Miscellaneous Map Series

Generalized Water-Table Elevation of Dunn County, Wisconsin

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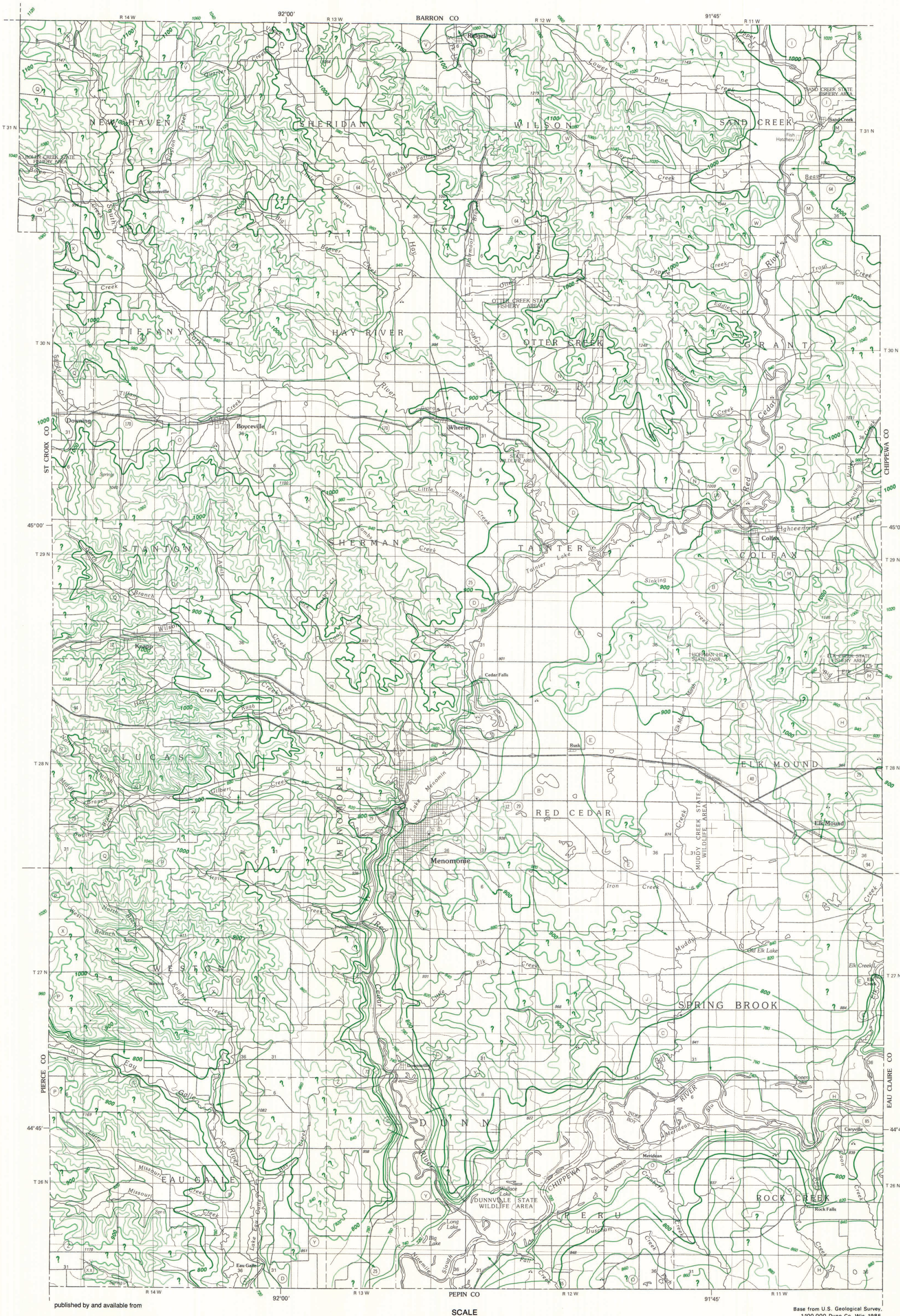
1988

Wisconsin Geological and Natural History Survey Map 88-2



SCALE

1:100,000

1 ½ 0 1 2 3 4 Miles

1 .5 0 1 2 3 4 5 Kilometers

Base from U.S. Geological Survey, 1:100,000 Dunn Co. Wis., 1985

published by and available from

Geological and Natural History Survey
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Explanation

Average elevation of water table in feet, solid where believed accurate within ±0.25 mile on the land surface; screened where believed accurate within ±0.50 mile on the land surface; 20-ft contour interval. Datum is mean sea level.

? Elevation of water table unknown due to insufficient data

General direction of shallow groundwater flow

Data have not been field checked. Water-table elevation was generalized from multiple years of information.

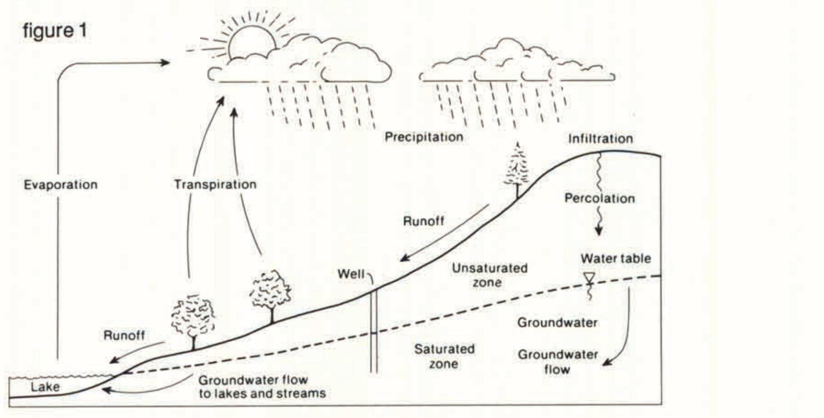
Introduction

This map is part of the Dunn County Groundwater Resource Investigation, a joint project of the Wisconsin Geological and Natural History Survey and the Dunn County Board. The intent of this project was to compile and interpret hydrogeologic data for Dunn County. Information from the resulting maps can be used by Dunn County's soil-and-water-resource and land-use planners.

The water cycle

Gravity and solar energy play active roles in a continuous water recycling process called the **water cycle** (fig. 1).

figure 1



Water falling on land flows downhill as runoff, evaporates, transpires through plants, or infiltrates into the ground. As this infiltrating water percolates downward through rock or soil, it travels through pore spaces and open cracks or fractures in the subsurface material. When these pores and cracks are completely filled with water, the material is said to be **saturated**.

The **water table** is the surface of this saturated zone. The amount of infiltrating precipitation partly determines the position, or elevation, of the water table, which fluctuates seasonally, and from one year to another. Above the water table, pores and cracks are partly or completely filled with air, and the material is said to be **unsaturated**.

Groundwater is the water contained in the saturated zone below the water table. Gravity moves groundwater slowly through pore spaces; eventually, the groundwater discharges to a land surface or water body where solar energy evaporates it into the atmosphere, thus continuing the water cycle.

In Wisconsin, the water cycle generally operates with 30 to 32 inches of precipitation during an average year, from which about 75 percent (22 to 26 inches) returns to the atmosphere by evapotranspiration. The remainder either runs off on the surface or infiltrates into the ground as recharge to groundwater. The ratio of surface runoff to groundwater recharge varies considerably around the state, depending upon factors such as topography, soil type, vegetative cover, rainfall intensity, and individual farming and general land-use practice.

Movement of groundwater

The rate of movement of groundwater is controlled by the nature of the materials through which it flows. Large pores or fractures in the subsurface can hold more water than small ones, but in order for water to flow, these pores or fractures must be interconnected. If conditions in the saturated subsurface material allow a well to yield fresh water economically, the material is called an **aquifer**.

For example, sandy soils may have relatively large pore spaces that are well connected with each other, allowing water to seep more rapidly than it can in clayey soils that have poorly connected pores. Rocks such as limestone and dolomite are usually highly fractured; if these fractures are open and interconnected, water flows quickly. Other rocks, such as crystalline granite, usually have fewer and smaller fractures than limestone and dolomite, and they transmit less water.

Groundwater can move as quickly as several feet per day in porous sand, or as slowly as less than 1 inch per year in clay or in dense crystalline rock. However, no matter how rapidly or slowly the groundwater flows, its natural direction of movement is from upland recharge areas (where water infiltrates into the subsurface) to lowland discharge areas (springs and seeps). Discharge areas are often associated with surface-water bodies, so groundwater has a significant role in the development and environmental health of lakes, streams, and wetlands.

Contamination of groundwater

Areas with either thin soils over a rock aquifer or sandy soils with a shallow water table are especially susceptible to groundwater contamination from land-use activities. Because groundwater comes from water that percolates down from the land surface, any water-soluble material that is put on or in the ground has the potential to be transported to the groundwater. Soil is usually a good natural filter, attenuating harmful material from the recharging water as it moves downward. However, thin or sandy soils do not effectively remove many potential contaminants contained in liquid or solid waste products, or in other materials -- such as road salt, manure, chemical fertilizers, pesticides, and herbicides -- that are applied to the land surface. Once a contaminant reaches the water table, very little attenuation takes place; dilution will disperse but not remove it.

Because groundwater can seep as slowly as a few inches per year, contamination that occurs today may not become evident for several or even hundreds of years. Once contaminated, groundwater is difficult to purify and may take many years, decades, or centuries to clean itself by the dilution process.

Data compilation and interpretation

Data were compiled at a scale of 1:24,000, using United States Geological Survey quadrangles (7.5-minute series, topographic) as base maps. All available Wisconsin Geological and Natural History Survey geologic logs were plotted onto these base maps. The Wisconsin Department of Natural Resources well constructor's reports were examined and checked against each other, and the most representative, reliable, and useful data available for each section were plotted. For some areas, there were no reports, and for others, only a few; however, for most areas at least 1 report per 2 square miles was available.

Because well constructor's reports provide measurements taken at different times of the year and in different years, water level as determined from a well constructor's report was not usually used as an exact data point. Instead, the water level was considered to be part of a range of values. For this reason, and because the large number of data points would tend to clutter the map, the locations of wells are not shown on the water-table elevation map. The elevations of springs, groundwater seepage areas, seepage lakes, and rivers were also used as data points in construction of this map.

Limitations of the map

Because shallow groundwater flow is perpendicular to the lines of equal water-table elevation, this map shows a generalized picture of the direction of shallow groundwater flow. The accuracy of the interpretation varies throughout the study area, increasing with greater data density, and decreasing with greater hydrogeologic complexity. The water-table elevation lines are solid where enough data are present to enable the lines to be located with a reasonable degree of confidence. The horizontal position of the line is believed to be accurate to within ±0.25 mile. The lines are screened where data are less abundant or reliable; their horizontal position is believed to be accurate to within ±0.50 mile. In areas where question marks are present, more data are required. This usually occurs near the tops of hills, where data are scarce.

It was beyond the scope of this project to field check the published and unpublished data (such as the locations and water levels given on the Department of Natural Resources well constructor's reports) that were used to construct this map. Therefore, this map should *not* be considered definitive for site-specific applications.

Sources of data

*Wisconsin Department of Natural Resources well constructor's reports (1936-86)

*Wisconsin Geological and Natural History Survey published and unpublished geologic logs (1896-1986)

*United States Geological Survey quadrangles (7.5-minute series, topographic; 1972-75)

*Water-level observation wells from the Groundwater Level Monitoring Network operated and maintained by the United States Geological Survey and Wisconsin Geological and Natural History Survey

*Preliminary Report on the Irrigation Potential of Dunn County, Wisconsin, by Perry G. Olcott, Francis D. Hole, and G. F. Hanson, 1967, Wisconsin Geological and Natural History Survey Special Report 1

*Availability of Ground Water for Irrigation in the Rice Lake-Eau Claire Area, Wisconsin, by E. A. Bell and S. M. Hindall, U.S. Geological Survey, 1975, Wisconsin Geological and Natural History Survey Information Circular Number 31

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