Ground Water Monitoring In The Verdi Wellhead Protection Area

March 2001

In 2000, the Minnesota Pollution Control Agency (MPCA) established a ground water monitoring network in the Verdi Wellhead Protection Area. The network is part of a multiagency effort to protect ground water resources in Southwest Minnesota. This effort includes research, on-farm demonstrations, and development of nutrient management plans.

Project Description

The Verdi well field, in Lincoln County, Minnesota (Figure 1), is one of three critical well fields that supplies drinking water to a large area in Southwestern Minnesota. The associated aquifer has a history of elevated nitrate-nitrogen (nitrate-N_ concentrations. The Southwest Research and Outreach Center, University of Minnesota, Agricultural Research Service, Natural Resource Conservation Service (NRCS), and the Soil and Water Conservation District offices have launched an aggressive education program to modify farmer behavior related to nutrient management. The Minnesota Department of Agriculture has coordinated the project through a grant provided by the Legislative Commission on Minnesota Resources (LCMR). Funding began in 1999, with major activities beginning in 2000. The MPCA monitoring effort described in this fact sheet was not funded by the grant and serves to compliment the grant's goals. Figure 1 shows the location of individual farms where voluntary nutrient management plans are being implemented within the wellhead protection area under a cost-share program administered by the NRCS.

Regional promotion of nitrogen fertilizer Best Management Practices (BMPs) and nutrient management planning are intended to protect ground water. It will take several years to determine if BMPs are protective of ground water quality. Long-term ground water monitoring is needed to evaluate the effectiveness of BMPs.

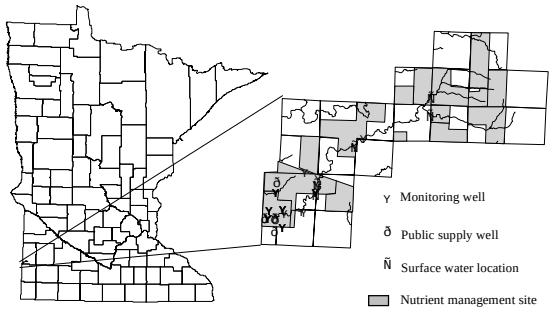

Figure 1

Activities in 2000

In 2000, the MPCA worked with cooperating agencies to establish a ground water monitoring network. The monitoring network includes ten monitoring wells, five public supply wells, and five surface water sampling locations on Spring Creek (Figure 1). Wells and surface water were sampled during Spring and Summer of 2000.

Environmental Outcomes Division

Sampling parameters included nitrate-N, chloride, other inorganic chemicals, and agricultural herbicides. To determine the significance of surface water in aquifer recharge, we also measured streamflow, sampled water quality, and collected samples for stable isotopes of hydrogen and oxygen in Spring Creek.

Results for 2000

The study revealed a loss of approximately 8 million cubic feet (60 million gallons) of water between upstream and downstream locations on Spring Creek in 2000. This loss primarily occurred during May and June (Figure 2) and appeared to contribute to aquifer recharge, as indicated by changes in chloride and organic carbon concentrations in the aquifer in response to stream discharge. Stable isotope data indicate that recharge to the aquifer may be very rapid in some places because temperature signatures in ground water correlated strongly with temperature signatures in stream water.

Nitrate-N concentrations varied across the study area and increased from north to south in the aquifer. Nitrate-N concentrations ranged from less than 1 part per million (ppm) to 11 ppm in monitoring wells and 3 to 10 ppm in Spring Creek. The drinking water standard for nitrate-N is 10 ppm.

Two wells contained detectable concentrations of herbicides. Herbicide concentrations in upstream samples from Spring Creek were 5.59 and 2.26 parts per billion.

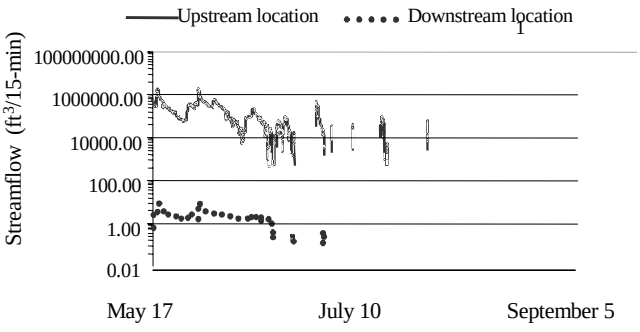

Figure 2

Recommendations

Spring Creek appears to contribute to ground water recharge and may affect concentrations of nitrate-N and herbicides in the aquifer. The significance of Spring Creek's effect on drinking water will depend on climatic variables.

It is apparent that a number of years will be required to fully observe the impacts of the educational and cost-sharing activities. The following activities help meet the project goals.

1. Consolidate the monitoring network under one local or state agency.
2. Sample quarterly for nitrate-N, chloride, dissolved oxygen, and oxidation-reduction potential.
3. Install two or more monitoring wells that are screened near the bottom of the aquifer.
4. Sample surface and ground water annually for herbicides.
5. Collect water level measurements from Spring Creek and two or more monitoring wells.
6. Establish Geographic Information coverages of historical and current land use.
7. Relate monitoring results to changes in human behavior through nutrient management planning.

In 2001, the MPCA will conduct sampling in May, assist with installation of two monitoring wells, collect water level measurements from monitoring wells and Spring Creek, and write an annual report. The MPCA, however, cannot commit to activities beyond January 1, 2002, due to budget constraints. In the event that the MPCA cannot maintain the monitoring network, hydrologists will work with local agencies to transfer long-term monitoring responsibilities.

For further information, you can obtain a copy of the 2000 annual report (*Ground Water Monitoring In The Verdi Wellhead Protection Area – 2000 Annual Report*), access our web address (http://www.pca.state.mn.us/water/groundwater/gwmap/index.html), or contact Erin Eid at (651) 296-8633.