

Watershed Hydrology



Literally translated from its ancient Greek origin, *hydrology* means the “study of water.” As practiced today, hydrology is the study of water as it interacts with the land, the sea, and the sky.

About 70% of the Earth’s surface is covered by water, and almost all of that water has been around since the Earth was formed billions and billions of years ago. Thus, the glass of water you drink today could be the water that a dinosaur once sipped. Water is constantly recycled on Earth as rain, snow, oceans, lakes, streams, hail, and glaciers. Scientists refer to this as the *water cycle*.

There are several parts to the water cycle. Evaporation occurs when lakes, oceans, rivers, and streams are heated by the sun. The liquid water evaporates into a gas called water vapor. Trees and plants also release water vapor through their leaves through a process called transpiration. Condensation is when the water vapor comes together to form clouds.

Precipitation occurs when water from the clouds falls to Earth as rain, sleet, hail, or snow. Some of the precipitation that reaches the Earth filters through the soil and ends up as groundwater. If more precipitation falls than the soil can absorb, it ends up as runoff. Both runoff and groundwater eventually reach a

stream or other water body, and the cycle starts all over again, around and around, all the time, all over the world.

But human activities can have significant impacts on the water cycle. When vegetation is removed and impervious surfaces, such as parking lots, buildings, and highways, are added to the landscape, less precipitation can infiltrate the soil. Thus, runoff increases, which results in an increase in flooding. It can also cause streambanks to erode.

Flooding is not the only negative impact associated with urban runoff. Water has often been called the “universal solvent,” which means that most substances will mix at least somewhat with it. As water runs over land during heavy storms, it can pick up fertilizers, pet waste, and other chemicals and materials and carry these pollutants into our streams, rivers, and lakes.

Stormwater management practices can offset some of the adverse impacts caused by urbanization. However, they can not be viewed as a cure-all. While the technology is improving, stormwater management practices can provide only partial control.

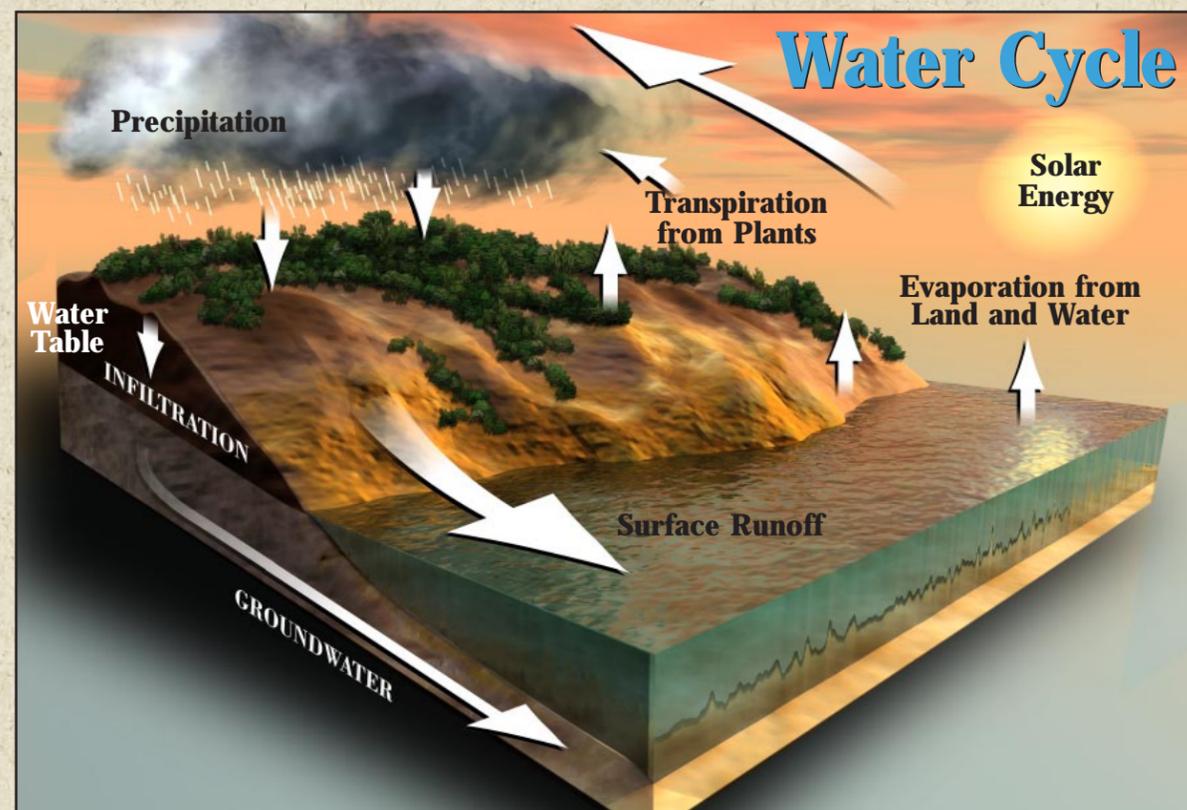
How is urbanization affecting stream quality? In fall 1993, the Department conducted biological and habitat assessments in 39 nontidal streams in the Piedmont Basin. The larval stages of aquatic insects served as the principal indicators of biological quality. Besides being generally long-lived, these insects are known to be sensitive to pollution and are the primary food source for fish.

Three-fourths (74%) of the nontidal streams in the basin were found to have degraded biological conditions; an equal number of sites were deemed moderately and severely degraded. The degraded sites were dominated by pollution-tolerant species such as fly larvae, snails, and worms, while “good” sites were dominated by pollution-sensitive species such as mayfly, stone fly, and caddis fly larvae.



The Brandywine River does not meet standards for fishing, drinking, or swimming.

Almost all (90%) of the nontidal streams had undergone some degree of habitat degradation as exhibited by eroded banks, newly deposited sediment in the channel, and lack of a shade canopy. Many of these conditions are indicative of urban streams, where roads, parking lots, and other impervious surfaces have increased the frequency and magnitude of peak flows during storms.



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Challenges for the Future

The Department’s challenge will be to do a better job of mimicking Delaware’s natural hydrology in the face of an increasingly urbanized landscape.

- ◆ Watershed management will be the preferred method to control flooding, maintain stability of streams and rivers, and prevent further environmental degradation due to urban runoff.
- ◆ Sophisticated computer modeling and Geographic Information Systems (GIS) are becoming accessible to virtually anyone with a desktop computer. These will become increasingly important tools as urbanization, and the complex issues associated with it, continues in the future.