Aquifer Water Quality Assessment for Kansas Annual Report: 2025

by

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Acknowledgments

We are grateful for the support of the Kansas Department of Health and Environment (KDHE) and for their delegation of the project to the Kansas Geological Survey (KGS). KDHE provided funding and historical data to aid the KGS in the successful revival of the statewide groundwater quality project. We also thank the various organizations that helped spread the word about the project across the state, including all five groundwater management districts, the Kansas Rural Water Association, the Kansas Farm Bureau, and other local groups. We also thank the cities and individual well owners that agreed to participate in the project.

Introduction

In 2025, the Kansas Geological Survey (KGS) led the second year of the Aquifer Water Quality Assessment (AWQUA) for Kansas project. AWQUA made advancements in private well owner participation, website development, additional analysis capabilities for private wells, outreach, and laboratory efficiency. The website development is an important step as it represents the primary way for Kansans to interact with AWQUA, particularly with the groundwater quality results. The updated AWQUA webpage can be found here: https://kgs.ku.edu/awqua-kan-aquifer-water-quality-assessment-kansas.

Major sampling developments during 2025 included expanding analysis on many domestic wells to include pesticides, herbicides, and per- and polyfluoroalkyl substances (PFAS), and adding the survey well sampling option and the flexible regional study. Through the survey well sampling option, wells are sampled only once rather than every other year as part of the core group of wells. The flexible regional study focuses on a specific groundwater quality parameter (or parameters) in samples from several wells in a localized area. The goal is to obtain higher-resolution data to determine if the groundwater quality issue is affecting a larger regional area or is more localized, perhaps related to the specific property, well depth, or well construction.

This report describes new AWQUA developments during 2025 and analytical results for either 2025 alone or 2024 and 2025 together. The 2024 AWQUA Annual Report outlines the history of the groundwater quality program in Kansas, from its origins with the United States Geological Survey in 1985 to the Kansas Department of Health and Environment's (KDHE) stewardship of the program from 1992 to 2001. That report also outlines the steps the KGS took in 2024 to restart the groundwater testing program and establish sampling techniques.

2025 Well Sampling

During 2025, 109 people signed up for well sampling through the AWQUA website, an improvement over the 59 sign-ups during 2024. Other additions included well owners who had participated in the former KDHE groundwater quality program, several Kansas Department of Transportation rest stop wells, irrigation wells owned by the University of Kansas Endowment Association, and people who responded to invitation letters sent to random well owners in locations that did not have adequate AWQUA sample representation. AWQUA also began monitoring 23 nested wells drilled to varying depths in central Kansas to help determine how depth affects water quality. Overall, 166 wells were sampled in 2025.

Every sample collected in 2025 for AWQUA was analyzed in the KGS laboratory for the analytes listed in Table 1.

pH	Silica	Barium
Nitrate	Potassium	Lithium
Ammonium	Bicarbonate	Beryllium
Phosphate	Strontium	Vanadium
Fluoride	Manganese	Chromium
Sulfate	Arsenic	Cobalt
Bromide	Selenium	Nickel
Chloride	Uranium	Zinc
Sodium	Lead	Silver
Calcium	Iron	Cadmium
Total Organic Carbon	Copper	Antimony
Total Dissolved Solids	Magnesium	Titanium
Electrical Conductivity	Boron	Thallium

Table 1

Table 2 shows the number of wells sampled each year by the Kansas groundwater quality project from inception to 2025. The KGS project samples 150 wells in the core group every other year.

Entity	Year	Number of Wells Sampled
USGS	1985	35
USGS	1986	238
USGS	1987	241
USGS	1988	238
USGS	1989	227
USGS	1990	187
USGS	1991	199
KDHE	1992	124
KDHE	1993	124
KDHE	1994	128
KDHE	1995	136
KDHE	1996	137
KDHE	1997	134
KDHE	1998	0
KDHE	1999	83
KDHE	2000	101
KDHE	2001	103
KGS	2024	151
KGS	2025	166

Table 2

A concerted effort was made to include more domestic wells in the program in 2025. Public water supply wells are tested regularly by the municipalities to ensure distributed water meets federal and state drinking water quality requirements. However, domestic wells are sampled much less frequently, if at all, leaving many residents unaware of their drinking water quality. Table 3 shows the number of each well type that AWQUA sampled and tested in 2024 and 2025.

	PWS	Domestic	Irrigation	Lawn & Garden	Stock	Monitoring	Total
2024	112	38	0	1	0	0	151
2025	13	104	16	4	6	23	166

Table 3. Number of each type of well tested.
PWS: public water supply

Figure 1 shows well sampling locations for 2024 and 2025. The difference in locations between the years reflects the effort made in 2025 to collect more samples within the Ogallala aquifer in the western third of the state and the southeast quarter of the state where few samples were collected during 2024.

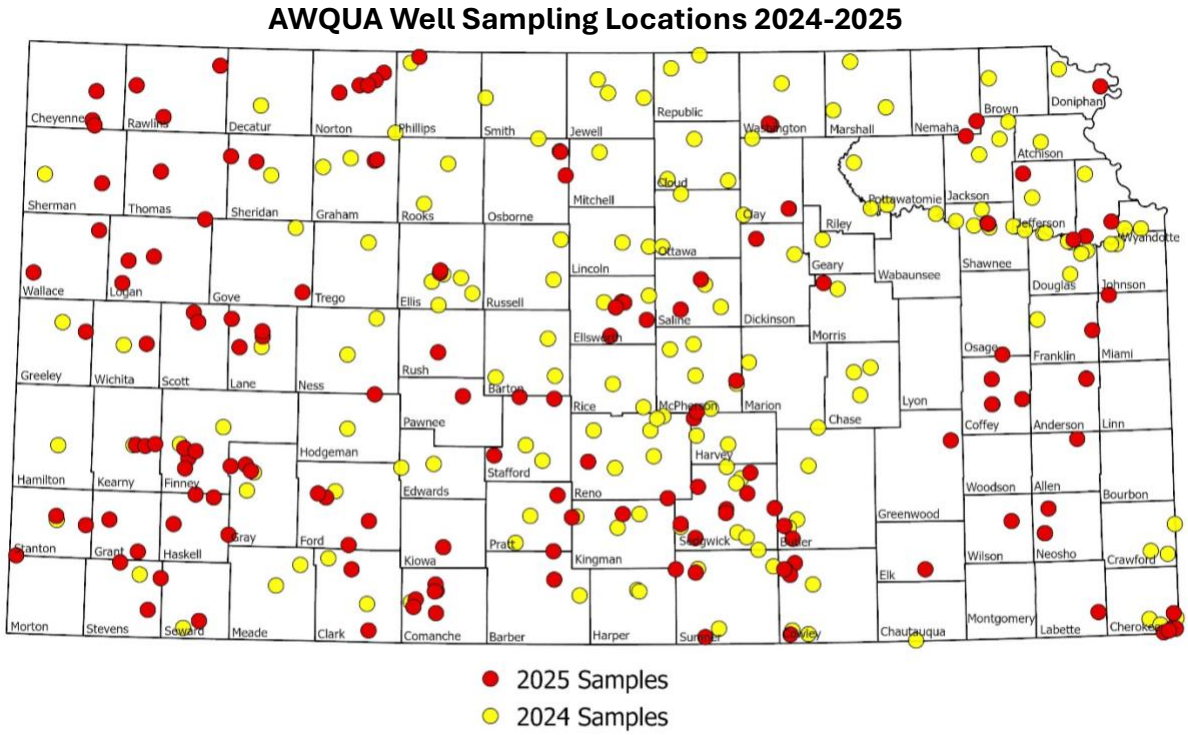

Figure 1

2025 Well Sampling Results

In 2025, AWQUA established contracts with two outside laboratories to analyze samples for PFAS, pesticides, and herbicides. PFAS are commonly referred to as “forever chemicals” because they are not easily broken down in the environment and persist for a very long time. They have been used in many common industrial and household items such as firefighting foam, cosmetics, food wrappers, non-stick pans, water- and stain-resistant fabrics, and cleaning products. Exposure to PFAS can lead to many different health effects. The labs analyzed 85 domestic well samples for PFAS compounds and 88 domestic well samples for pesticides and herbicides. No pesticides or herbicides were detected in any of the 88 samples, while PFAS compounds were detected in 13 of the 85 samples. Figures 2 and 3 show the locations of wells sampled for pesticides, herbicides, and PFAS, with detections indicated. A notable exception to herbicide analysis conducted in 2025 was glyphosate because it is not on standard herbicide analysis lists for laboratories. Some laboratories offer it as a standalone test. In 2026, the glyphosate test rather than the full herbicide list may be administered on sampled wells. Cost is a limiting factor for analyzing every well for every analyte.

Domestic Well Samples Tested for Pesticides and Herbicides

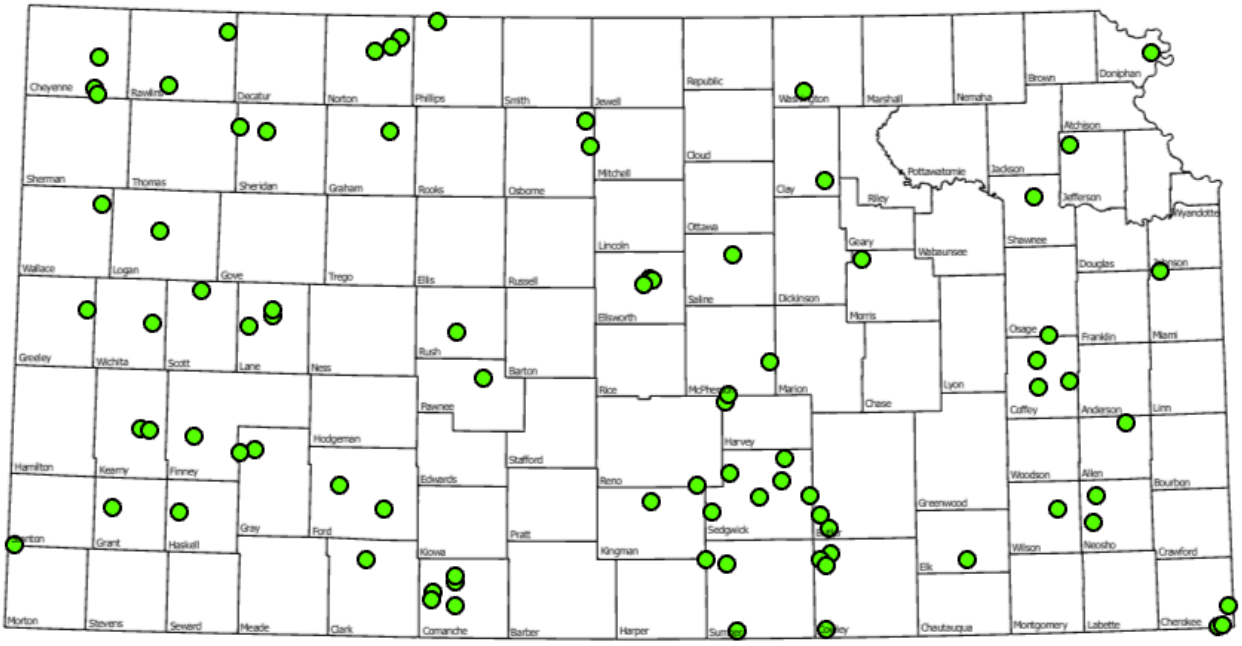

Figure 2. Detections of pesticides and herbicides in 88 wells sampled during 2025. Green indicates no detection.

Domestic Well Samples Tested for PFAS

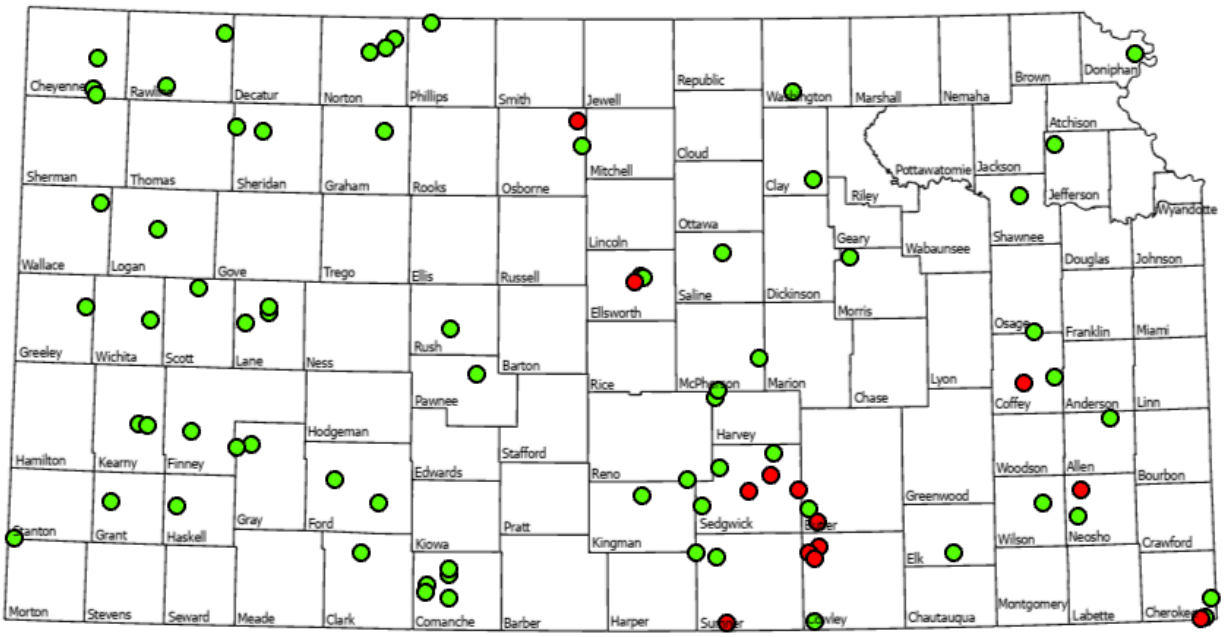

Figure 3. Detections of PFAS in 85 wells sampled during 2025. Red indicates detection while green indicates no detection.

Table 4 lists the PFAS compounds detected and their frequency in the 13 samples. Some samples may have had more than one PFAS compound detected. There were no detections above the U.S. Environmental Protection Agency's maximum contaminant level (MCL).

	# of Detections
PFBA	7
PFBS	5
PFOS	4
PFHxS	4
PFPeA	3
PFOA	2
PFHxA	1
PFHpA	1

Table 4

Table 5 lists the number of detections of select analytes with established MCLs and secondary maximum contaminant levels (SMCLs) in the 143 production wells sampled in 2025. Table 5 does not include results for the 23 monitoring wells.

	Number of samples that exceed the EPA MCL	Number of samples that exceed the EPA SMCL	Percentage of samples exceeding MCL or SMCL	EPA MCL or SMCL
Nitrate	12		**8.39%**	10 mg/L
Chloride		10	**6.99%**	250 mg/L
Sulfate		30	**20.98%**	250 mg/L
Arsenic	7		**4.90%**	0.01 mg/L
Iron		11	**7.69%**	0.3 mg/L
Manganese		24	**16.78%**	0.05 mg/L
Uranium		6	**4.20%**	0.03 mg/L
Total Dissolved Solids		90	**62.94%**	500 mg/L
Fluoride	2	7	**4.90%**	4.0 mg/L (MCL) 2.0 mg/L (SMCL)

Table 5. Number of samples from 143 production wells exceeding MCLs or SMCLs for select analytes.
Note: The 23 monitoring wells have been removed because of their selection due to targeting possibly elevated analytes related to location or depth. Therefore, they may not be indicative of aquifer conditions where a production well may be placed.
mg/L: milligrams per liter

2025 Flexible Regional Study

AWQUA chose to conduct the 2025 flexible regional study on areas with wells sampled in 2024 that exhibited nitrate contamination above the EPA's MCL of 10 milligrams per liter (mg/L). Of the 151 wells sampled in 2024, 12 indicated nitrate above 10 mg/L. The purpose of the regional study was to determine if the nitrate contamination extends over a larger area or if a more localized source affects the wells. Letters were sent to known or assumed well owners within one mile of the affected wells. The letter notified them that a nearby well exhibited elevated nitrate and that AWQUA would sample their well for free. It included a link to the AWQUA sign-up form on the KGS website. In total, 41 letters were sent to prospective well owners and 6 signed up to get their well tested. Four of the wells were sampled in 2025. The fifth well had no pump, which requires an alternative method of sampling that was not completed by the end of the year. The sixth well owner signed up too late for 2025 sampling, so that well will be sampled in 2026. Testing found nitrate above 10 mg/L in 2 of 4 sampled wells, likely indicating a regional issue with elevated nitrate in groundwater. Table 6 compares data from the well with elevated nitrate sampled in 2024 and the flexible regional study well(s) sampled in 2025.

		Nitrate (mg/L)
Original Well City	Downs	14.95
Flexible Study Wells	#1	12.72
	#2	NS

		Nitrate (mg/L)
Original Well City	Wakefield	60.28
Flexible Study Well	#1	17.25

		Nitrate (mg/L)
Original Well City	Topeka	10.60
Flexible Study Wells	#1	3.90
	#2	4.22

Table 6
mg/L: milligrams per liter
NS: Not sampled in 2025

Maps of Results for Select Analytes

Figures 4–13 show results for analytes that exhibited certain patterns or localized differences in wells sampled in 2024 or 2025.

Nitrate

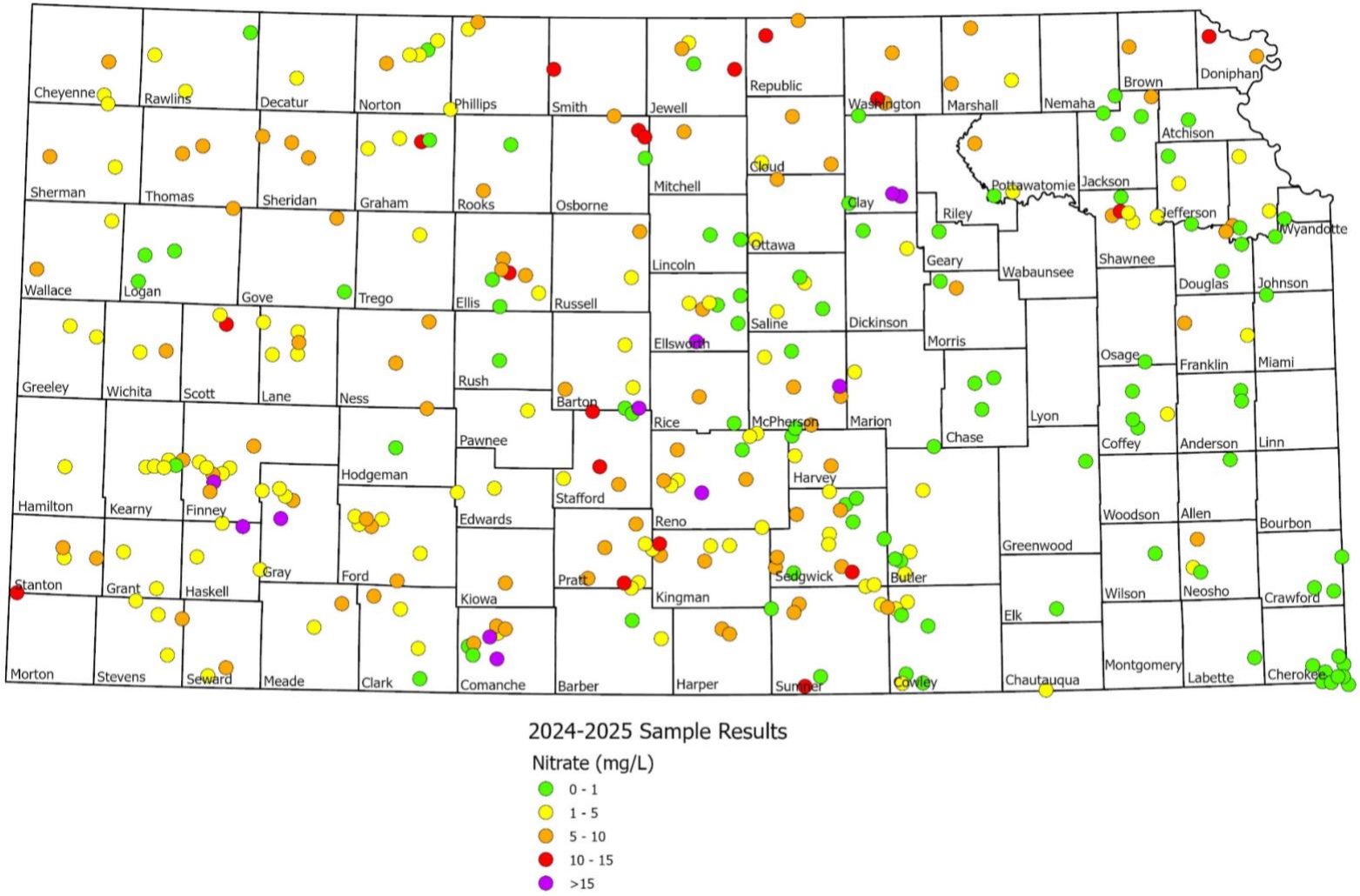

Figure 4. Red and purple dots indicate detections above the EPA MCL of 10 mg/L. Elevated nitrate results are widespread across Kansas. Lower results are generally seen in the eastern and southeastern portion of the state where crop-based agriculture is less common, and higher results are generally seen in the central portion of the state where crop-based agriculture is prevalent and groundwater is relatively shallow.

Chloride

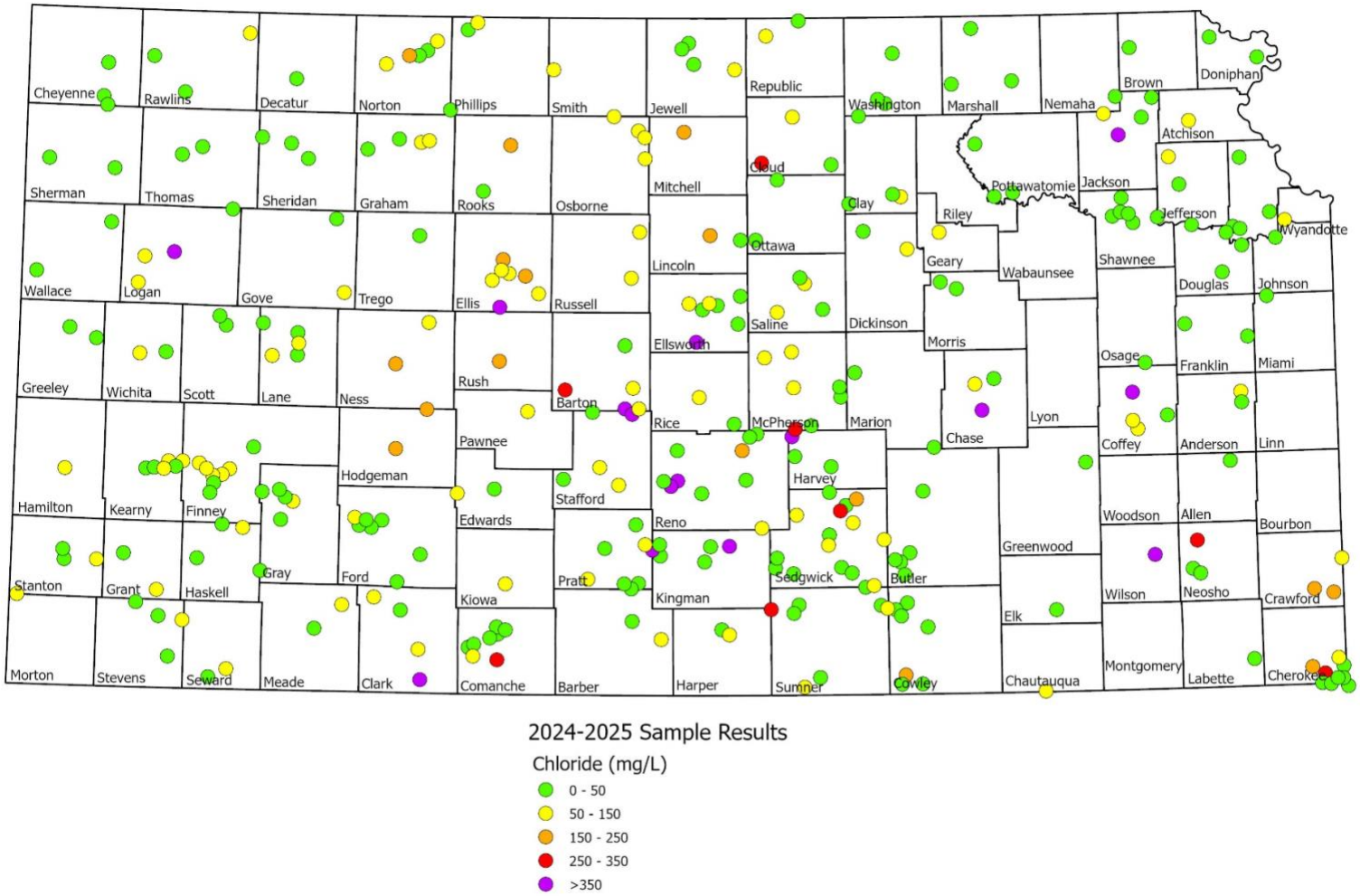

Figure 5. Red and purple dots indicate detections above the EPA SMCL of 250 mg/L. Elevated chlorides are found more often in the central area of the state, where several groundwater monitoring wells drilled into highly mineralized bedrock aquifers were sampled. Shallower wells in this area may be affected by chloride-rich bedrock aquifers mixing upward into the shallow unconsolidated aquifer. Elevated results are also seen in some wells in the southeastern portion of the state where wells are drilled into bedrock.

Alkalinity

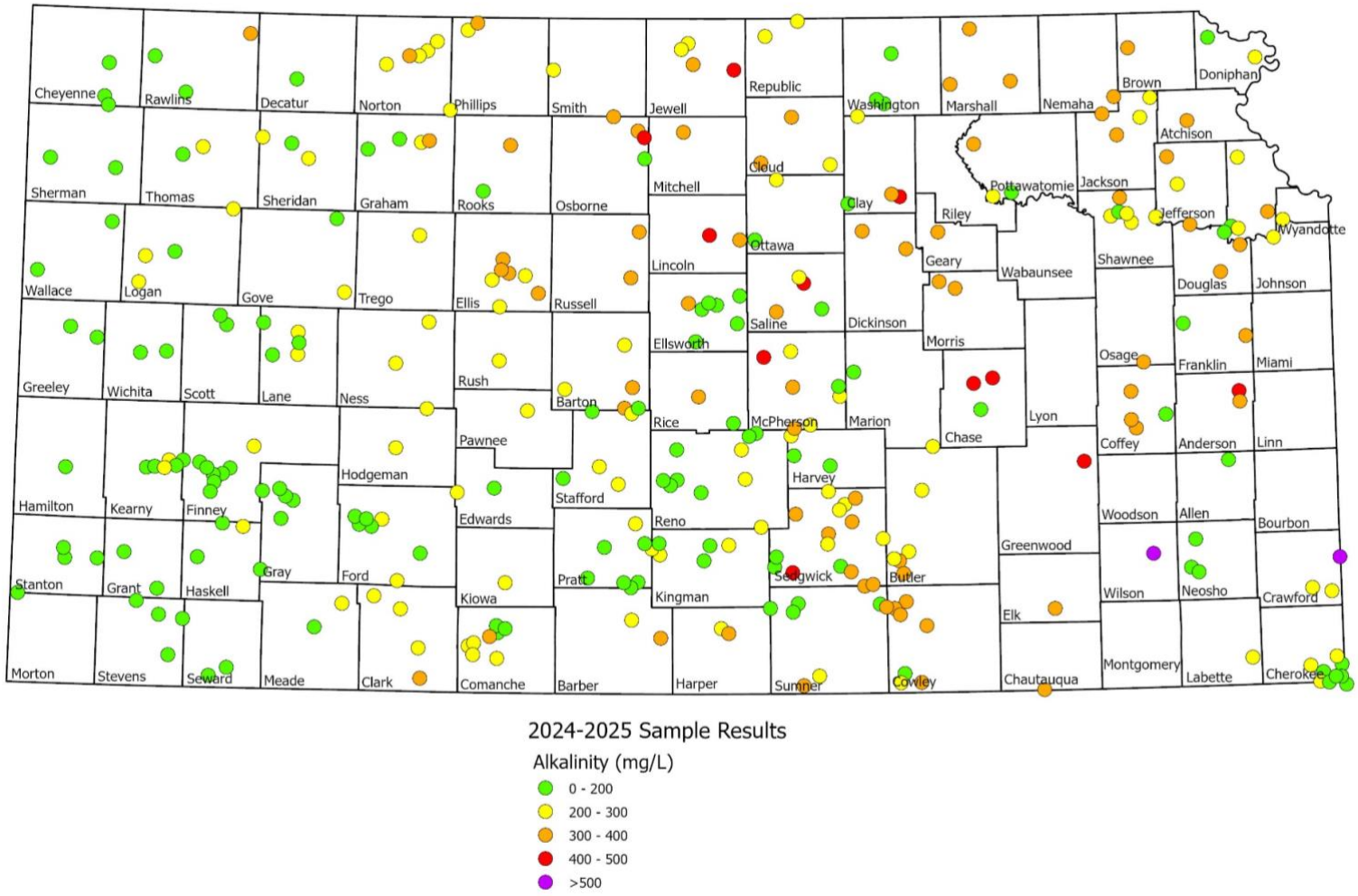

Figure 6. Alkalinity appears to be low in groundwater within the High Plains aquifer, which covers much of the western third and south-central areas of the state.

Fluoride

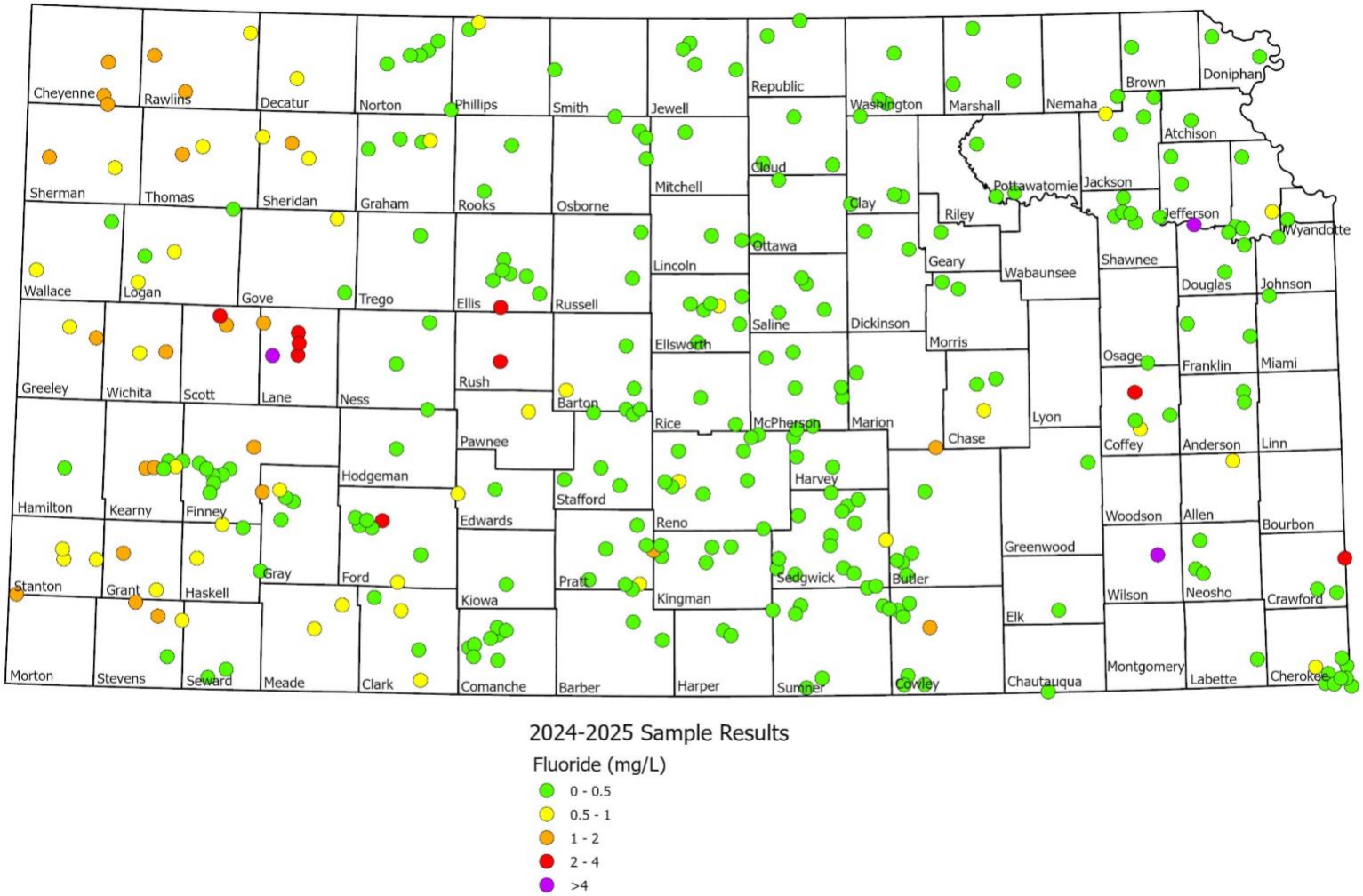

Figure 7. Red dots indicate detections above the EPA SMCL and purple dots indicate detections above EPA MCL. Fluoride is generally low across the state except in some areas of the High Plains aquifer in western Kansas.

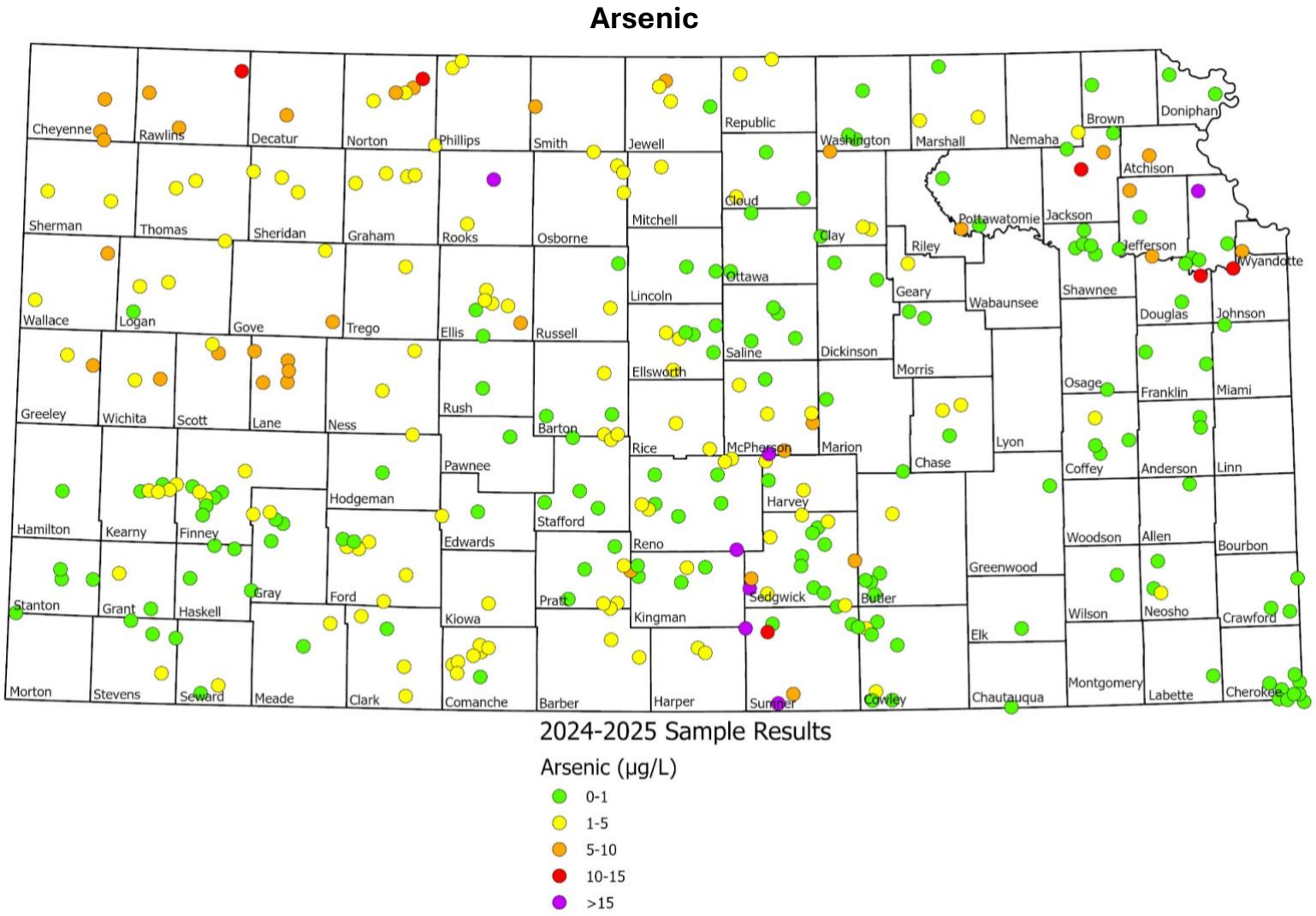

Figure 8. Red and purple dots indicate detections above the EPA MCL of 10 micrograms per liter (µg/L). Arsenic has several hot spots across the state due to localized sediments.

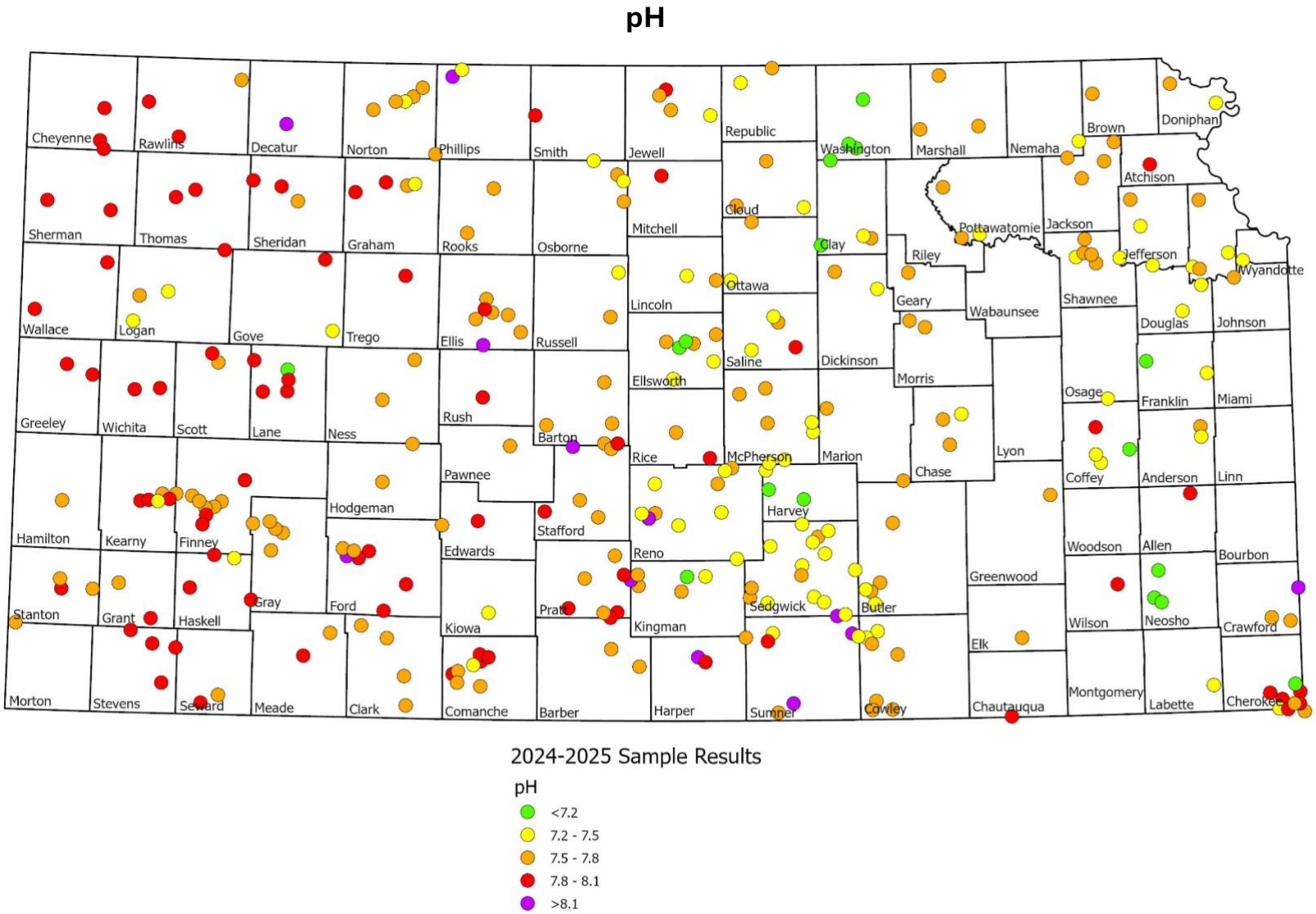

Figure 9. In addition to deep wells drilled in Cherokee County, pH is generally highest in the western half of the state.

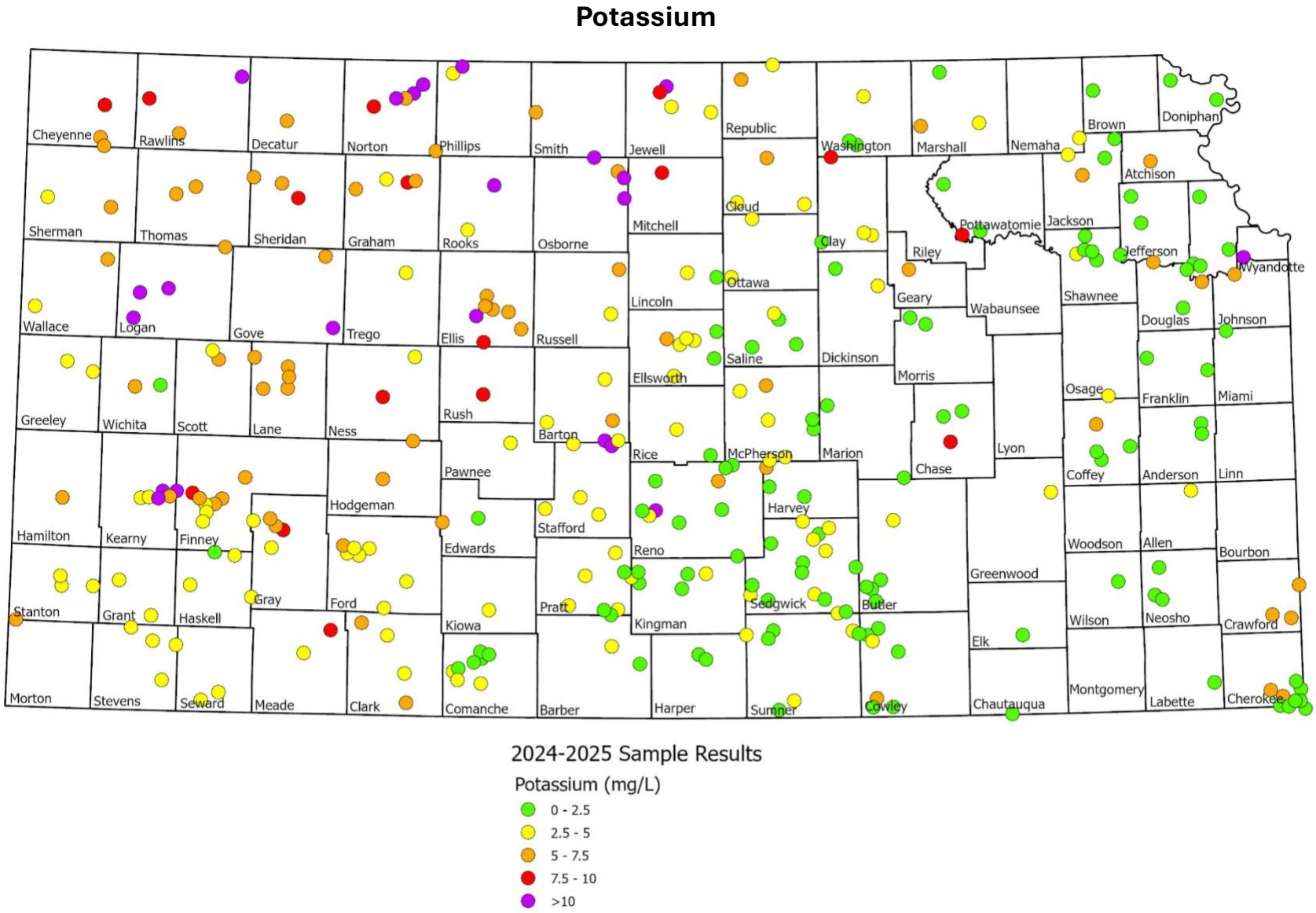

Figure 10. Potassium is high in some areas with bedrock mineralization influence.

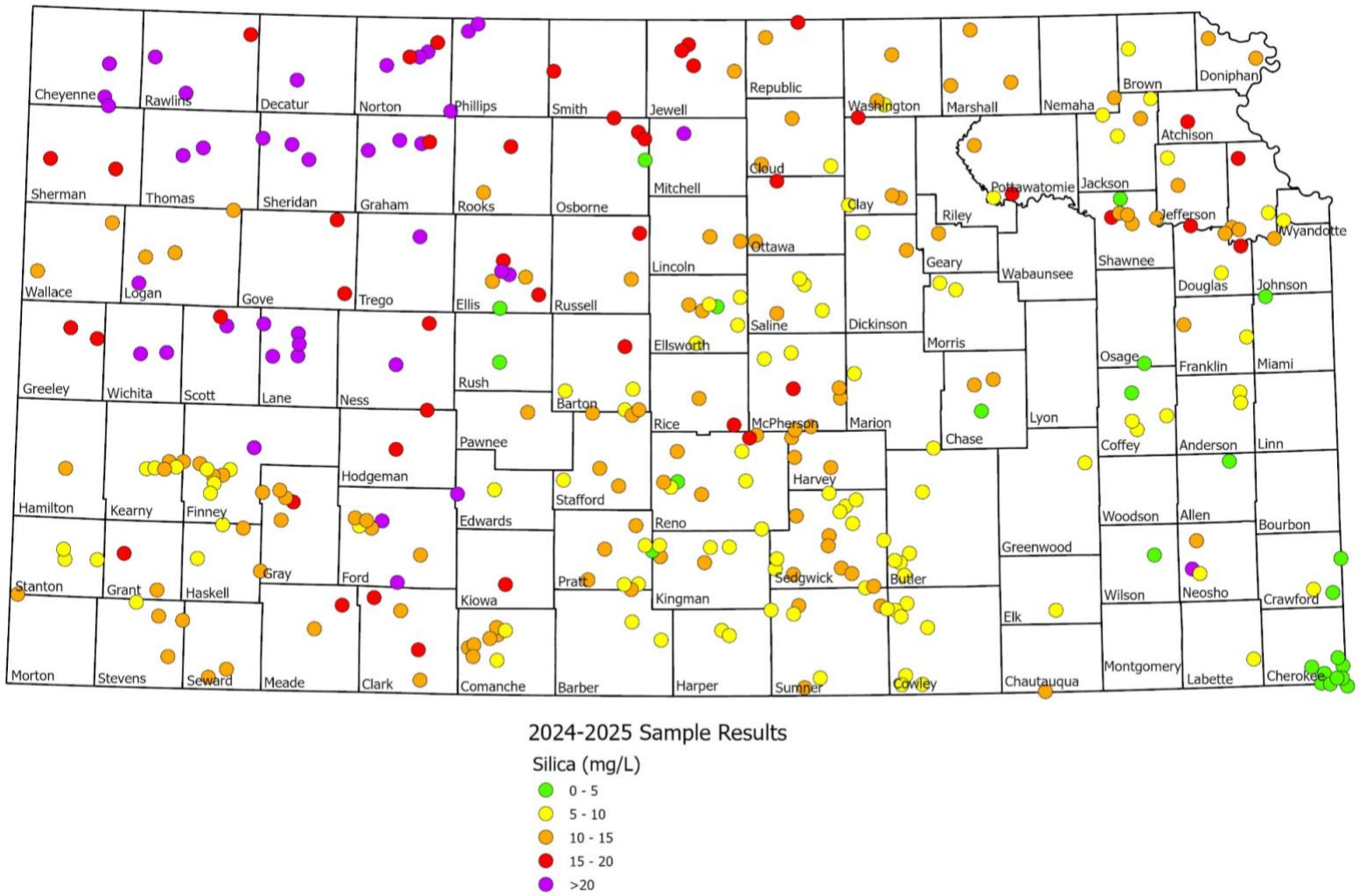

Figure 11. Silica is highest in the northwestern area of the state.

Sulfate

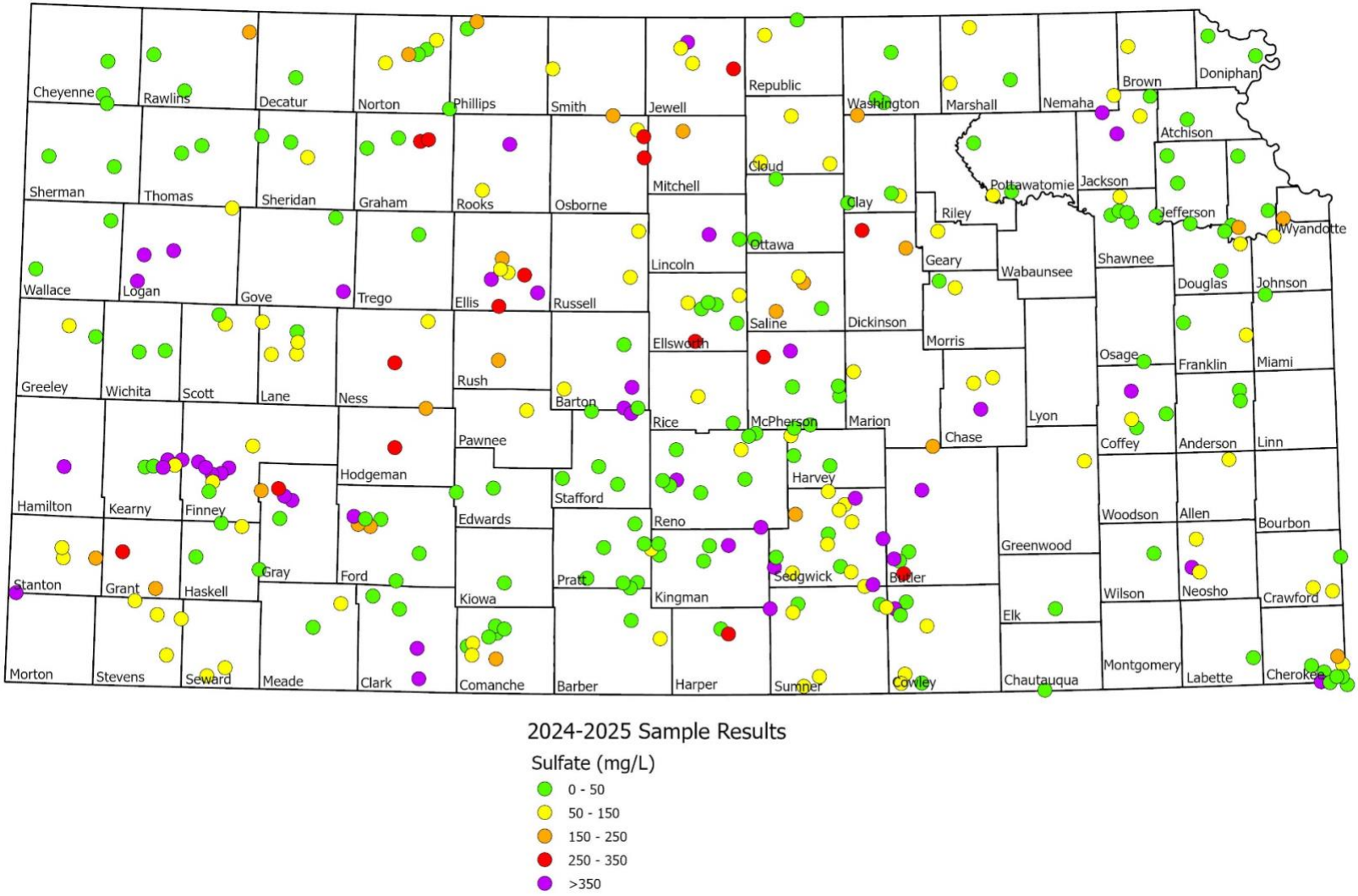

Figure 12. Red and purple dots indicate detections above the EPA SMCL of 250 mg/L. Sulfate is high in localized areas with bedrock mineralization influence or where surface water carries sulfate into the aquifer (Hamilton, Kearny, and Finney counties).

Uranium

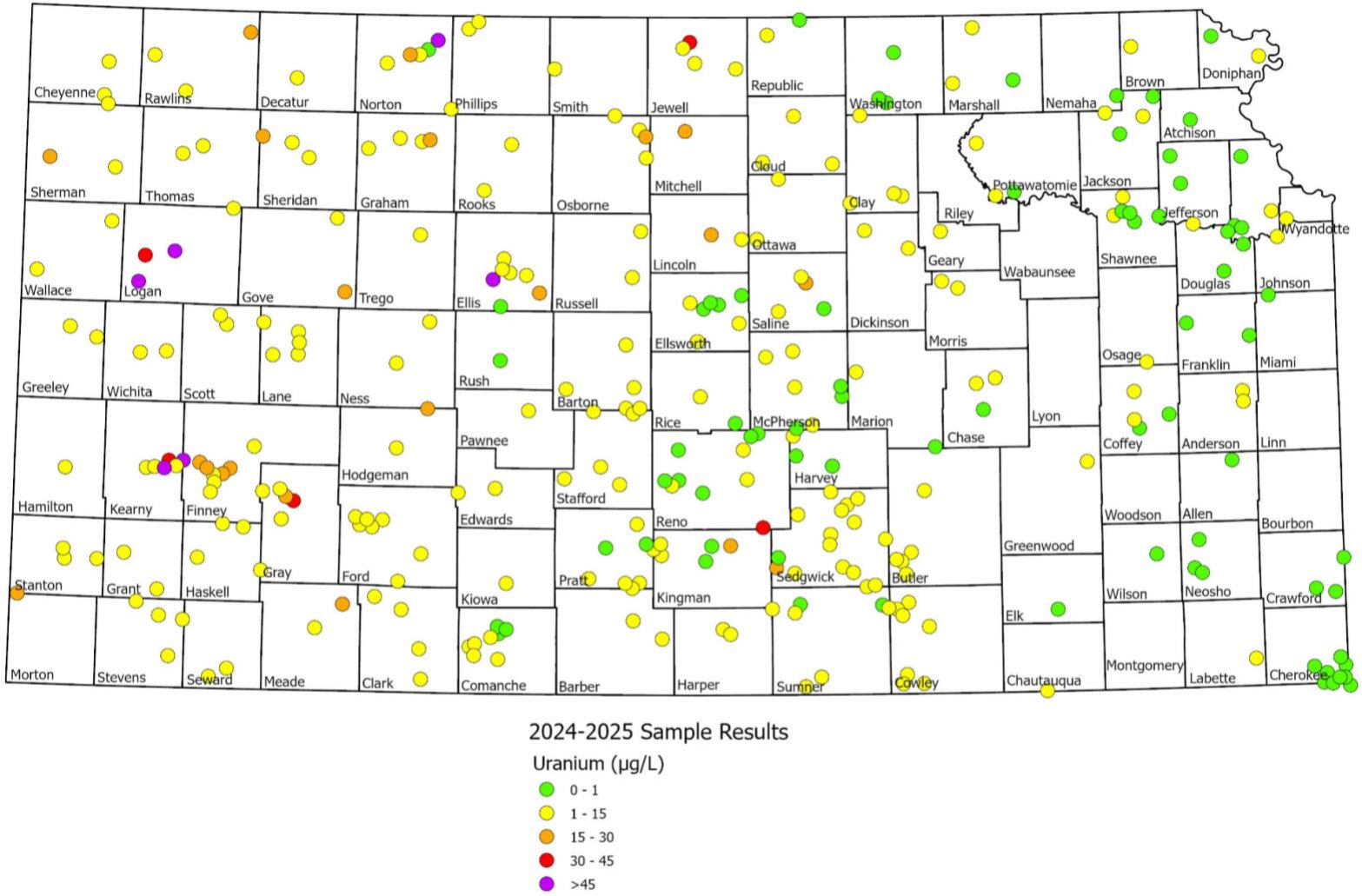

Figure 13. Red and purple dots indicate detections above the EPA MCL of 30 µg/L. Uranium is high in localized areas with either bedrock mineralization influence or surface water carrying uranium into the aquifer (Kearny and Finney counties).

Website Development and Online Mapper

Some results from AWQUA testing are regularly uploaded to an online Kansas Groundwater Quality Data Explorer developed in 2025 and found here: https://maps.kgs.ku.edu/wq_data_explorer/. Users can filter results for specific solutes, sample years, and other factors. This allows users to view groundwater quality results from the entire state as well as their local area, which can aid in determining the water quality of their well or what they may need to test for to protect the health of themselves, animals, or plants. The mapper and an online database, currently under development and set for public rollout in 2026, will continue to expand as more wells are tested through AWQUA and results from these samples as well as groundwater sample results from other institutions and studies are submitted to the KGS for inclusion.

Figure 14 shows a screenshot of the mapper displaying nitrate results from samples collected in 2025 at the township level. Figure 15 shows a screenshot displaying chloride concentrations from monitoring wells within Groundwater Management District 2 collected in 2023. These represent two ways data can be displayed on the mapper, with Figure 14 highlighting the broader regional differences and the point-level map (Figure 15) illuminating details of interest on localized levels. The blank areas on these maps will be filled in over time as more samples are collected and results can be added.

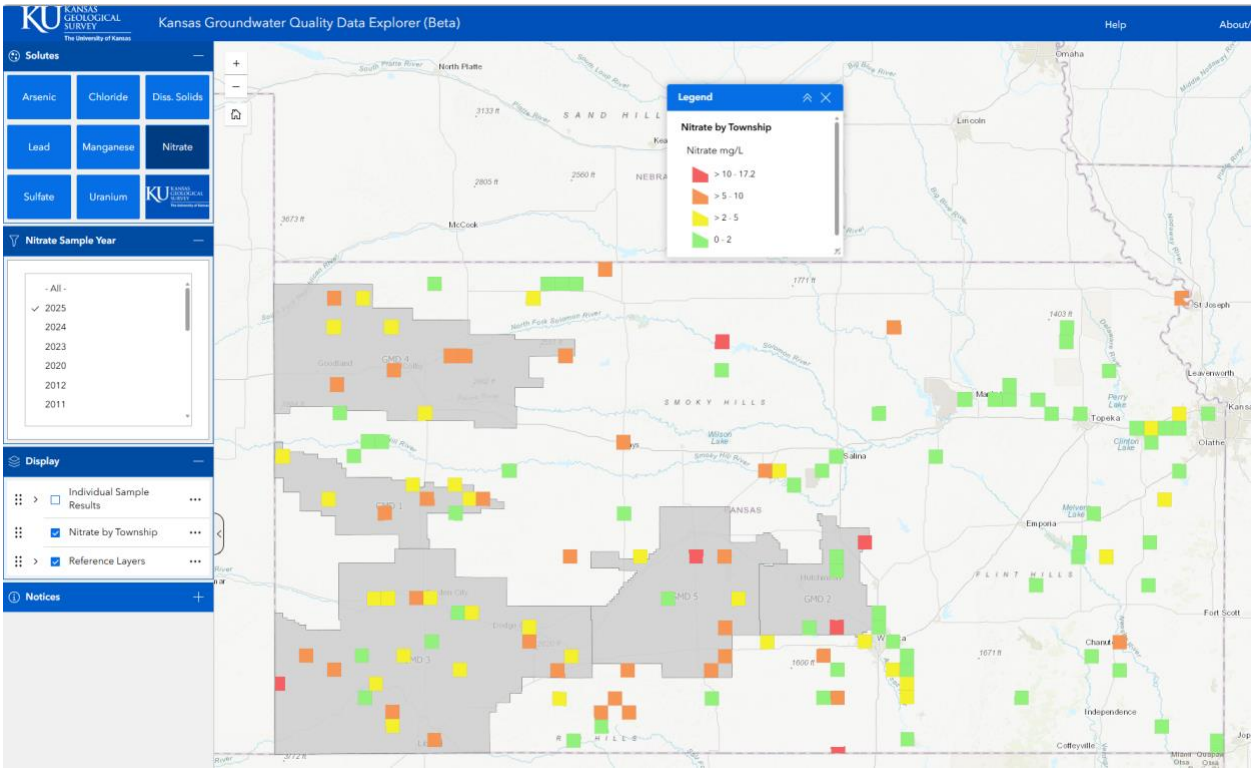

Figure 14

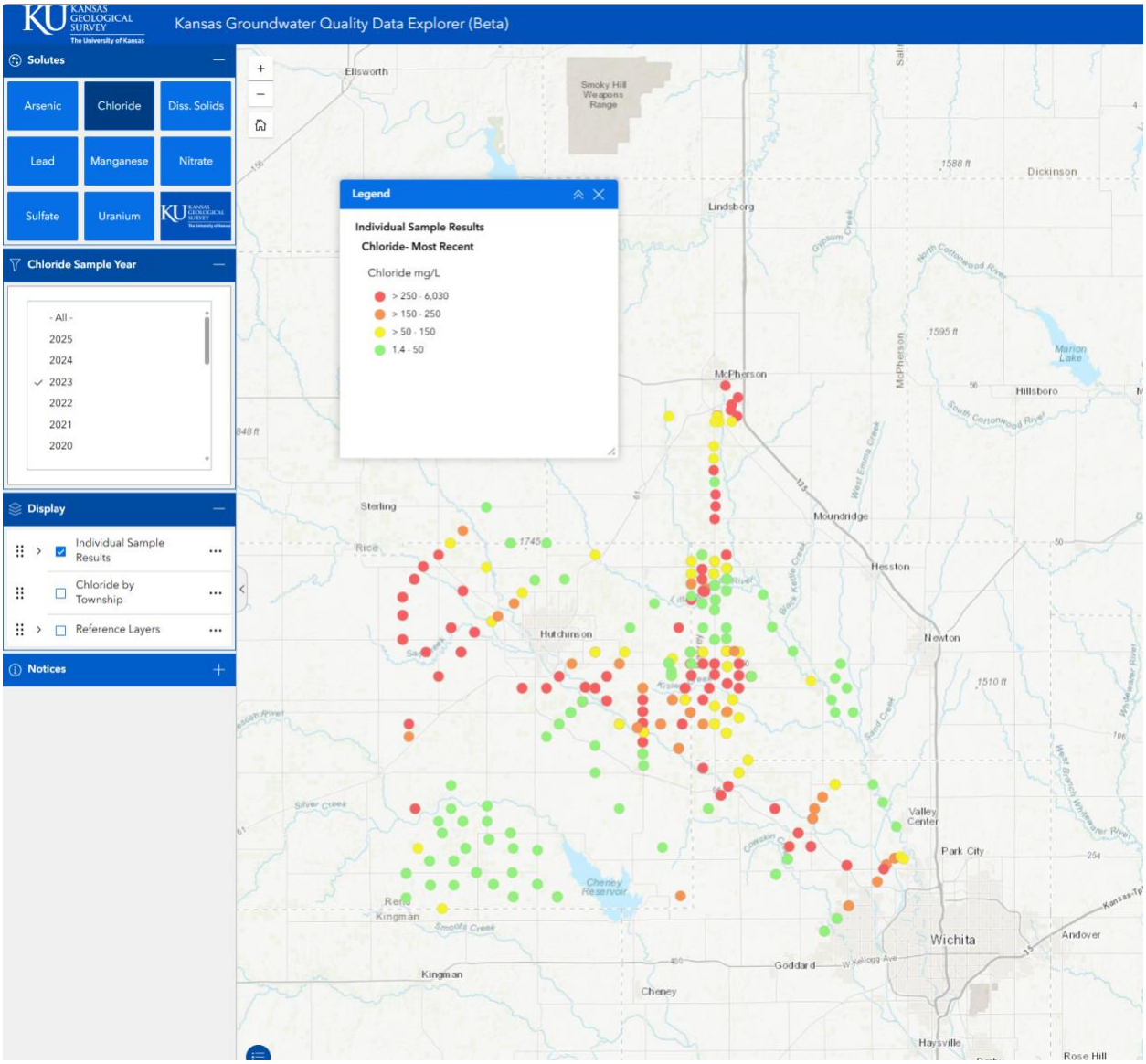

Figure 15

Outreach

Outreach for AWQUA expanded during 2025 to include more presentations and booth presence at conferences as well as initial teacher workshops. A poster for AWQUA and informational materials were available at the KGS booth during the Kansas Groundwater Association Conference (January 15–17, 2025), Kansas Rural Water Association Conference (March 25–27, 2025), Kansas Environmental Conference (August 13–14, 2025), KDHE Geology and Well Technology Seminar (October 21–22, 2025), and Governor's Water Conference (November 12–13, 2025). Additionally, a presentation on AWQUA was given during the Kansas Rural Water Association Conference and an AWQUA team member served on a discussion panel during the Kansas Field Conference (June 17–18, 2025).

The Kansans Live WELL teacher workshop also made its debut in 2025. This outreach event is designed to help teachers learn more about environmental and water quality issues and provide lessons they can take back to their students. Two workshops were held during 2025: June 2–4 in Great Bend and August 4–6 in Lawrence. These workshops included field trips to learn how to collect water samples and invertebrate samples, PowerPoint presentations on water quality and online informational resources, a KGS-originated board game involving water as a resource, and panel discussions with local water-issue experts.

Conclusion

The AWQUA project completed another successful year in 2025. Domestic well sampling increased and contracts with outside laboratories allowed for expansion of testing capabilities to include PFAS, pesticide, and herbicide compounds. The additional groundwater samples reduce spacing between sample locations, allowing for the beginning of observations of trends and regional- and aquifer-specific disparities in maps of the various groundwater quality parameters. These characteristics can generate ideas for future AWQUA flexible regional studies as well as possible research topics by other groundwater quality researchers at the KGS and universities.

Future goals include continued expansion of the number of wells sampled each year, the addition or replacement of other chemicals to the current PFAS, pesticide, and herbicide analyses for domestic wells, a large increase in the number of well results in the database and mapper, and the introduction of the database search function on the AWQUA webpage. AWQUA has a large backlog of datasets containing groundwater quality results that will be reviewed, configured, and added to the database in 2026.