



*"Protecting water quality through community planning"*

Nonpoint Education for Municipal Officials



Fact Sheet-04-43

# The Effects of Urbanization on the Water Cycle

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As our communities grow, we notice many visible changes, including housing developments, road networks, expansion of services, and more. These changes impact our precious water resources, with pollution of water resources being one potential impact. To understand how our water supplies can become polluted, it's important to understand the oldest solar-powered "recycling" system: the water cycle, also called the hydrologic cycle.

The hydrologic cycle transports water between earth's land, atmosphere, and oceans. The major processes moving water are evaporation, transpiration, condensation, and precipitation. Evaporation occurs when the sun's energy turns liquid water on the earth's surface into water vapor, which enters the atmosphere. Wa-

ter vapor leaves plants in a process called transpiration. Collectively, these two processes are called evapotranspiration.

The water vapor in the atmosphere cools to form clouds (condensation). Through precipitation in the form of rain or snow, the water returns to earth. Snow accumulates in the mountains, providing storage in the form of a snow pack that will slowly melt and release water in the spring and summer. Some of the rain runs off the land, into rivers or lakes. While it's hard to believe, rivers contain only about 0.0001 percent and fresh water lakes only about 0.009 percent of all water on earth!

Rain also soaks into the ground, or infiltrates, and replenishes the water stored in the soil. We call the subsurface water supply in the saturated zone below the water table groundwater. It contributes flow to rivers and oceans. Aquifers are geologic formations containing groundwater in sufficient quantities to provide water to extraction wells.

Groundwater accounts for about 0.61 percent of the earth's

water. The oceans contain most of the earth's water, or about 97.2 percent. Of the fresh water supply on earth, 78 percent is tied up in polar ice caps and snow, leaving only a minute fraction available for use by people. Of the available fresh water, 98 percent is in the form of groundwater, while the remaining 2 percent is in the form of surface water. Because our usable water supply is so limited, it's vitally important to protect water quality.

Within the context of the hydrologic cycle, there is no "new" water ever produced on the earth. The water we use today has been in existence for billions of years, and may have once provided a drink for a dinosaur. The hydrologic cycle continually renews and refreshes our finite water supplies.

## How does urbanization affect the water cycle?

When we develop within a watershed, we affect the hydrologic cycle. The increase in impervious or hard surfaces, including rooftops and pavement (roads, driveways, and parking lots), decreases the

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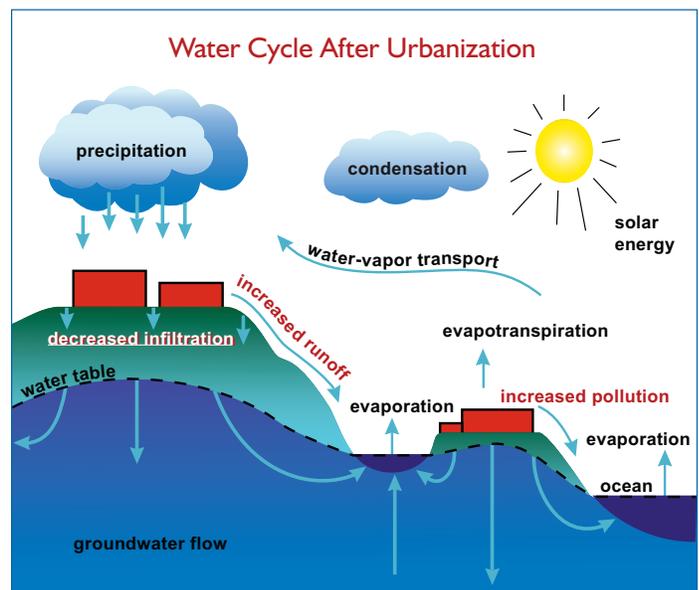
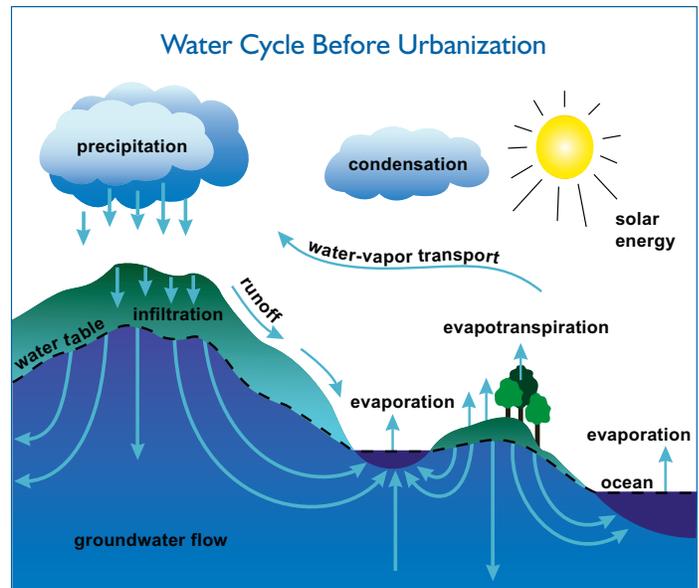
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amount of water that soaks into the ground, or infiltrates. This increases the amount of surface runoff. The impervious surfaces collect and accumulate pollutants, such as those leaked from vehicles, or deposited from the atmosphere through rain or snowmelt. The runoff water carries pollutants directly into water bodies. Because there is less infiltration, peak flows of storm water runoff are larger and arrive earlier, increasing the magnitude of urban floods.

However, affects on the water cycle are not limited to surface water. Paving may alter the location of recharge, or replenishment, of groundwater supplies, restricting it to the remaining unpaved areas. If infiltration is decreased sufficiently, groundwater levels may decline, affecting stream flows during dry weather periods. Lowered groundwater levels can result in subsequent well failures.

While the effects of urbanization on the water cycle can be major, if wise choices are made during the development process, the impacts can be minimized and our future water supply protected. This fact sheet is one in a series that discusses the choices that can be made during the development process to protect our water resources.

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