of our contemporary water pollution problems. There are reports of Roman aqueduct water containing too much sediment, so settling basins were constructed to allow the sediment to settle out. Archaeologists have found aqueducts leading to the Roman Forum that were made of lead. When water travels through a lead pipe, some of the lead from the pipe goes into solution, thereby increasing the lead concentration of the water. It has been hypothesized that the decline of the aristocracy in the Roman empire was due to the neurotoxicological impacts of lead poisoning (although wine that was stored for long periods in lead vessels was perhaps a more significant factor than water from lead pipes). And Frontinus may have been the first to consider the use of gray water (wastewater that does not contain sewage), explaining that "it was. . . determined to separate them all and then to arrange so that [one of the aqueducts] should serve wholly for drinking purposes, and that the others should be used for purposes adapted to their special qualities. For example, Old Anio [aqueduct] should be used for watering the gardens, and for the more dirty uses of the city; because the further from its source its waters are drawn, the less wholesome they are."

Water pollution motivated the Ancient Romans to build an elaborate system of aqueducts, pipes, and supporting structures to transport water over long distances.

Many of the problems experienced during the Roman Empire still exist in modern societies. In this section, we will look at where we get our water, how we pollute it, and how we are attempting to safeguard our water supplies in the present and for the future. A law passed in ancient Rome—"No one shall with malice pollute the waters"—is a mandate that is as true today as it was then.

Water's Importance to Earth's Environmental and Human Systems

We can see how water fits into Earth's environmental systems by thinking back to the hydrologic cycle that we discussed in Section II of this guide. Though water covers 75 percent of Earth's surface, surprisingly little of it is available for our use. The oceans are the largest repository for water, so virtually all the water on Earth is saltwater. Only about 3 percent of total water is fresh water, and most of that is tied up in glaciers and icecaps; only a little more than 1 percent of all water on Earth is potentially usable by humans and other terrestrial organisms. Fresh water is the primary subject of our discussion in this section.

Most of Earth's useable fresh water is contained underground. Lakes, rivers, and reservoirs, which supply more than half the drinking water in the United States, comprise only 0.009 percent of the water on Earth. There is even less water (perhaps 0.001 percent) tied up in the atmosphere and even less than that (0.0001 percent) contained within organisms. Of course, water moves between these different compartments, and at any given time, there might be slightly more or less water in any compartment. Nevertheless, these proportions demonstrate how little of the water on Earth is accessible.

Groundwater and Surface Water

Groundwater comprises all water that is below the ground in **aquifers**, permeable layers of rock and sediment that hold water. Water enters the groundwater system through infiltration of precipitation and discharge of rivers and streams. It usually stays in an aquifer indefinitely unless human interference disrupts it, or some kind of tectonic activity shifts the orientation of the aquifer so that the water flows due to gravity. Some aquifers intermittently flow into streams, rivers, or the ocean. It is possible to extract water from an aquifer by drilling a hole into it (called a well), much like drilling into an oil reserve, and pumping the water out.

The most basic aquifer is porous rock such as sandstone or other consolidated sediments, covered simply by soil. Water fills up the pore space within the rock, forming what is known as an *unconfined aquifer* because it is not constrained on the top by any confining rock. The part of the aquifer that is filled with water is called the saturated