Protecting, maintaining and improving the health of all Minnesotans

DATE: September 1, 2006

TO: Licensed and Registered Well Contractors
Mr. William Patnaude, Beltrami County
Mr. Dennis Zeto, Eckles Township
Mr. Chris Parthun, Beltrami Soil and Water Conservation District
Advisory Council on Wells and Borings

FROM: John Linc Stine, Director
Environmental Health Division
P.O. Box 64975
St. Paul, Minnesota 55164-0975

SUBJECT: Notice of Designation of a Special Well Construction Area in a Portion of Eckles Township, Beltrami County, Minnesota

The Minnesota Department of Health (MDH) is designating a SPECIAL WELL CONSTRUCTION AREA (SWCA), for Sections 13, 14, 23, and 24 which includes portions of Eckles Township northwest of the city of Bemidji in Beltrami County (see Figure 1). The SWCA designation, which becomes effective September 1, 2006, applies to construction, repair, modification, and sealing of wells and borings and remains in effect until further notice.

SITE HISTORY

In Section 14 of Township 147, Range 34, Eckles Township, Beltrami County, previous agricultural practices appear to have resulted in groundwater quality impacts. Testing of new water-supply wells in this area indicate that groundwater in the surficial-sand aquifer contains nitrate-nitrogen concentrations up to 27 milligrams/liter (mg/l).

Some water-supply wells have been constructed through the surficial-sand aquifer and a clay-confining layer, into an underlying confined-sand aquifer. Wells that were cased and fully grouted through the clay-confining layer have nondetectable or low levels of nitrate. Some wells, however, were only grouted to the minimum depth of 30 feet as required under Minnesota Rules, part 4725.3050, subpart 3, which in some cases, was above the clay-confining layer. The deeper annular space on these wells was filled with either cuttings or collapsed material, which does not provide an adequate annular seal. Consequently, although these wells are completed into the confined-sand aquifer and would normally be protected from contamination from the surficial-sand aquifer, they also have nitrate contamination, apparently due to groundwater migrating from the upper-sand aquifer through the annular space around the well casing, into the underlying confined-sand aquifer. The purpose of this SWCA is to increase the potential that water-supply wells will produce safe water and not allow contamination to spread to deeper aquifers.

PUBLIC HEALTH CONCERNS

Nitrate (NO_3) is a chemical compound of nitrogen and oxygen. Nitrate can be naturally found in air, soil, water, and plants. Nitrate can enter groundwater from these natural sources, usually in concentrations of 1 milligram per liter (mg/l) or less, or can result from animal wastes, human wastes, or fertilizers. Elevated nitrate levels in groundwater are usually caused by seepage from barnyards and feedlots, excessive fertilizer application, or septic systems.

Nitrate in drinking water poses a risk to infants under six months of age. Consuming water with a high nitrate concentration, such as in formula preparations, may produce a condition known as "blue baby syndrome" (or "methemoglobinemia"). Bacteria in the infant's digestive system can convert nitrate to nitrite (NO_2), which then interferes with the ability of the infant's blood to carry oxygen. If nitrate levels are high enough, the infant may die. As the infant matures, the child's digestive system becomes more acidic, reducing the numbers of nitrate-converting bacteria. People with reduced stomach acidity, people with certain blood disorders, and pregnant women may also be susceptible to nitrate-induced methemoglobinemia.

The Maximum Contaminant Level (established by the U.S. Environmental Protection Agency) for nitrate in drinking water served by public water supplies is 10 mg/l as nitrate-nitrogen. The Health Risk Limit (established by the Minnesota Department of Health) for nitrate is also 10 mg/l as nitrate-nitrogen. The Health Risk Limit is the recommended standard for private water systems.

HYDROGEOLOGY

This area of Eckles Township has 15-35 feet of surficial sand, identified as an outwash sand deposited by glacial meltwater (USGS 1989). This sand is an unconfined aquifer, with static water levels of approximately 10-15 feet below the ground surface. In the northeast quarter of Section 14, a continuous clay layer, having a thickness of 15-50 feet, underlies the surficial sand unit (WSN 2000). The clay layer is glacial till or a glacial lake deposit (USGS 1989). However, the continuity of the clay layer is unknown. Some well records (i.e., Minnesota Unique Well Numbers 722522, 722523) beyond this quartile indicate the presence of this unit while other records (i.e. 213456, 564746) do not. Regardless of the presence of the clay layer, sand continues to a depth beyond 100 feet. In the Bemidji area, this clay layer serves as a confining layer to the underlying confined aquifer, which is up to 60 feet thick (USGS 1989). The entire thickness of glacial deposits in the Bemidji-Bagley area is up to 550 feet, making it likely that additional aquifer units and confining layers may be present (Oakes and Bidwell, 1968). Figures 2 and 3 delineate and provide a cross section through the northeast quartile of Section 14, showing the major geologic features discussed above. In terms of yield, both of the surficial and upper confined aquifers are considered to be highly productive (USGS 1989).

Groundwater flow is not well defined, but is expected to be to the east-southeast towards Lake Bemidji and the Mississippi River, which is the regional discharge for both the unconfined aquifer and the uppermost confined aquifer. However, local groundwater flow patterns may discharge to local wetlands and smaller water bodies and may be influenced by heavy withdrawals, such as those associated with irrigation wells.

In 1989, the United States Geological Survey (USGS) noted that the unconfined, surficial-sand aquifer is susceptible to contamination from land use activities while the confined aquifer is relatively well protected (USGS 1989). These observations have been confirmed with findings of nitrate concentrations consistently exceeding 20 mg/l in the unconfined-sand aquifer in the northeast quartile of Section 14. The clay-confining layer appears to prevent natural migration into the underlying confined-sand aquifer. Wells that have been completed in this confined-sand aquifer and grouted through the clay-confining layer show much lower or no detectable nitrate concentrations. However, wells that were completed in the confined-sand aquifer but not grouted into or through the clay-confining layer show nitrate levels more consistent with the surficial-sand aquifer. In those wells that were not grouted into or through the clay-confining layer, it appears that groundwater from the surficial-sand aquifer has migrated through the annular space around the casing into the confined-sand aquifer.

BOUNDARIES OF THE SPECIAL WELL CONSTRUCTION AREA

The location of the SWCA is shown in Figure 1 and includes Sections 13, 14, 23, and 24 of Township 147, Range 34, Eckles Township, Beltrami County. The SWCA is broken into two zones (Zone A and Zone B), with different requirements for each zone.

Zone A consists of the NE¼ and the N½ of the SE¼ of Section 14 of Township 147, Range 34, Eckles Township. Zone B consists of the remainder of Section 14 and Sections 13, 23, and 24 of Township 147, Range 34, Eckles Township.

REQUIREMENTS IN THE SPECIAL WELL CONSTRUCTION AREA

All wells and borings regulated by the MDH are subject to the requirements of this SWCA. Wells include water-supply wells (domestic, public, irrigation, commercial/industrial, cooling/heating, remedial), monitoring wells, and dewatering wells. Borings include elevators, environmental bore holes, and vertical heat exchangers. Permit applications and notifications must be submitted to the MDH.

The requirements for Zone A and Zone B are as follows:

ZONE A

1. Construction, or modification of the depth, of a well or boring within Zone A may not occur until plans have been reviewed and approved by the MDH. In addition to the normally required notification or permit, the plan must include the following information: street address; well or boring depth; casing type, diameter, and depth; construction method(s), including grout materials and grout methods; well pumping rate; and well use. A well or boring that penetrates the clay-confining layer must be cased and completely grouted through the clay-confining layer(s) to within 10 feet of the well screen.

2. No potable water-supply wells may be completed in the surficial-sand aquifer in Zone A. For purposes of this SWCA, potable uses include any consumptive uses, such as drinking, cooking, bathing, manufacturing or processing food, drink, or pharmaceuticals, or to supply water to fixtures accessible to humans.

3. Special construction and/or monitoring requirements may be imposed on well/boring completion and use in order to protect public health and groundwater quality and to prevent contaminant migration. These requirements will be based on available knowledge of groundwater contamination and movement near the well site and the proposed use and pumping rate of the well.

4. In addition to plan approval by MDH, contractors must contact the MDH Bemidji district office by phone at least 24 hours and one business day (Monday-Friday) prior to the start of construction of a new well/boring or modification of the depth of an existing well/boring in Zone A to enable MDH to be on site during work.

5. Sealing of wells and borings in Zone A may not occur until plans have been reviewed and approved by the MDH. In addition to the normally required notification, the plan must include the following information: street address; well or boring depth; casing type, diameter, and depth; grout depth (if applicable), presence of open annular spaces, and proposed sealing method, including grout materials and grout placement. For those wells that are cased through a confining layer(s) and may have an ungrouted annular space around the casing, the MDH may require that the well casing be removed, perforated, or overdrilled through the confining layer(s) to enable proper sealing both inside and around the casing.

6. Contractors must contact the MDH Bemidji district office by phone at least 24 hours and one business day (Monday-Friday) prior to the start of sealing a well or boring within Zone A.

7. All provisions of Minnesota Rules, Chapter 4725, are in effect.

ZONE B

1. For wells and borings to be located within Zone B, well contractors must contact the MDH Bemidji district office by phone at least 24 hours and one full business day (Monday-Friday) prior to start of drilling to enable MDH staff to be on site during drilling in order to determine geology and to provide well contractors with current information on the hydrogeology and water quality in these areas. There are no additional construction or monitoring requirements at this time. This contact is in addition to the normally required notification or permit.

2. Sealing of wells and borings within Zone B may not occur until plans have been reviewed and approved by the MDH. In addition to the normally required notification, the plan must include the following information: street address; well depth or boring depth; casing type, diameter, and depth; grout depth (if applicable); presence of open annular space(s); and proposed sealing method, including grout materials and grout placement. For wells cased through a confining layer(s) that may have an ungrouted annular space around the casing, the MDH may require that the well casing be removed, perforated, or overdrilled through the confining layer(s) to enable proper sealing both inside and around the casing.

3. Contractors must contact the MDH Bemidji district office by phone at least 24 hours and one business day (Monday-Friday) prior to the start of sealing a well or boring within Zone B.

4. All provisions of Minnesota Rules, Chapter 4725, are in effect.

PERSONS TO CONTACT

For additional information regarding the SWCA, please contact Mr. Michael Convery at 651/201-4586

Plans for the construction, modification/repair, and sealing of wells and borings must be submitted to the MDH Bemidji district office for review and approval at least three working days prior to start of work. Phone notification for construction, modification/repair, and sealing of wells and borings within the SWCA must be provided at least 24 hours and one business day (Monday-Friday) prior to start of work to:

Mr. Mark Malmanger/Mr. Kelly Jorgensen
Minnesota Department of Health--Bemidji District
705 Fifth Street Northwest
Bemidji, Minnesota 56601
218/755-6300
mark.malmanger@state.mn.us/kelly.jorgensen@state.mn.us

NOTE: Notifications and permits required for the construction, modification, and sealing of wells and borings, as required by Minnesota Rules, Chapter 4725, must still be mailed or faxed to the MDH central office at:

Minnesota Department of Health
Well Management Section
P.O. Box 64975
St. Paul, Minnesota 55164-0975
Fax Number: 651/201-4599

References

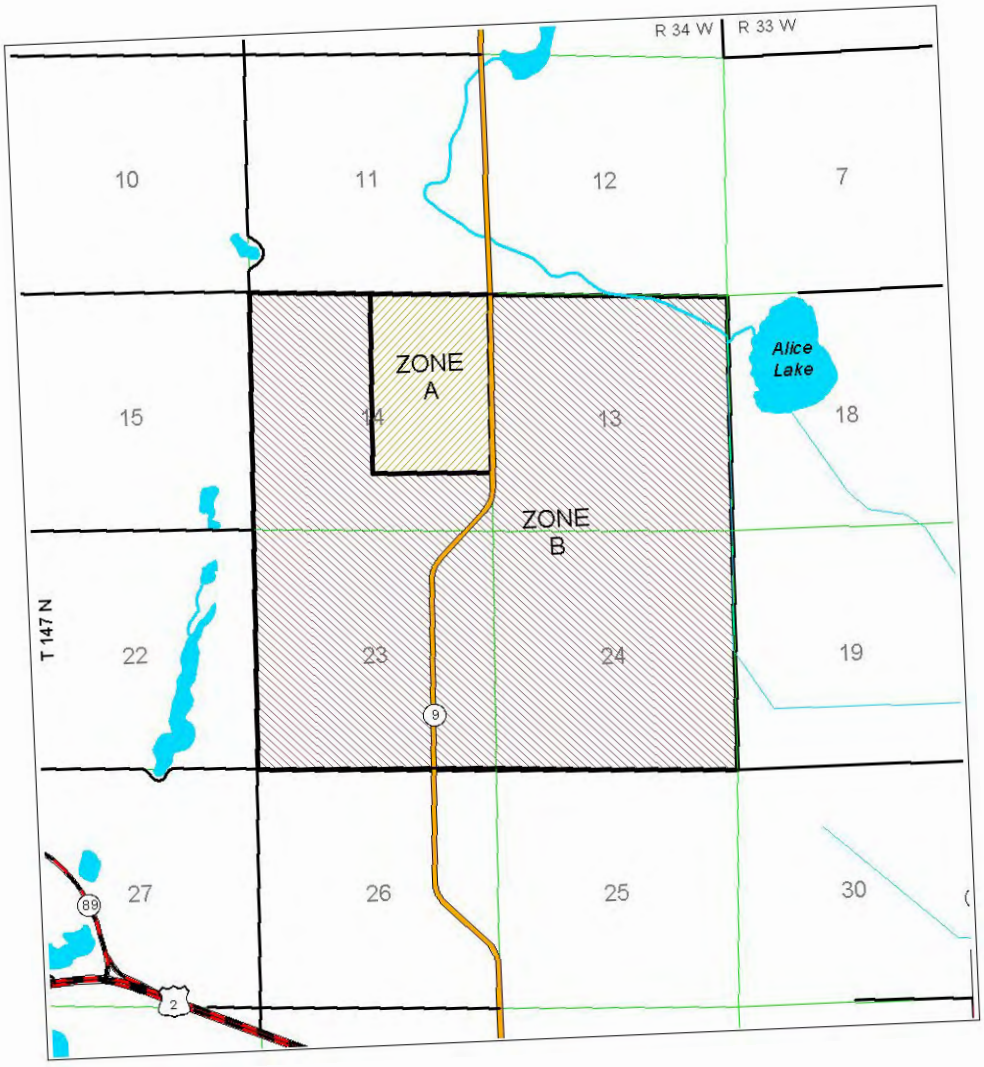
Oakes and Bidwell, 1968, *Water Resources of the Upper Mississippi Headwaters Watershed,* United States Geological Survey Hydrologic Investigations Atlas, HA-278, 4 sheets.

United States Geological Survey, 1989, *Hydrogeology and Water Quality of Glacial-drift Aquifers in the Bemidji-Bagley Area, Beltrami, Clearwater, Cass, and Hubbard Counties, Minnesota,* Water Resources Investigation Report 89-4136.

Widseth, Smith, and Nolting, 2000, *Beltrami County Ground Water Flooding Study*, WSN No. 802B001.

JLS:MPC:jmw

Figure 1. Special Well Construction Area
Eckles Township, Beltrami County



Special Well Construction Area

ZONE A

ZONE B

0.5 0 0.5 Miles

N W E S

28 August 2006 Minnesota Department of Health - Well Management Section Eckles Twp SWCA.apr

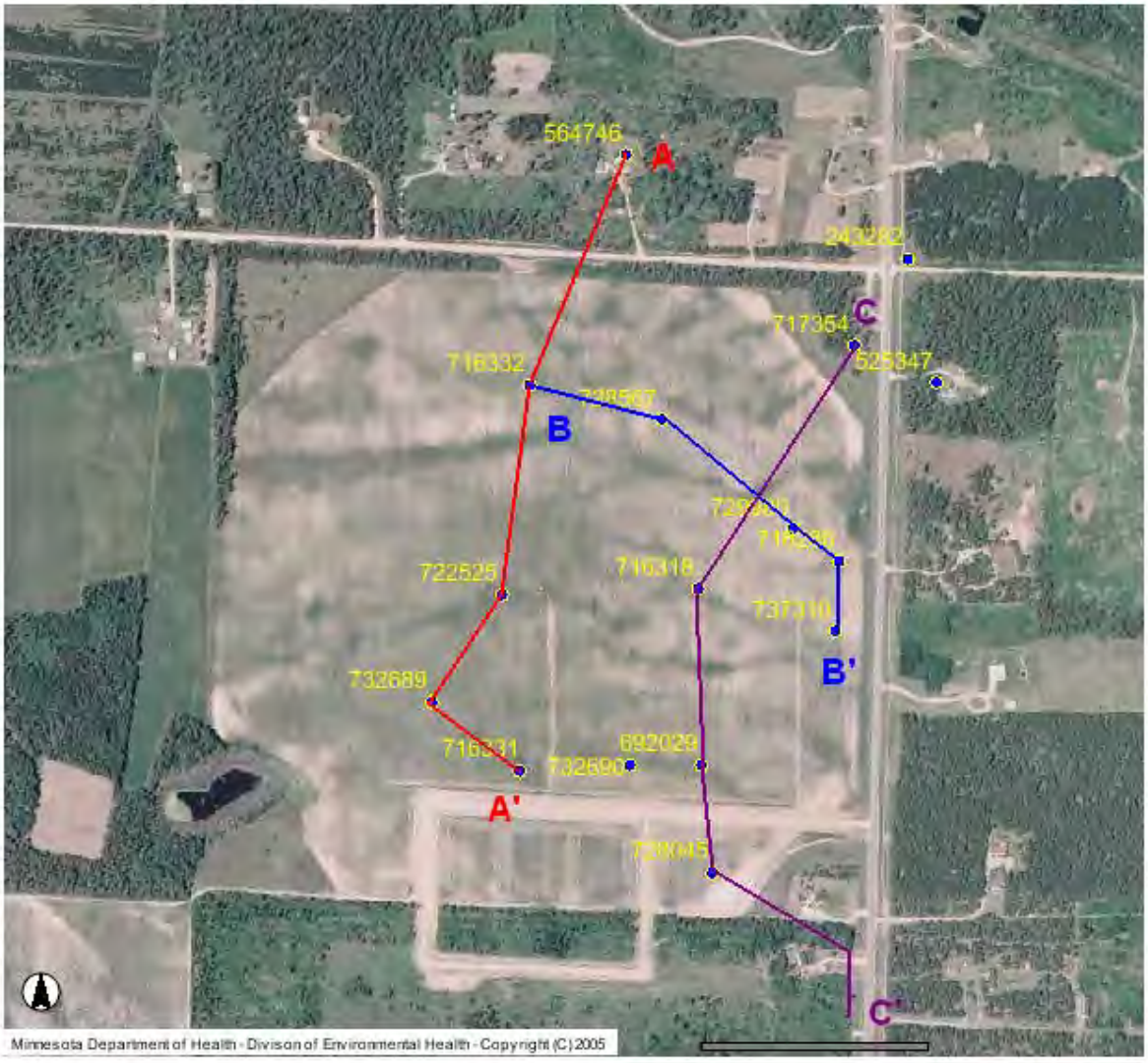


Figure 2: Eckles Township - Section 14
(Northeast Quartile Cross-Section Delineation)

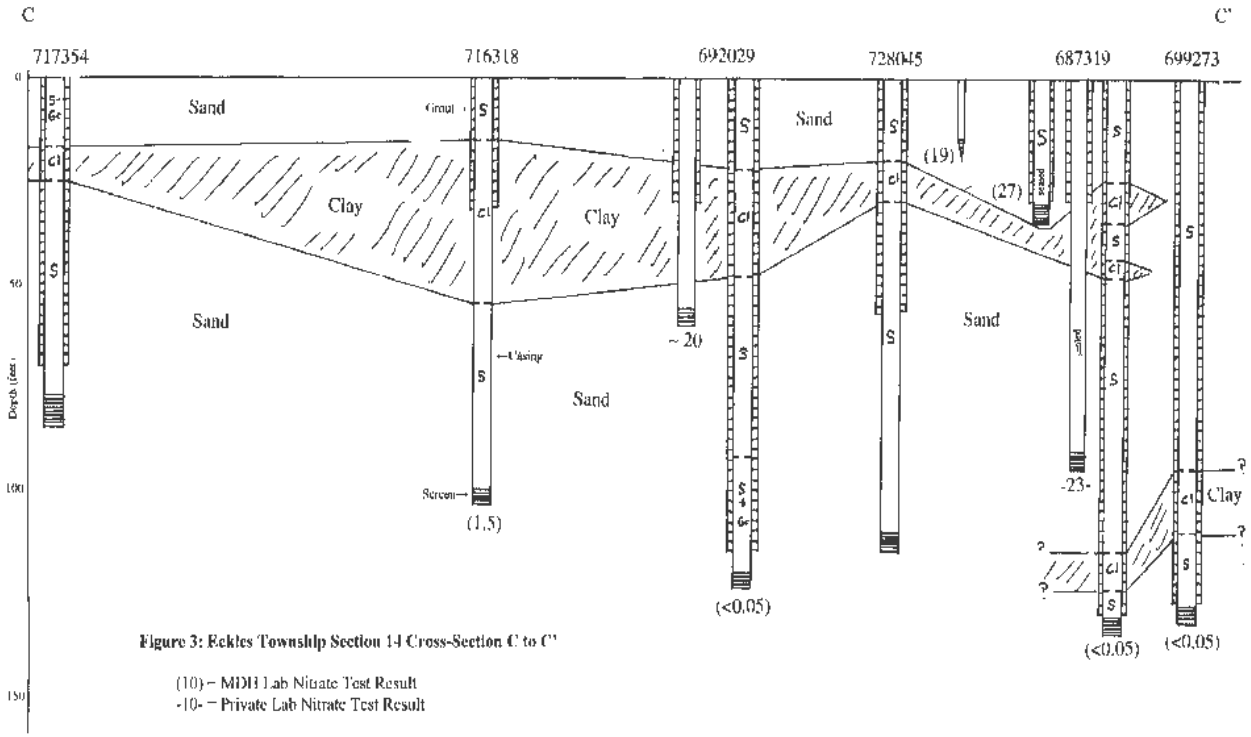


Figure 3: Eckles Township Section 14 Cross-Section C to C'

(10) = MDH Lab Nitrate Test Result
-10- = Private Lab Nitrate Test Result