



Information Item: Regional Chloride Trends on Metro Area Streams



Environment Committee, July 26, 2022

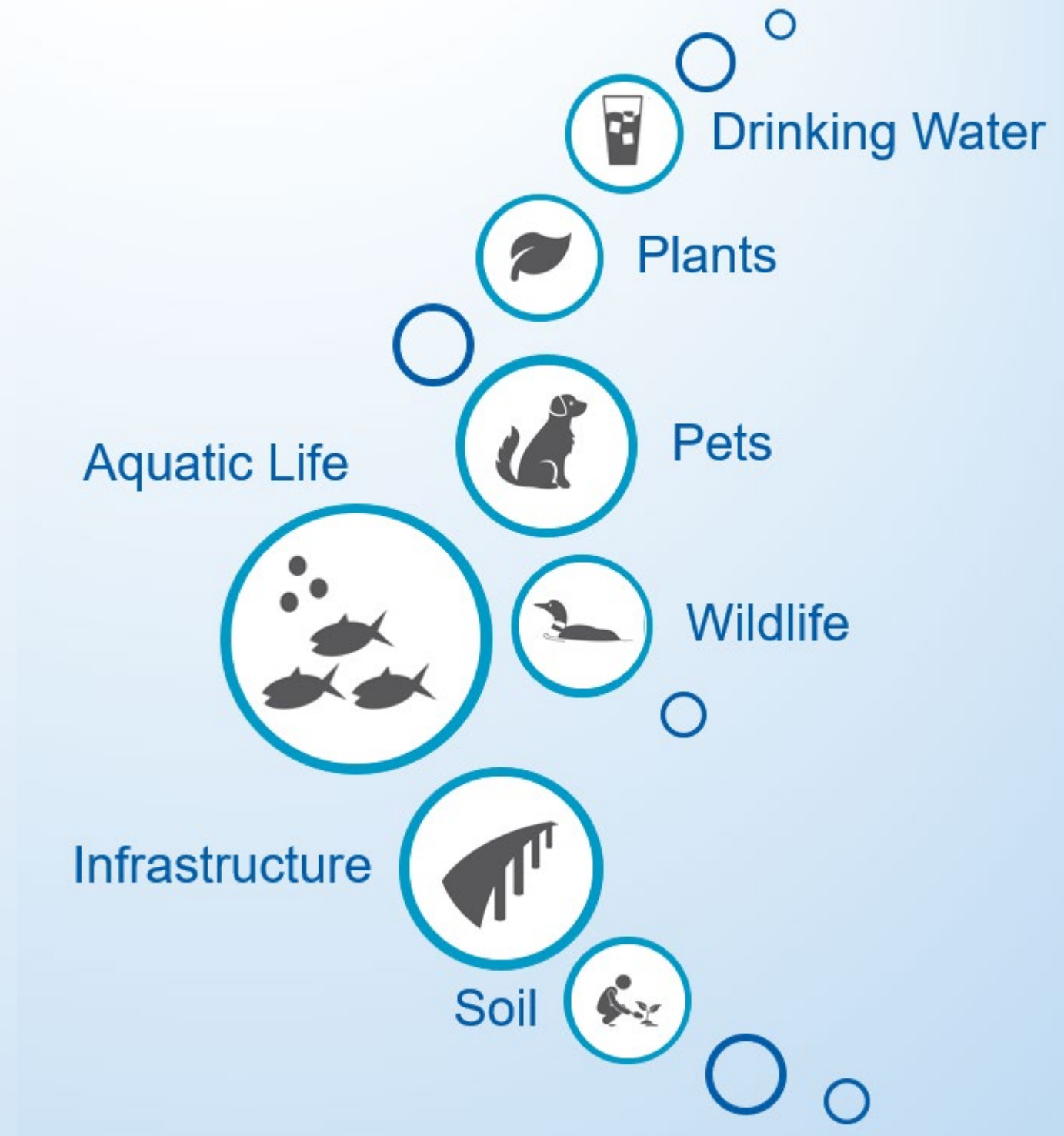
Cassandra Champion and Hong Wang

Chloride Sources in Minnesota Waters

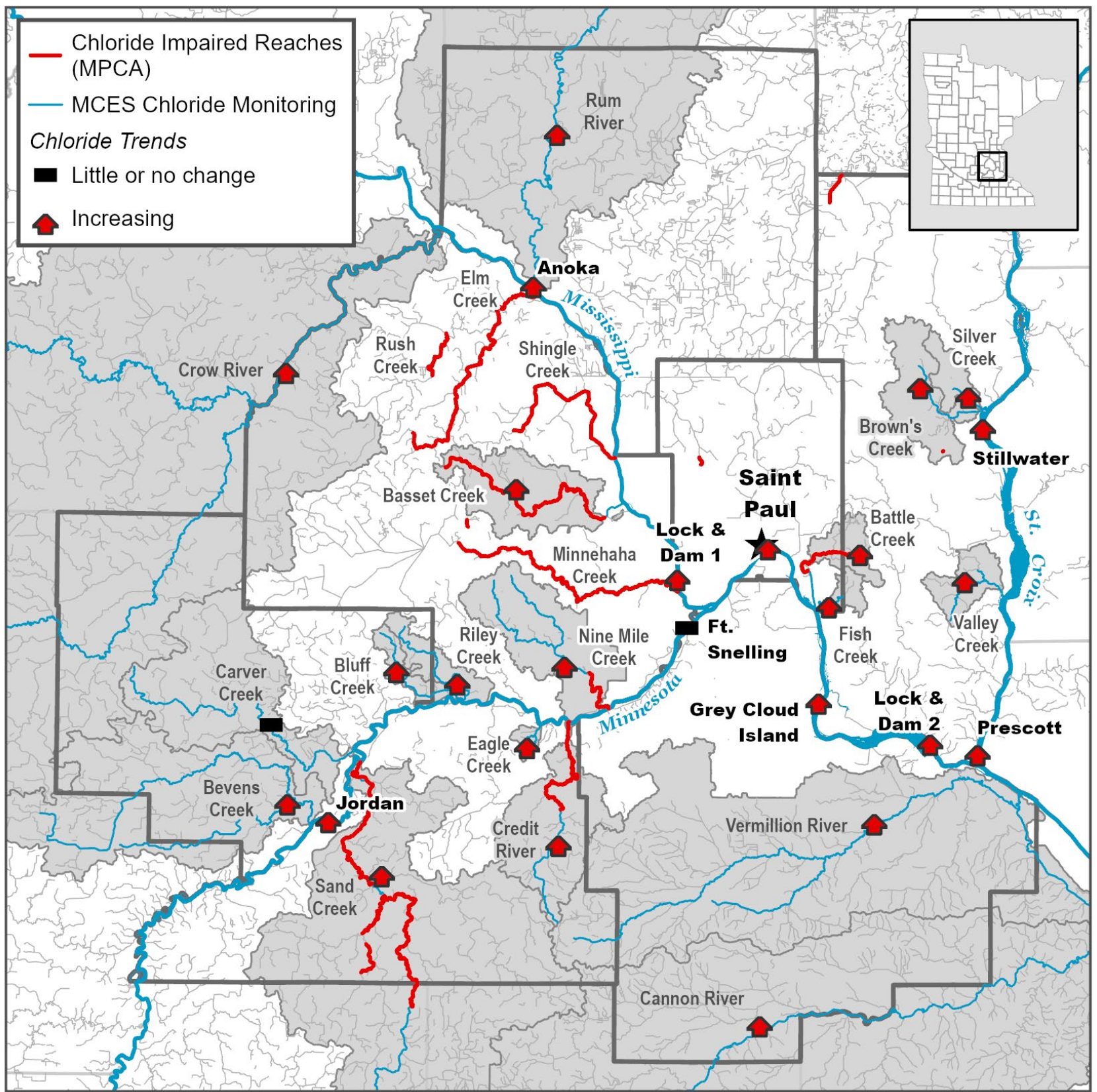


Source: Overbo and Heger, n.d. Estimating annual chloride use in Minnesota. Water Resources Center. <wrc.umn.edu/chloride>

Hazards of Chloride



Twin Cities River and Stream Chloride Pollution



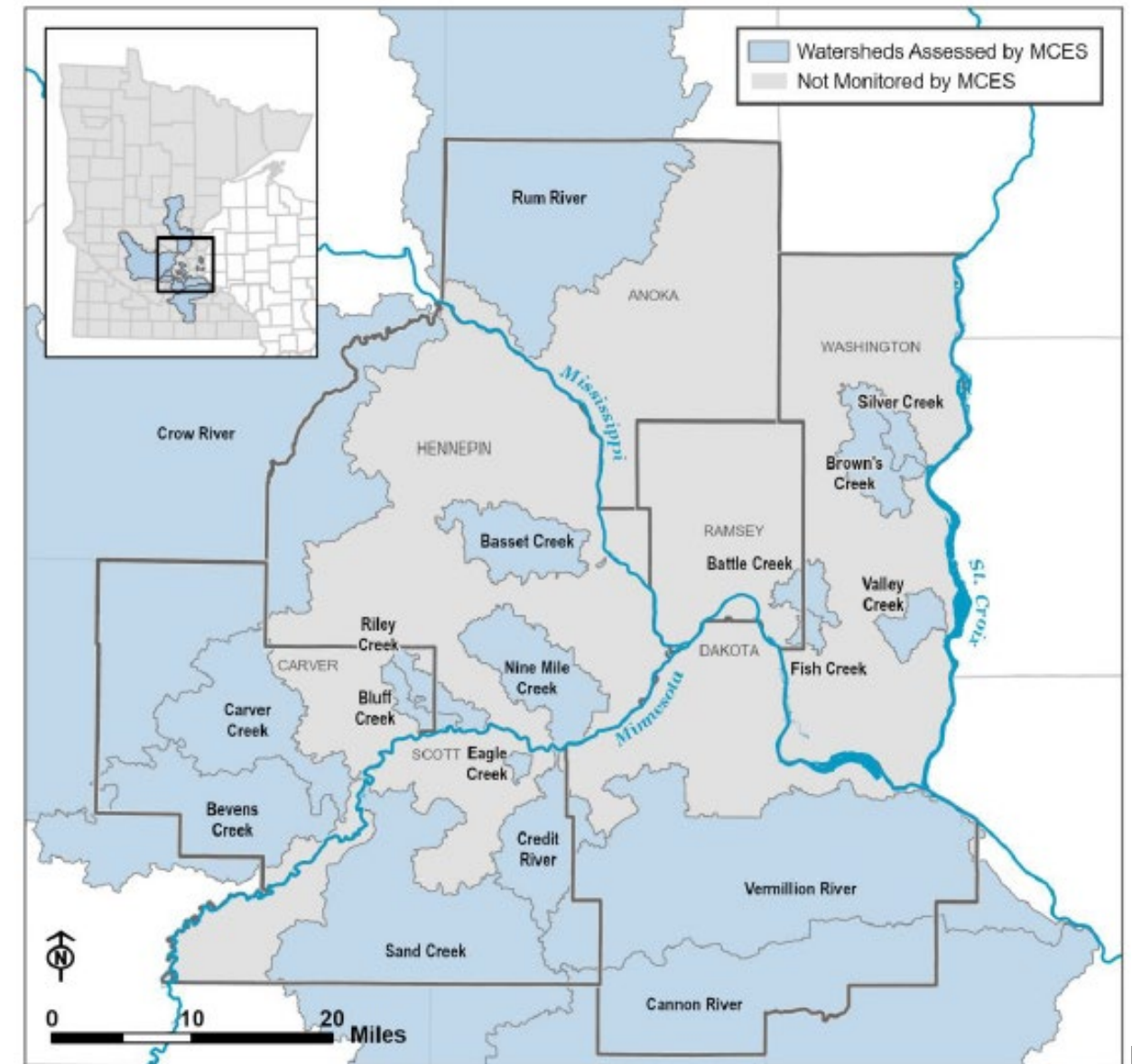
Study Objectives and Watersheds

To understand

- Current chloride conditions and changes over time
- Major impact factors
- Chloride budgets in metro area

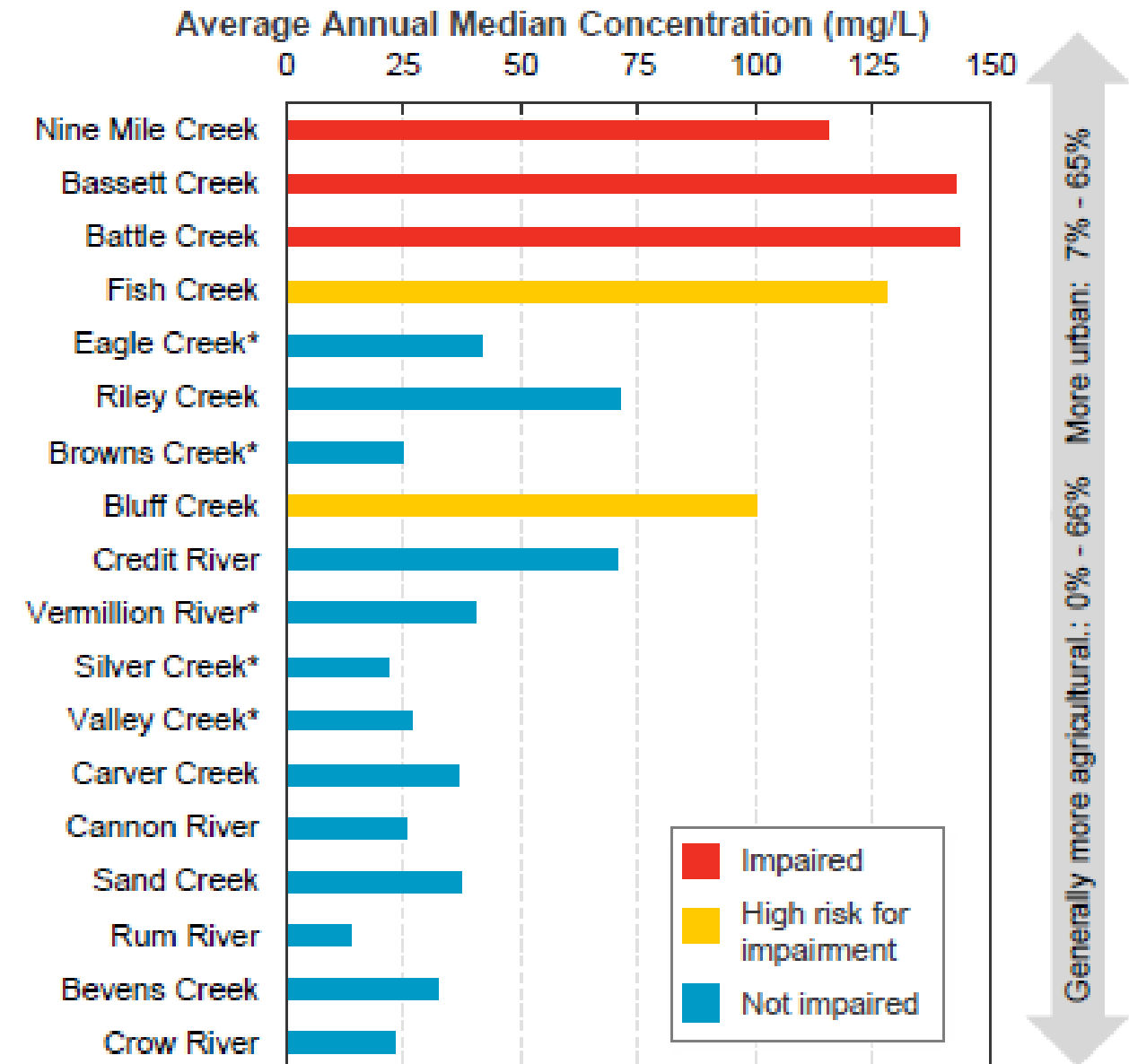
18 metro streams

- Various watershed sizes and locations
- Urban, agricultural and mixed natural land uses
- Three chloride impaired streams
- Five groundwater-dominated streams



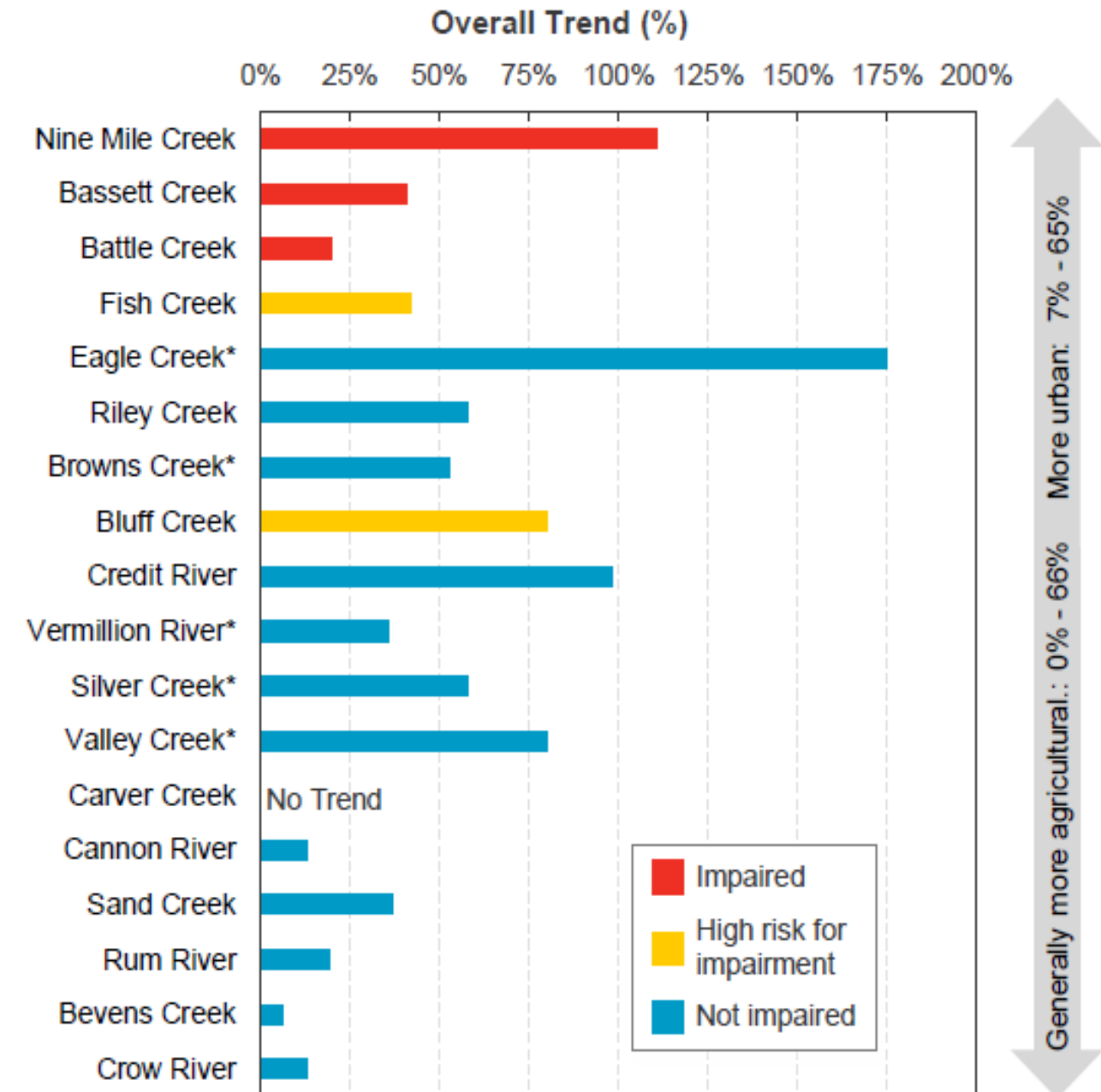
Stream Chloride Conditions

- Chloride concentrations varied significantly in streams
- High chloride concentrations found in more urbanized watershed streams
- Relatively low chloride concentrations in groundwater-dominated streams
- No apparent difference in three major river basins



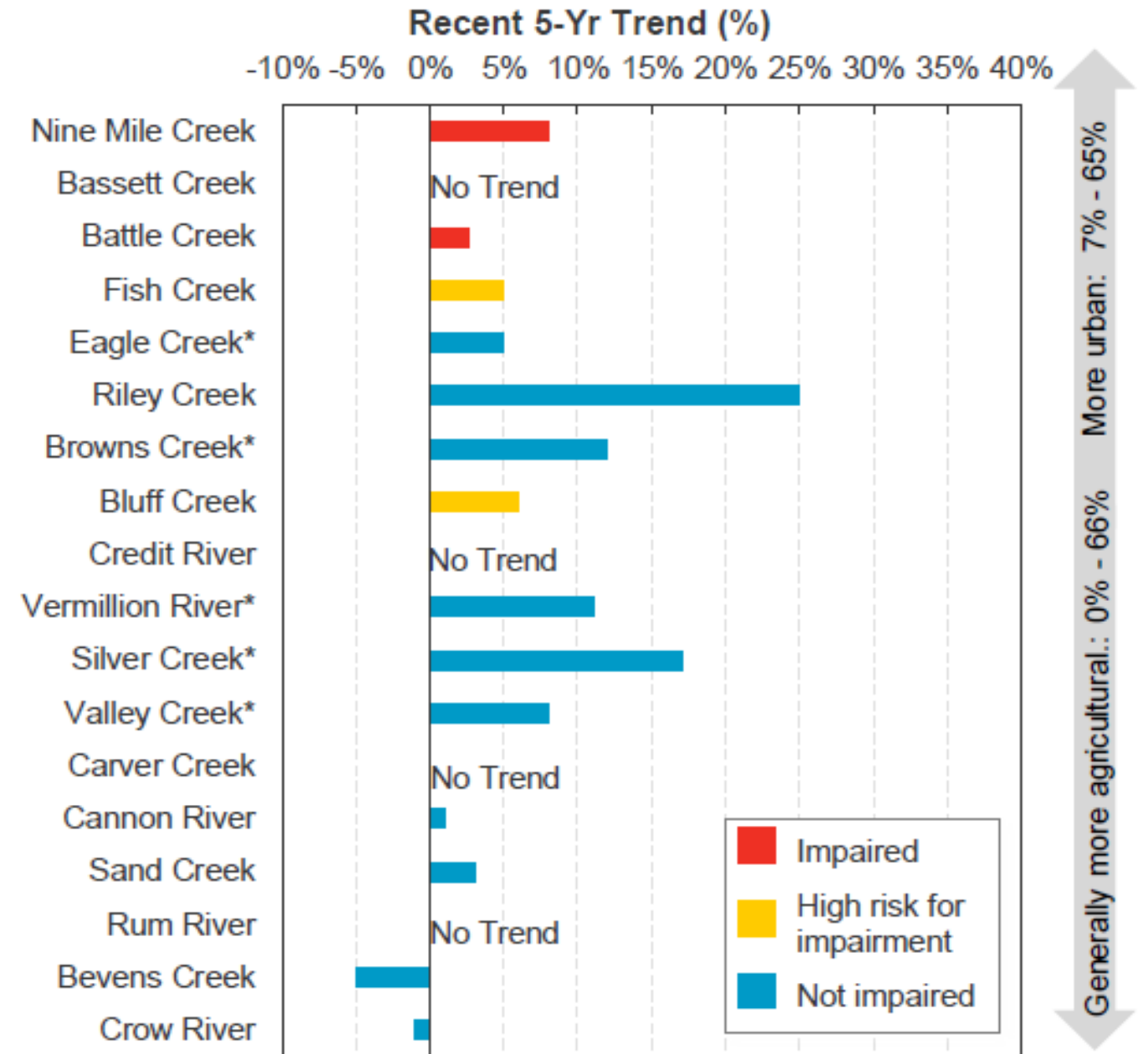
Overall Trends (1999 – 2019)

- Increases across all region except Carver Creek
- Chloride more than doubled during the last ten years in three streams
- Relatively large increases in groundwater-dominated streams
- No apparent difference in three major river basins



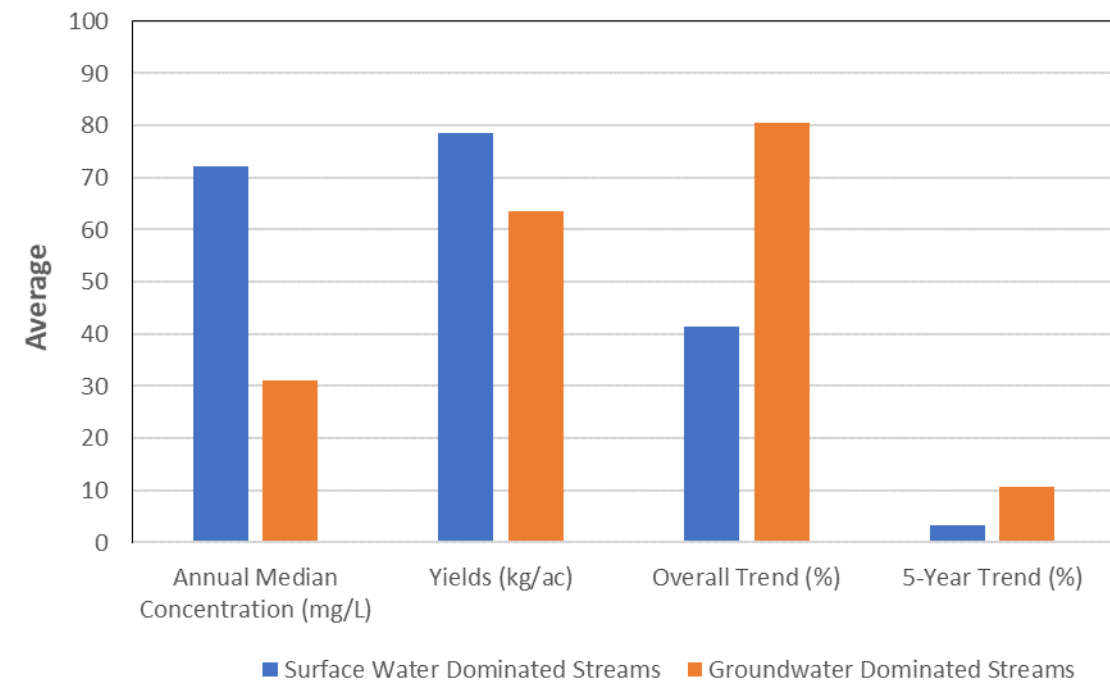
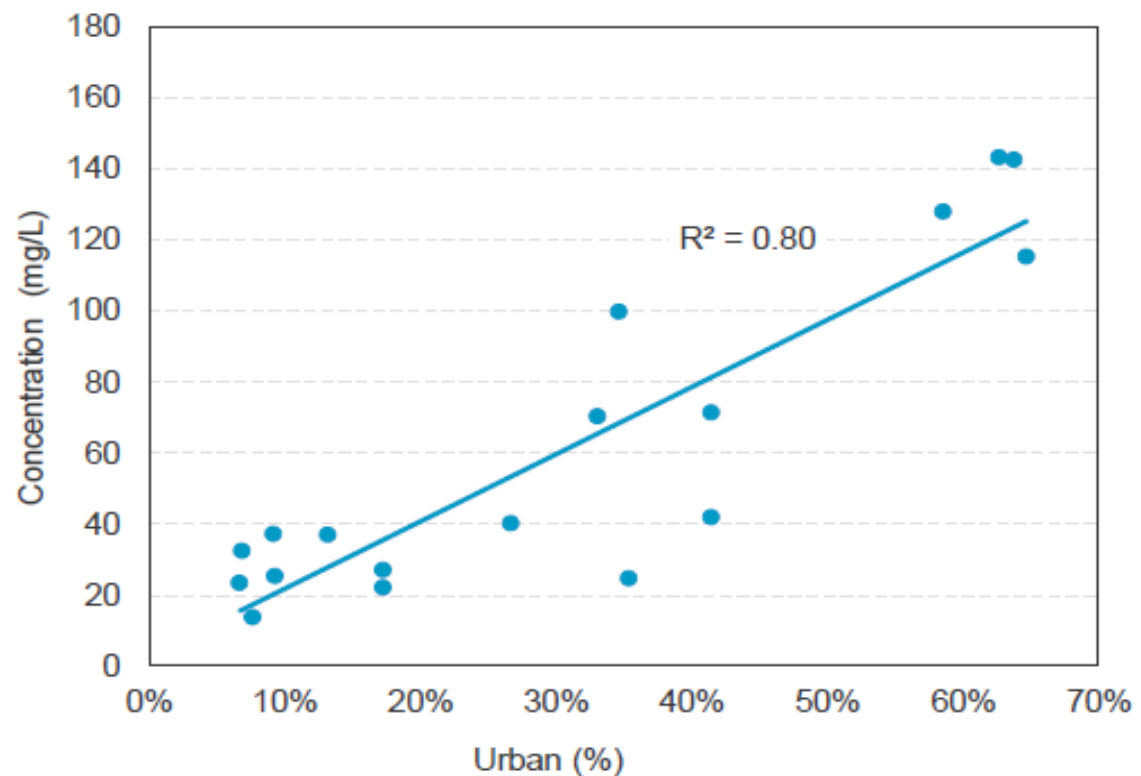
Recent 5-Year Trends (2015 – 2019)

- Mixed trends
 - 12 increase
 - 4 stable
 - 2 decline
- Slower increasing rates except one stream
- Relatively large increases in groundwater-dominated streams



Impact of Urbanization and Groundwater

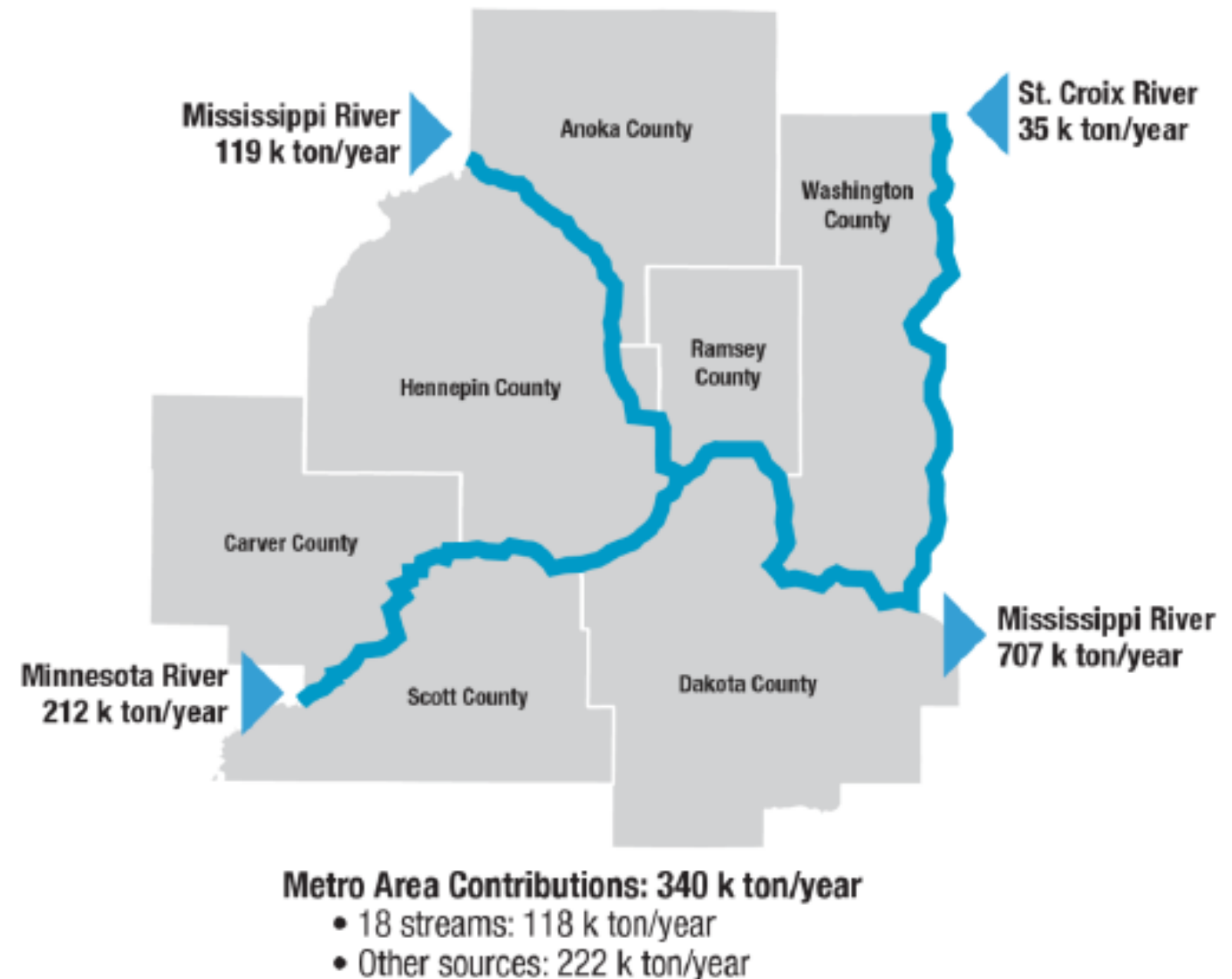
- Chloride concentration is highly correlated to urban land use ($R^2 = 0.80$)



- Lower concentration but larger increase generally observed in the groundwater-dominated streams

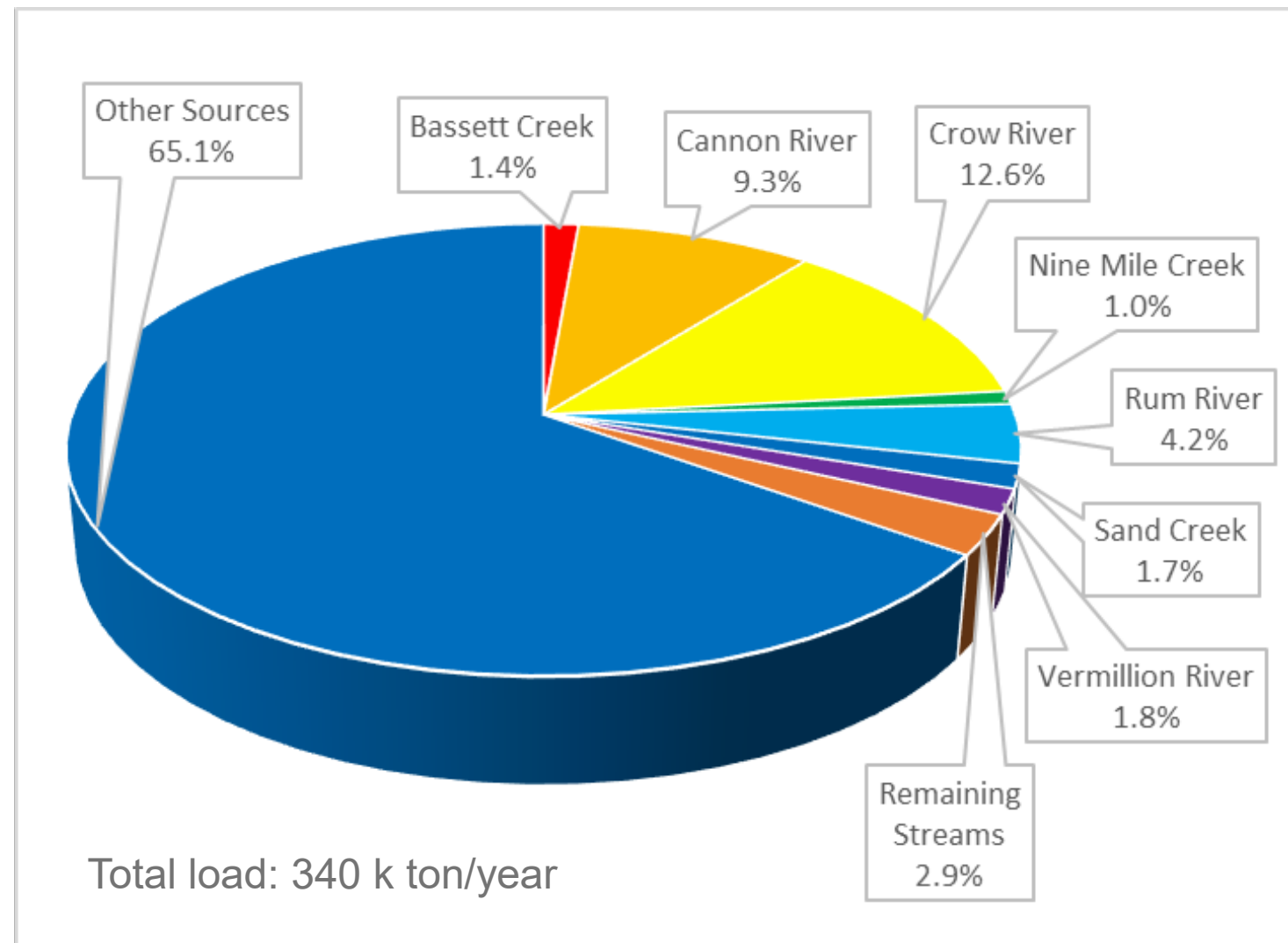
Metro Chloride Budgets

- Flow-in: 366k ton/year
 - Minnesota River: 30%
 - Mississippi River: 17%
 - St. Croix River: 5%
- Flow-out: 707k ton/year
- Chloride load almost doubled when flowing through the metro area
- Metro area: 340k ton/year
 - 18 Stream: 118 k ton/year
 - Other sources: 222 k ton/year



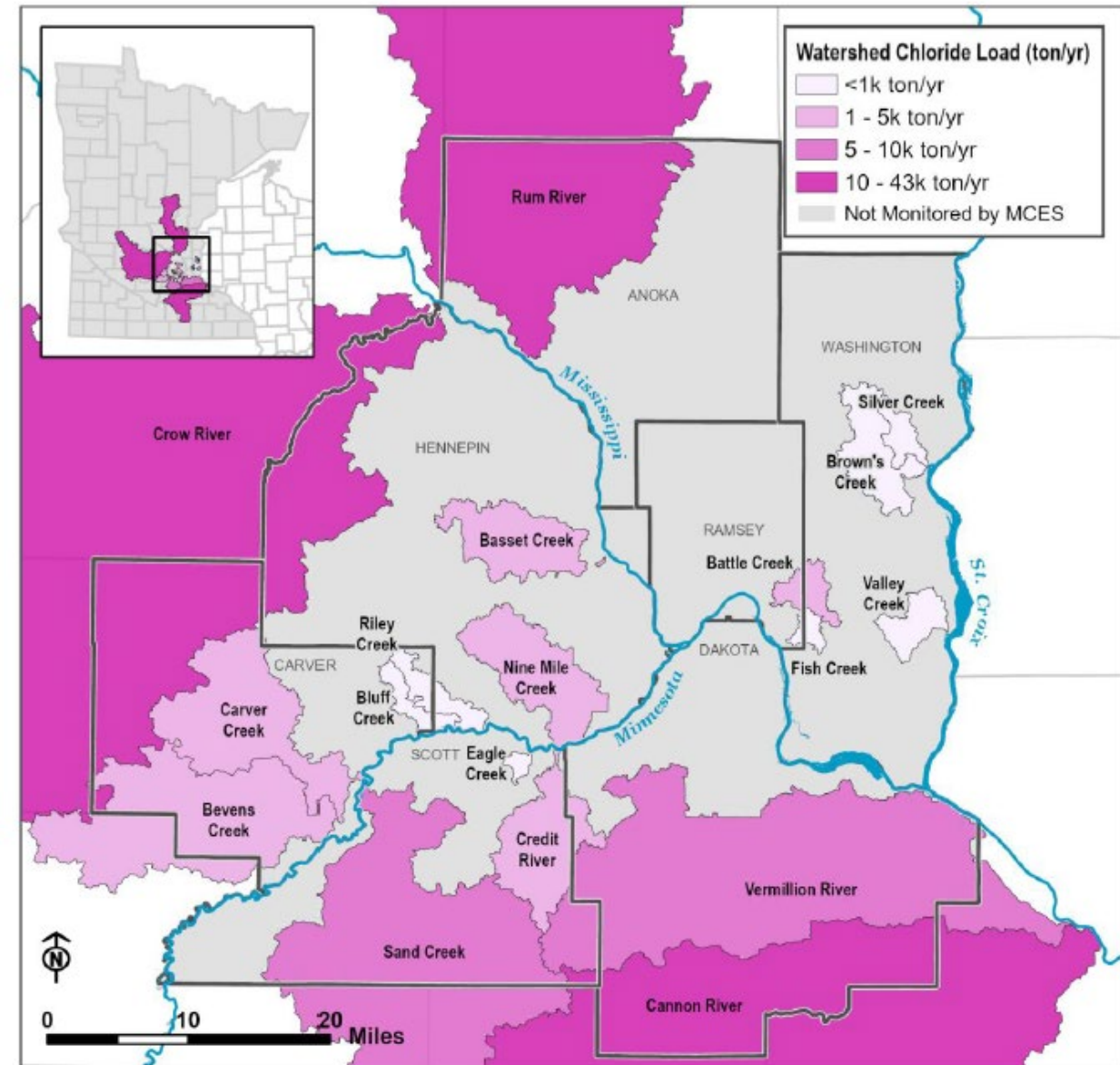
Metro Chloride Sources

- Studied streams: 35%
 - Three large rivers: 26%
 - The remaining 15 streams: 9%
- Other unstudied sources: 65%



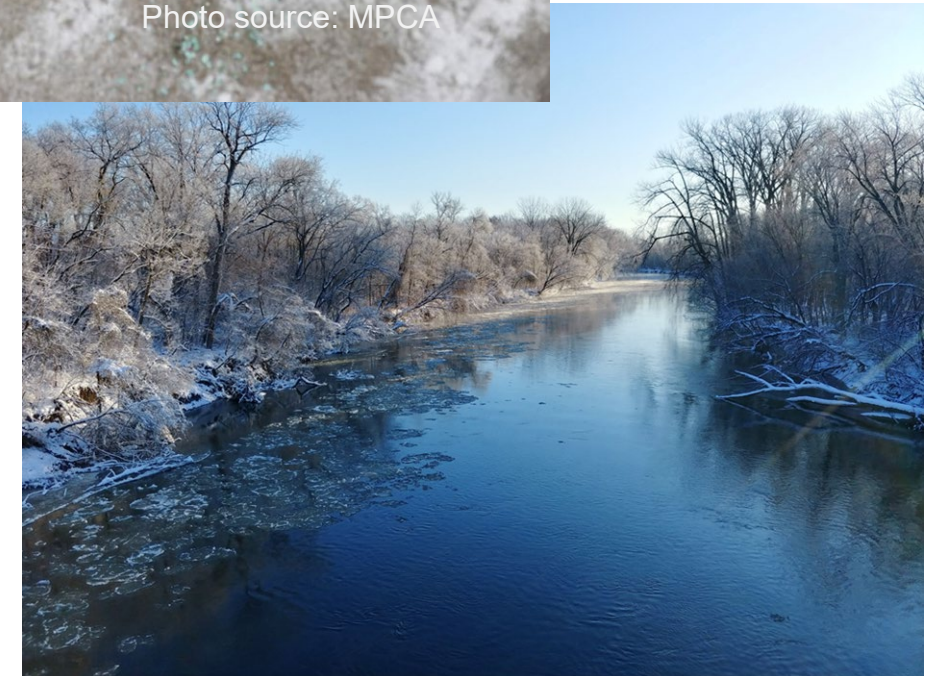
Impact of Metro Streams on Regional Rivers

- 17 of 18 assessed streams showed a potential impact
- Three large rivers contributed most chloride loads
- Most of the streams had a small impact on overall river water quality



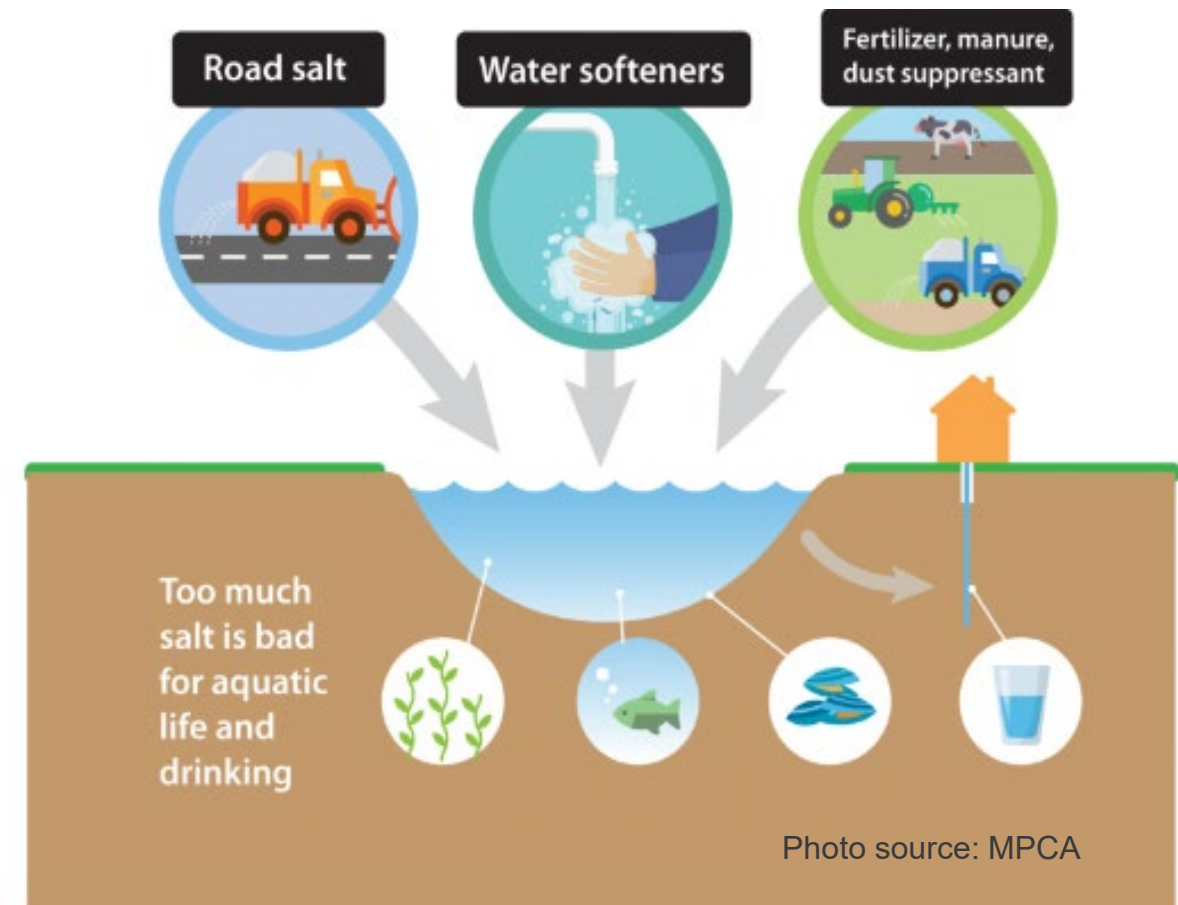
Key Findings

- Chloride concentration varied significantly in streams
- Chloride increased across region in the last 20 years
- The increases were mostly slowed down in the recent 5 years
- High chloride concentrations were related to urban land use




Key Findings

- Groundwater showed a potential impact
- Chloride load almost doubled in regional rivers when flowing through the metro area
- Major metro chloride sources:
 - Winter deicing
 - Fertilizer application
 - Household and industrial water softening
 - Atmospheric deposition



Partner Communications and Feedback

“Thank you for this great information! It's a very well-done memo and I included it in my [Bassett Creek WMC board] meeting materials this month as an informational item”



Bassett Creek CHLORIDE
www.metrocouncil.org
ENVIRONMENTAL SERVICES

KEY FINDINGS

Chloride concentrations, after adjustment for variation due to flow conditions, may have stabilized in Bassett Creek from 2013-2019. If so, this stabilization is possibly due to action taken in the watershed, including implementation of chloride best management practices.

Most chloride is exported from Bassett Creek between April and June. Full understanding of seasonal chloride dynamics in the watershed, including an understanding of chloride transport in shallow groundwater.

INTRODUCTION

The Metropolitan Council Environmental Services (MCES) is committed to monitoring and protecting our streams and tributary rivers and works with its partners to maintain and improve water quality. Our efforts are supported by the collection and analysis of high-quality, long-term monitoring data.

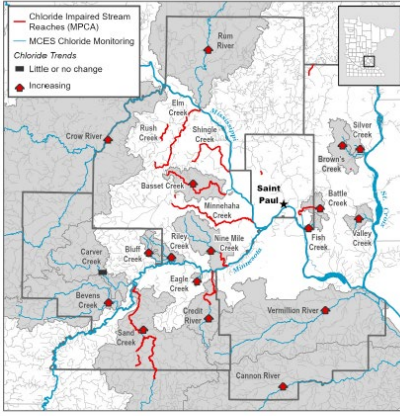
In 2014, *Comprehensive Water Quality Assessment of Select Metropolitan Area Streams* was published. This report analyzed water quality trends for streams and tributary rivers in the Twin Cities. At the time, chloride levels were a concern. By 2019, our monitoring work provided sufficient data to assess chloride trends. Meanwhile, concern about chloride pollution has increased for watersheds across the region. This memo includes information about chloride sources and timing of chloride loading to streams, and answers the following questions:

- How has in-stream chloride changed over time?
- How have upland watershed activities impacted in-stream chloride levels?
- What can monitoring data tell us about chloride sources and pathways?

During the analysis period, Bassett Creek Watershed Management Committee (Bassett Creek WMC) was formed. Bassett Creek WMC includes representatives from Plymouth, Minnetonka, Robbinsdale, and Minneapolis, the majority of Golden Valley, and all of St. Louis Park. The Minnesota Department of Transportation has been actively addressing chloride issues through equipment upgrades, salt application changes, pilot projects and other measures.

This memo provides data and analyses from Bassett Creek with state and regional context. This information has prompted questions from MCES staff and other stakeholders. This memo is intended to initiate a dialog about regional chloride issues.

REGIONAL ASSESSMENT OF CHLORIDE IN SELECT TWIN CITIES METRO STREAMS (1999 - 2019)



METROPOLITAN COUNCIL — ENVIRONMENTAL SERVICES
www.metrocouncil.org

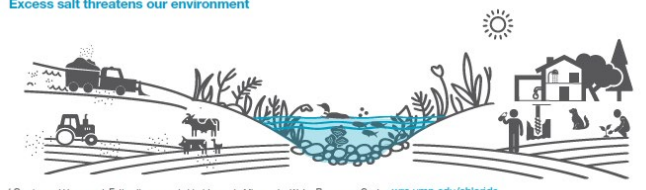
Preserving our region's streams
How to reduce rising chloride levels in local waterbodies

Chloride levels have increased in Twin Cities waterbodies. Over a two-decade span, the Met Council studied annual chloride concentration levels and trends for 18 streams in the seven-county metropolitan area. The recently published report — *Regional Assessment of Chloride in Select Twin Cities Metro Streams (1999 - 2019)* — reveals that nearly all the streams are experiencing rising chloride levels.

What's at risk?
More than **1.1 million tons** of chloride is released to the environment annually in Minnesota — damaging infrastructure, compromising drinking water, and threatening pets, wildlife, and aquatic organisms.

Currently, 42 Twin Cities waterbodies are contaminated with excess chloride levels.¹ Chloride pollution in water is permanent. There's no way to remove it — so it's critical we reduce chloride sources and uses immediately.

Excess salt threatens our environment



¹ Overbo and Heger, n.d. Estimating annual chloride use in Minnesota. Water Resources Center. wrc.umn.edu/chloride



“[we are] planning to summarize [the partner memo] and send it out in our [Riley, Purgatory and Bluff] creek fact sheets”

“.... a Nine Mile Creek WD board member...[called and] thanked and complimented us profusely for the Nine Mile memo”

Questions

Casandra Champion and Dr. Hong Wang

Principal Environmental Scientists

Metropolitan Council Environmental Services

390 North Robert Street, St. Paul, MN55101

www.metrocouncil.org

casandra.champion@metc.state.mn.us

hong.wang@metc.state.mn.us