Where Does the Water Go?

By Ole Hendrickson

Did you ever follow a stream to its source? Maybe you have walked uphill through a forest, or pasture, and reached a point where there is no longer a defined channel. Sometimes a stream plays hide and seek, alternately running along the surface and going underground.

Some streams begin at a clearly defined point, such as a spring bubbling up from the base of an enormous old tree. Other streams come and go with the seasons, running strong during spring snowmelt, and disappearing or forming a series of shallow pools by the end of the summer.

Included within the basin of a great river are the catchments of its tributaries, and then smaller and smaller sub-basins. Think of your roof as a headwater tributary and your property as a tiny watershed. Where does the water go during a heavy rain, or during snowmelt? Does it sink into the ground, or run down the driveway and into a ditch or a storm sewer? And then where?

Answering this question can be difficult. In urban areas, flowing waters (including streams themselves) may be hidden underground in storm sewers. On the one hand, this infrastructure prevents flooding of roads and buildings. The sewers of Paris are one of the world's great engineering marvels, enabling the dense urban architecture of the City of Light. But on the other hand, all that water running through buried pipes doesn't just vanish – it must be discharged to the surface.

While storm water management is essential in the downtown core, there is a trade-off between urban intensification and risks of water pollution -- particularly where cars and trucks are a main form of transportation. The greater the density of hard, impermeable surfaces (such as streets and paved driveways), the greater the need for storm drainage infrastructure. Storm water discharges are polluted by leaking oil and gasoline, brake lining fragments, lawn fertilizers, dog excrement, etc. Sometimes unscrupulous businesses or homeowners make illicit discharges to storm drains.

In some Canadian cities storm sewers and sanitary sewers are combined. Whenever it rains, raw human sewage is discharged directly to surface waters rather than going to a treatment plant. Storm sewer outfalls can have extremely high levels of E. coli, forcing beach closures and increasing risks of drinking water contamination for downstream users.

In Canada, the federal government has dismantled water legislation and left water quality protection in the hands of provinces, municipalities, and individual homeowners. In contrast, the United States government is actively involved in storm water management and efforts to improve water quality.

The U.S. Environmental Protection Agency (EPA) has developed an extensive system (see http://water.epa.gov/polwaste/npdes/stormwater/Municipal-Separate-Storm-Sewer-System-MS4-Main-Page.cfm) of regulations and permits for storm water management, accompanied by guidance documents on best practices for reducing discharges and pollution to an acceptable level. The EPA uses a Total Maximum Daily Load (TMDL) concept, defined as "the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards." In 2013 the EPA significantly ramped up efforts in this area and has now set tens of thousands of TDMLs for U.S. waterways. These TDMLs identify where water quality is impaired and help target clean-up efforts.

Besides contributing to water pollution, roads and storm sewers represent costly infrastructure that must be maintained and repaired. Road maintenance is paid through property taxes; storm sewer maintenance through water bills. Some municipalities now provide incentives such as tax breaks to homeowners who take measures to reduce their discharges to storm sewers, thereby improving water quality and saving on maintenance costs.

These measures can be as simple as ensuring that water flowing off a roof doesn't end up in a storm sewer. Water can be stored in a rain barrel for use during drier periods, or discharged directly to a vegetated portion of the yard. Many urban residents plant trees and shrubs instead of lawns: permanent woody vegetation captures more rain and recycles it to the atmosphere through the process of transpiration. Green roofs, rain gardens, and bio-swales are coming into vogue. And rather than "sealing" their driveways, enlightened homeowners are finding ways to make them permeable.

Larger scale options include constructed wetlands and storm water ponds, restoration of natural streams that were once confined to storm sewers, and narrower streets lined by urban forests.

"Green infrastructure" is a catch-all term for use of natural landscapes and water cycling processes to replace artificial water infrastructure. A central tenet is to use vegetated/permeable surfaces and natural watercourses in preference to hardened surfaces and pipes. This holds great promise for reducing pollution, beautifying urban landscapes, increasing property values, reducing long-term maintenance costs, and lowering property taxes and water fees.