



The Salinization of Our Region's Waters

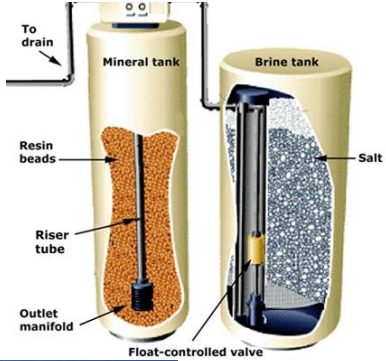
Walt Kelly
Illinois State Water Survey
Prairie Research Institute
University of Illinois at Urbana-Champaign



Salt: The World's Most Important Mineral



Water Treatment



Agriculture

<http://www.motherearthnews.com/>

240 million tons/year



<http://geo-mexico.com/?p=5667>

Industry



<http://www.inmagine.com/crb134/crb134039-photo>

Food



Road Salt



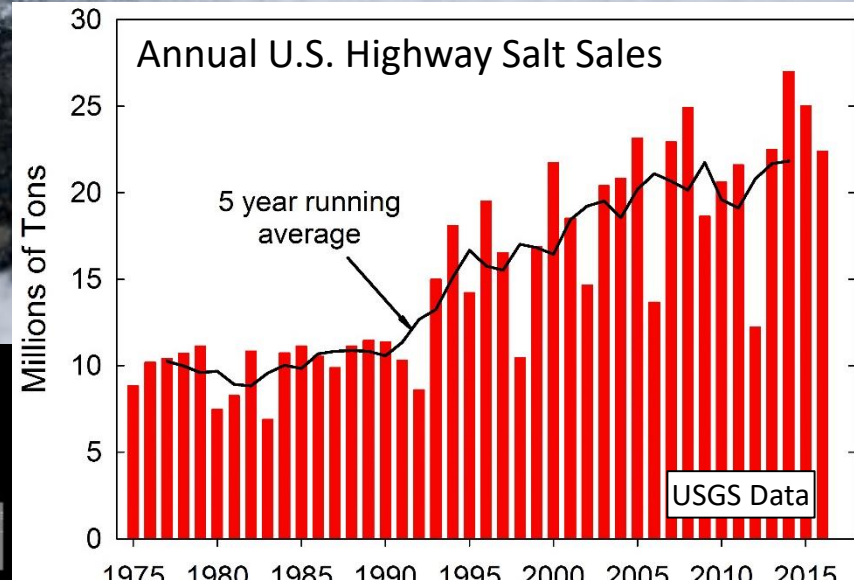
15-25 Million Tons of Road Salt
Applied in the U.S.
in a Typical Winter



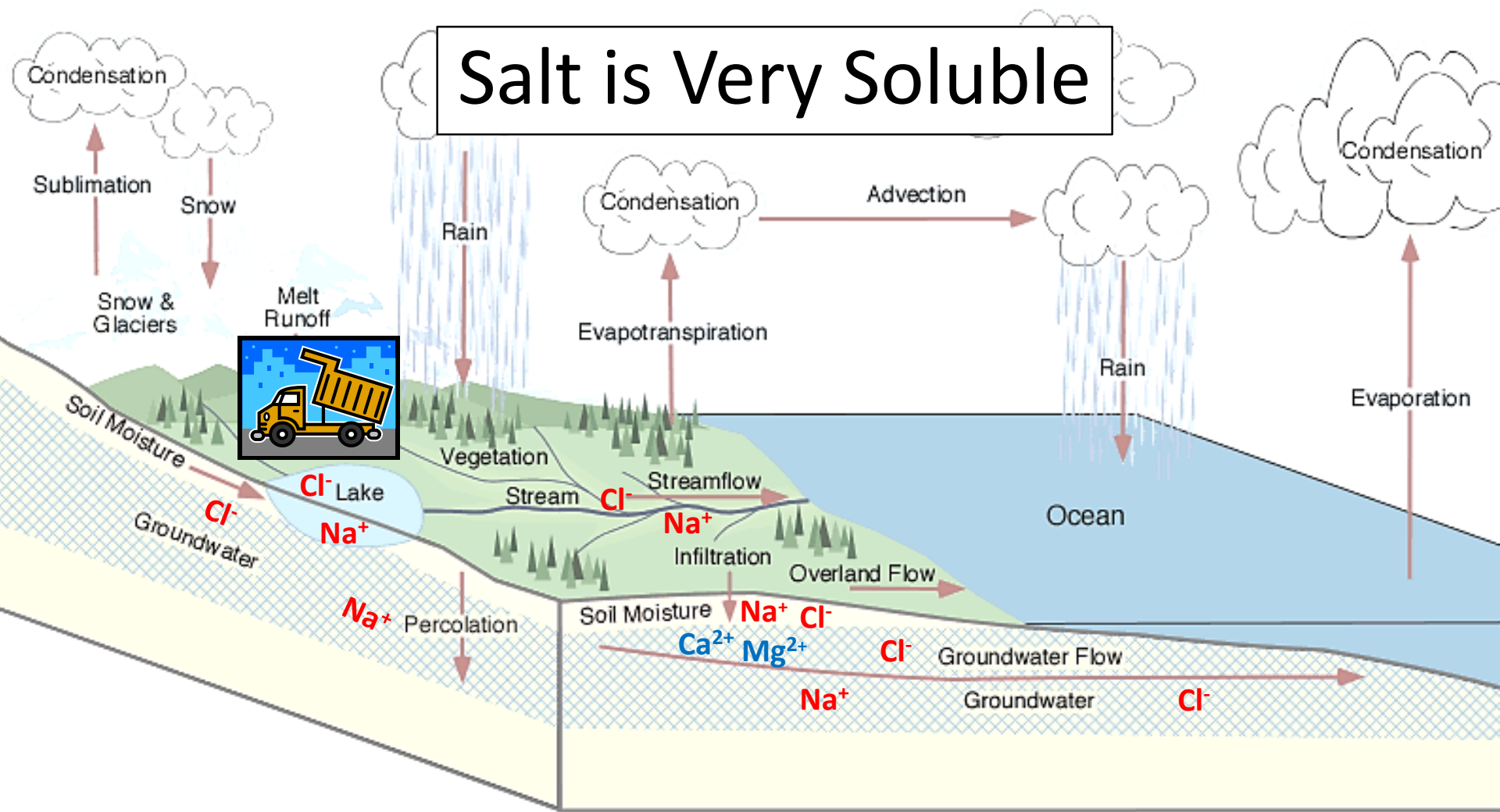
Why do we put Salt on snow and ice?

- Salt lowers the melting/freezing point of water

A 10% NaCl solution freezes at 20°F (-6°C)



Salt is Very Soluble



Drinking Water Contaminant

- Chloride has a secondary (aesthetic) standard of 250 mg/L
- Sodium < 20 mg/L recommended for people with hypertension



Cl⁻ is a Major Corrosive

Steel reinforcement in concrete



Can accelerate corrosion of metallic pipes and structures





Plant Damage

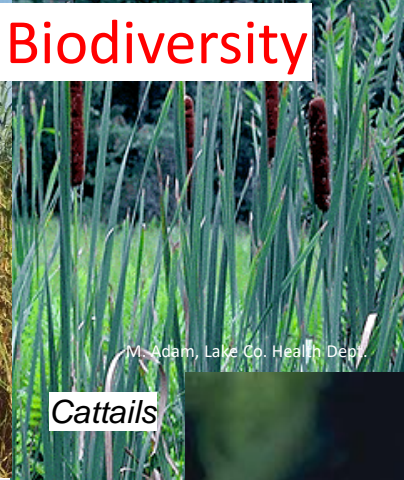


Reduction in Biodiversity



Phragmites
Common reed

M. Adam, Lake Co. Health Dept.



Cattails

M. Adam, Lake Co. Health Dept.



Buckthorn

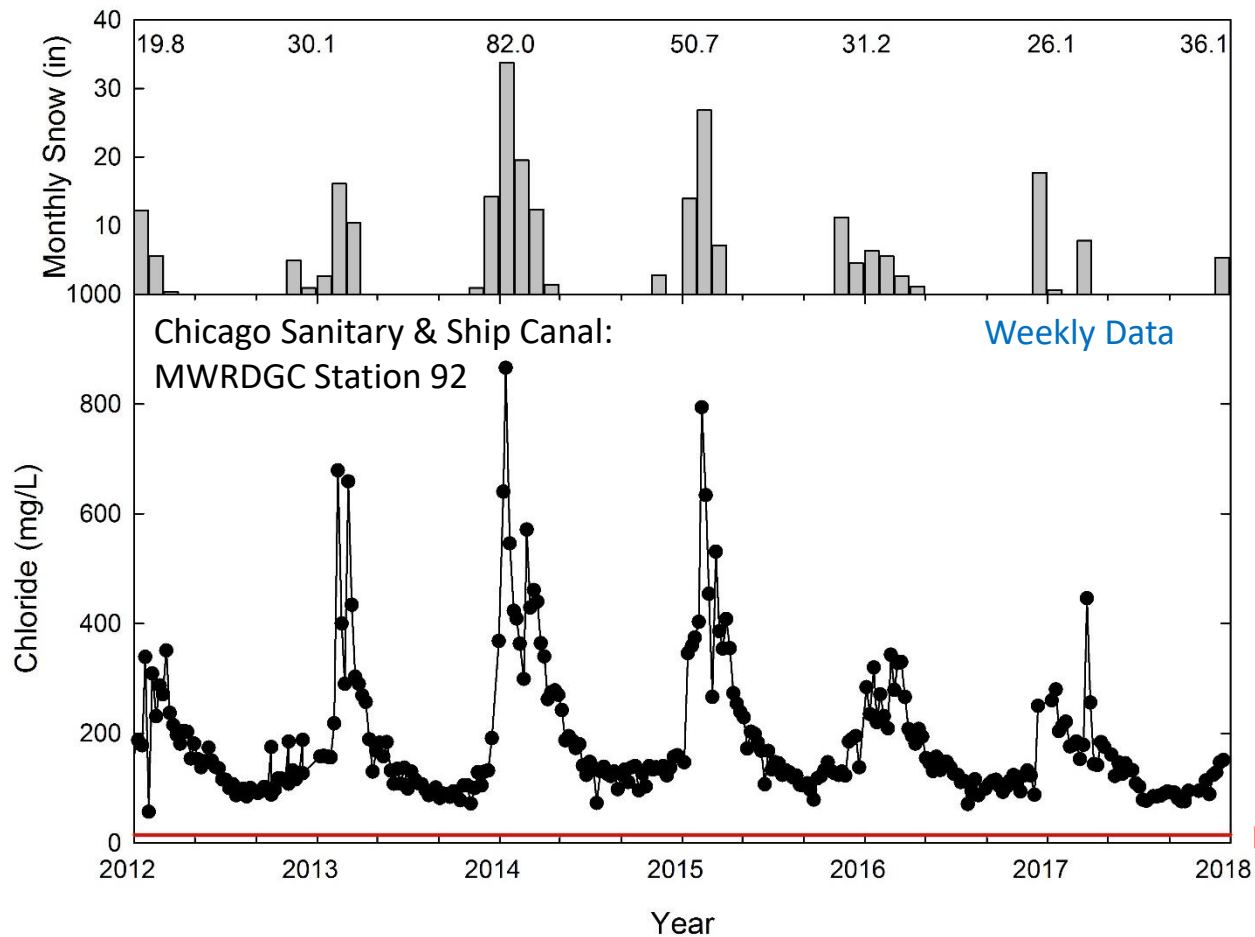


<http://dwr.cdc.nr.utah.gov/>

Aquatic Species Toxicity

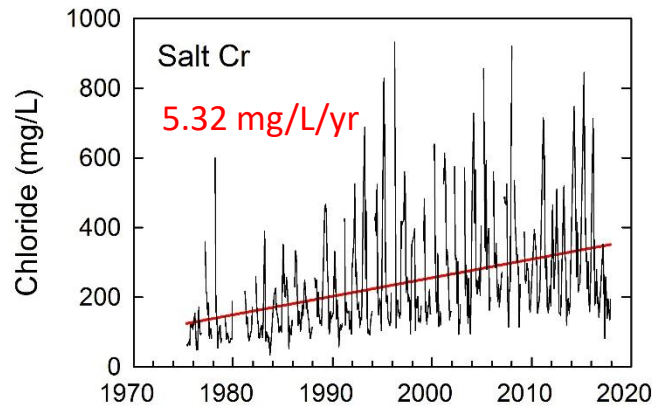
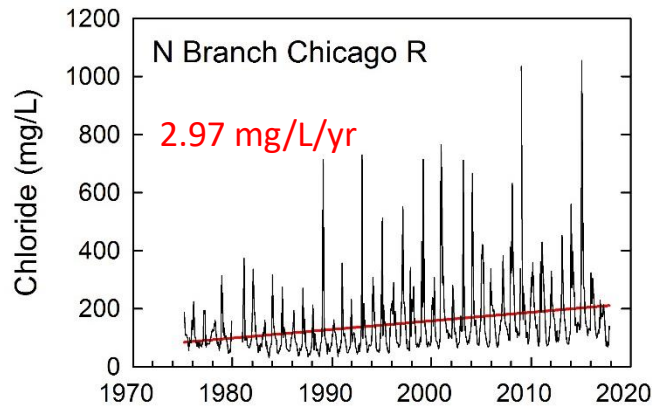
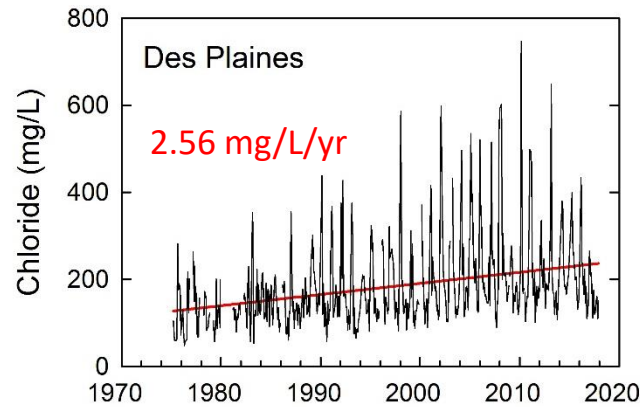
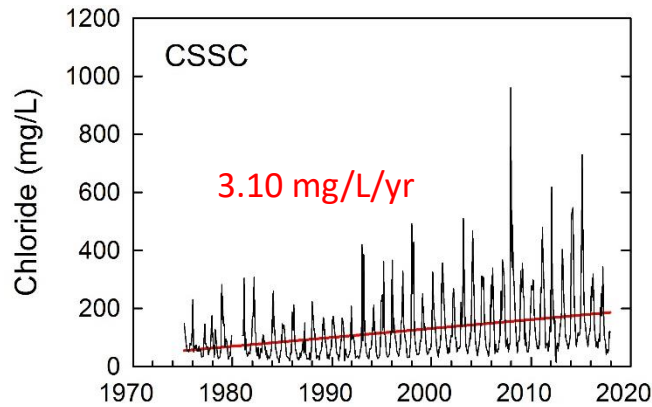


Slugs of Chloride in Rivers and Streams



Background: <math>< 15 \text{ mg/L}</math>

Chloride and other major ions are increasing in many parts of the Chicago Waterways



35 of 41 sites monitored by the MWRDGC since 1975 have significant positive trends in Cl⁻

Annual Salt Balance in Chicago Region Using Cl⁻

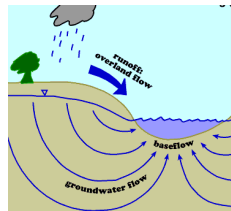
Inputs:



Road Salt
236,000 tons



Wastewater
193,000 tons



Nat'l Baseflow
61,000 tons



Other*
110,000 tons



TOTAL
600,000 tons

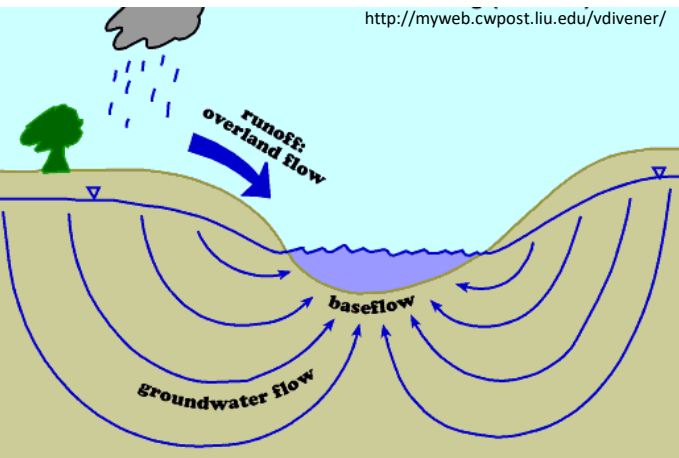
Outputs:



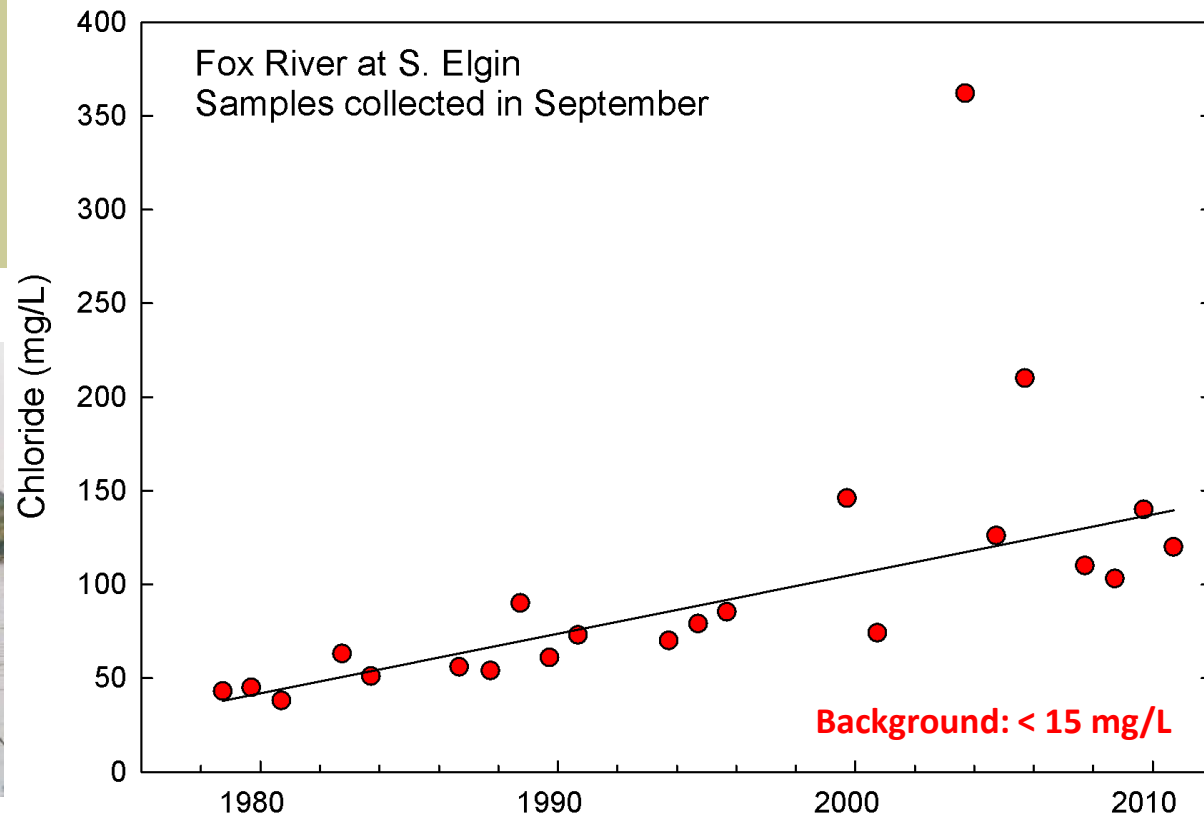
River Discharge
551,000 tons

About 49,000 tons of road salt, or about **14% of Road Salt** (and other human sources) remains in relatively long-term storage, i.e., groundwater

* Water conditioning salt, KCl fertilizer, livestock, groundwater withdrawals

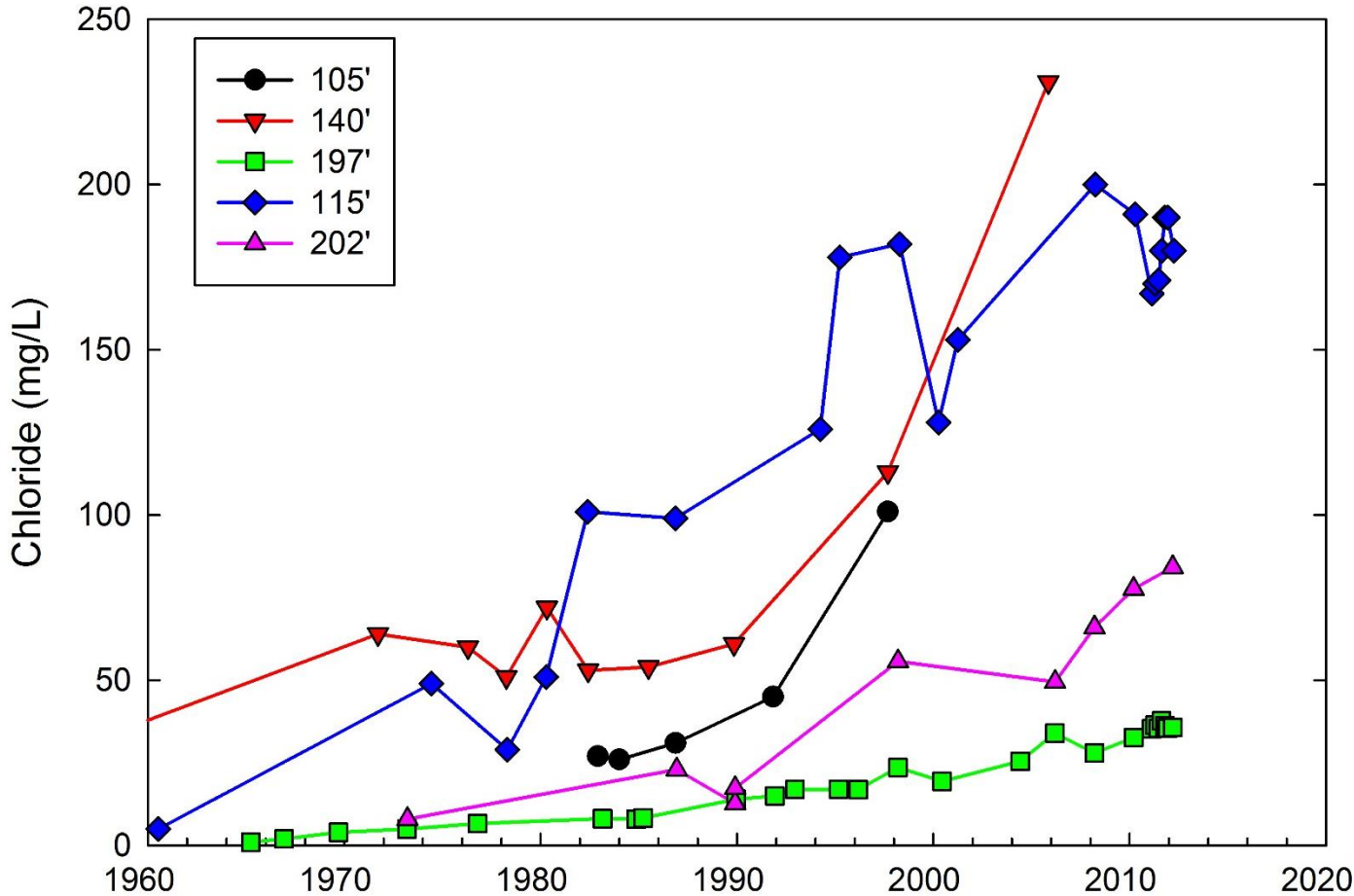


Increasing Chloride Concentrations in Baseflow



Public Water Supply Wells in McHenry County

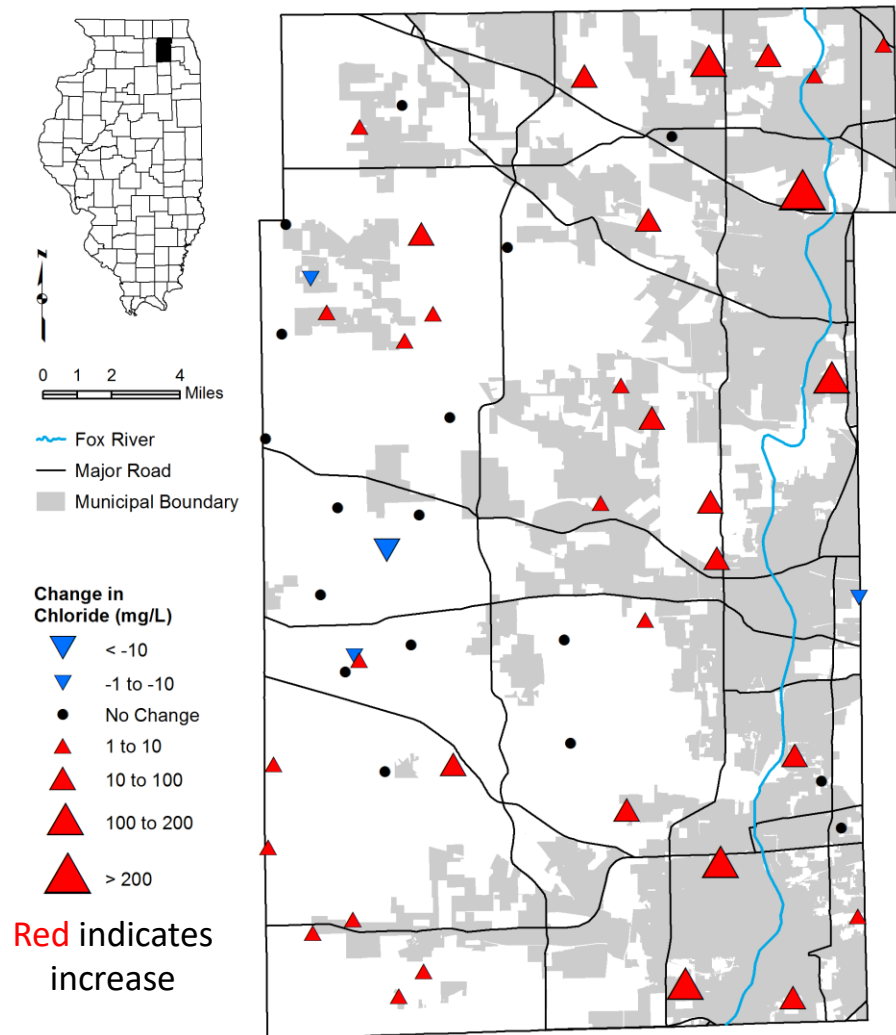
The majority of PWS wells in Chicago region have increasing chloride concentrations



Kane County Shallow Groundwater

Change in Chloride: 2003 - 2015

- 5 wells increased more than 100 mg/L
- Average chloride increase in East wells was 46.3 mg/L
 - (about 4 mg/L per year)



Road Deicing: Can We Be Smarter?

- Updated policies are calling for decreased salt use
 - Is “bare pavement” always necessary?
 - Reduce application in sensitive areas?
- Improved deicing materials and techniques available
- But NaCl still predominates (cheap)

Pre-application
of brine

