

**Title:** Hydrogeology of the Wisconsin River Valley in Marathon County, Wisconsin (Study No. 25)

**Investigators:** Principal Investigator

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**Period of Contract:** May 1, 1986 through June 30, 1986

**Objectives:** To provide the basic geologic and water resource data needed to protect and use the Wausau aquifer. This aquifer, defined for the study, is comprised of sand and gravel deposits that fill the lower part of the Wisconsin River valley in Marathon County.

**Background/Need:** A variety of organic chemicals including nitrates and pesticides have been detected in the groundwater of the Wausau aquifer. No previous attempt had been made to define aquifer characteristics, delineate groundwater paths, quantify groundwater flow rates or delineate groundwater recharge and discharge areas for the entire aquifer.

**Methods:** 17 piezometers were installed to supplement existing data. A geophysical survey was carried out to obtain data on the thickness of the Wausau aquifer beneath the Wisconsin River and Lake Wausau. Hydraulic characteristics were determined with pumping tests, specific-capacity tests, piezometer tests and grain size analyses. A deterministic mathematic model was used to analyze groundwater flow and predict aquifer response to lead contamination. A groundwater contamination susceptibility map was constructed based on soil morphology, physical characteristics and chemical data. Each soil series classified in the Marathon County soil survey was assigned a rating according to physical and chemical characteristics. Soils were grouped into four associations with the highest rating having the greatest capacity to attenuate pollutants.

**Results:** Most of the soils overlying the Wausau aquifer have low attenuation potentials. Sandy deposits from outwash streams rarely contain the fine material and organic content necessary for effective contaminant attenuation. Soils in the area are mostly coarse-grained and highly permeable. Every documented case of contamination in the area underlies soil of the lowest attenuation potential.

**Conclusions:** The Wausau aquifer has experienced change from human intervention in three ways: dam construction altered groundwater flow patterns, groundwater pumping created local cones of depression and urbanization and industrialization contaminated groundwater. The elevation of the base of the aquifer varies greatly over short distances due to the irregular surface of the underlying bedrock. Hydraulic conductivity increases from north to

south. Groundwater pumping reduces the amount of groundwater that would otherwise discharge to the Wisconsin River. The Wausau aquifer is extremely susceptible to groundwater contamination due to the high permeability, variability in gradient and geologic setting.

**Recommendations/  
Implications:**

The data compiled in this report should be used to develop aquifer protection plans including mathematical models using data contained in this report. The aquifer should be protected from future contamination rather than attempting restoration because the heterogeneity of the aquifer material makes site-specific investigations particularly difficult.

**Availability of Report:**

This report is available for viewing and loan at:

The Water Resources Center  
1975 Willow Drive  
Madison, WI 53706  
(608) 262-3069  
Publication 050857

Copies of this report can be obtained from:

Wisconsin Geological and Natural History Survey  
3817 Mineral Point Road  
Madison, WI 53705  
Information Circular 64

**Key Words:**

Groundwater flow system, hydrogeology, Marathon County

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