Understanding the Water Cycle

The Key to Maintaining Michigan Water Quality

(Editor's Note: The following information is based on the publication "Michigan's Water Resources" published in 1987 by the Institute of Water Research at Michigan State University. The 57-page booklet is available through the county Cooperative Extension Service office.)

From a raging stream during spring snowmelt, to a gentle summer rain, to the slow movement of water through the ground, the water around us is in constant motion. The movement and endless recycling of water between the atmosphere, the land surface, and underground is called the hydrologic cycle. Understanding the hydrologic cycle is basic to understanding all water and is a key to the proper management of Michigan's water resources.

Following the Pathways

Water that falls to the ground as precipitation follows many paths on its way back to the atmosphere. The water may be intercepted and taken up by plants; it may be stored in small depressions or lakes; it can infiltrate the soil; or it can flow over the surface to a nearby stream channel. The energy of the sun may evaporate the water directly back into the atmosphere, or the force of gravity may pull it down through the

Infiltration and Soils

Several factors influence the rate and amount of water that infiltrate soil. Soil is made up of tightly packed particles which can be of many shapes and sizes. As water reaches the land surface, it can seep downward through the pores between soil particles. A high porosity soil has the ability to hold large amounts of water due to the presence of many pore spaces. If the pores are well connected and allow water to flow easily, the soil is said to be permeable. The size and shape of clay particles, along with the arrangement of the pores between these particles, cause clay soils to resist infiltration. Sands and gravels allow more rapid infiltration due to porosity and high permeability.

The initial water content of the soil is also important. In general, water infiltrates drier soils more quickly than wet soils. The intensity of a storm, or the length of time during which precipitation occurs, can also influence infiltration. If rain or

saturated, and the water level which results is called the water table. The water table is not always at the same depth below the land surface. During periods of high precipitation, the water table can rise. Conversely, during periods of low precipitation and high evapotranspiration, the water table falls. The area below the water table is called the saturated zone, and the water there is called groundwater. The area above the water table is the unsaturated zone.

An aquifer consists of soil or rock in the saturated zone that can yield significant amounts of water. In an unconfined aquifer, the top of the aquifer is defined by the water table. Confined aquifers are bound on the top by impermeable material, such as clay. Water in a confined aquifer is normally under pressure and can cause the water level in a well to rise above the water table. If the water rises above the ground surface, it is said to be a flowing artesian well. A perched water table occurs when water is held up by a low permeability material and is separated from a second water table below by an unsaturated zone.

In the saturated zone, groundwater flows through the pores of the soil or rock both laterally and

typically discharges from aquifers to replenish rivers, lakes or wetlands. An aquifer may receive recharge from these sources, an overlying aquifer or, more commonly, from precipitation followed by infiltration. The recharge zone is that area, either at the surface or below the ground, which provides water to an aquifer and may encompass most of the watershed.

All of the above- and below-ground areas that drain to the same lake or stream are in the same watershed. Land use activities in a watershed can affect the quality of the groundwater, especially through infiltration of pollutants, and can affect surface water quality as contaminants are carried with groundwater discharge.

The Human Influence

In the days of fur trading and canoe travel, the impact of human activity on water moving through the hydrologic cycle was minimal. In the early 1800s, with the discovery of copper and iron ore reserves in the Upper Peninsula and the development of Michigan's territorial lands, a noticeable impairment and exploitation of Michigan's natural resources began. Today, the water resources of the state still suffer from early mining activities. For example, disfiguring tumors on the fish in Torch Lake in Houghton County are suspected to be the result of past disposal of copper mining wastes.

The network of rivers flowing from the center of the state to the Great Lakes made easy access between interior forests and markets throughout the world. In fact, the first reported court ruling on water rights involved a dispute between logging companies that used the rivers to