

# ***Kane County Shallow Groundwater Quality 2023: A Twenty-Year Retrospective***

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**ILLINOIS**

Illinois State Water Survey

PRAIRIE RESEARCH INSTITUTE

# ISWS - Kane County Contract has three components

Assessment of Shallow Groundwater Sustainability in Kane County, IL – 2023 – Dec. 2025  
Community discussions and modeling to define sustainability methodology for the shallow aquifer and constrain metrics for long term sustainability of this system

Establishment of a Real-Time Monitoring Network in Kane County, IL – 2023 - 2026  
Using telemetry stations to monitor water levels throughout the county

Assessment of Shallow Groundwater Water Quality in Kane County, IL – Fall 2023  
Repeat study of water quality in Kane County's shallow aquifer and homeowner's wells.  
How has water quality changed since 2003? Since 2015?

# Previous Work

**ILLINOIS**  
DEPARTMENT OF  
NATURAL  
RESOURCES

**Shallow Groundwater Quality  
Sampling in Kane County**  
October 2003

**Illinois State  
WATER  
Survey (1895)**

Illinois Department of Natural Resources April 2005

In October 2003, Illinois State Water Survey (ISWS) scientists collected water samples from 70 shallow domestic and industrial wells in Kane County for analysis of groundwater quality. The primary objectives were to provide a “snapshot” of water quality in these shallow aquifers and compare water quality from different parts of Kane County, especially the eastern urban corridor and the western rural region.

Wells chosen for sampling were less than 250 feet deep and were approximately equally divided between eastern and western halves of Kane County. About two-thirds of the wells were in shallow bedrock, usually dolomite, and the remainder were in shallower unconsolidated sand-and-gravel deposits found in glacial till overlying bedrock.

Samples were collected for analyses of inorganic chemistry, total organic carbon, and coliform bacteria. Some wells were also sampled for atrazine and hydrogen sulfide. The ISWS Public Service Laboratory (PSL) in Champaign conducted all the analyses.

**Results and Discussion**

**Dissolved Solids and Major Ions**

Total dissolved solids (TDS) are a measure of the dissolved minerals in water and also a measure of drinking water quality. There is a secondary drinking water standard of 500 milligrams per liter (mg/L) TDS; water exceeding this level tastes salty. Groundwater with TDS levels greater than 1500 mg/L is considered too saline to be a good source of drinking water. A map of the TDS concentrations in Kane County (Figure 1) indicates a difference in the shallow groundwater quality between the urban corridor and the rest of the county: values were much higher in eastern wells than in western or central wells. Concentrations in 20 wells exceeded 500 mg/L (represented by red circles in Figure 1), including 60 percent of the wells in the eastern third of the county. Concentrations in two wells exceeded 1,000 mg/L.

The eastern urban corridor had significantly higher concentrations of all major ions [calcium ( $\text{Ca}^{2+}$ ), magnesium ( $\text{Mg}^{2+}$ ), sodium ( $\text{Na}^+$ ), chloride ( $\text{Cl}^-$ ), bicarbonate ( $\text{HCO}_3^-$ ), and sulfate ( $\text{SO}_4^{2-}$ )]. The most likely explanation for these high chloride and cation ( $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ , and  $\text{Na}^+$ ) concentrations is road-salt runoff.

A map of chloride concentrations with the locations of all roads in Kane County is shown

**Notes:** Lines are major roads; shaded areas are municipalities.

**Figure 1. Total dissolved solids concentrations in Kane County**

[https://www.isws.illinois.edu/pubdoc/IEM/ISWS\\_IEM2005-01.pdf](https://www.isws.illinois.edu/pubdoc/IEM/ISWS_IEM2005-01.pdf)

Contract Report 2016-04

**Shallow Groundwater Sampling  
in Kane County, 2015**

Walton R. Kelly, Daniel R. Hadley, Devin H. Mannix

March 2016

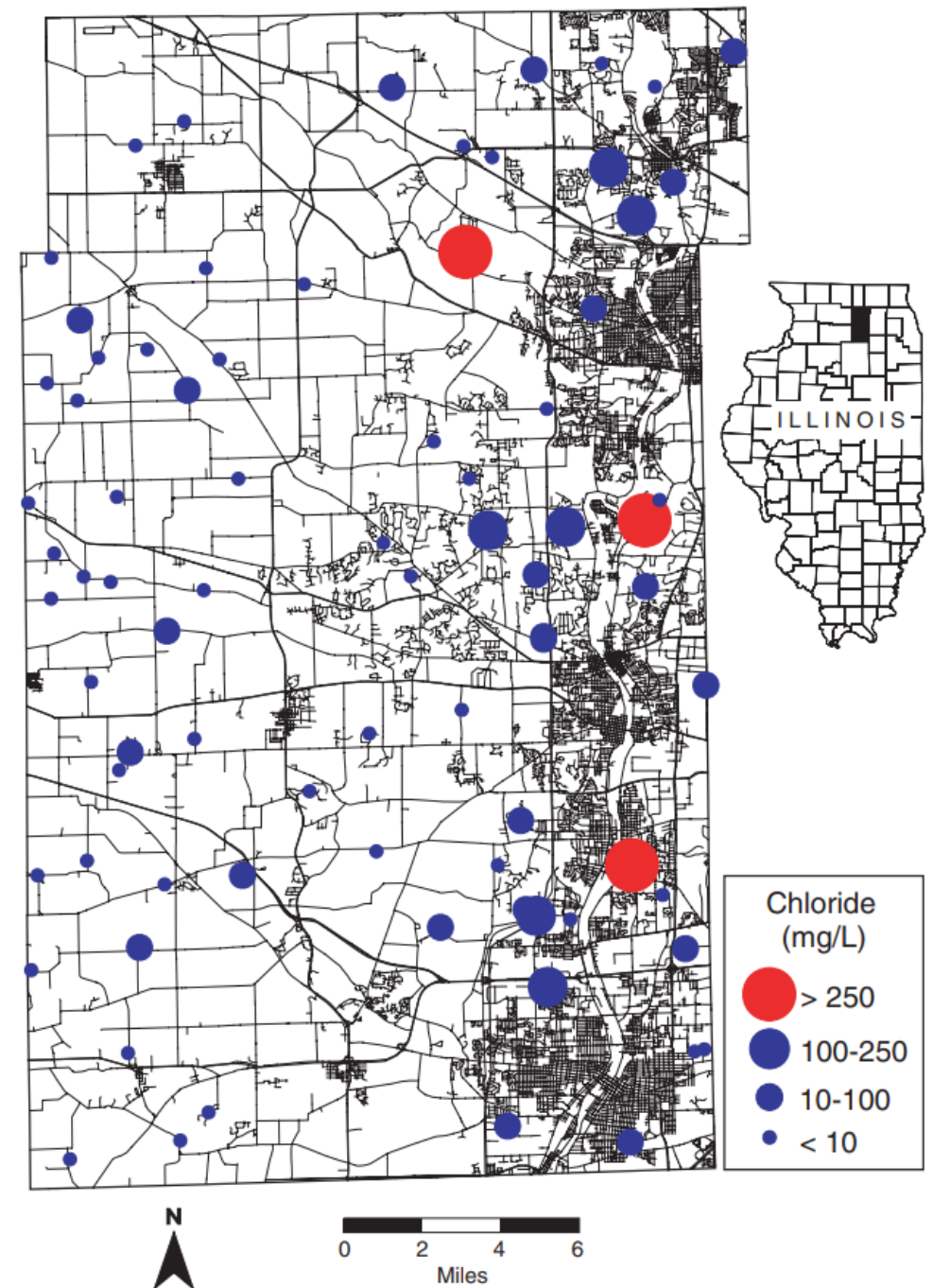
Illinois State Water Survey  
Prairie Research Institute  
University of Illinois at Urbana-Champaign  
Champaign, Illinois

<https://hdl.handle.net/2142/91002>



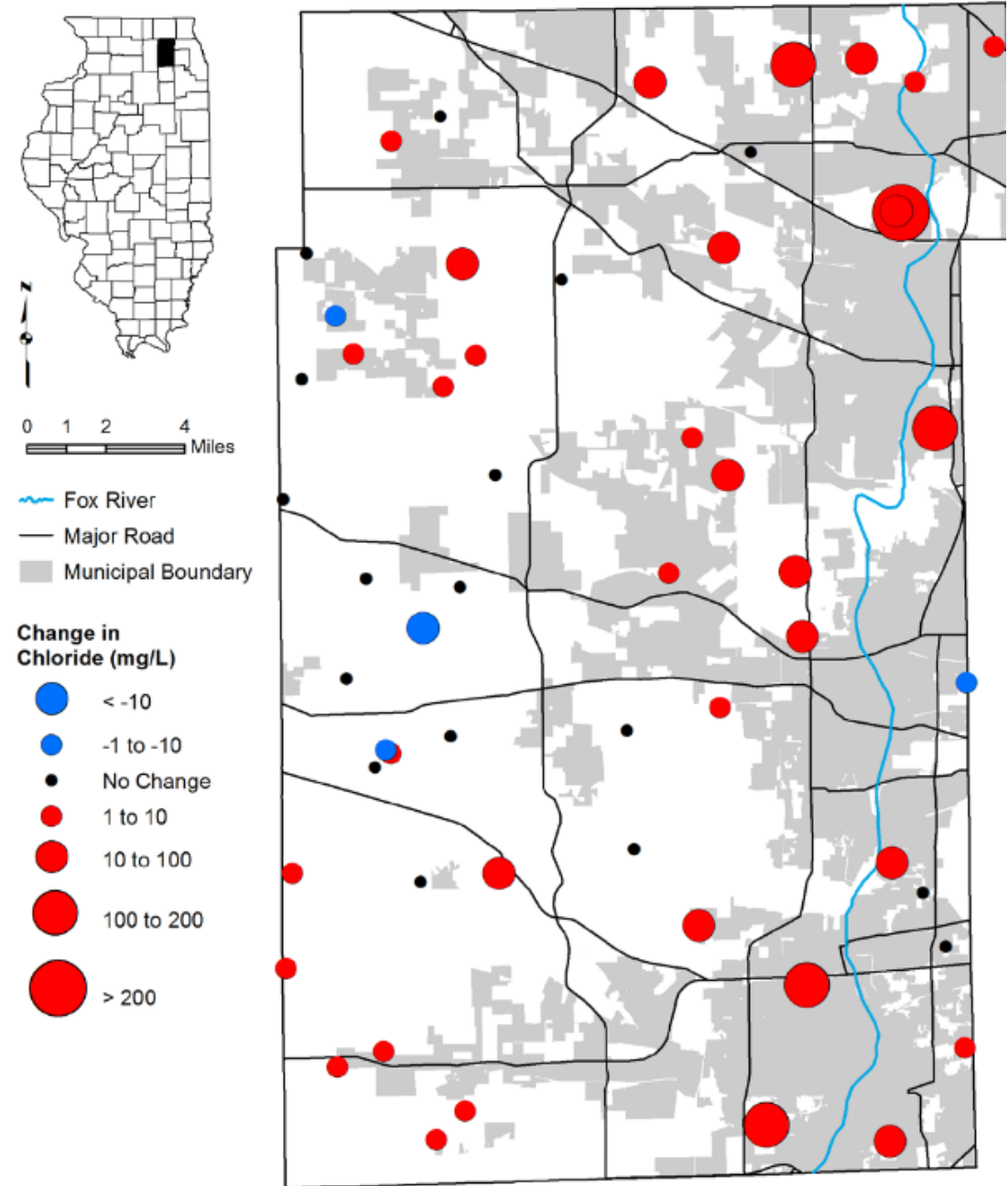
# 2003 Results

- Elevated chloride in eastern Kane County
- Three wells were above the USEPA standard of 250 mg/L
- Other contaminants of interest in this first study arsenic, sulfate, total dissolved solids (TDS), iron, hardness
- Arsenic exceeds drinking water standards at 19% of wells
- Sulfate significantly higher in the east compared to central and west



# 2015 Results

- Elevated chloride in eastern Kane County
- Chloride increased in 78 percent of wells sampled in both 2003 and 2015
- The rate of increase in chloride in the eastern third of Kane County of 3.9 mg/L per year
- Arsenic exceeds drinking water standards at 18% of wells (similar to 2003)
- Sulfate still significantly higher in the east compared to central and west



# How can we implement this version of the study to best understand shallow groundwater quality?

- Resample as many of the past study wells as possible to establish a basis of comparison
- Improve coverage of the shallow aquifer in central Kane County, where land use changes are mostly happening
- Inclusion of monitoring wells. These will be points that will always be available for sampling and in addition will have water level data

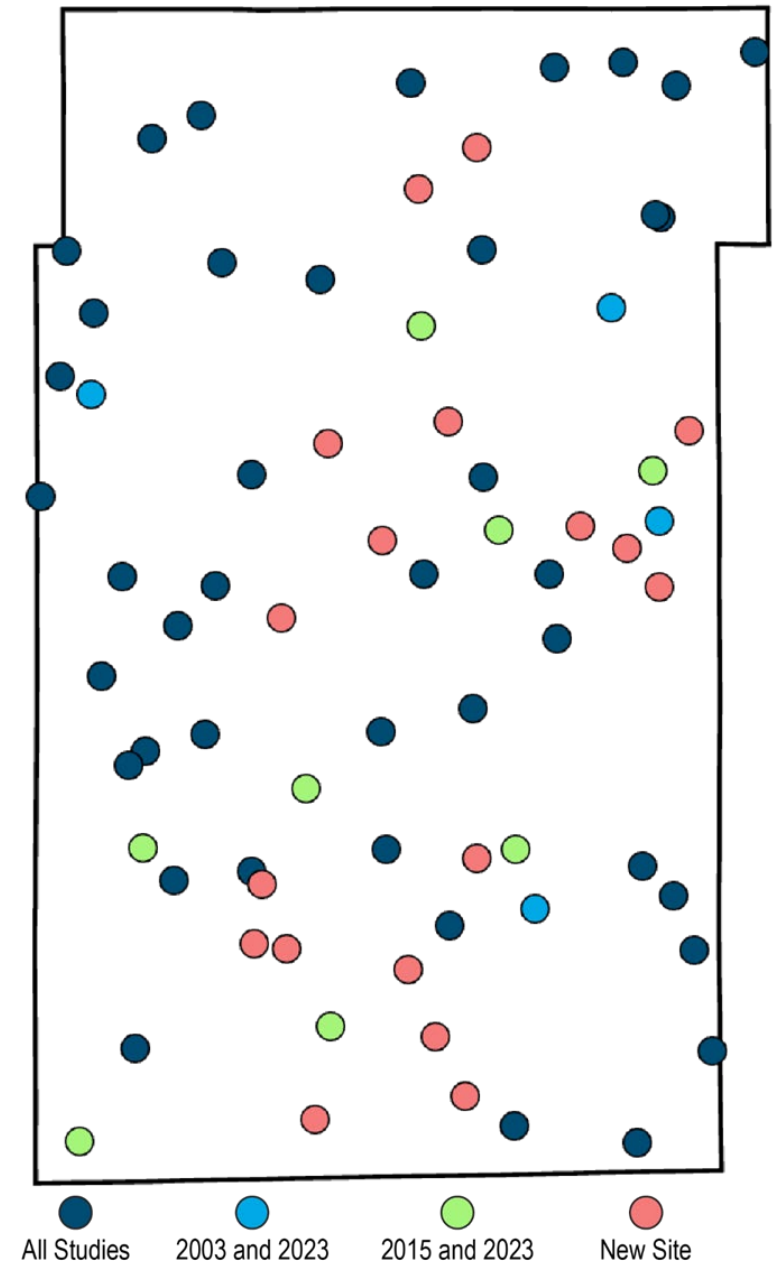
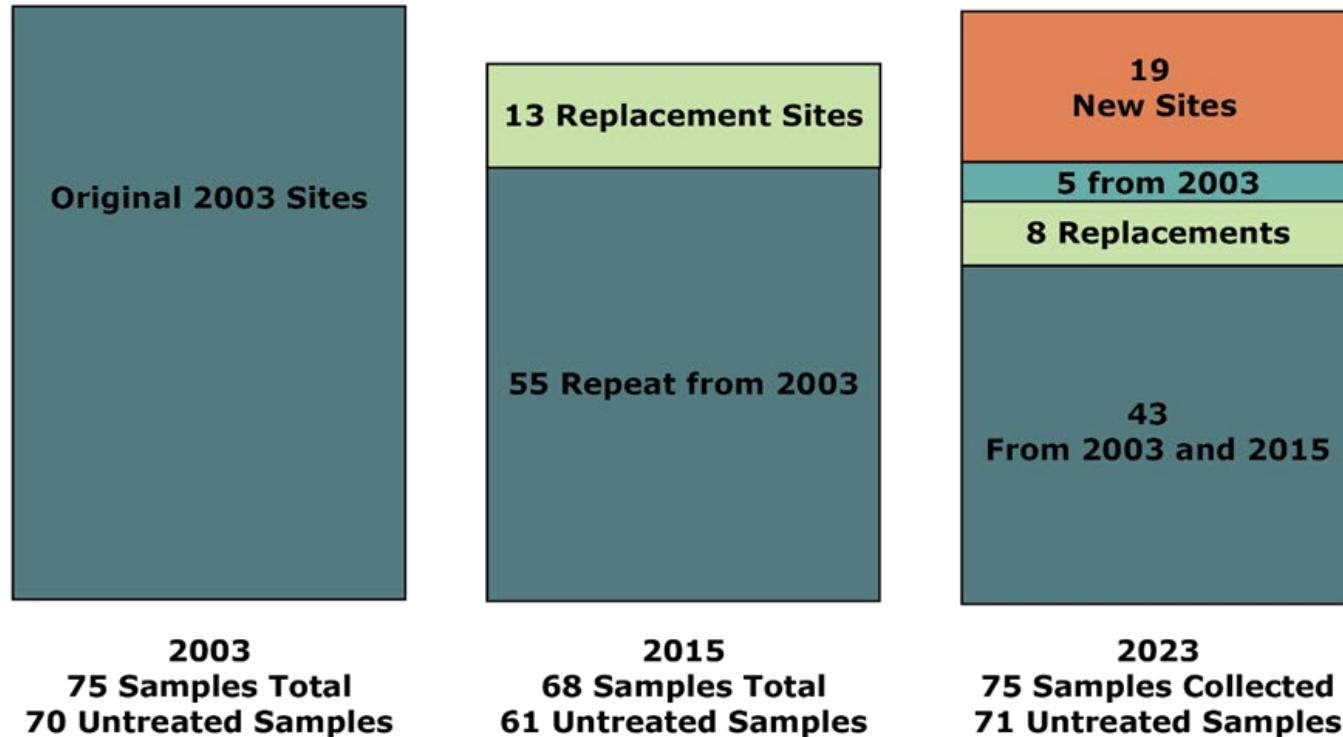


Dan collecting a sample at a monitoring well in central Kane County

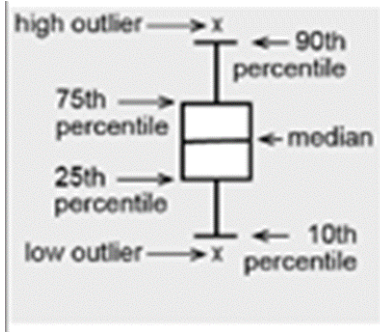


# Sampling effort complete

- 75 samples collected, distributed for 25 in each third of the county: west, east, central
- Over half of sites were sampled in 2003 and 2015.
- 6 of the new sites sampled were monitoring wells, 2 in each third of the county

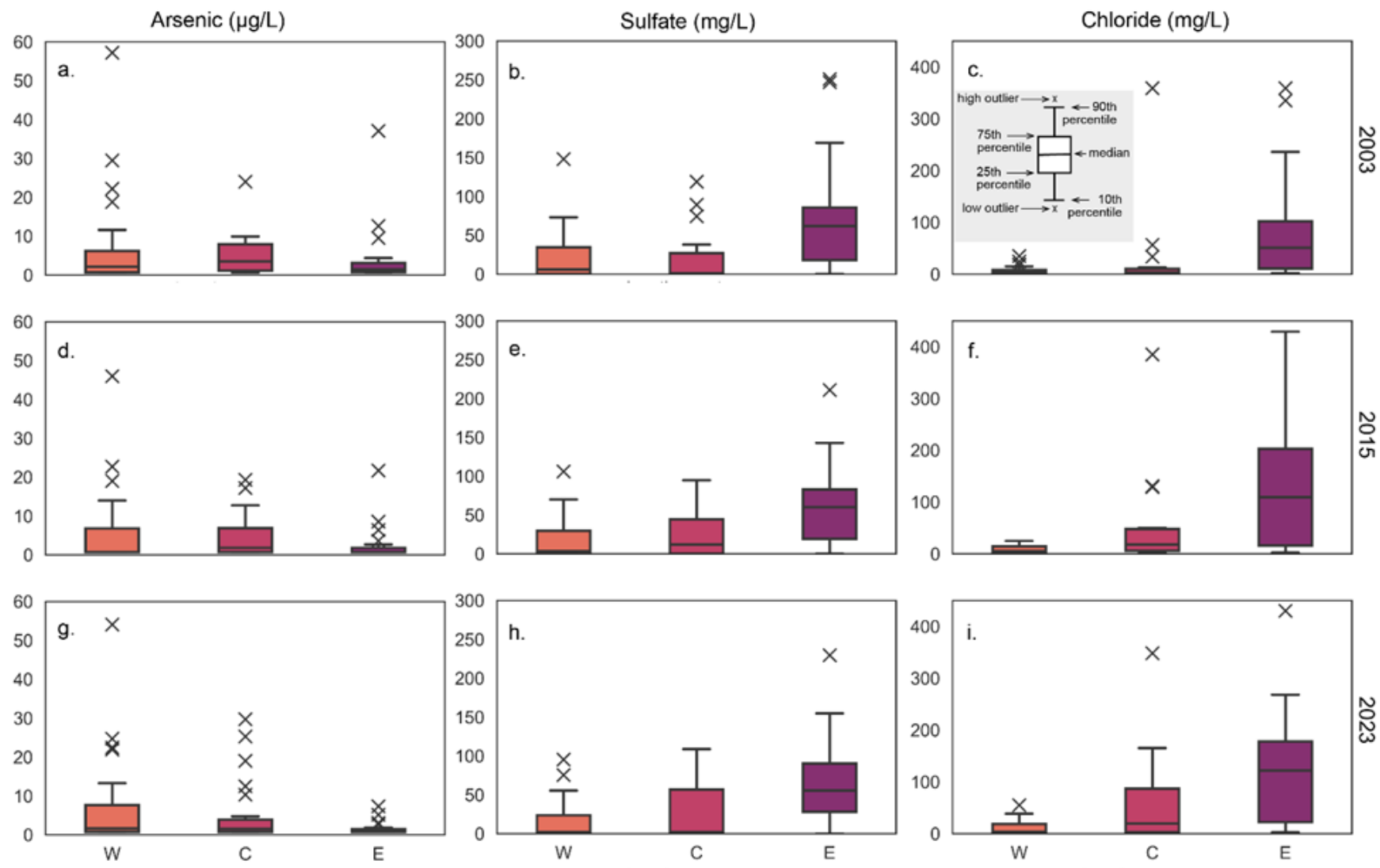


# Comparing results from the three study periods for west, central, and east Kane County



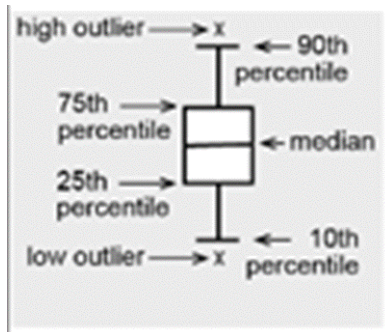
Arsenic variation is not statistically significant.

In all three iterations of the study, chloride and sulfate were significantly higher in east Kane County compared to central and west.



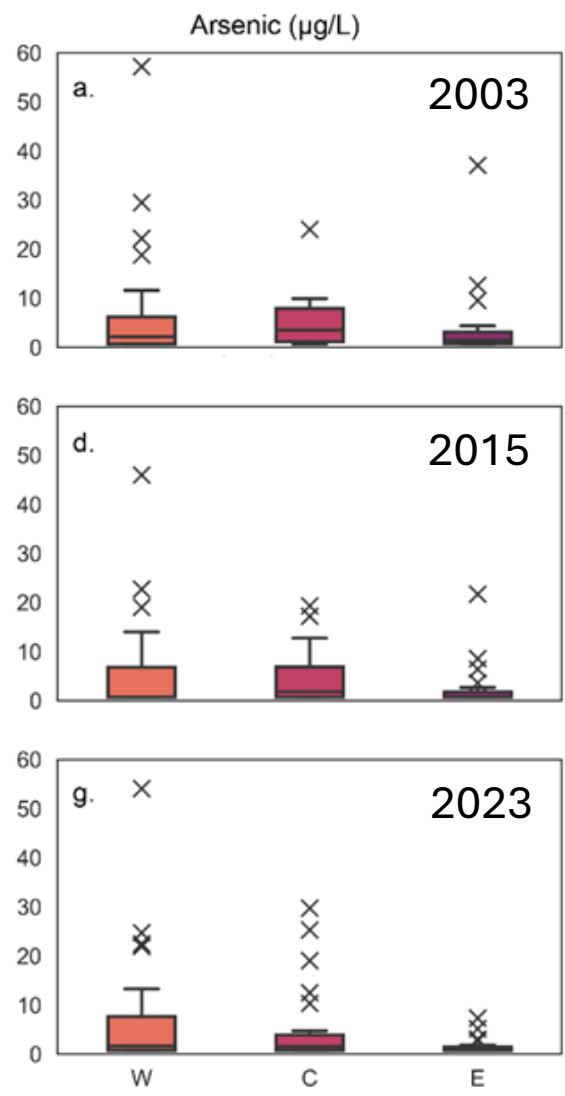


Comparing total chloride results from the three study periods for west, central, and east Kane County



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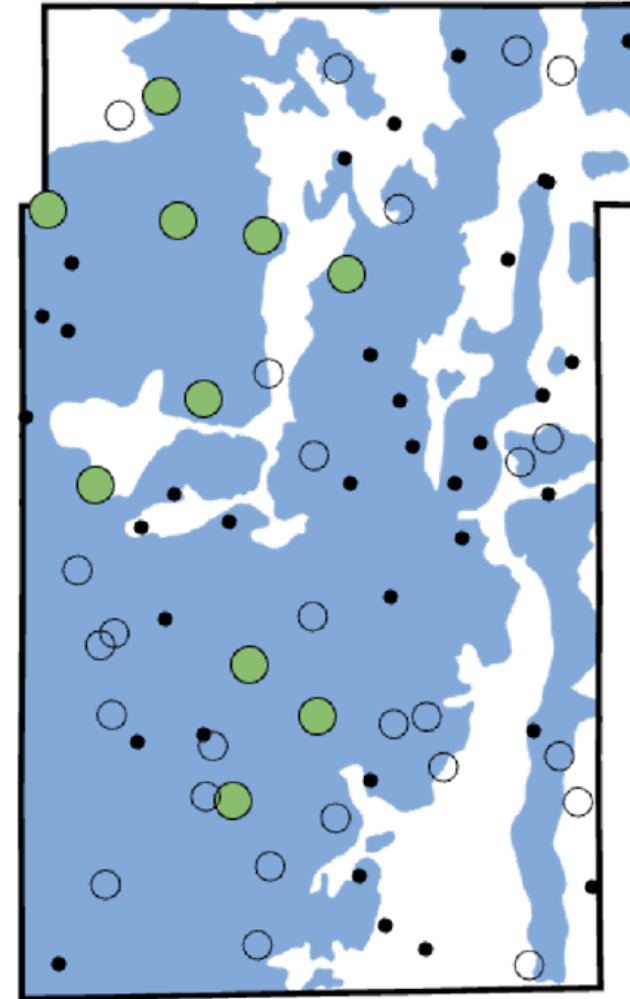


# Arsenic is the most impactful and elusive to understand constituent

Most of the wells with arsenic above USEPA Primary Standard had geochemical conditions consistent with low energy geochemical environments.

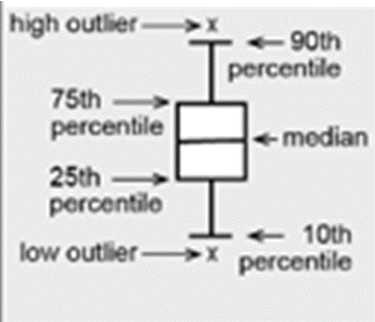
Well owners were informed about high arsenic from previous studies. They will be encouraged to test their treated water to ensure their home treatment systems are effective.

(Blue shading indicates areas covered by moraines)



• < 1 µg/L    ○ 1 - 10 µg/L    ● > 10 µg/L

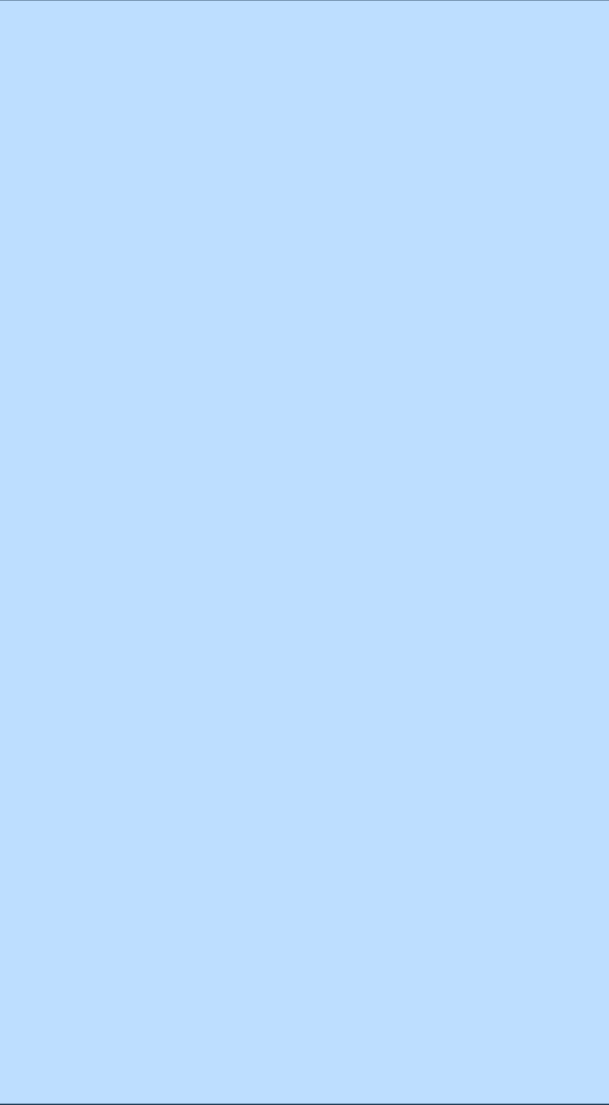
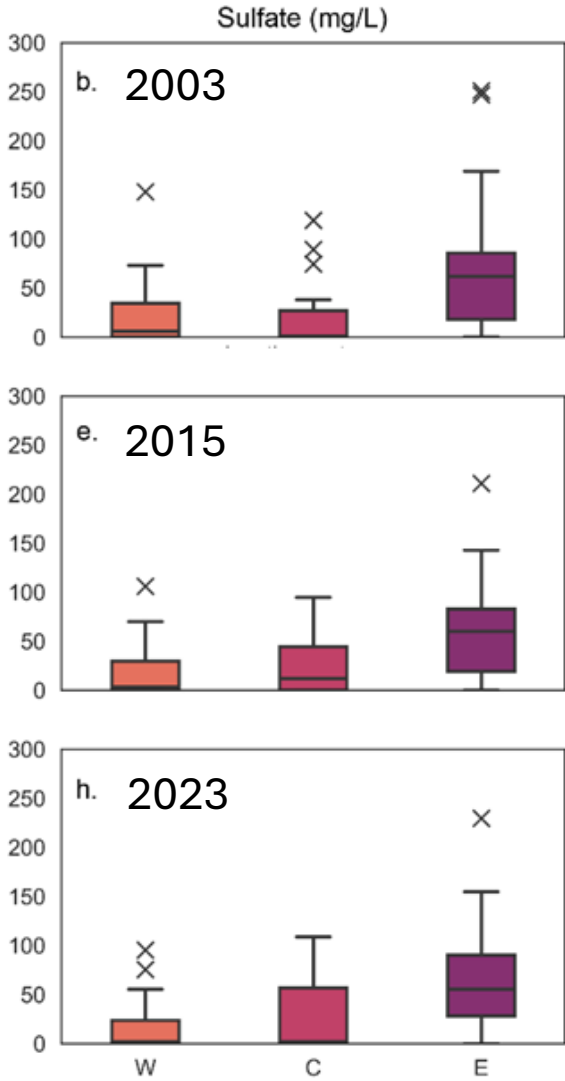
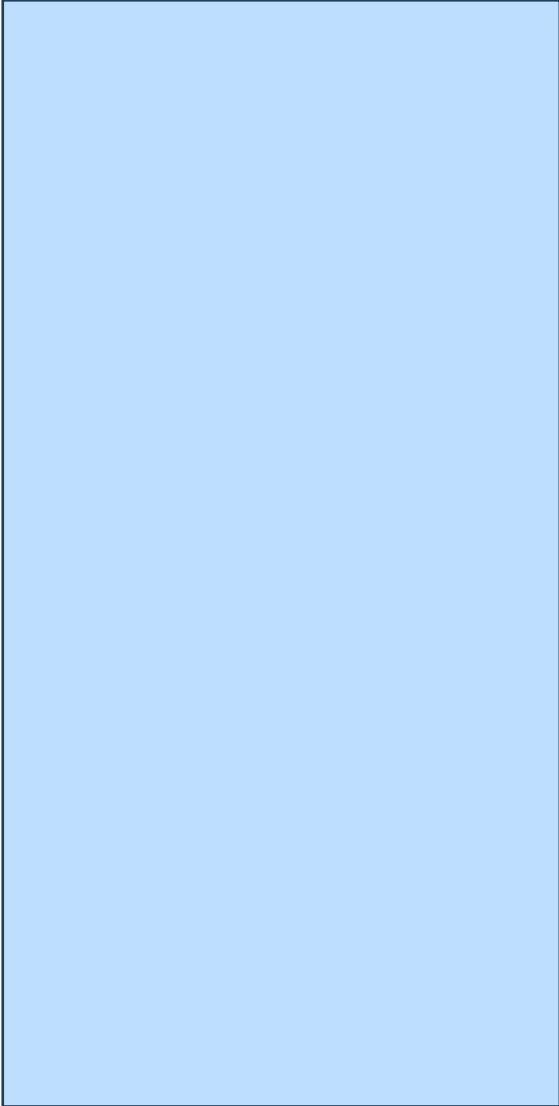
# Comparing results from the three study periods for west, central, and east Kane County



Elevated sulfate has been observed in parts of Kane, Will, and Lake counties in recent ISWS studies.

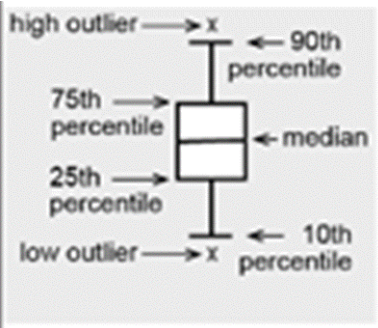
Taken together, this signified a source other than car exhaust.

Idea on this in development

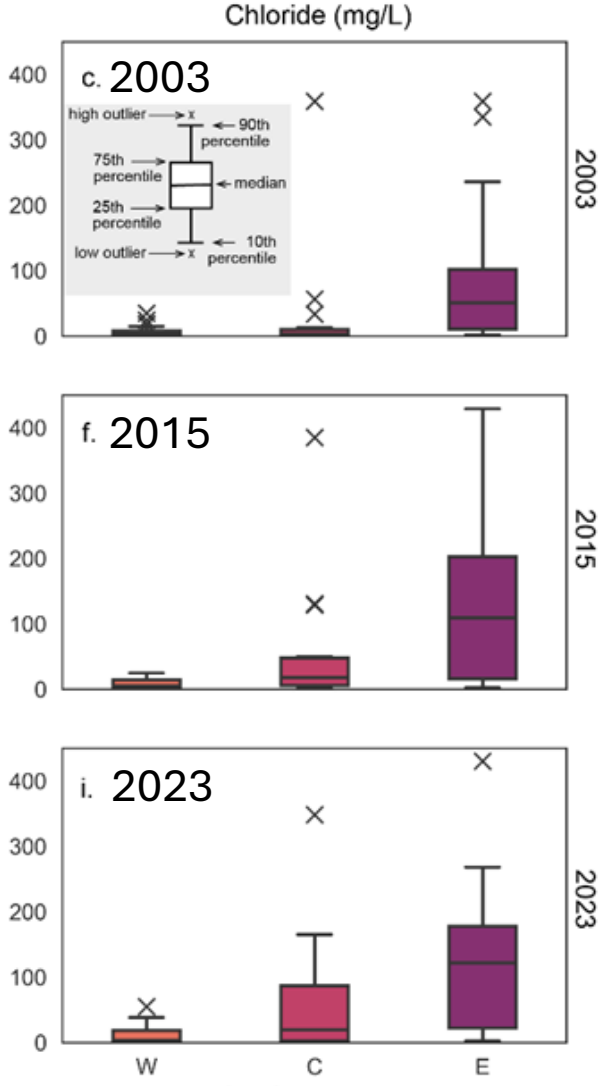
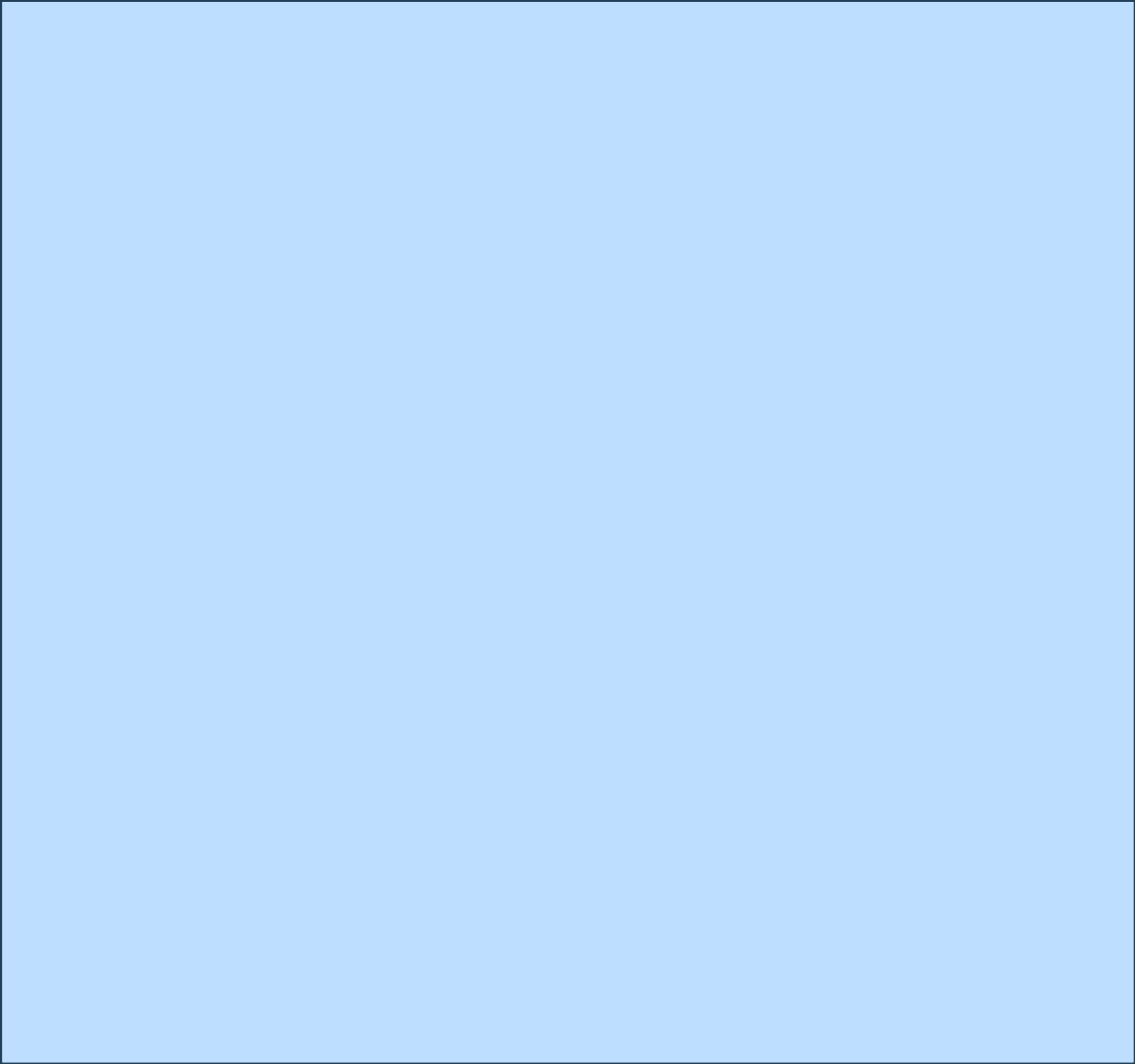




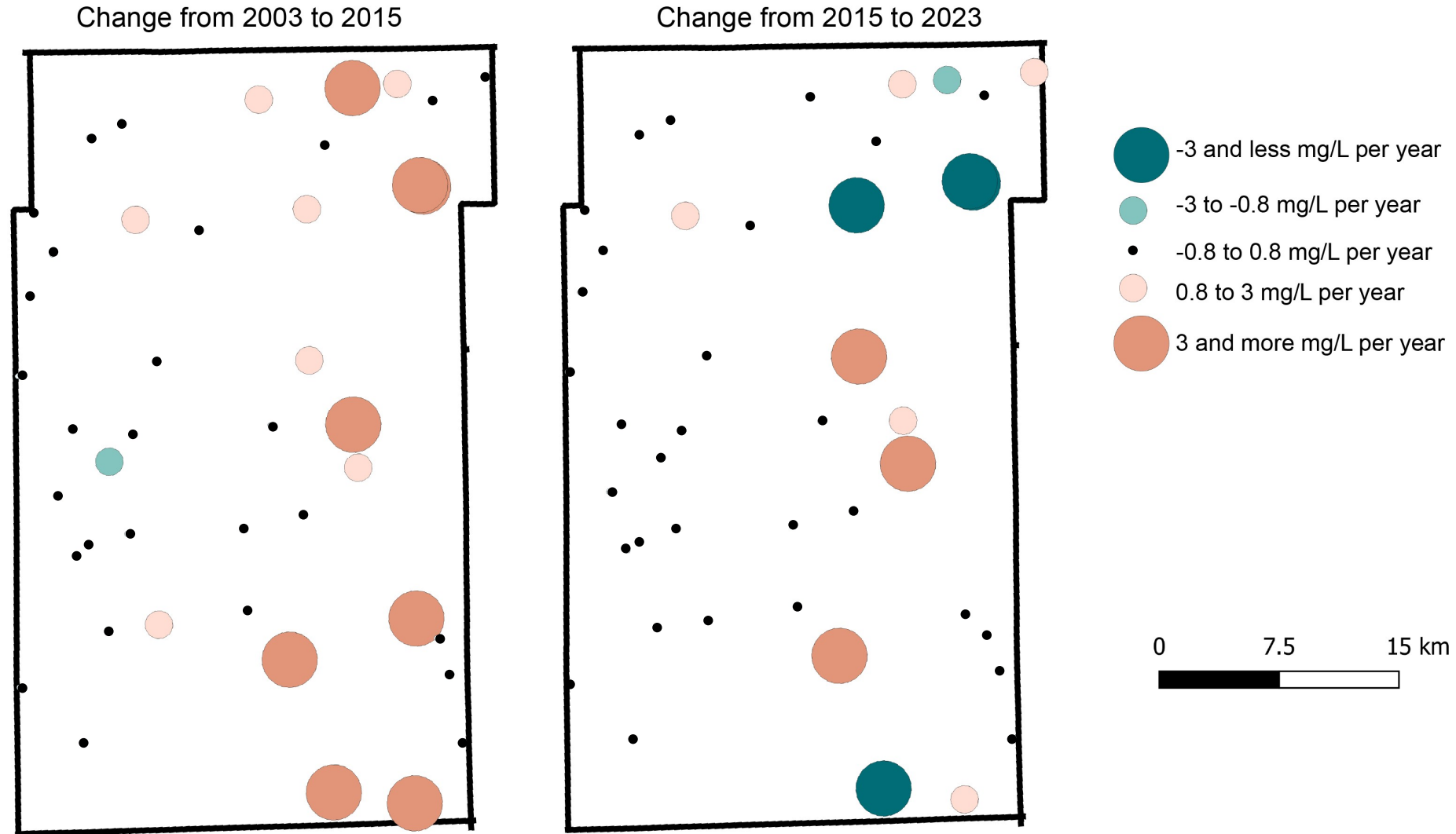
# Comparing results from the three study periods for west, central, and east Kane County



In 2023, chloride is increasing most significantly in central Kane County



# Chloride accumulation rate change



# What could impact chloride accumulation rates in Kane County shallow aquifer?

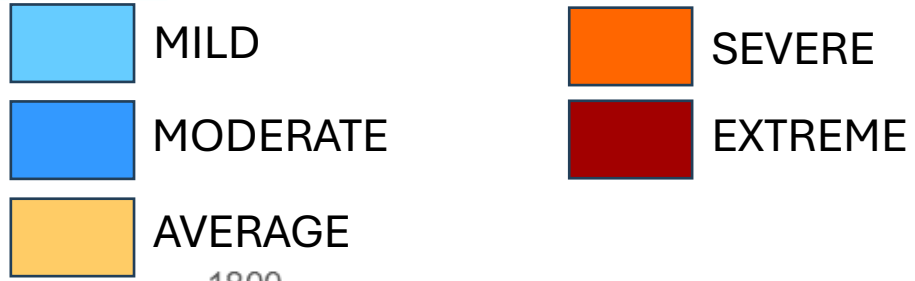
- **Conservation and Sensible Salting efforts**

When we talked to communities in eastern Kane County, we found most have been participating in sensible salting efforts since the 2000s

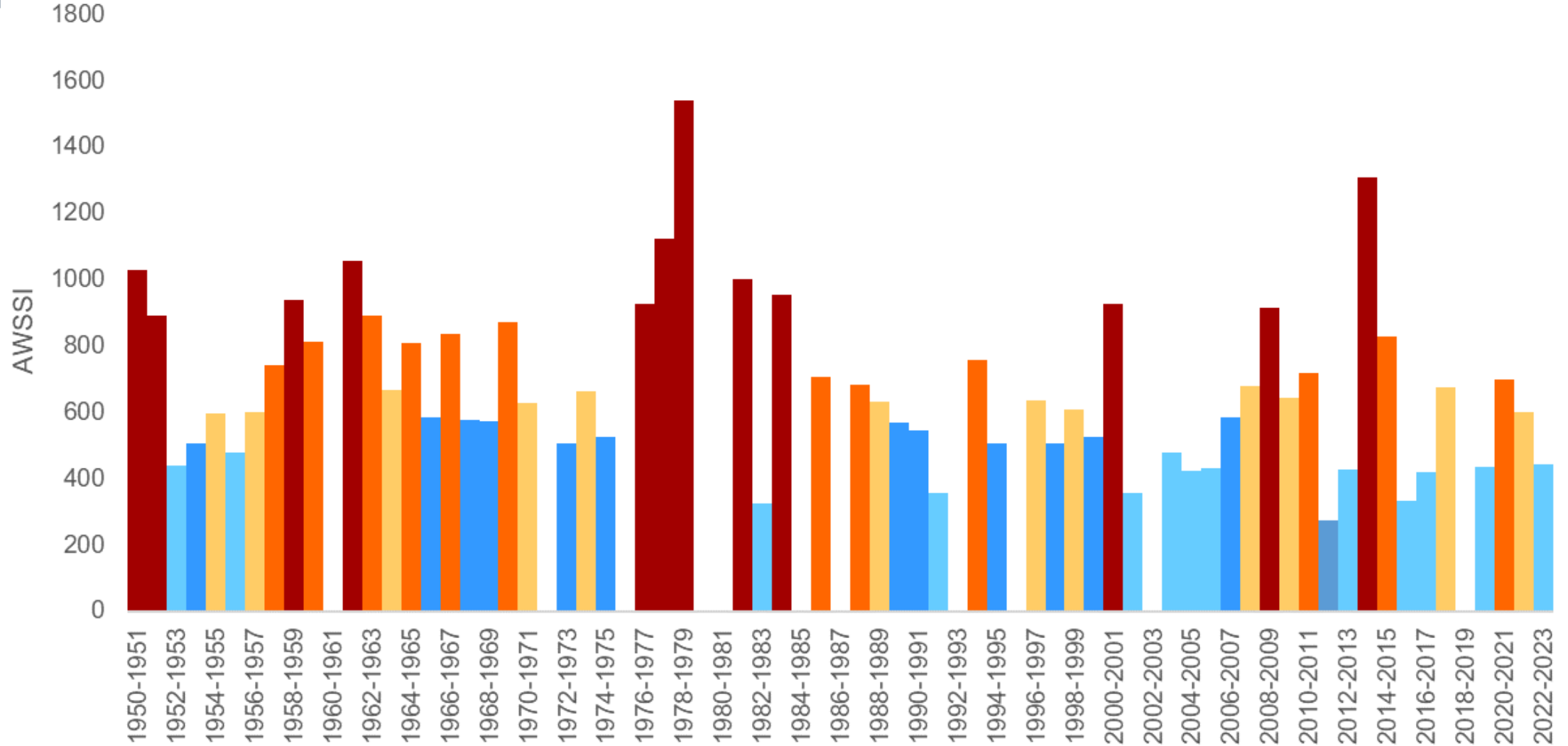
- **Milder winters**

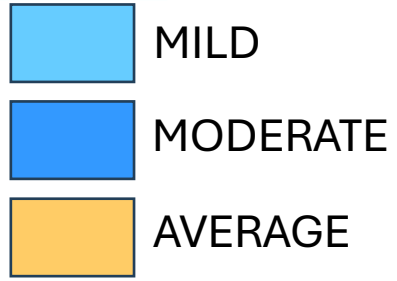
A colleague from the climate section of the ISWS shared a paper on 'Accumulated Winter Severity Index' to put perspective on if winters are changing in northeast Illinois



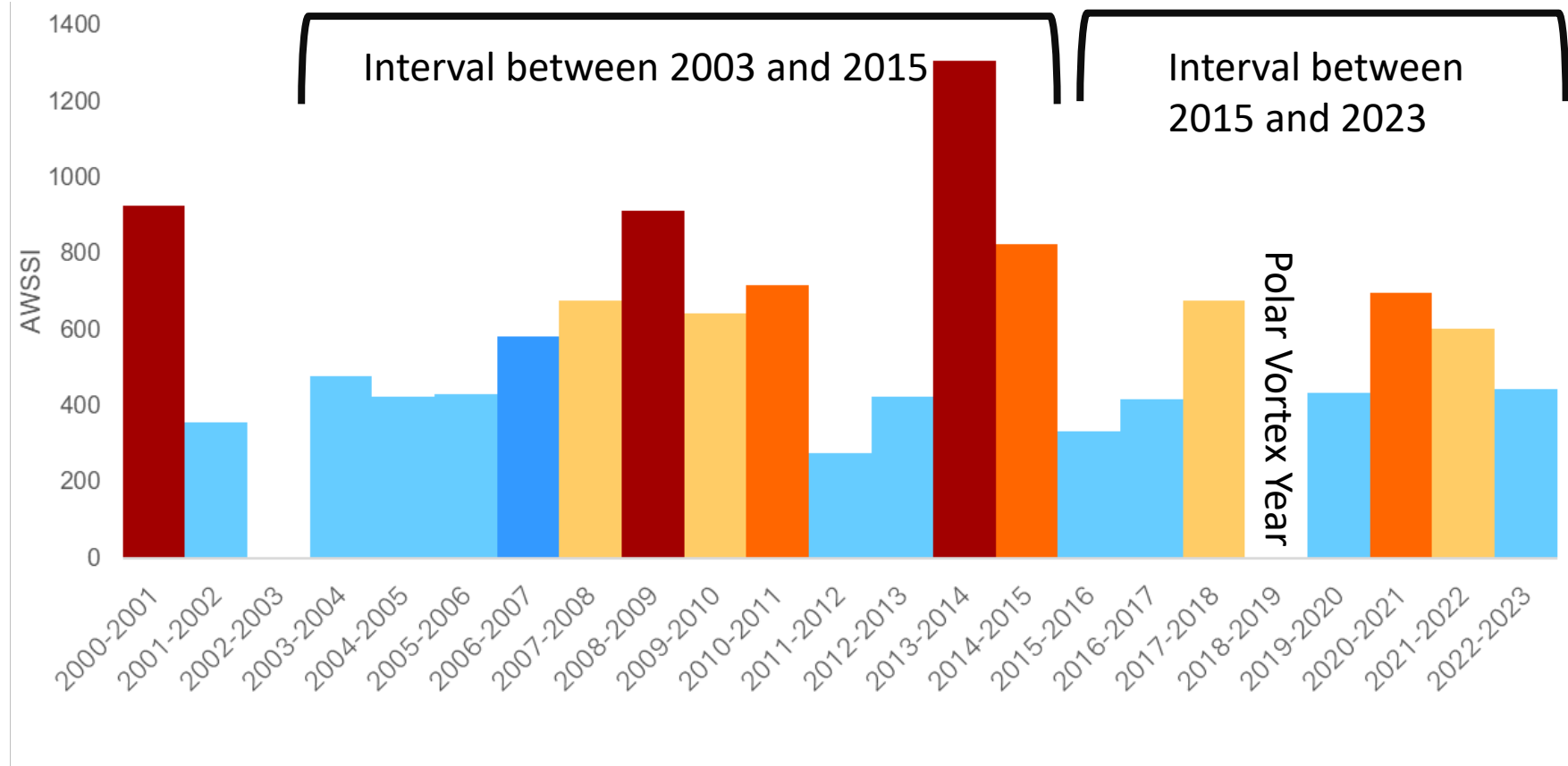


Data from climate station in Aurora  
 The winter severity index (AWSSI) is calculated from Temperature and snow fall. Categorization based on percentile (Mayes Boustead et al., 2015)





Data from Aurora show less severe winters between 2015 and 2023 than in the interval between 2003 and 2015



# This analysis and more in upcoming report

## Next Steps

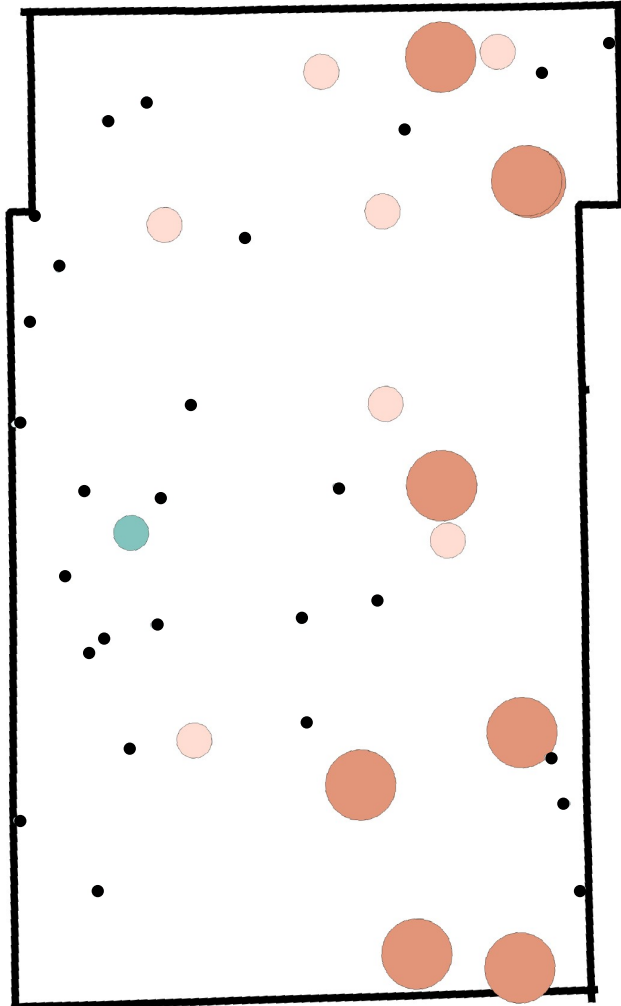
- Polish figures
- Review from Kane County collaborators and internal review
- Finalize Water Quality Contract Report
- Create Web application
- Publish on IDEALS

END

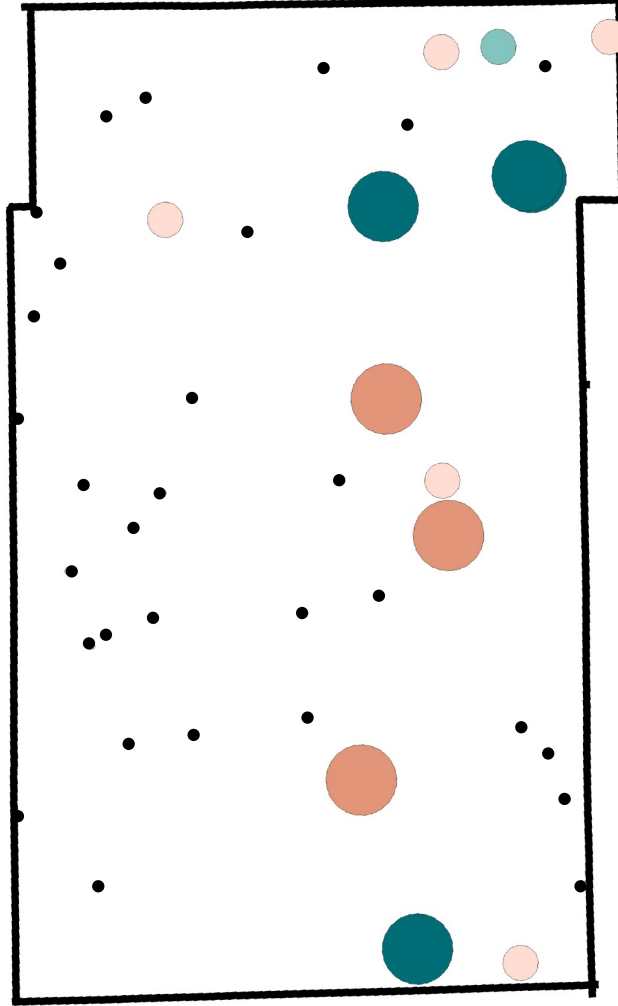


# Chloride accumulation rate change

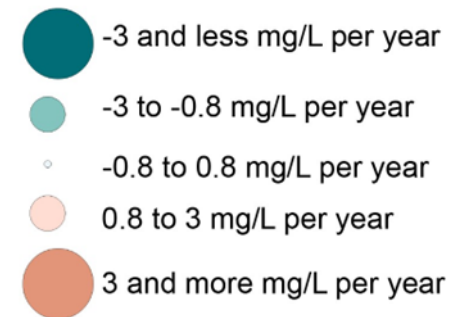
Change from 2003 to 2015



Change from 2015 to 2023



	2003	2015	2023
Background (0-15 mg/L)	29	24	25
Low (15 - 50 mg/L)	5	7	6
Moderate (50 - 100 mg/L)	6	3	2
High (100 - 250 mg/L)	1	6	7
Excessive (250 + mg/L)	2	3	3



# 2023 Kane County Secondary Standards

