Iowa Science Teachers Journal

Volume 27 | Number 1 Article 5

1990

# Ag-Drainage Wells and Groundwater Quality

Robert D. Libra
*Iowa Department of Natural Resources*

# AG-DRAINAGE WELLS AND GROUNDWATER QUALITY

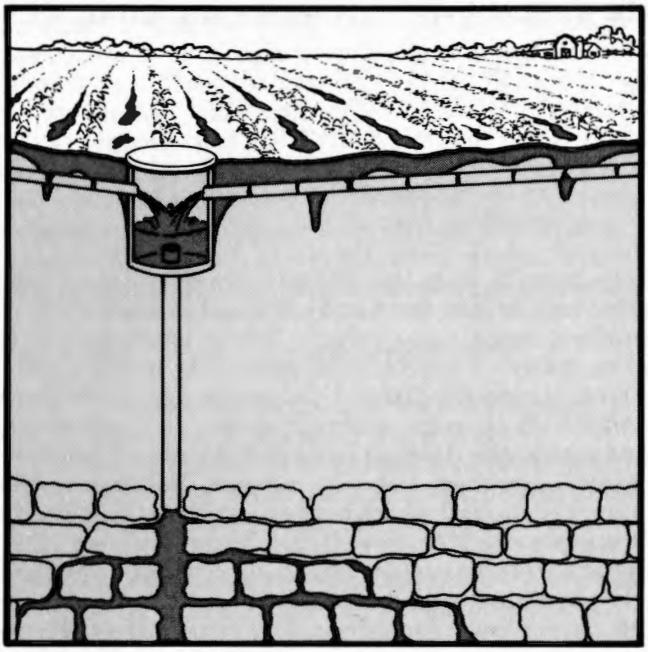
*Robert D. Libra*
*Hydrogeologist*
*Geological Survey Bureau*
*Iowa Department of Natural Resources*
*123 North Capitol Street*
*Iowa City, Iowa 52242*

Iowa agriculture benefits from two important natural resources, the rich soils that blanket the landscape and sufficient precipitation, in most years, to produce large crop yields. While precipitation is essential to farmers, many of Iowa's soils, especially in the north-central part of the state, are poorly drained and at times contain excess water that can hinder field operations or ruin crops. In these areas, farm fields are often artificially drained by buried tile lines leading to ditches or to streams. Another, but less common, method is the agricultural drainage well, a shaft which funnels excess water directly underground. The upper parts of these wells are fed by tile lines; other wells also are designed to receive surface runoff. Ag-drainage wells are usually 5 to 10 inches in diameter and are cased from the land surface to the top of bedrock. They vary in depth from 30 to over 300 feet. There is currently no accurate count of these wells in Iowa, but most estimates suggest 600 to 700 with the greatest concentration in Humboldt, Pocahontas and Floyd counties.

Ag-drainage wells are particularly efficient at removing excess water when drilled into shallow, creviced and fractured limestones. Such limestones, however, are also capable of yielding large quantities of groundwater to pumped wells. Over the eastern two-thirds of Iowa, most private wells rely on these shallow carbonate aquifers for drinking water.

Since chemical fertilizers and pesticides in groundwater have been a growing concern over the past decade, attention has focused on ag-drainage wells. Water percolating into tile lines or flowing directly to these wells contains relatively high concentrations of nitrate, pesticides and bacteria. Ag-drainage wells deliver this water directly into aquifers utilized by local residents. Although studies have documented this degradation of groundwater quality by ag-drainage wells, our understanding of the process is still incomplete.

Researchers from Iowa State University sampled numerous private wells in Pocahontas and Humboldt counties. In parts of these counties, the carbonate aquifer tapped by rural residents for drinking water lies beneath 50 feet or more of clay-rich glacial deposits. In these areas, the thick, slowly permeable glacial deposits protect the underlying aquifer from contaminants infiltrating from the surface, and nitrate concentrations in water wells should be relatively low. This



Ag-drainage wells remove excess water from farm fields in the low-relief landscapes of north-central Iowa. Drainage water carrying nitrate, bacteria, pesticides, and sediment is funneled directly into limestone formations that are widely used as sources of drinking water.

was found to be true where ag-drainage wells are not present. Nitrate concentrations were significantly higher, however, where numerous drainage wells are present in these protected areas. While the presence of these wells caused higher nitrate concentrations, not all water wells near drainage wells reported high nitrate; in fact, many were quite low.

During 1985-86, the Geological Survey Bureau conducted a similar study of the effects of ag-drainage wells on groundwater quality in Floyd County. Similar results were found. Both studies suggest that some--but not all--water wells located near a concentration of drainage wells will contain relatively high levels of nitrate and, occasionally, pesticides.

The Floyd County study also attempts to explain why all wells located near ag-drainage wells are not affected equally. A nested cluster of four monitoring wells was drilled at a site in a protected bedrock area southwest of Charles City, where many drainage wells are present; a 305-foot-deep drainage well was located just 500 feet away. The four nested wells varied in depth from about 80 to 350 feet. During a long dry spell early in the project, nitrate and pesticides were rarely detected in the monitoring wells. Spring of 1986 brought a large snowmelt and heavy rains; surface runoff developed, and tile lines that had not flowed for months began to discharge large volumes of water

into the drainage wells. During this period, nitrate concentrations in the deepest and shallowest monitoring wells increased sharply. Pesticides were also detected in these wells, although different products were present in each. Sampling of the water entering nearby drainage wells demonstrated that the monitoring wells were receiving water from different drainage wells. The other two monitoring wells contained neither nitrate nor pesticides, even during the wet period.

So, do ag-drainage wells affect groundwater quality? The answer is a definite yes. The magnitude and location of the effect, however, depend on the depths and casing of both drainage wells and water wells, and on the complexities of groundwater flow in fractured rock aquifers.

*This article is reprinted from the 1988 issue of* Iowa Geology. *It is one of 11 articles from this one issue which are of general interest and particular classroom use to Iowa teachers.* Iowa Geology *is published once each year by the Iowa Department of Natural Resources. It is edited by Jean Prior, who is known for her excellent presentations to teachers. Teachers may be added to the mailing list to receive* Iowa Geology *(no charge) by sending a request to Prior at the Geological Survey Bureau, 123 North Capitol Street, Iowa City, Iowa 52242.*