



# Chloride in Minnesota Waters

## Understanding impacts of salt use on Minnesota surface waters and groundwater

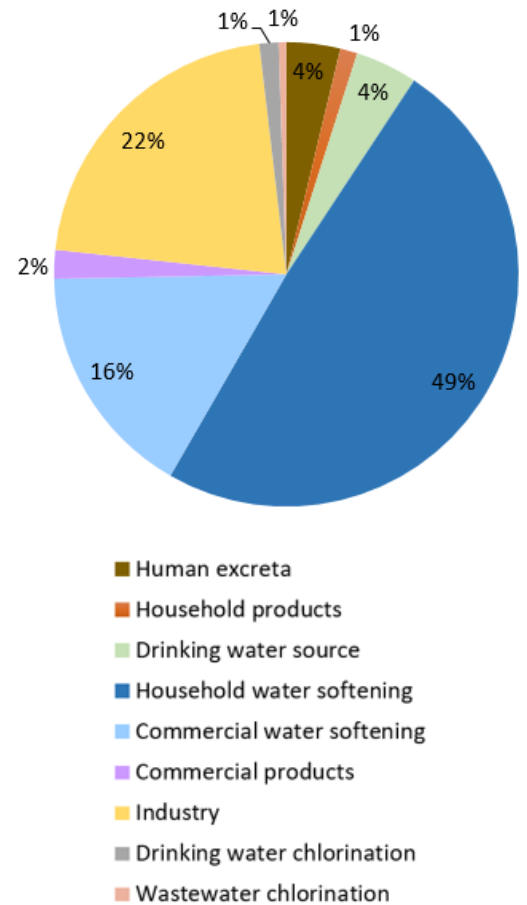
Chloride levels in many surface waters are increasing and pose an emerging environmental concern, since elevated chloride levels are harmful to aquatic life. There are 50 lakes, rivers, and streams in Minnesota with chloride water quality impairments, and an additional 75 water bodies that are at high risk of chloride impairment. Chloride levels in groundwater are also elevated, particularly in the Twin Cities Metropolitan Area.

Researchers at University of Minnesota Water Resources Center conducted a three-year research project to evaluate the impact of chlorides used for water softening on Minnesota water quality.

The study found that:

- Water softeners were the largest chloride source discharging to wastewater treatment plants (WWTPs) statewide, contributing **136,400 t** annually;
- Road salt infiltration was found to be a minimal chloride source to most WWTPs;
- Industry is a major source of chloride to WWTPs, and an unknown proportion of this discharge is from water softening.

In the statewide chloride budget, road salt and fertilizer were also found to be substantial chloride sources. However, fertilizer may be a less important source since it is applied over large land area.



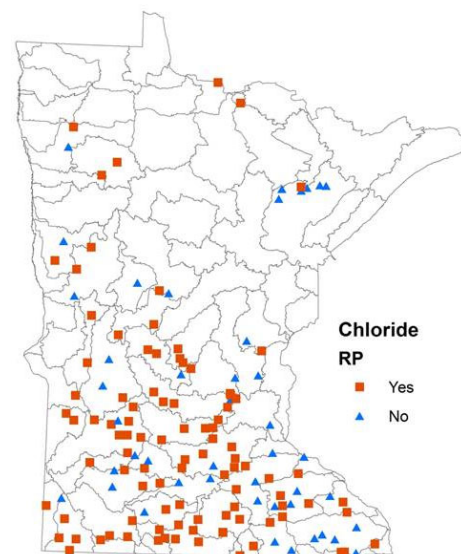
### Chloride contributions to WWTPs

It is estimated that **65%** of chloride discharged from WWTPs across the state is from residential and commercial water softening.

# Water softening

Much of Minnesota has hard water, characterized by high calcium and magnesium concentrations, and water softeners are commonly used to remove these minerals. Softened water provides benefits such as improved lather and reduced staining on washed dishes and clothing. Most water softeners in households are ion exchange softeners that use sodium chloride salt to remove hardness. The sodium chloride used by the water softener is eventually discharged to wastewater treatment plants or septic systems.

Approximately 100 communities across the state have high chloride levels in their wastewater treatment plant discharge that may exceed state water quality standards (see *right*). Estimating chloride from water softeners provides valuable information to wastewater treatment plant operators, regulators, and community members to identify potential opportunities for chloride reduction and attaining water quality standards.



Read the final research report and case studies on chloride issues in Minnesota at [www.wrc.umn.edu/watersoftening](http://www.wrc.umn.edu/watersoftening)

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## Statewide annual chloride contributions from major point and nonpoint sources

Source	Chloride mass (t)	Per cent of total
WWTPs	209,900	22%
Permitted industries	14,200	1%
Residential septic systems	33,100	3%
Fertilizer use	221,300	23%
Livestock waste	62,600	6%
Atmospheric deposition	14,200	1%
Dust suppressant use	9,400	1%
Road salt use	403,600	42%
<b>Total</b>	<b>968,300</b>	<b>100%</b>

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