

Baseline Water Quality of Minnesota's Principal Aquifers: Region 2, North-Central Minnesota

GWMAP, March 1999

What was the baseline study?

Between 1992 and 1996, the Minnesota Pollution Control Agency's (MPCA) Ground Water Monitoring and Assessment Program (GWMAP) sampled 954 primarily domestic wells across Minnesota. The goal of this study, called the baseline study, was to determine ambient water quality in Minnesota's principal aquifers.

What parameters were sampled?

Each well was sampled for 48 inorganic chemicals, such as nitrate, chloride, arsenic and metals; 68 volatile organic compounds (VOCs), such as benzene; other parameters, such as pH and temperature; total dissolved solids and total organic carbon. In addition, selected wells were tested for tritium, an indicator of water less than 50 years old.

What is Region 2?

The MPCA has divided Minnesota into six regions. Region 2 encompasses the north-central portion of the state and includes the counties of Benton, Cass, Chisago, Crow Wing, Hubbard, Isanti, Kanabec, Mille Lacs, Morrison, Pine, Sherburne, Stearns, Todd, Wadena and Wright. The regional office is in Brainerd.

How many wells were sampled and in which aquifers?

Between 1994 and 1996, 238 wells in Region 2 were sampled. Of these 238 samples, 99 were collected from wells completed in surficial sand and gravel aquifers, 90 were from wells completed in buried confined sand and gravel aquifers,

five were from wells that draw from Cretaceous aquifers, 19 were from wells that draw from Precambrian aquifers, and 25 were from wells that draw from Paleozoic aquifers, such as the Mt. Simon.

What is the quality of ground water in Region 2?

Ground water quality in most aquifers of Region 2 is very good. Concentrations of most chemicals were similar to or lower than concentrations in similar aquifers statewide. The number of exceedances of drinking water criteria are shown in the table on the back of this page. Nitrate is the chemical of greatest concern in Region 2. Seven percent of wells sampled from surficial sand and gravel aquifers exceeded the drinking criteria for nitrate, compared to the statewide rate of 3.4 percent. Thirty-six percent of samples exceeded a nitrate concentration of 1 mg/l (1 part per million), indicating probable human sources of nitrate. The surficial sand and gravel aquifers appear to be sensitive to human activity, such as septic systems and agriculture. The buried sand and gravel, Precambrian, Cretaceous and Paleozoic aquifers are usually well protected from human impacts, unless contaminated locally from point sources. They may, however, have high natural concentrations of chemicals, such as boron, manganese, iron and arsenic. VOCs were found in 25 wells. The primary VOCs were chemicals associated with fuel oils, gasoline and well disinfection. All VOCs were below drinking water standards.





| Parameter | Number of exceedances of drinking criteria | | | | |
|----------------------------|--|------------|-------------|------------------------|---------------------------|
| | Paleozoic aquifers | Cretaceous | Precambrian | Buried sand and gravel | Surficial sand and gravel |
| Arsenic (As) | 0 | 0 | 0 | 1 | 0 |
| Beryllium (Be) | 0 | 1 | 2 | 1 | 1 |
| Boron (B) | 0 | 0 | 3 | 3 | 0 |
| Manganese (Mn) | 2 | 0 | 1 | 2 | 4 |
| Nickel (Ni) | 0 | 0 | 1 | 0 | 0 |
| Nitrate (NO ₃) | 0 | 0 | 1 | 1 | 7 |
| Selenium (Se) | 0 | 0 | 0 | 0 | 1 |
| Thallium (Tl) | 1 | 1 | 0 | 0 | 0 |
| Vanadium (V) | 0 | 0 | 1 | 0 | 0 |

What are the primary research needs in Region 2?

Research needs for Region 2 include:

1. quantifying recharge rates to surficial sand and gravel aquifers;
2. studying ground-surface water interactions for recreational lakes and major rivers;
3. quantifying the relationship between land use and water quality, particularly for unsewered communities, irrigated agriculture, and storm water capture and discharge impacts to wetlands, lakes and hydrologic systems;
4. determining whether changes in pumping, particularly for irrigation, increase nitrate concentrations in deeper portions of the surficial aquifers.
5. developing computer models to predict impacts to ground water when land use changes; and
6. sampling for pesticides and metabolites in the upper few feet of surficial aquifers.

What are the primary monitoring needs for Region 2?

Monitoring needs for Region 3 include:

1. collecting additional samples from Precambrian and Cretaceous aquifers;

2. establishing a central database for water quality of surficial aquifers; and
3. establishing an ambient monitoring network of 100 to 200 wells for nitrates, pesticides and VOCs in surficial aquifers. The network would have 80 percent of the wells screened at the water table; be focused on watersheds with a variety of land uses, where best management practices (BMPs) are implemented, and where land use is changing; and include quarterly sampling for a minimum of 10 years.

What is the role of GWMAP in addressing these research and monitoring needs?

GWMAP discontinued baseline sampling in 1997. We feel the emerging ground water issues are identifying aquifer and regional water quality as impacted by human activity, assessing the effectiveness of environmental policies and programs, and establishing long-term monitoring networks to determine whether water quality is changing in response to human activity. We will strive to work with other ground water programs that deal directly with ground water problems and effectiveness monitoring, and attempt to secure funding for establishing long-term-monitoring networks.