

Analysis of the Effects of Road Salt on Water Quality in the Northern United States

John R. Mullaney¹, David Lorenz², Allan Arntson²

¹U.S. Geological Survey, Connecticut Water Science Center, 101 Pitkin Street,
East Hartford, Connecticut 06108

²U.S. Geological Survey, Minnesota Water Science Center, 2280 Woodale Drive,
Mounds View, Minnesota 55112

Biographical Sketches of Authors

John Mullaney is a hydrologist in the USGS Connecticut Water Science Center. Over the last 20 years he has worked on a variety of projects that relate land use to ground-water and surface water quality.

David Lorenz is a hydrologist with the US Geological Survey, specializing in surface water and water-quality studies. Since 1991, he has been involved with local, regional, and national aspects of the National Water-Quality Assessment Program of the USGS.

Mr. Arntson earned a Bachelor of Civil Engineering degree from the University of Minnesota. He has been a hydrologist with the U. S. Geological Survey in Minnesota for 30 years and has worked on a variety of hydraulic and hydrologic studies from step-backwater models to watershed system models.

Abstract

Data collected from 1993-2004 by the U.S. Geological Survey National Water Quality Assessment Program (NAWQA) in northern glaciated parts of the United States were analyzed for relations among concentrations of road-salt related chemicals in ground water and surface water and ancillary factors including land use, hydrology and climate.

Significant variables for predicting the natural log of chloride concentrations in shallow ground water include the mean annual frequency of one inch or greater snowfall, the percentage of road area in a 500-meter buffer around the well, and the ground-water recharge rate. Variables that are significant in predicting maximum chloride concentrations in surface water include road density, potential evapotranspiration, and the percentage of total runoff from overland flow.

Typical chloride concentrations in ground water and surface water in selected forested areas in the study area were less than 10 milligrams per liter (mg/L). The maximum concentration of chloride in shallow ground water underlying urban areas was 800 mg/L and the median concentration was 38 mg/L. Chloride concentrations were as large as 4,300 mg/L in surface water in 27 selected urbanized basins averaging 51 square miles. The median of the maximum concentrations in samples from the 27 basins was 190 mg/L.

Yields of chloride from the selected surface-water basins were typically less than 10 tons per square mile per year in forested basins and greater than 50 tons per square mile per year from urban basins.