

Title: Digital Simulation of Solute Transport to Green Bay and Lake Michigan by Groundwater from Door County, Wisconsin (Study No. 51)

Investigators: Principal Investigator

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Period of Contract: July, 1987 through September, 1990

Objectives: To quantify the delivery of solutes via groundwater from Door County to the bay of Green Bay and Lake Michigan and assess effects of human activities on concentrations of chloride, nitrate, lead in groundwater with a digital transport model.

Background/Need: Previous studies have quantified the flow of groundwater in the Great Lakes, though little has been done to assess the magnitude of chemical inputs from groundwater. Recently several major studies have been done in Door County measuring quantities of groundwater seepage, though none have attempted quantification of the chemical transport of groundwater.

Methods: The finite element model SUTRA (for saturated, unsaturated transport) was adapted to simulate the movement of water and chemicals through the dolomite aquifer. Wells were sampled for chloride, nitrates and lead from private and public wells in a network designed to determine concentrations countywide, emphasizing shorelines. Collections were taken from wells on five different occasions between July of 1987 and June of 1989. Collections were made within a two- to four-day period on each occasion.

Results: A total of 64,800 cubic meters (m³) of groundwater carrying 285 kilograms (kg) of chloride and 268 kg of nitrate enter Green Bay and Lake Michigan on an average day. Green Bay receives only 38% of the water discharge (24,600 m³), but 58% of the chlorides (165 kg) and 50% of the nitrates (134 kg). Discharge and chemical loads tend to be concentrated in embayments due to the penetration of the bays into the aquifer.

The dominant sources of chemical loading to groundwater on the Door Peninsula are agricultural land usage and the approved septic waste spreading areas. These contribute 46% and 25% of the chloride load, respectively, and 63% and 18% of the nitrate load. Lead was also examined but was detected in only 3 of the monitoring wells of the study.

Conclusions:

Investigators concluded that agricultural land uses and septic waste disposal sites are the two largest contributors to chloride and nitrate loads. Lead is derived entirely from lead arsenate pesticide use in the past on orchards.

Availability of Report:

This report is available for viewing and loan at:

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Related Publications:

Cherkauer, Douglas S. and McKereghan, Peter, 1990. Groundwater Discharge to Lakes Focusing in Embayments. *Journal of Groundwater*, 32 pp.

McKereghan, Peter Fleming, 1988. Digital Simulation of Chloride Transport in the Silurian Dolomite Aquifer in Door County, Wisconsin. Unpubl. M.S. Thesis, University of Wisconsin-Milwaukee, Milwaukee, Wisc., 137 pp.

Schalch, Linda H., 1989. A Digital Simulation of Nitrate Transport within the Dolomite Aquifer System Underlying Door County, Wisconsin. Unpubl. M.S. Thesis, University of Wisconsin-Milwaukee, Milwaukee, Wisc., 145 pp.

Key Words:

Chloride, Door County, lead, models, nitrate-nitrogen.

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