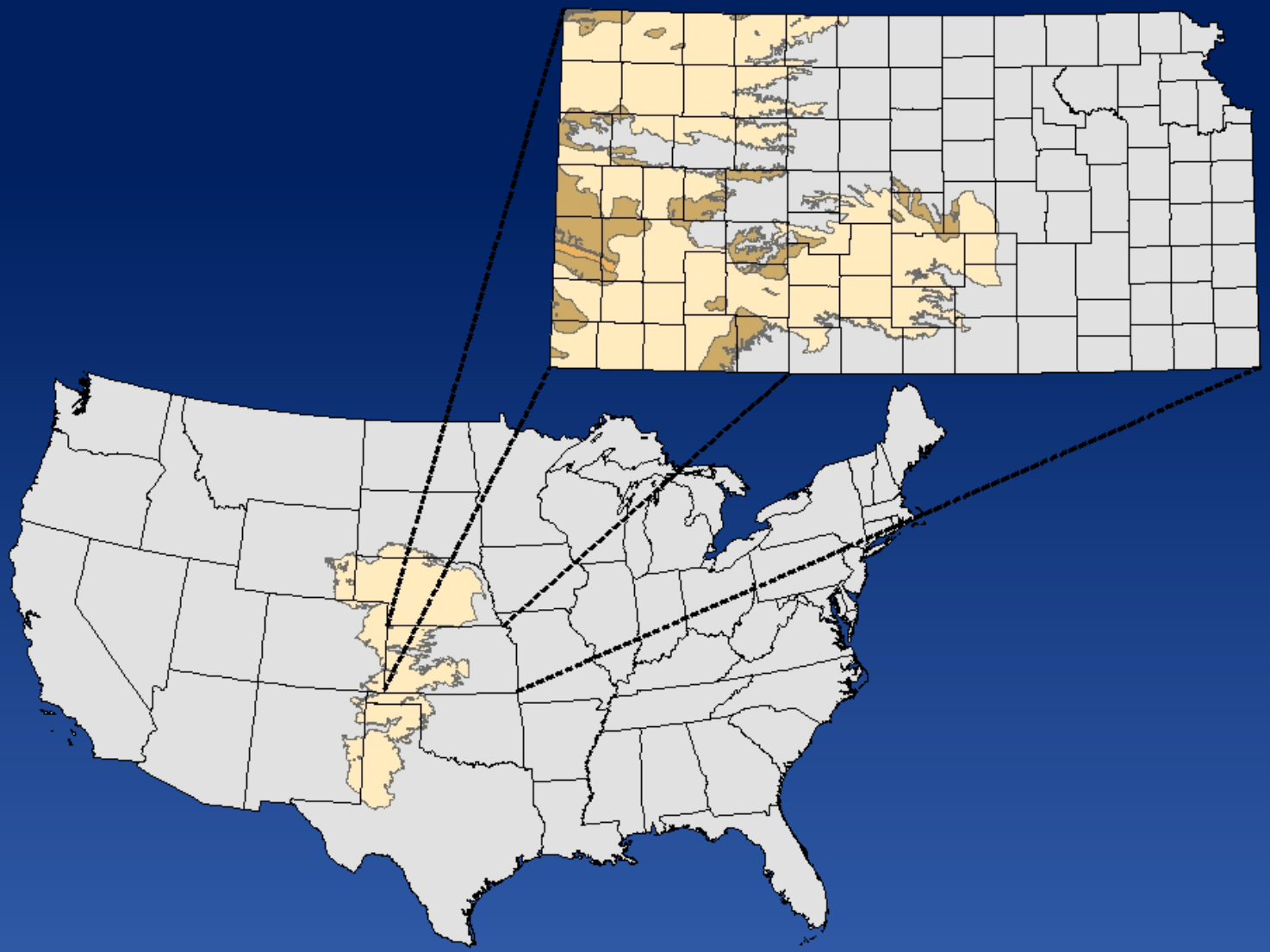
Conditions and Trends in the Kansas High Plains Aquifer

Upper Arkansas Regional Advisory Committee Meeting
June 9, 2020

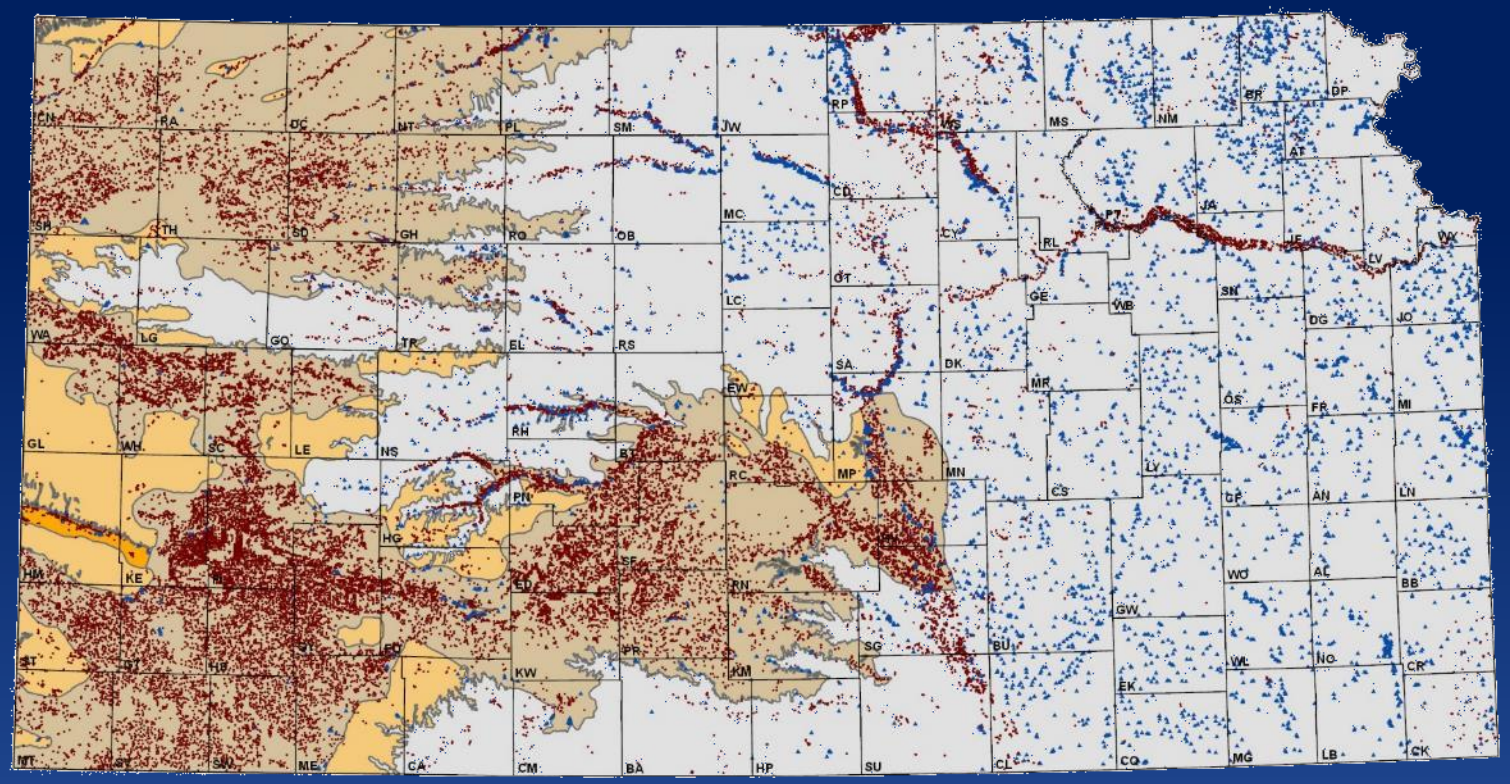


Kansas Geological Survey
University of Kansas

The High Plains Aquifer

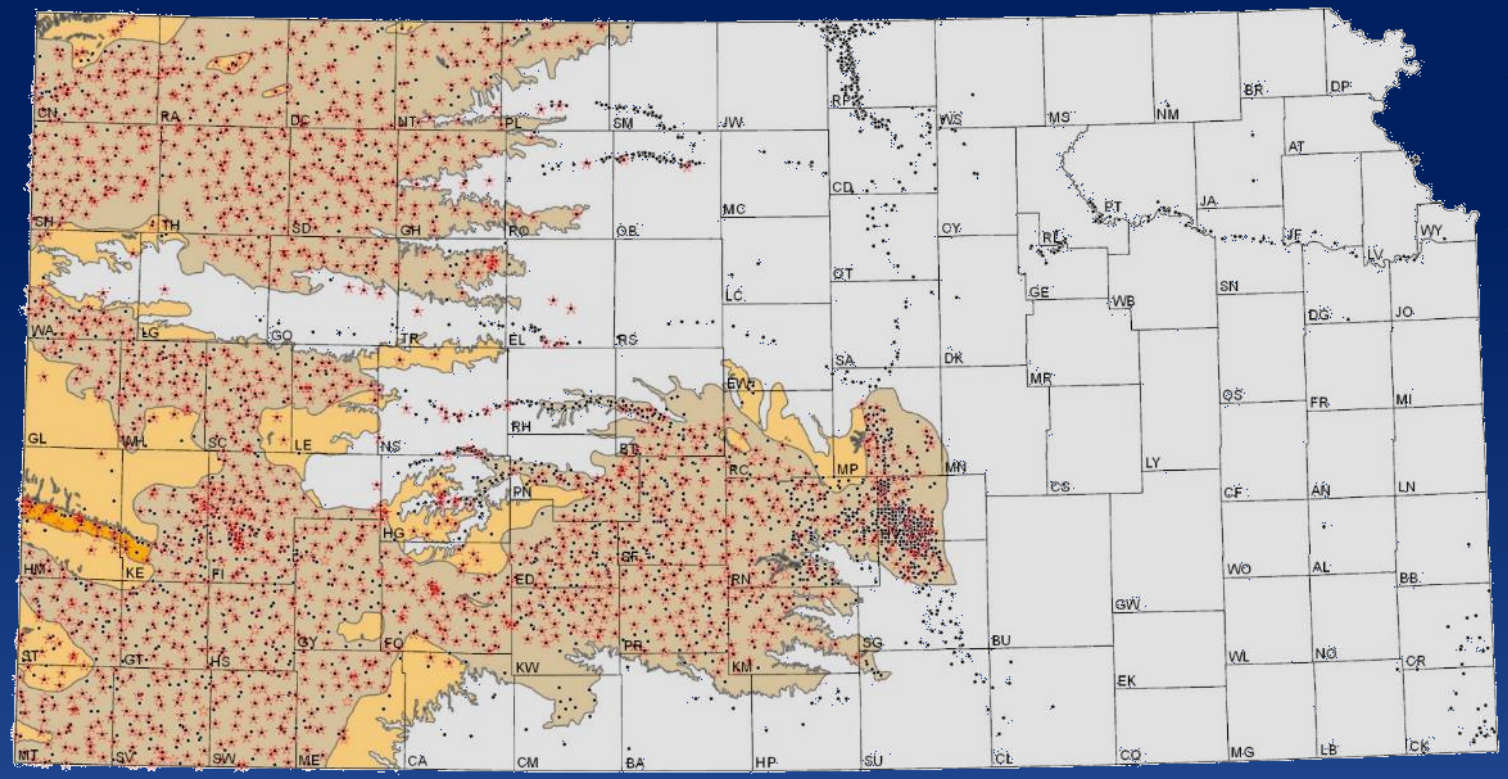


Water Right Development in Kansas

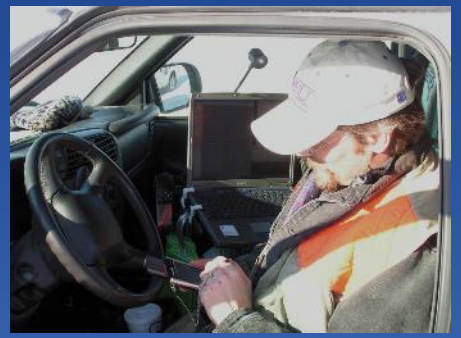


- Water Information Management and Analysis System (WIMAS)
- Kansas Department of Agriculture, Division of Water Resources
- Water Rights
  - Authorized Annual Permits/Certificates
  - Historic Reported Water Usage

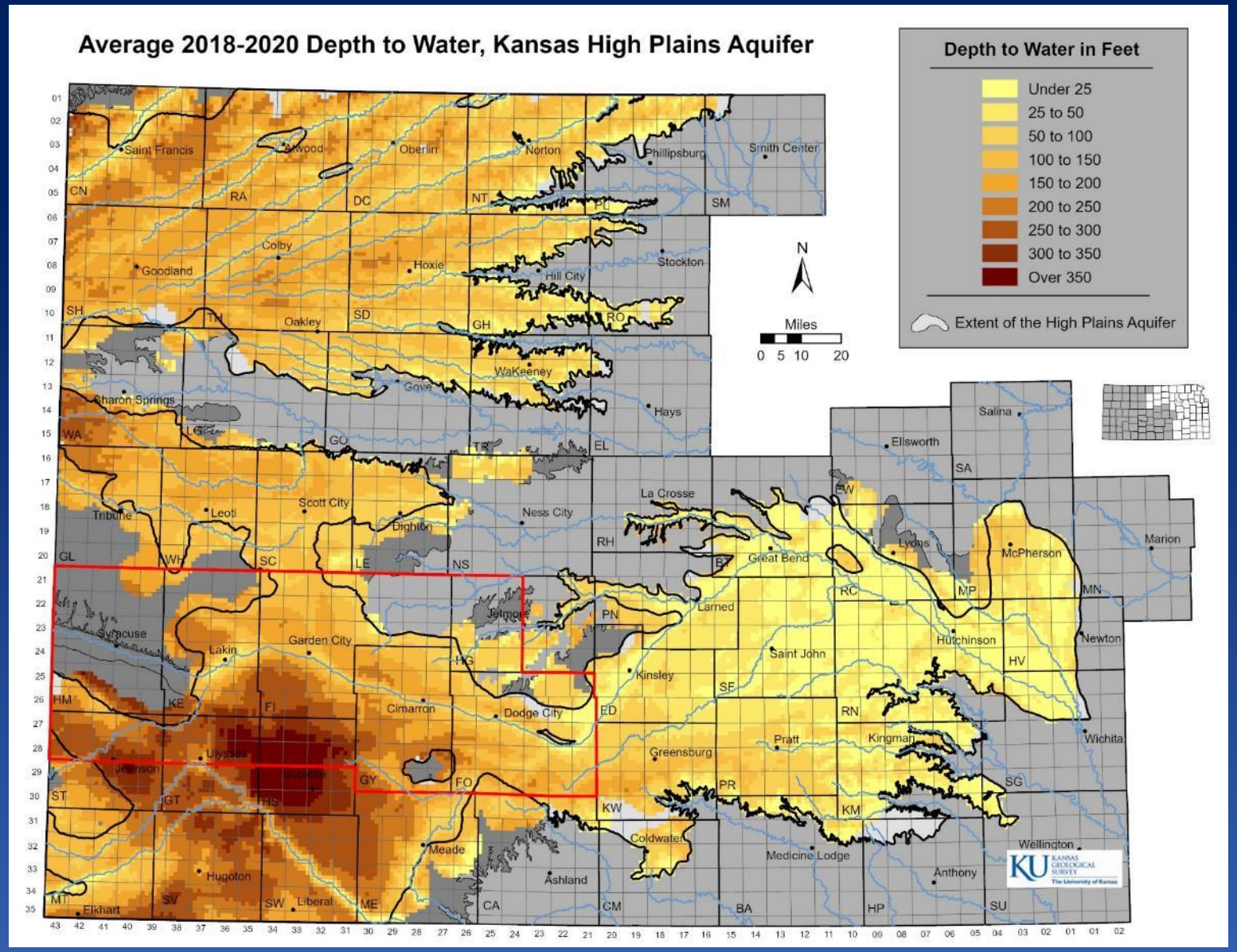
Measuring Wells in Kansas



- Water Information Storage and Retrieval database (WIZARD)
- Kansas Geological Survey
- Wells measured by GMDs 2 and 5, KDA-DWR, USGS, and the KGS
- Cooperative Water Level Network
  - Focused on High Plains aquifer
  - Annual measurements by the KGS and KDA-DWR
  - Regional aquifer characterizations



Depth to Water, Kansas High Plains Aquifer

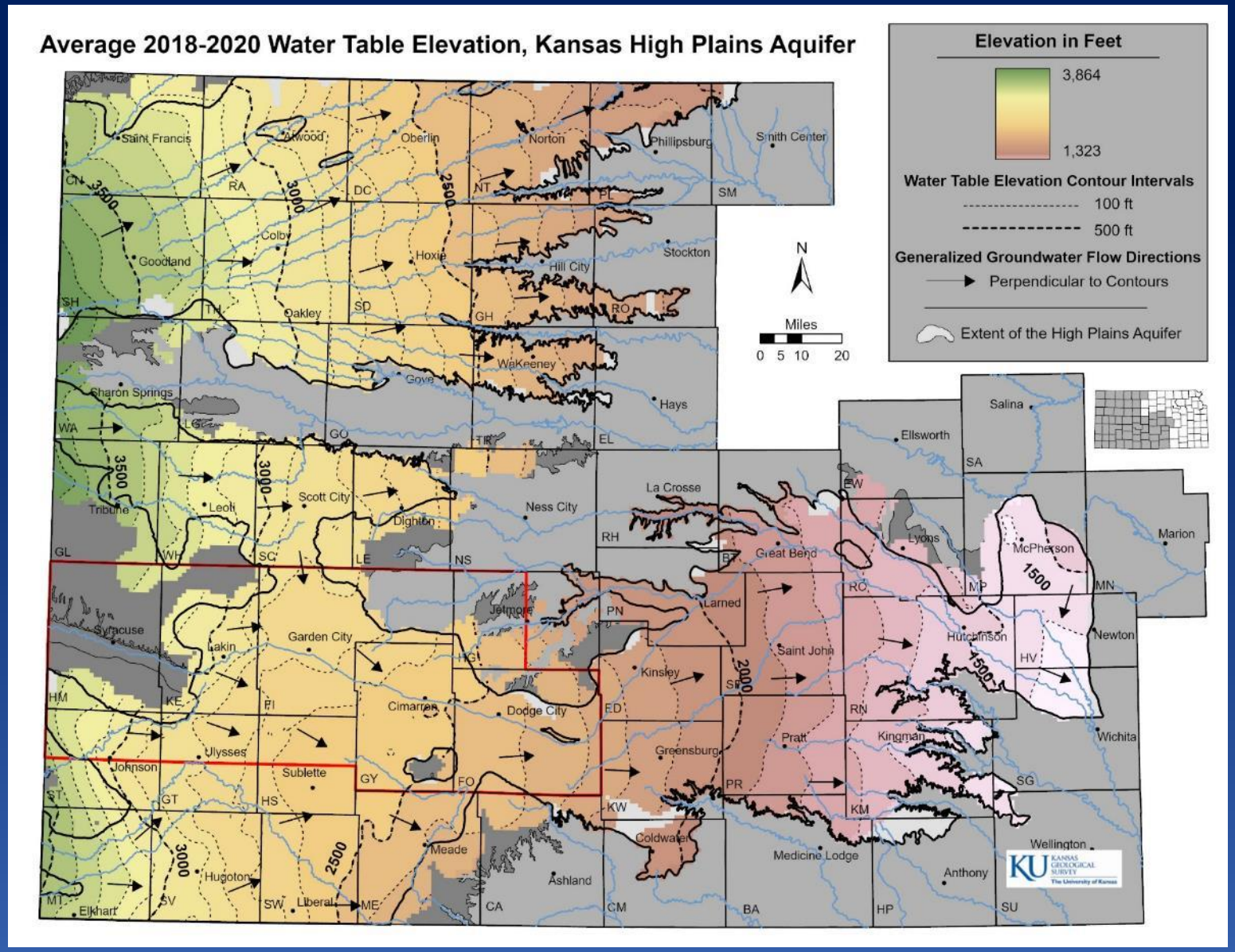


Depth to water ranges:

- **At or near the land surface**
- **Over 400 ft (Haskell County)**
- **Upper Ark RAC**
  - **Averages 180 ft**
  - **Ranges from 0 to 422 ft**

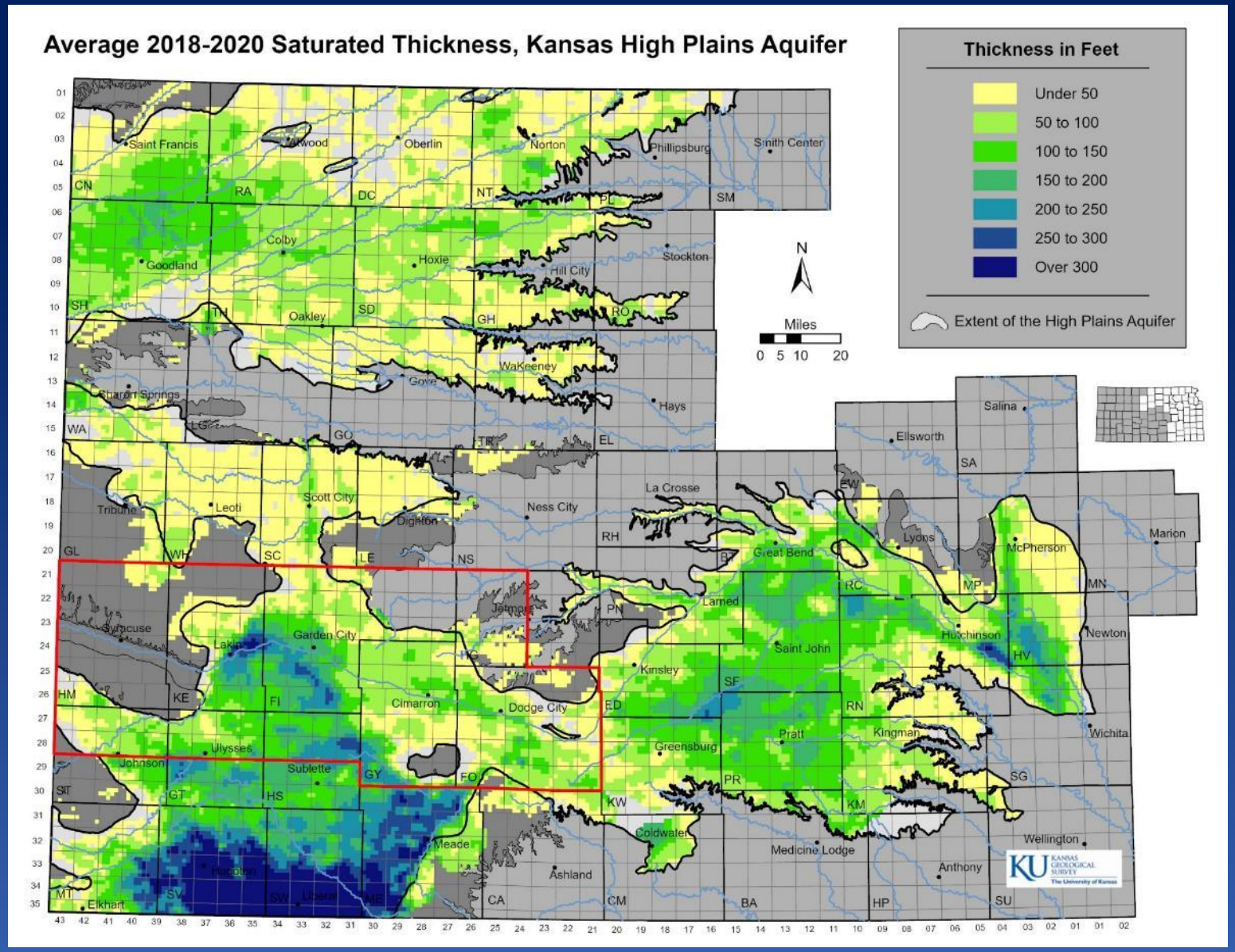
http://www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html

Water Table Elevation, Kansas High Plains Aquifer

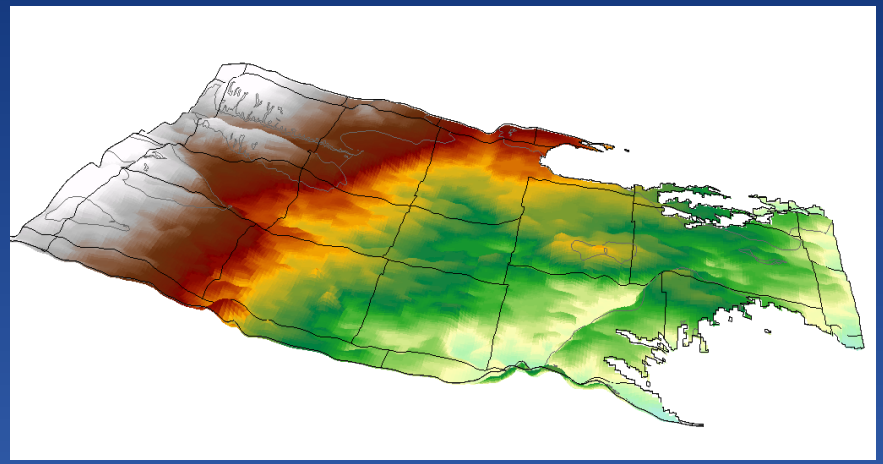


- Follows land surface
- Flow paths are generally west to east with some local variations
- Linear flow velocities
  - Range from 1 ft per 1 to 4 days
  - 10 to 20 years to go a mile

Aquifer Thickness, Kansas High Plains Aquifer

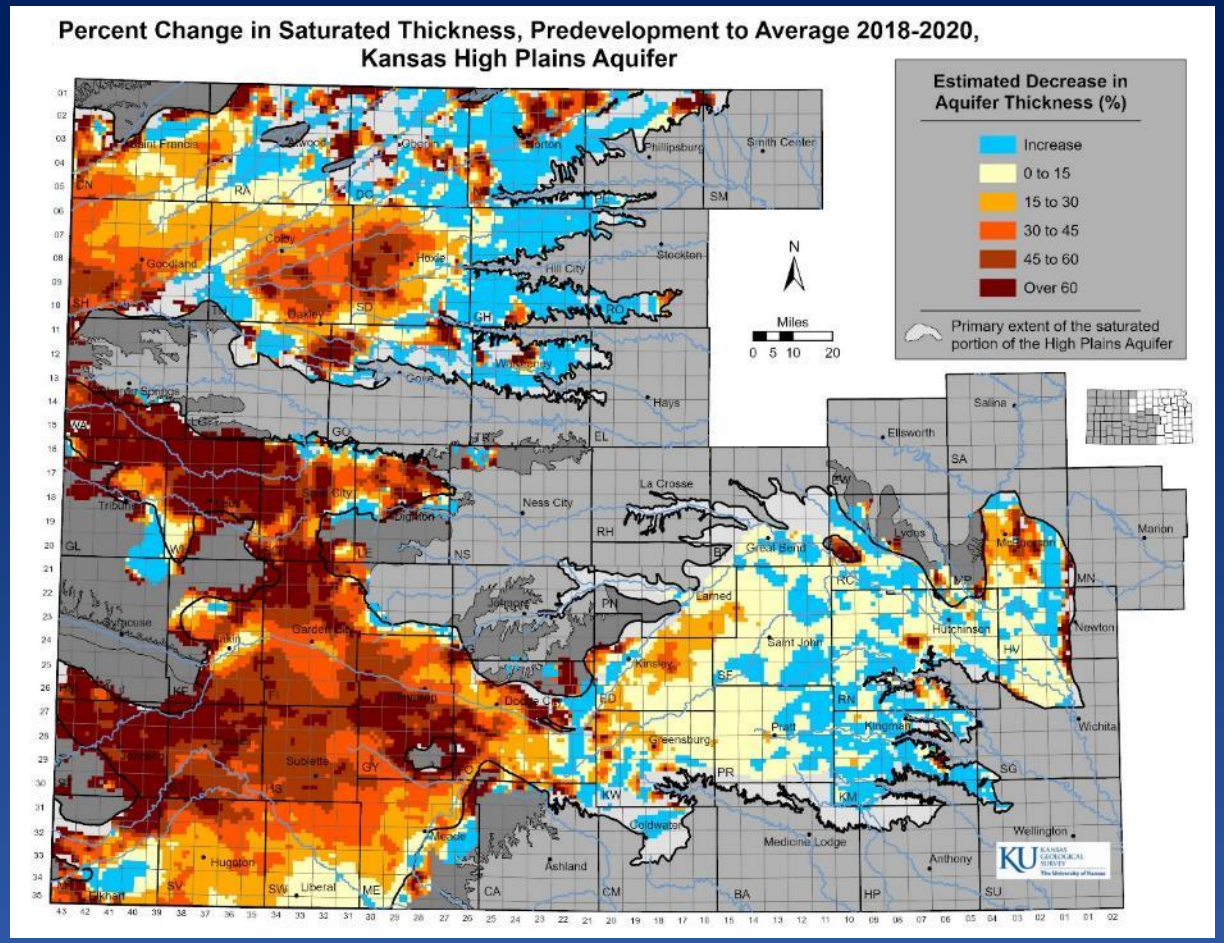


- Ranges from 0 to 500 ft (Seward County)
- Upper Ark RAC
  - Averages 80 ft
  - Ranges from near 0 to 322 ft
- Variability driven by underlying bedrock surface

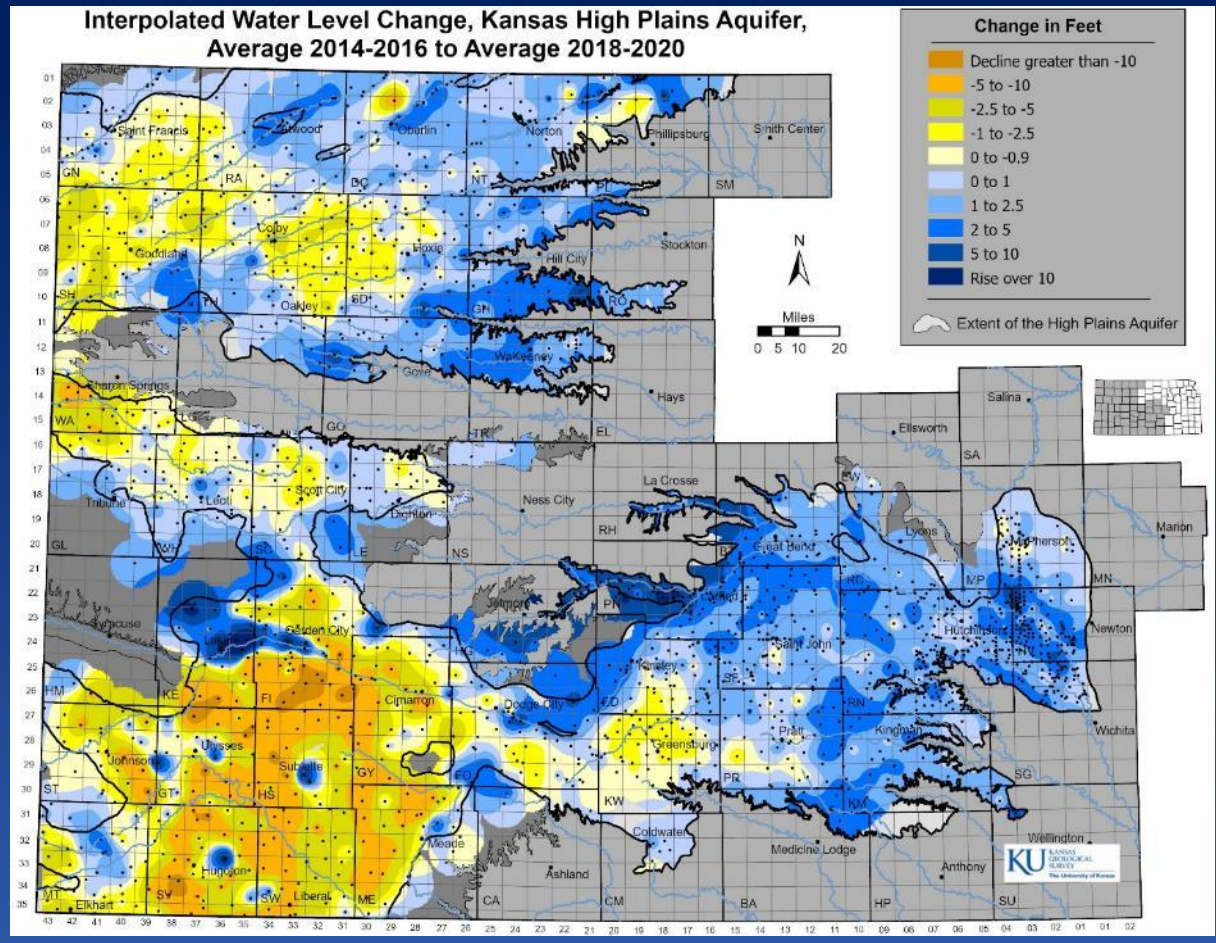


Water-Level Change

Since Predevelopment

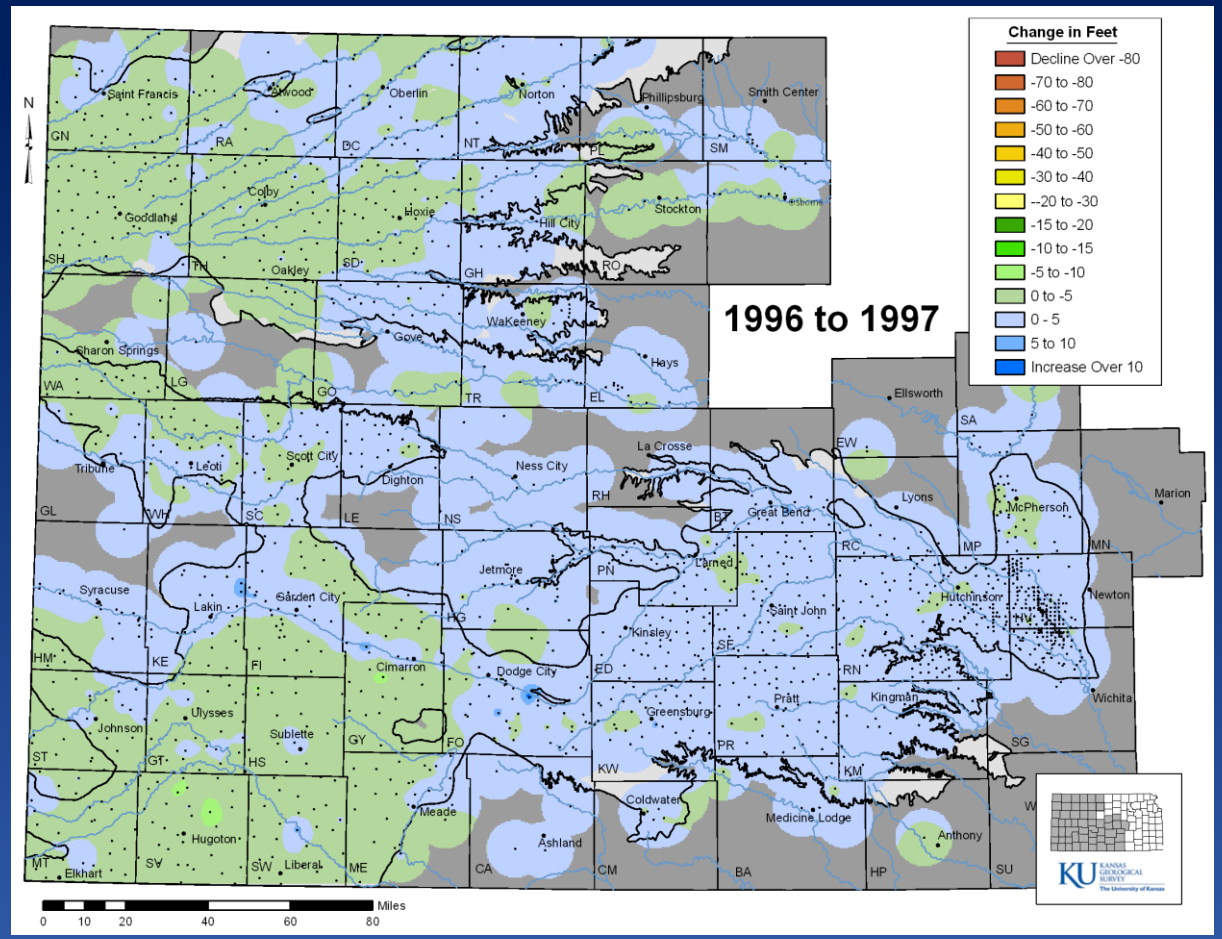


Last 5 Years

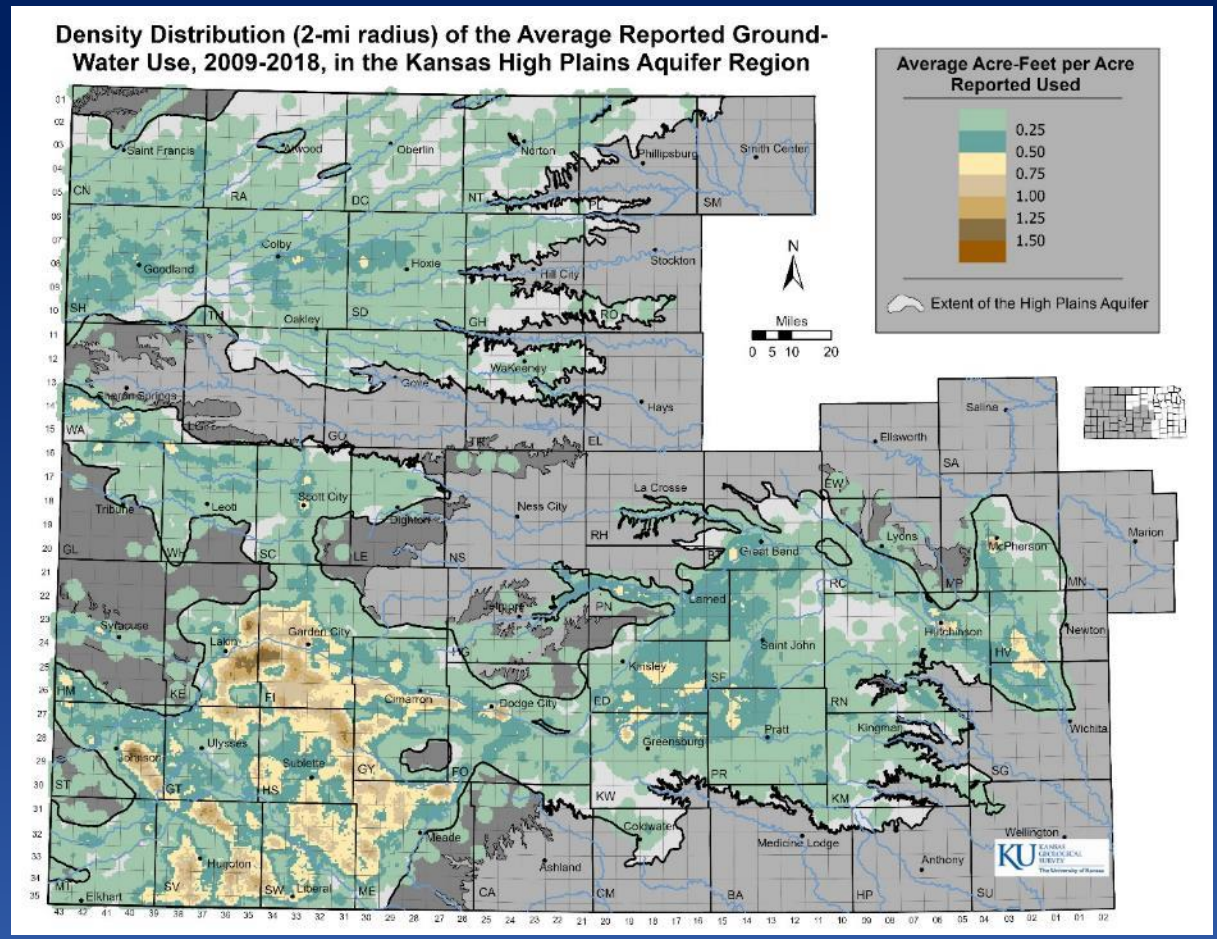


Water-Level Change vs Reported Water Use

Water Level Change

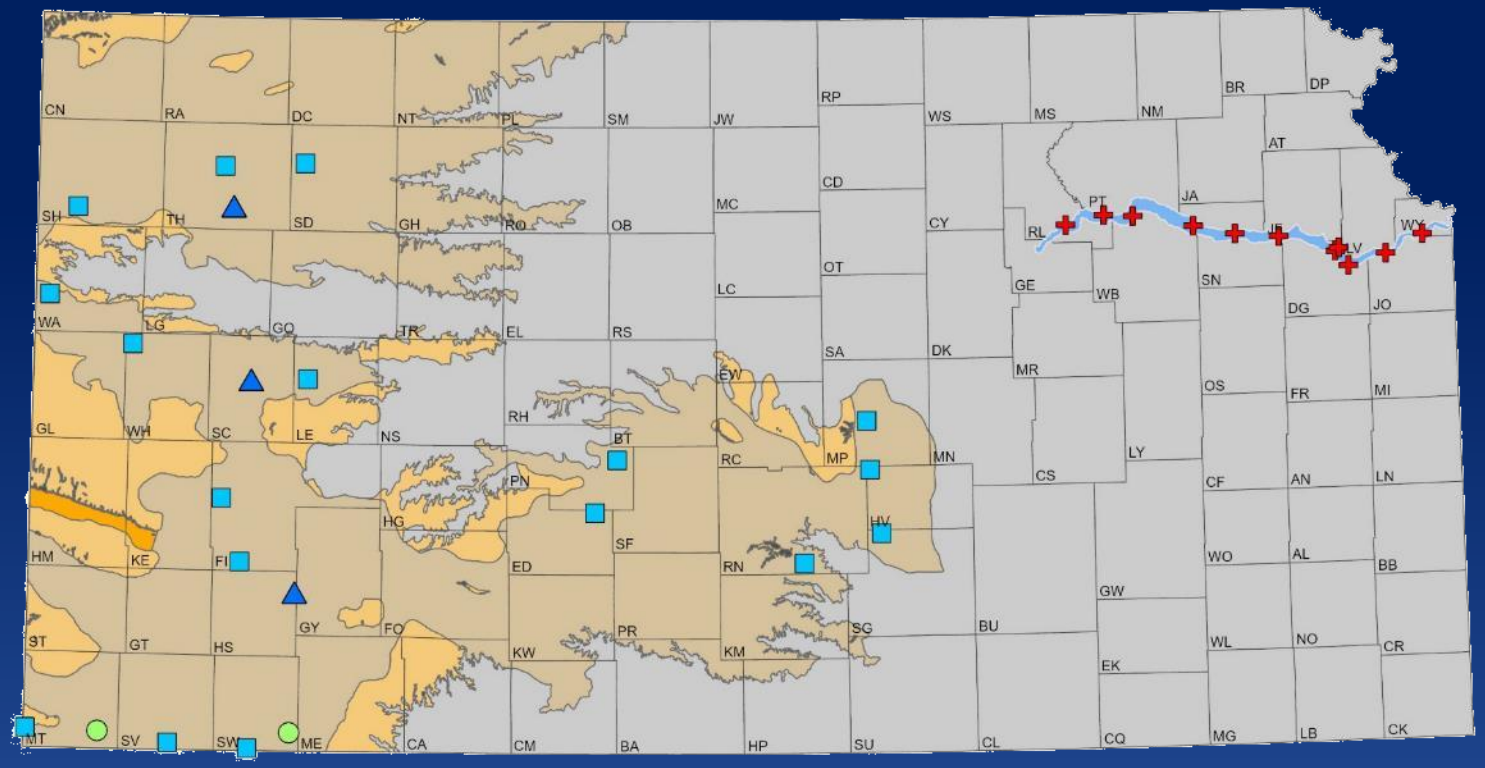


Groundwater Usage

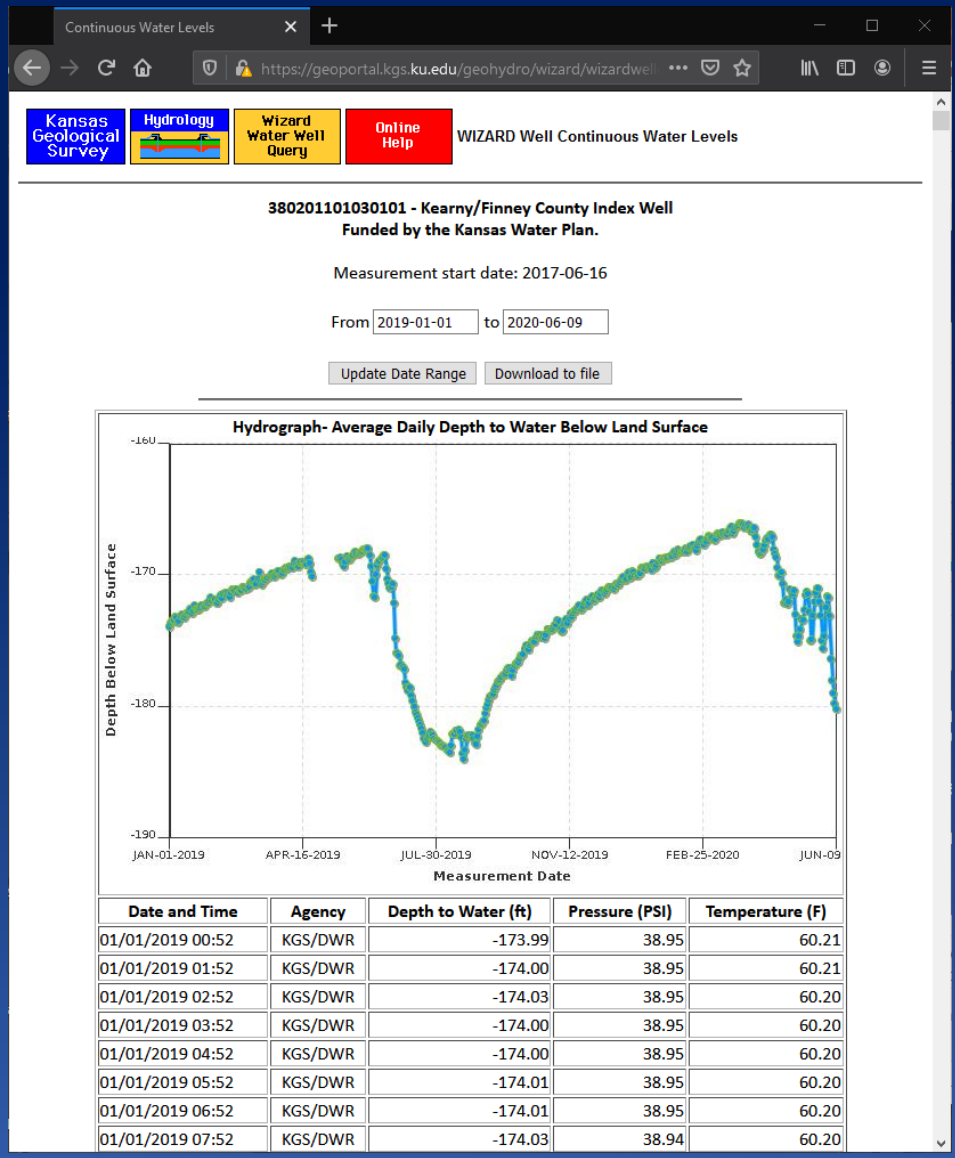


How far out of whack are we?

Kansas Index Well Program



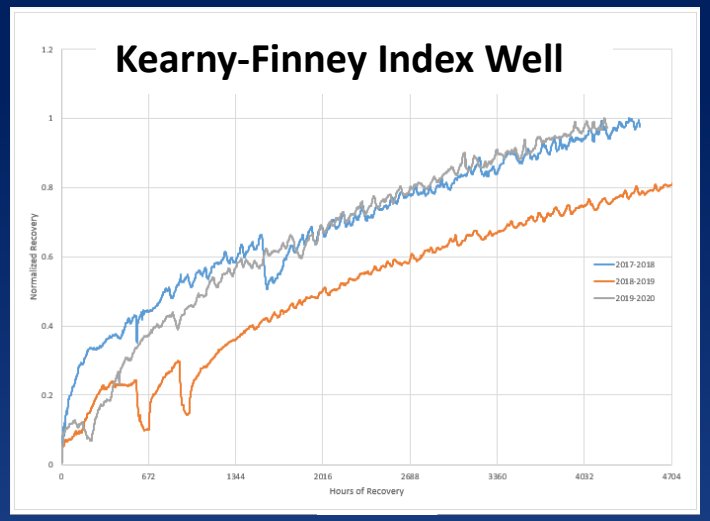
- First wells installed in 2007 through the Kansas Water Plan Fund
- Continuous, real-time water-level recordings
- Characterizations at the local scale

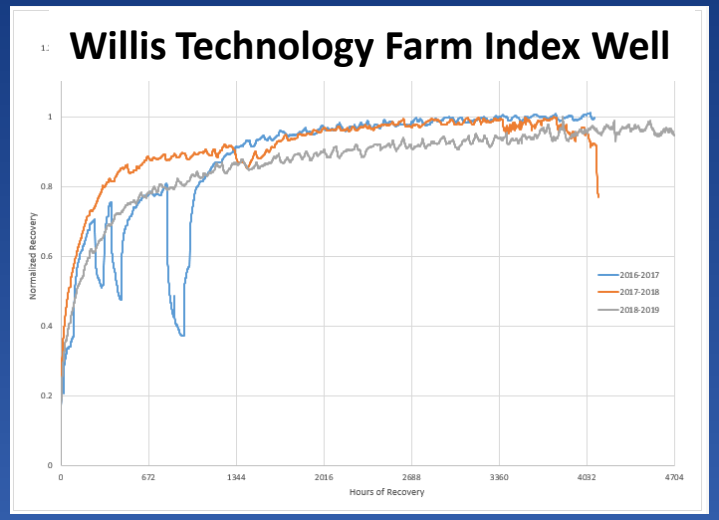


Date and Time	Agency	Depth to Water (ft)	Pressure (PSI)	Temperature (F)
01/01/2019 00:52	KGS/DWR	-173.99	38.95	60.21
01/01/2019 01:52	KGS/DWR	-174.00	38.95	60.21
01/01/2019 02:52	KGS/DWR	-174.03	38.95	60.20
01/01/2019 03:52	KGS/DWR	-174.00	38.95	60.20
01/01/2019 04:52	KGS/DWR	-174.00	38.95	60.20
01/01/2019 05:52	KGS/DWR	-174.01	38.95	60.20
01/01/2019 06:52	KGS/DWR	-174.01	38.95	60.20
01/01/2019 07:52	KGS/DWR	-174.03	38.94	60.20

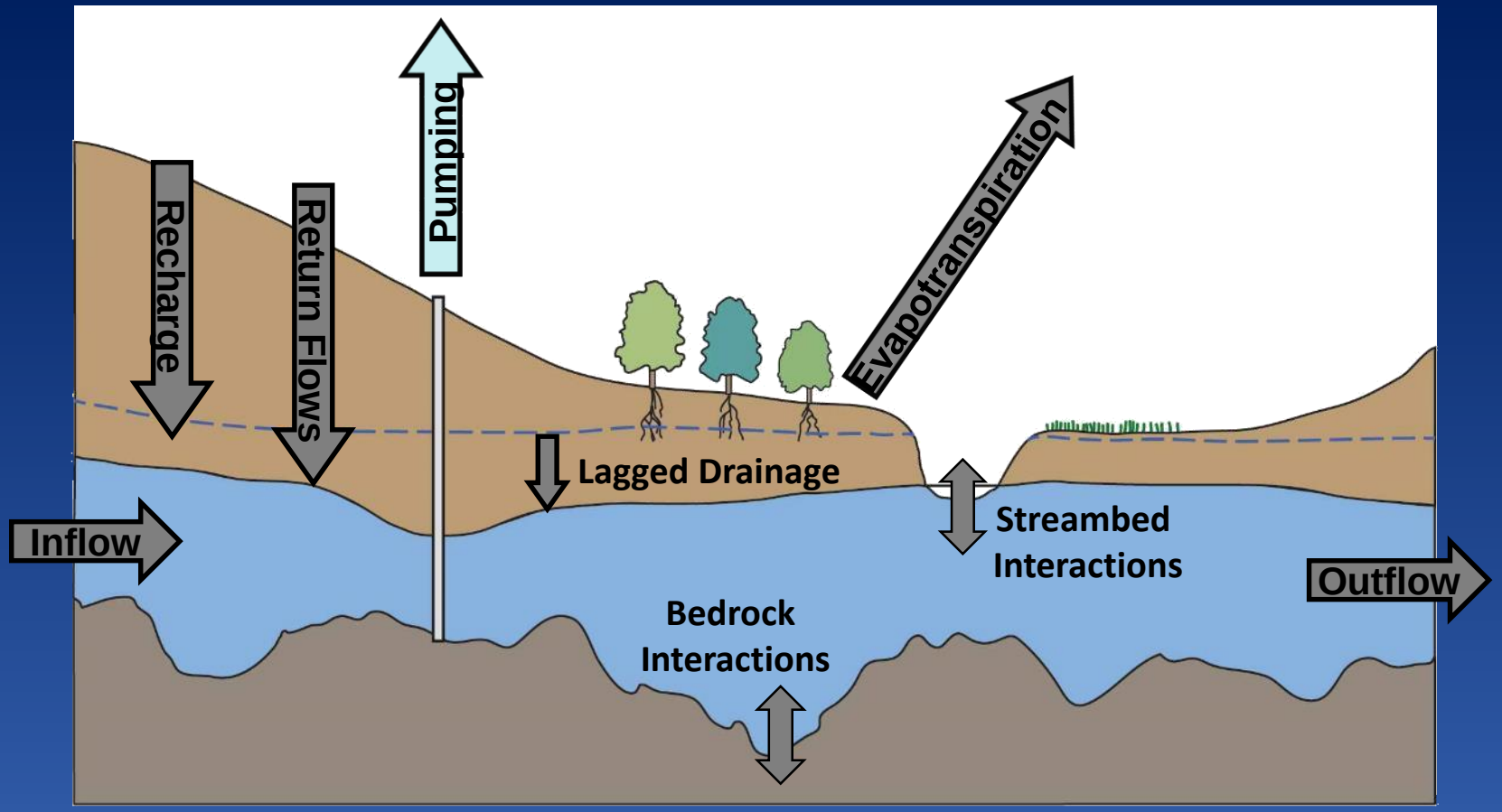
Simple Water Balance- Isolating Water Use and Water-level Change

End-of-season recovery is similar regardless of past pumping or climatic conditions

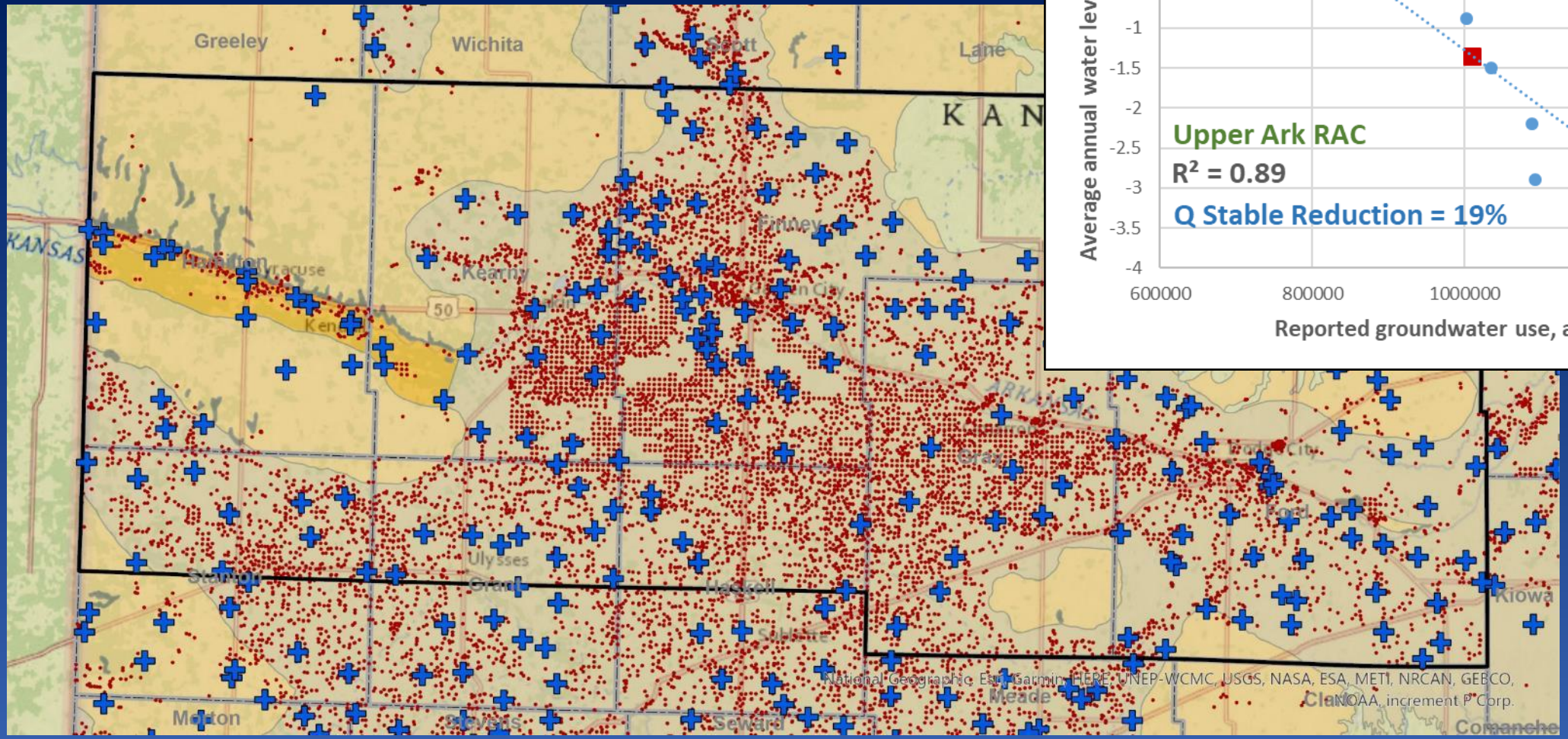


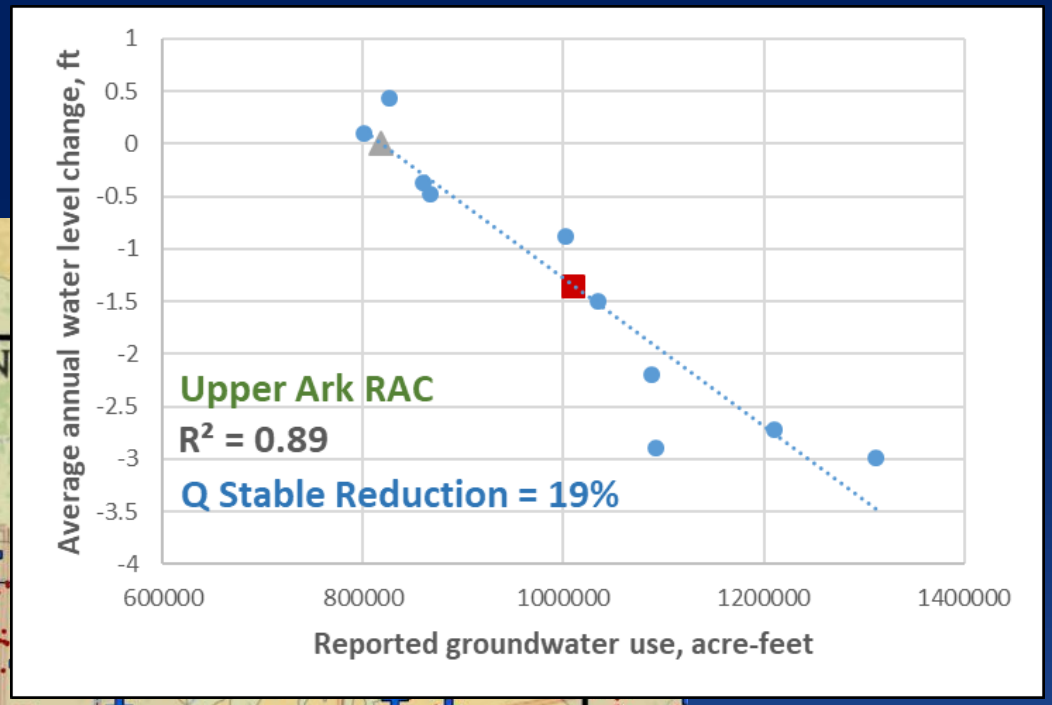


Water Volume Change in Aquifer = Net Inflow - Pumping



Reductions in Average 2009 to 2018 Reported Water Use Needed to Stabilize Water Levels





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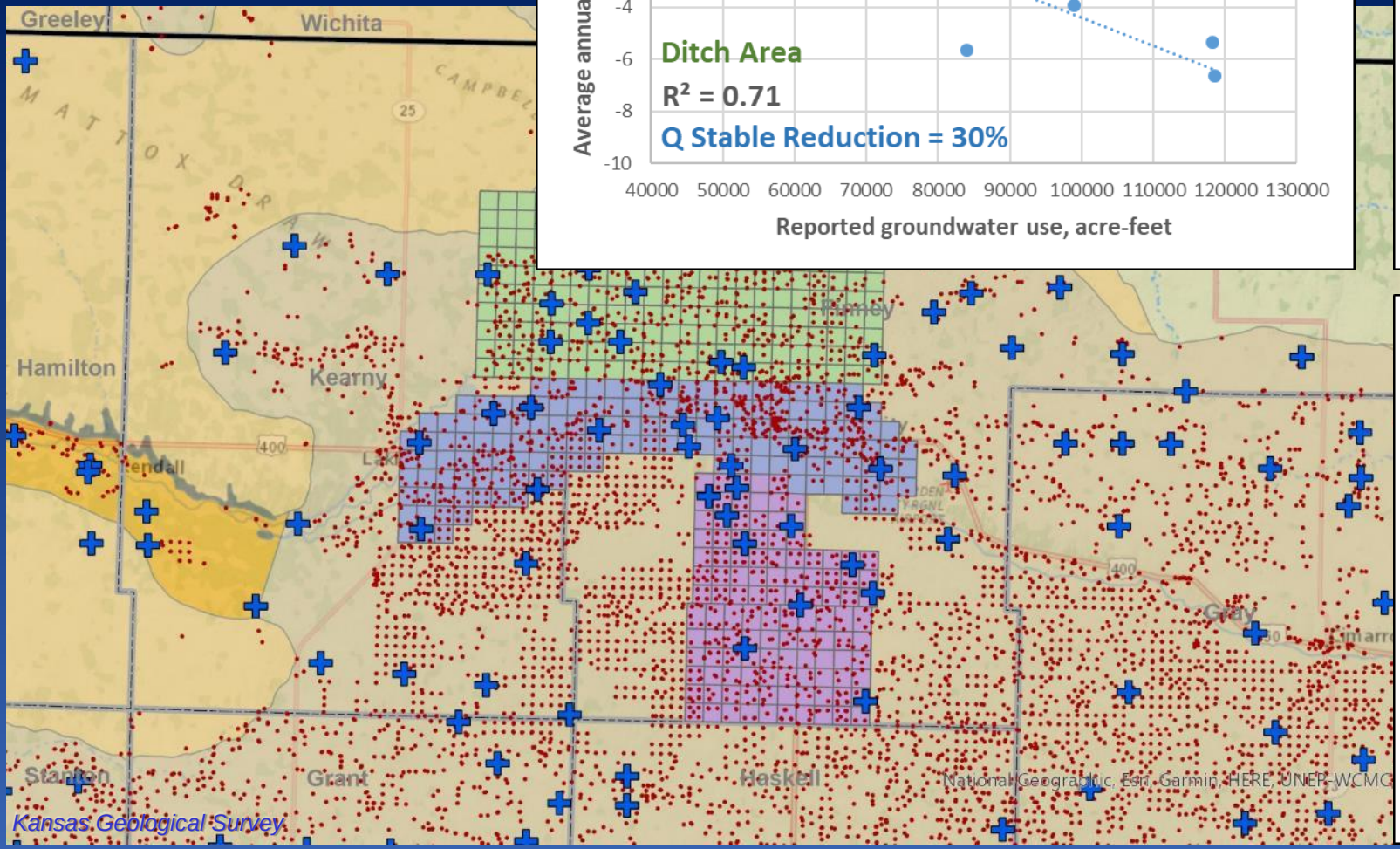
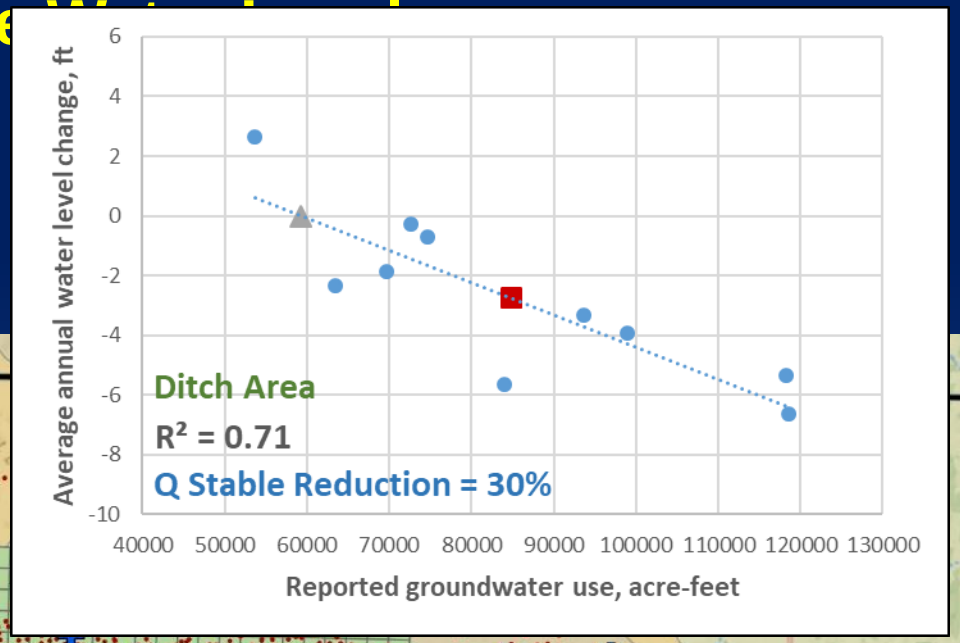
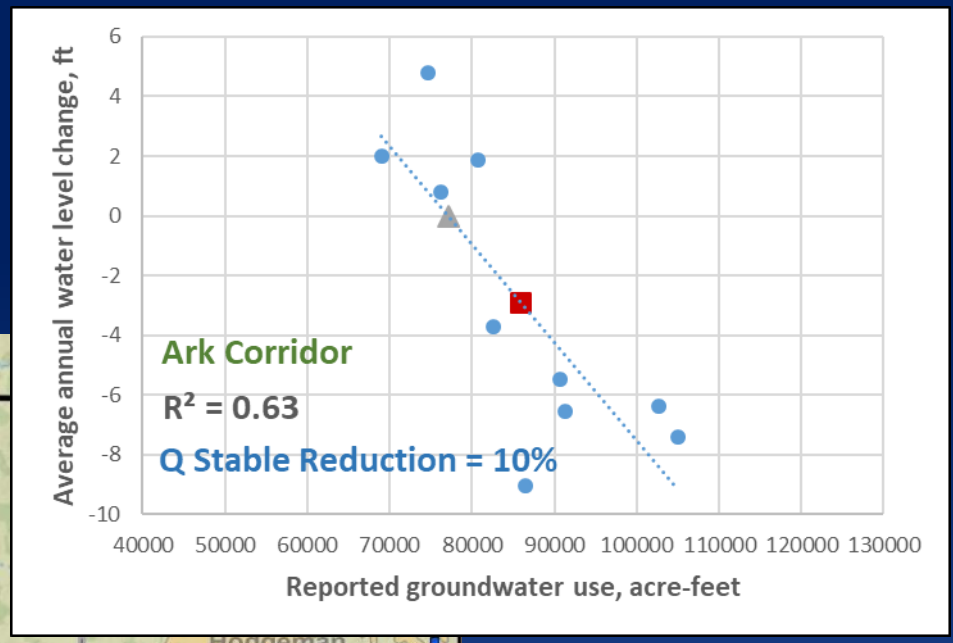
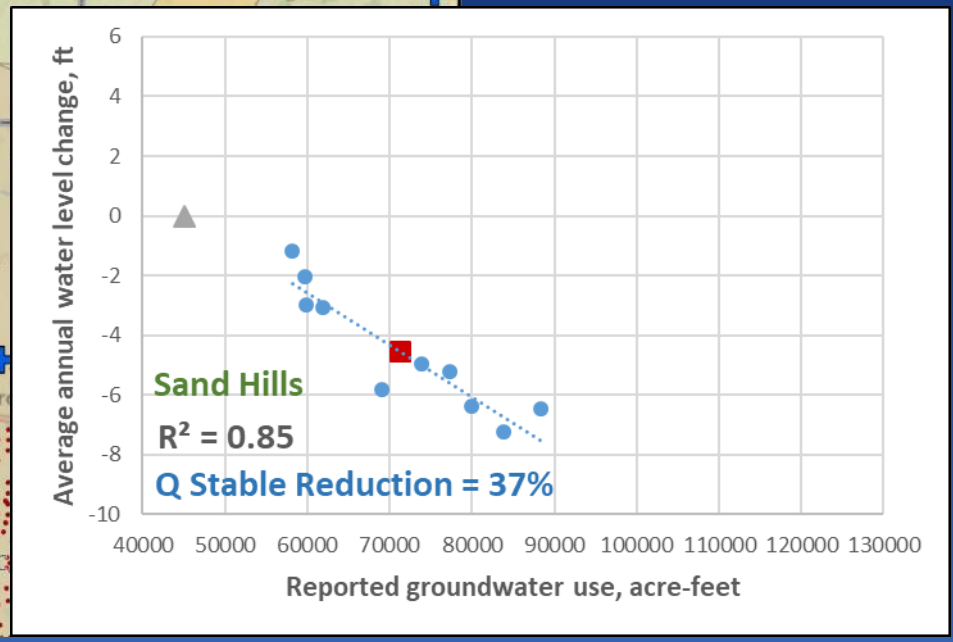
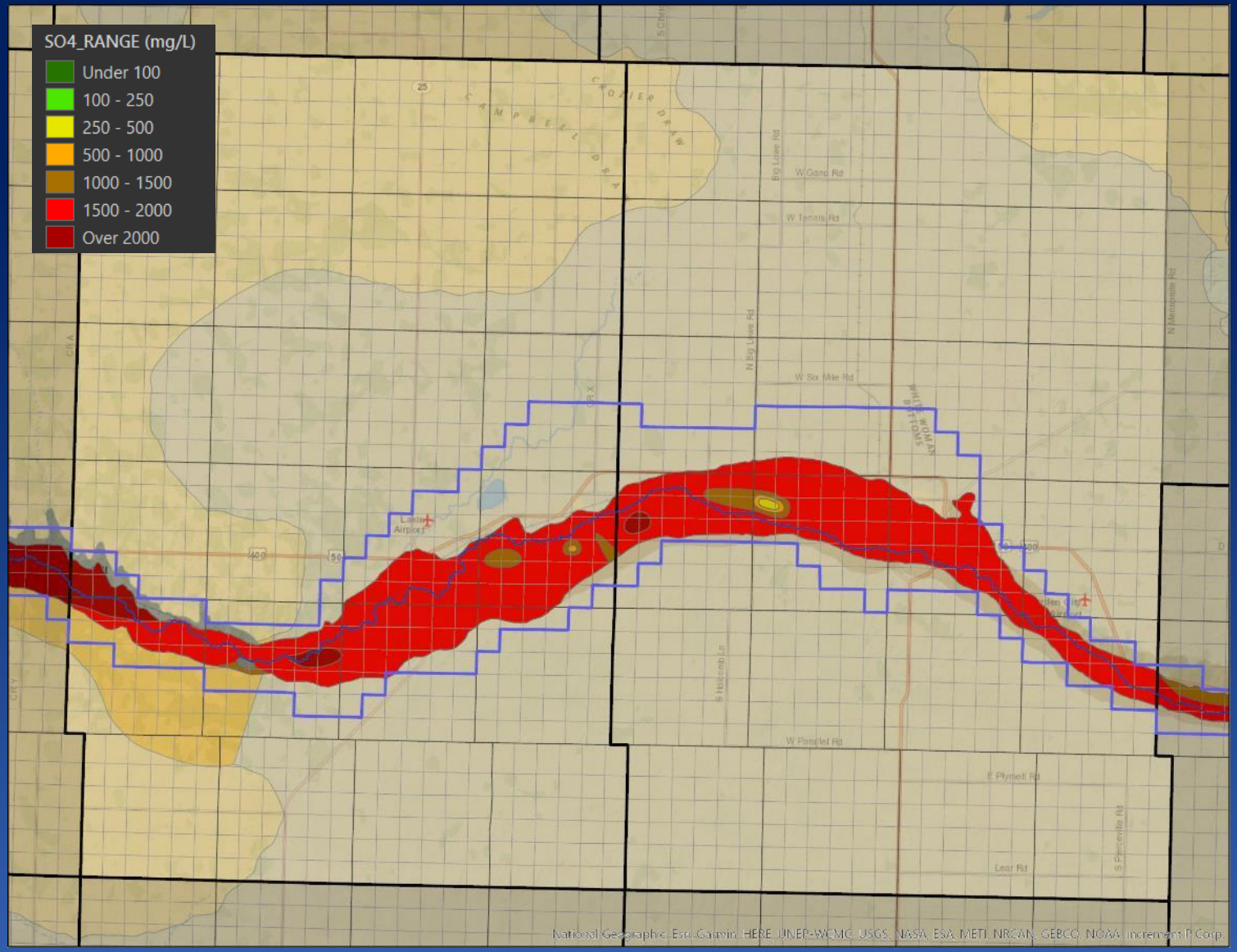






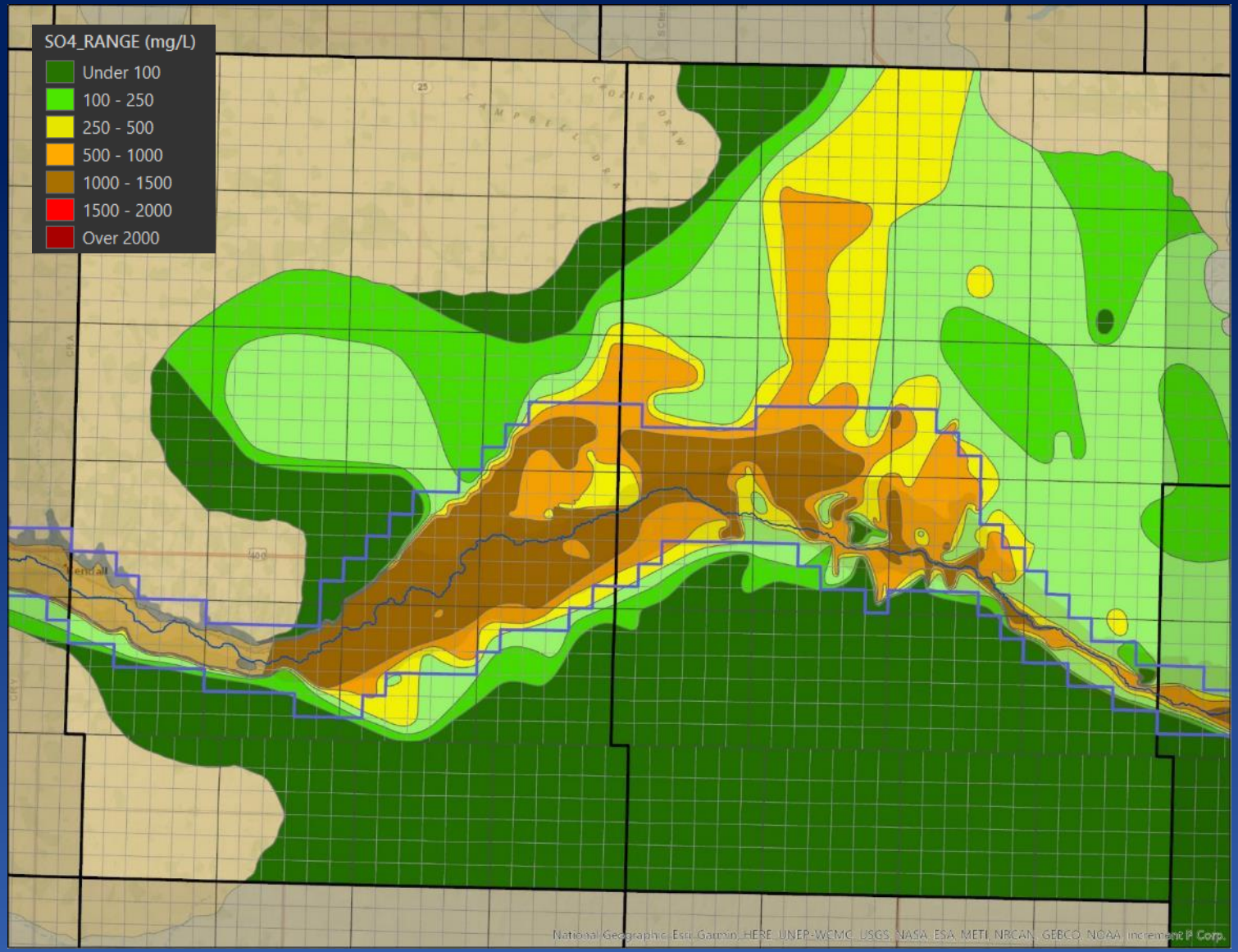


Sulfate Concentrations, Ark River Alluvium, Circa 1999-2000



- KGS Open-file Report 2000-73.
- Recommended drinking water level for sulfate is 250 mg/L
- Uranium concentrations can exceed 30 µg/L (maximum contaminant limit for public drinking water) when sulfate exceeds about 500-1000 mg/L
- Today, sulfate and uranium concentrations are likely elevated north of the river and have migrated southeast of the river
- Purple line represents current areas with high probability for uranium exceeding drinking water standard
- Map is currently being updated- Minieralization Project

Sulfate Concentrations, High Plains aquifer, Circa 1999-2000



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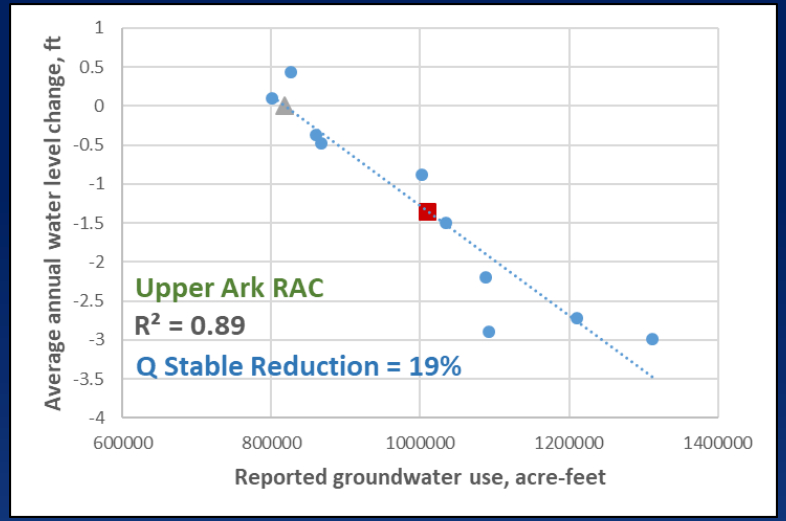
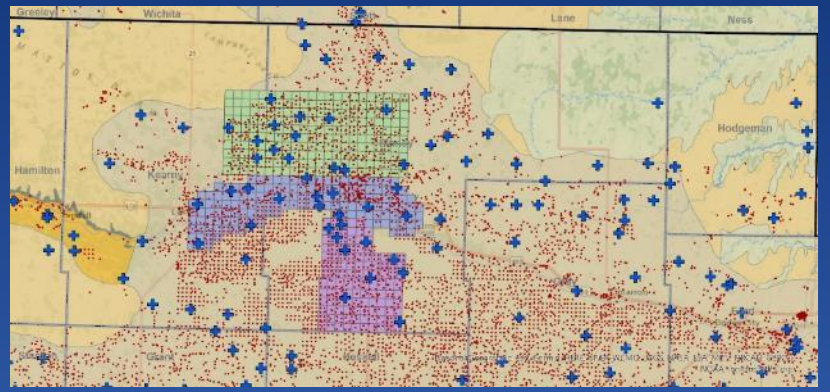
Conclusions and Observations

- Water-level change versus water usage relationships
  - Modest reductions in pumping, 10 to 15%, will reduce decline rates.
  - Benefits to water conservation efforts stay local.
  - Conditions will likely hold for the next decade or two but will need to be revisited, especially with prolonged wet or dry conditions.
  - Even with reductions on the short-term, long-term sustainability will be challenging, especially further away from the influence of surface water.
- Salinity and uranium are accumulating within the aquifer with concentrations in many areas exceeding recommended or primary drinking water standards.





Questions????

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