GROUNDWATER QUALITY OF BARRON COUNTY

1987

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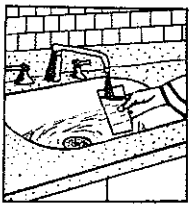

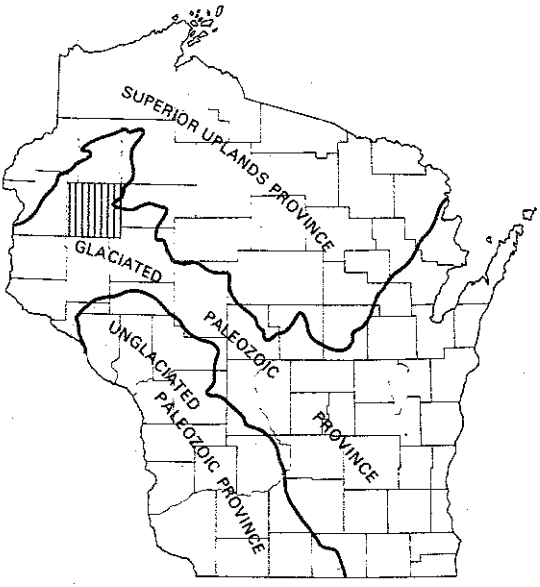

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WHAT YOU SHOULD KNOW ABOUT GROUNDWATER AND ITS QUALITY

GROUNDWATER AS A RESOURCE IN BARRON COUNTY

There is groundwater--most of it accessible and generally of good quality--everywhere under the county. About 95 percent of all water used in Barron County comes from groundwater sources. Every day some 9 million gallons of fresh water are withdrawn from underground water-bearing rocks; that's about 230 gallons of water for every man, woman, and child in the county each day. Groundwater use is about evenly distributed between three major uses: industrial and commercial, private and municipal, and agricultural (irrigation and stock watering).

HOW GROUNDWATER OCCURS AND MOVES

Precipitation that infiltrates the soil is the source of groundwater. Because groundwater is normally hidden from view, many people have difficulty visualizing its occurrence and movement. Groundwater does not occur in underground rivers or lakes, nor does it migrate thousands of miles through the earth. Generally, the water withdrawn by pumping in Barron County originates within county boundaries.

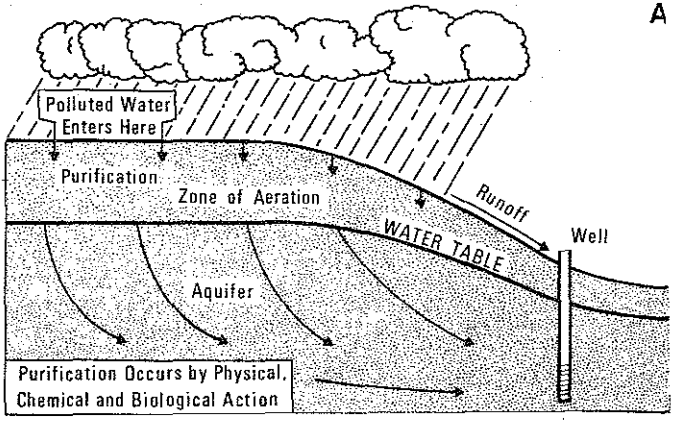
Most of the rocks near the earth's surface contain numerous interconnected, small openings (pores or cracks) filled with water. Those rocks saturated with enough water form aquifers that function as reservoirs (storing water) and pipelines (transmitting water from one point to another). Groundwater is constantly moving toward lower-lying places and ultimately discharges into lakes, streams, and springs, or into wells.

The intricate maze of interconnected openings offers natural frictional resistance to the flow; therefore, water moves through the aquifers very slowly (several feet per day to several feet per year, depending on the texture of the rocks). Because of the slow movement of the water, it might take years for pollutants to appear in water wells or at the points of surface discharge. By that time, the source of pollution may be long forgotten and the aquifer polluted beyond repair.

THE NATURAL QUALITY OF GROUNDWATER

The value of groundwater as a resource depends not only on its widespread occurrence but also on its generally consistent and excellent quality. The quality of groundwater is determined mainly by the character of the earth materials through which the water moves. When water comes into contact with earth materials, it dissolves some minerals; the longer the contact, the more minerals are dissolved. These dissolved minerals are rarely harmful to health.

Because the earth materials act as natural filters to screen out some pollutants, the quality of groundwater is usually better than that of surface water. Water entering the soil at the ground surface may be polluted but it is naturally purified to some degree as it percolates through soil and other fine-grained materials in the zone of aeration (see diagram A).



The natural quality of groundwater in Barron County is very good and is suitable for most uses. In some parts of the county the quality of groundwater is changing as a result of man's activities. However, the quality of most groundwater in the county is better than the quality required by state drinking-water standards.

Under natural conditions, most chemical constituents of groundwater originate from the solution of earth materials. In Barron County groundwater moves primarily through glacial deposits and sedimentary rocks that contain calcium and magnesium carbonates; consequently, these elements predominate in the county's groundwater. The quality of water differs only slightly between the two major aquifers in the county: the sand-and-gravel and sandstone aquifer.

Calcium, magnesium, and bicarbonate form about 85 percent of all dissolved solids in the water; other major dissolved mineral substances are sodium, sulfate, chloride, and nitrate. Beside these common constituents, groundwater in Barron County contains a number of minor elements that do not exceed established limits.

The total concentration of dissolved minerals in the county's groundwater is within the recommended limit of 500 parts per million (ppm). Mineralization of groundwater in Barron County is low under natural conditions (100-200 ppm); only 17 of 566 analyzed samples exceeded the limit of 500 ppm. These higher concentrations indicate degradation of natural water quality.

COMMON GROUNDWATER QUALITY PROBLEMS

Water in nature is never pure water; it always contains at least small quantities of dissolved gases and mineral substances. Some of these natural "impurities" may cause groundwater quality problems.

Calcium and magnesium bicarbonates cause **hardness** in groundwater. The groundwater in Barron County is, on the average, moderately hard (around 90 ppm). Hardness increases across the county from the east (less than 60 ppm) to the west (more than 180 ppm). Hard water (above 120 ppm) is undesirable for domestic and industrial uses because the insoluble residue

collects in pots and boilers used for heating water and a curd forms when hard water comes into contact with soap. Softening water readily reduces hardness problems. However, no serious health problems are known to result from consumption of hard water. Naturally soft water (below 60 ppm) may cause corrosion in water distribution systems. This problem can be removed by installing a water hardener or neutralizing filter.

Of the substances added by the activities of man, bacteria and nitrate are the ones that most commonly cause problems in Barron County.

Coliform bacteria, which themselves are harmless, are useful indicators of satisfactory quality of groundwater. Their presence may indicate the presence of other more harmful microorganisms, and pollution in general. If coliform bacteria are found in your well water in numbers that indicate the water is unsafe, the water should be chlorinated or boiled before ingestion until further sampling indicates that the water is safe. If the problem persists, your well should be examined by a registered well driller or plumber.

Nitrate is the most commonly identified pollutant in groundwater. Its sources are natural and manmade. The concentration of nitrate-nitrogen in groundwater in Barron County was low during the 1983-85 survey, and averaged 3.0 ppm. Wells yielding water with nitrate-nitrogen concentration above the drinking-water limit (10 ppm) are scattered throughout the county, but the incidence is higher in the irrigated areas of outwash plains in the southeast and in the areas of shallow bedrock in the south. About 10 percent of the 722 samples collected during 1983-85 exceeded the limit of 10 ppm nitrate-nitrogen. The locations of wells with higher nitrate concentrations were field-checked. It was found that the potential sources of nitrate in the inspected wells were septic systems, barnyards, temporary manure storage, and fertilizer application--in combination with deficiencies in well construction.

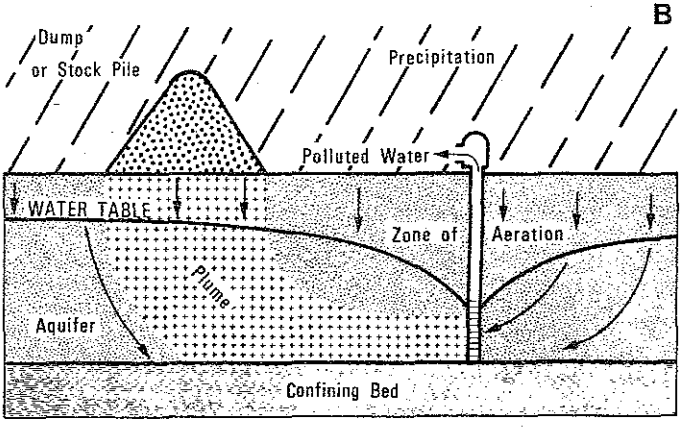
If the water in your well has a nitrate-nitrogen content greater than 10 ppm, it should not be given to infants under 6 months of age; sometimes these higher concentrations are dangerous to them. Don't boil the water--boiling does not reduce the nitrate level; in fact, it actually concentrates the nitrate in water. If you are concerned about the high concentration of nitrate in your well, have your water tested regularly or seek professional advice. A sampling kit can be ordered from the State Laboratory of Hygiene or from private commercial laboratories.

HOW POLLUTANTS TRAVEL UNDERGROUND

Before strategies for dealing with groundwater pollution can be developed, the movement of groundwater and pollutants must be understood. Near the surface, pollutants travel first downward, and after reaching the top of an aquifer (the water table), they move in the same direction as groundwater.

Pollutants in groundwater tend to travel in relatively compact and well defined slugs or "plumes" (see diagram B). The polluted plume moves along with the groundwater flow and is drawn into the well to pollute the well water. The shape and size of a plume depends upon local geology, the groundwater flow,

the type and concentration of pollutant, and the continuity of its supply. The concentration of pollutants in groundwater usually decreases with time and distance traveled.



Several factors influence the transport of pollutants and the rate of reduction in their concentration. The most important is the character of openings through which the polluted water passes. Fine-grained materials filter out bacteria and reduce concentration of some pollutants by ion exchange. Clay in particular is very effective in reducing the concentration of pollutants. Materials with large openings, such as coarse sand and gravel and fractured rock, afford little or no reduction in concentration.

POTENTIAL POLLUTION SOURCES

The quality of groundwater in Barron County most commonly is affected by inadequate disposal or storage of all kinds of wastes; by application, handling, or storage of fertilizers and pesticides; by underground storage (leaks) or transport (spills) of hazardous materials; and by improperly constructed or abandoned wells.

Disposal of solid and liquid wastes on the land, in sanitary landfills, and in holding ponds, or stockpiling chemicals on the ground, can, if not located and managed properly, result in groundwater pollution. However, waste-disposal sites are regulated in Barron County, and there is no evidence that they have caused groundwater problems.

Septic systems are common sources of groundwater pollution. Proximity of a disposal system to a well can create a serious pollution hazard. When a septic system fails to treat the wastewater before it reaches groundwater, the pollutants can enter the nearby well. Proper location, installation, and maintenance can prevent these unnecessary cases of pollution. The Wisconsin Well Code requires minimum distance of 25 feet between well and septic tank.

Animal waste produced, stored, and disposed of on farms is a potential source of groundwater pollution. As rainfall and runoff percolate through decomposing waste (on temporary manure piles in barnyards or on exposed exercise yards) and infiltrate into soil, bacteria and other potential pollutants (primarily nitrate and chloride) are also carried into the ground.

Moderate amounts of the pollutants are removed by the soil filtration process. If the source of pollution is concentrated--such as a manure pit--the soil filter can become overloaded and the excess pollutants will leach through the soil to the shallow groundwater (see diagram C).

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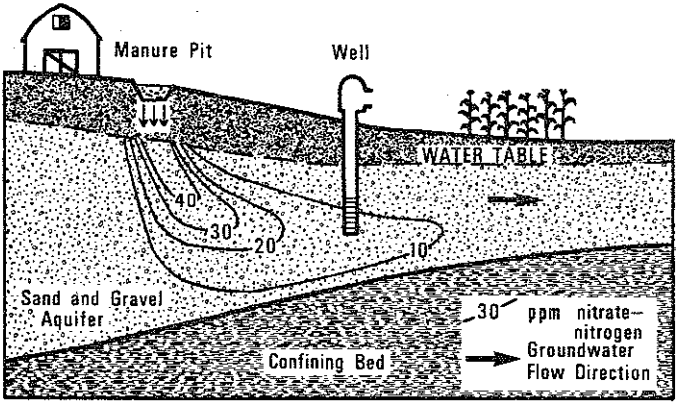
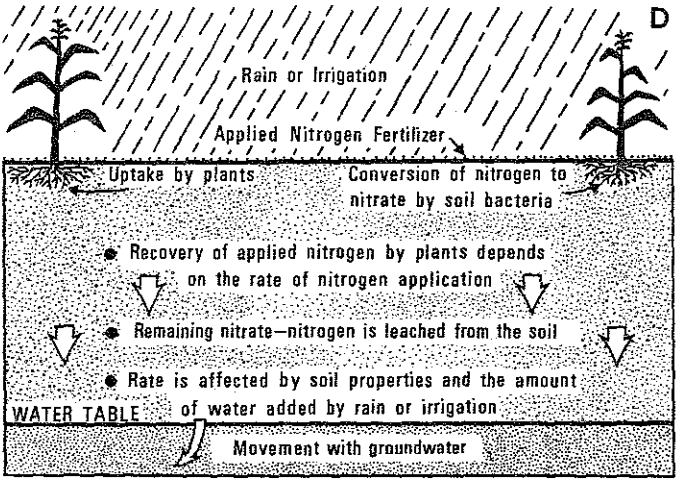


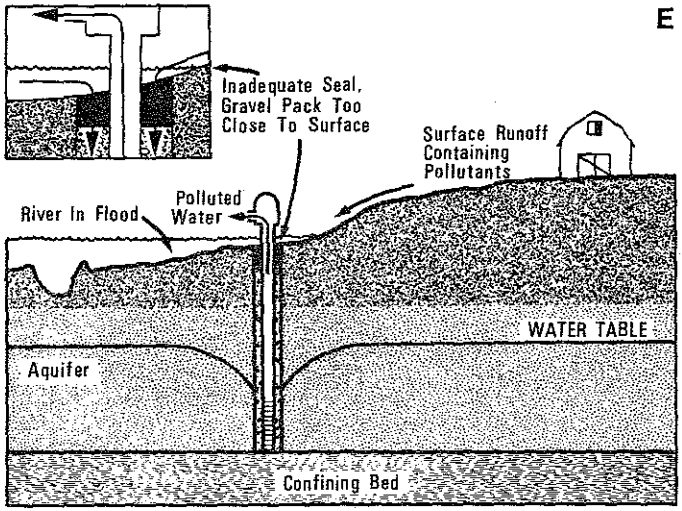
Storing manure in earthen pits has become increasingly popular on farms in Barron County. Installation of animal-waste handling systems is regulated by county ordinance. Studies of a variety of earthen storage pits have shown that all pits may leak at least a little. Therefore, it is necessary to site and design them according to county standards. On soils that have low potential for attenuating pollutants, concrete or metal storage facilities should be used. If you are planning an animal waste management system on your farm, contact the Soil Conservation Service office for technical assistance.

Fertilizers and pesticides are a significant portion of the crop production cost for a farmer. Loss of these chemicals to groundwater is an economic loss as well as a health hazard. If excessive amounts of nitrogen-based fertilizer are applied on agricultural land, the plants will recover only a portion of the nitrogen and the rest may be flushed into the groundwater (see diagram D). Leaching of nitrate can be a problem, especially on sandy soils. Use fertilizer according to the characteristics of your soil. A soil test will tell you how much fertilizer your soil needs and how much your soil can handle.

Pesticide pollution of groundwater from agricultural uses is a relatively recent discovery. Most pesticides are held in the surface layer of the soil where they degrade to harmless substances after they have accomplished their purpose. However, sometimes pesticides are not held by the soil and move into groundwater before they degrade. Following the discovery of aldicarb--a pesticide used primarily on potatoes--in Wisconsin well water, the state adopted modifications in the way pesticide is applied. Use pesticides according to manufacturer's directions. Using lower application rates means less pesticide is present and less can leach. Ask your County Agricultural Agent for advice.



Poorly constructed and improperly abandoned wells can become easy avenues for pollutants to enter groundwater. The most common cause of well pollution is an inadequate seal in the space between the casing and the borehole, which allows surface pollutants to enter the well along the casing (see diagram E). When drilling a new well, be sure to select a reputable well contractor who will complete your well according to the state's standards; and make sure that any nearby, abandoned wells are properly filled and sealed. If you have an old well, have its location and construction checked, and upgrade it to meet current standards. If you decide to drill a well on your property on your own, ask DNR district or area water-supply specialists for the applicable provisions of the Wisconsin Well Code.



PROTECTING GROUNDWATER AGAINST POLLUTION

Barron County does not have serious, large-scale pollution problems at this time. However, potential for pollution exists because the soils and rocks of the county do not always provide good

natural protection. A large portion of the county is underlain by highly permeable sand and gravel that is the primary source of groundwater supplies and that has little or no potential for attenuating pollutants. Once underground, the pollutants are hidden from view and slowly move with the groundwater. It is extremely difficult, if not impossible, to reclaim the polluted aquifer. Even after the source of pollution has been removed, groundwater may remain polluted for many years.

Groundwater pollution by human activities cannot be completely eliminated, but it can be minimized. The best answer to pollution is prevention, which includes finding out what the potential sources of pollution are and learning to control them. Everybody can help to curb the pollution--whether it be a farmer, homeowner, well driller, developer, waste-disposal-facility operator, gas-station attendant, fertilizer or pesticide dealer, manufacturer, or merchant--by realizing which of their activities may harm the groundwater and by trying to eliminate or improve them, and by reporting any potential threats to the groundwater. But remember: before you blame someone else for polluted water, look around carefully! Good housekeeping is the first step in protecting your water supply.

For more information contact:

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