Department of Geology
McMicken College of Arts & Sciences
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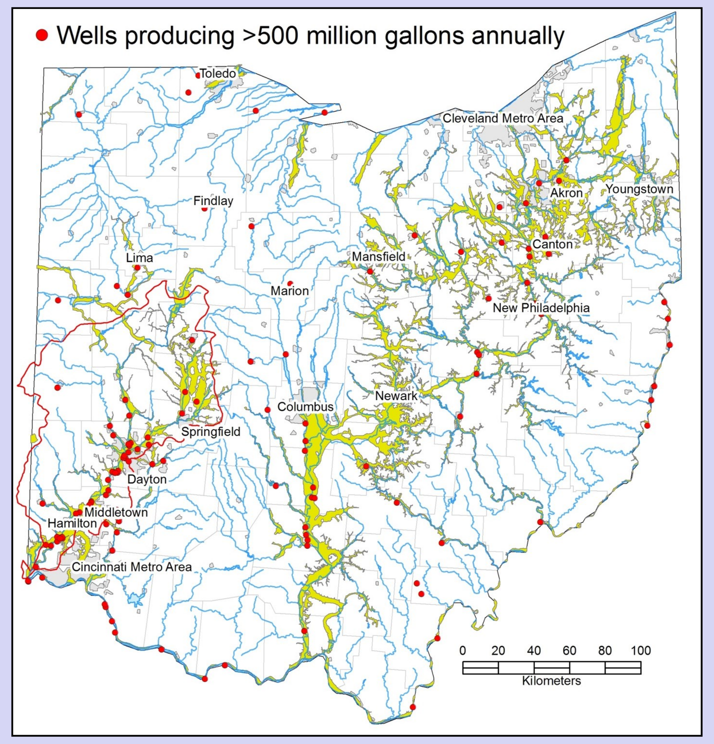
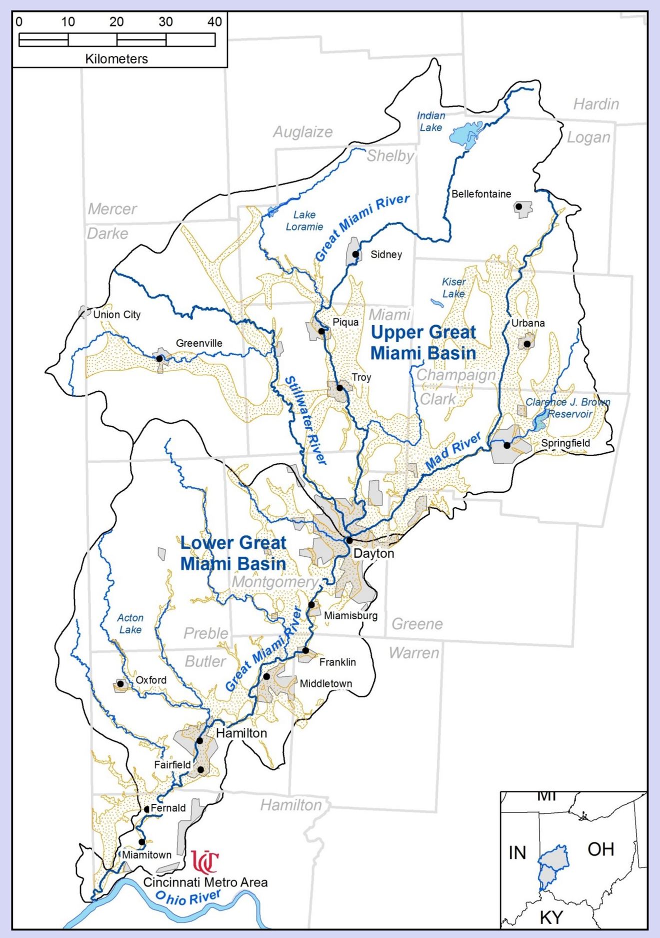
The River Runs Through Us
Showers to Flowers

Ohio's Wells



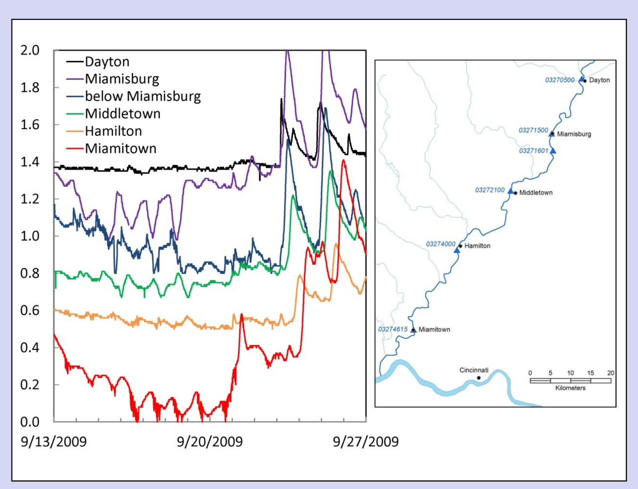
Most of Ohio's large public water suppliers (PWS) produce water from wells in alluvial aquifers immediately adjacent to rivers. Ground-water from these wells is less prone to contamination and more reliable than surface water from rivers and lakes.

Great Miami Buried Valley Aquifer System



In Southwest Ohio, Great Miami Buried Valley Aquifer System (GMBVAS – shown with stippling) is a *sole source aquifer* , the only source of water for most of the 1.6 million residents of the Great Miami River Basin.

Ground Water – Surface Water: a single resource



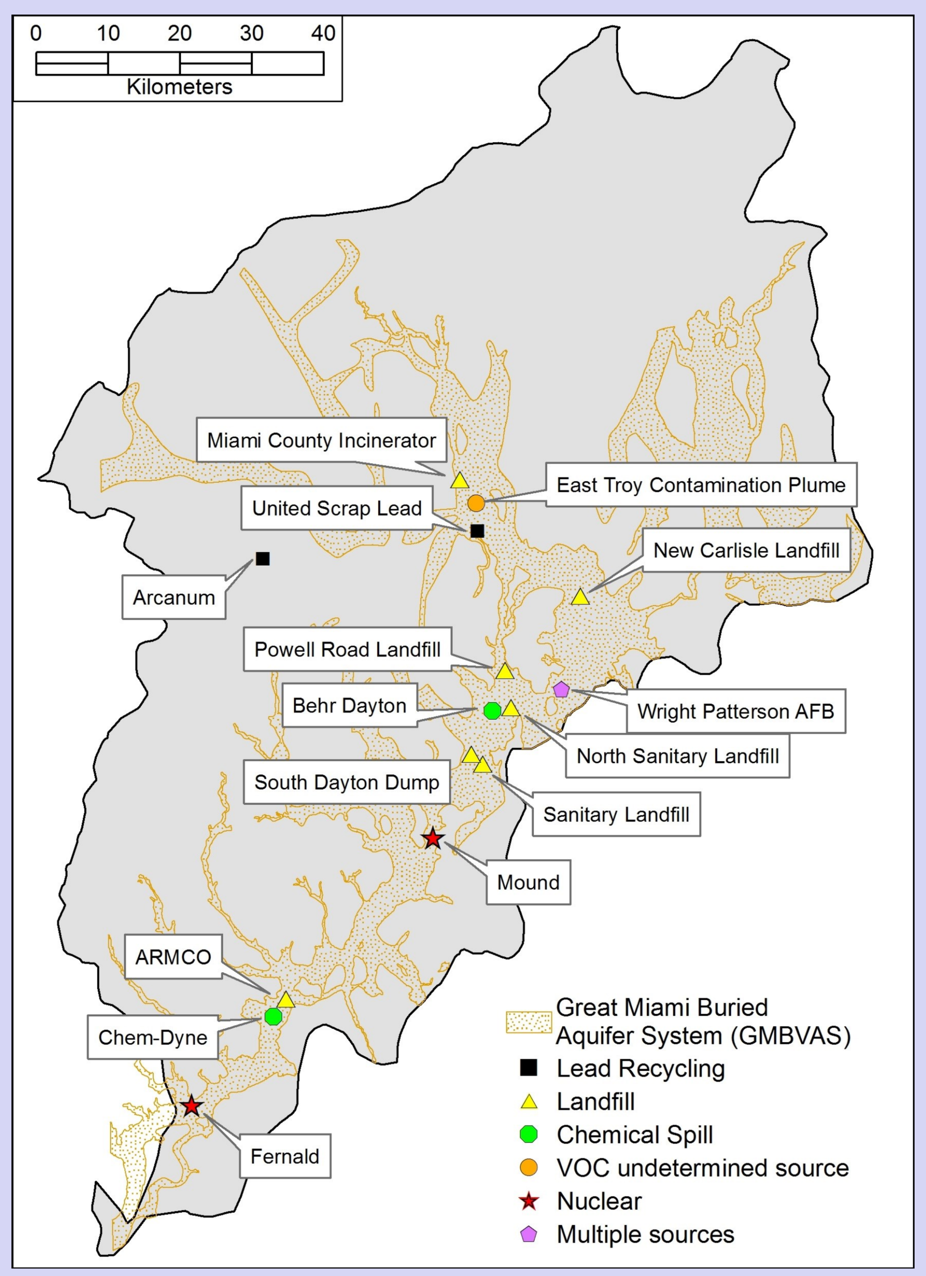
Virtually all water is recycled. In late summer, a substantial portion of the flow in the Great Miami River measured at Miamitown is treated sewage released by the Dayton. Because heavy pumping induces water to flow from the river to the GMBVAS, contamination of the river water will result in contamination of the aquifer.

In many of the more arid areas of the country, most notably in the arid Southwest, ground-water supplies have been overdrafted (ground-water is removed from aquifers faster than it is recharged). In addition to significant environmental problems resulting from such over drafting (*e.g.,* dramatic land subsidence and dramatic reduction or elimination of water flow in streams and rivers), it places serious limits on continued economic and population growth. Water, once consumed by industrial or domestic use, is not "gone" but rather through a variety of means, significantly sewage treatment, it is returned to the hydrosphere where it is reused. To facilitate efficient recycling of water in municipal areas, treated water is returned to rivers where it infiltrates into aquifers, travels through the aquifer material andis naturally filtered, then withdrawn from wells for reuse. Many municipalities have placed outfalls of treated water upstream to facilitate the efficient recycling of water. Some municipalities where water overdrafting has resulted in critical water shortages, notably San Diego, are considering return of appropriately treated waste water directly to the water supply without the natural filtration by the aquifer system (Orange County has already spent $490 million on such a water purification system). This direct recycling of wastewater is formally known as *Indirect Potable Reuse (IPR)* and commonly referred to as a "toilet to tap" system, and has encountered public hesitancy.

Although Southwest Ohio has not yet needed to consider IPR, the desirability of placing wastewater outfall points where they can efficiently recharge the aquifer system has been appreciated since the potential for overdrafting of the Great Miami River Aquifer System, which supplies most of the public's water, was recognized in the 1960s. Although the treated wastewater is relatively clean, biological and chemical contaminants in water from other sources such as runoff from agricultural areas and storm water runoff from urban areas are of concern, particularly *Cryptosporidium*. The rate and the path by which water infiltrates from the river to aquifer needs to be thoroughly understood to preserve the health of our water supply.

There are two end-member scenarios by which water travels from the river to a well in the aquifer: *baseflow* in which the travel time and distance are relatively short and *underflow* in which the time and distance between water entering the aquifer and traveling to the well are great. The greater travel times and distances between the river and well provided by a underflow system provide better filtration of water. Fortunately the Great Miami Buried Valley Aquifer System (GMBVAS) is a classic example of an underflow system. During flooding events, however, the increase in river stage precedes the increase in ground-water level and the underflow system becomes a baseflow system. During these baseflow events, the travel time and distance between the river and well are decreased. The potential health hazard during these periods of baseflow needs to be assessed.

Great Miami Superfund Sites

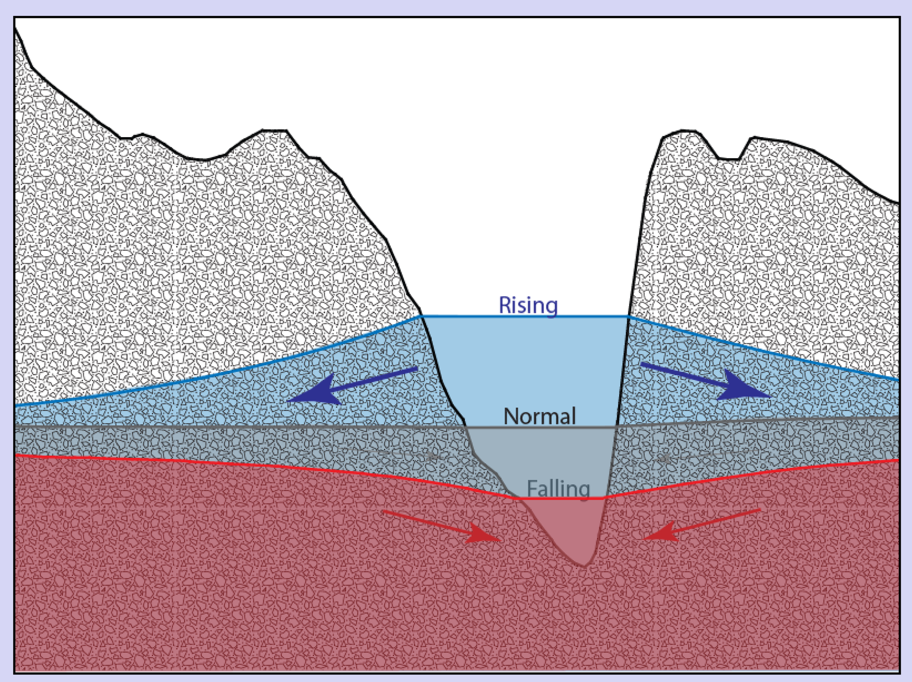


There are 15 US EPA Superfund Sites on the National Priority List in the Great Miami Basin. Many are contaminated landfills put into abandoned sand and gravel quarries (a practice no longer permitted).

The Great Miami River

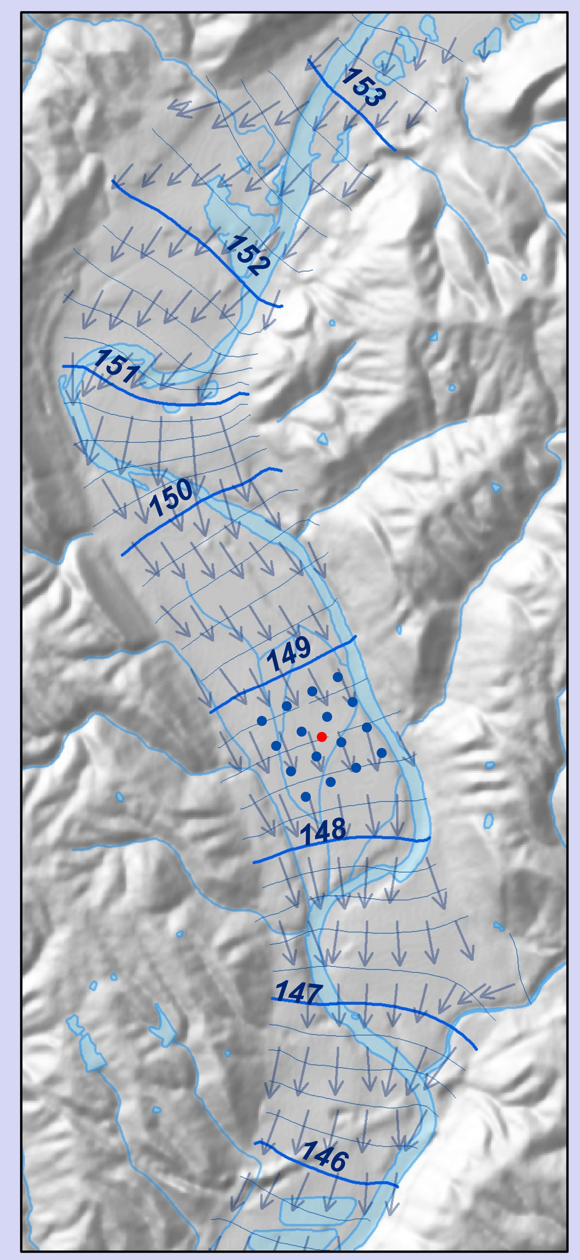
Flood stage

Normal flow

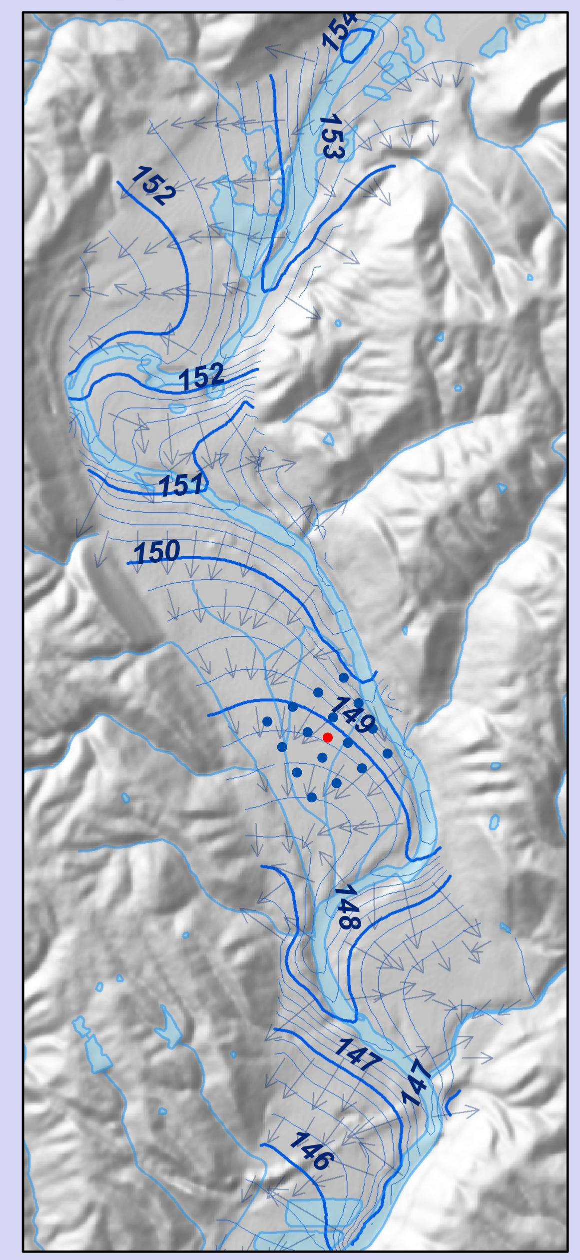


During high discharge (flood) events, the water-level peak in the aquifer lags the river's discharge peak by several days. During this lag, the normal underflow system becomes a *baseflow* system, substantially reducing the travel time and distance necessary for water to travel between the river and well. Geology greatly simplified.

Flooding event – Map view



Steady-State



Increased Flow

When discharge increases during floods, flow within the aquifer changes from a baseflow to underflow system. At such times, the distance and time necessary for water to move between the river and well will decrease, posing a potential contamination hazard.

Aerial view of the Great Miami River