



Demands for water from the Sugar River basin and concern for the river's long-term health compelled the cities of Madison and Verona to ensure that most of the groundwater for southwest Madison and Verona pumped from the basin is returned to the basin. This "waterfall" (foreground) is actually treated effluent that's traveled nearly 20 miles round-trip, from the Sugar River basin to the Madison sewage treatment plant, and back again. This effluent flows to Badger Mill Creek (background), eventually bringing the water back to the Sugar River, in whose basin the water originates.

# Connecting the Drops

## Understanding groundwater from the top down



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### Understanding the Water Underground

Understanding the connection between water under the ground (groundwater) and water on top of it (surface water) is almost a metaphysical exercise, a leap of faith. Everywhere we deal with water, it is contained – in a beer bottle, in a bathtub, in a pond, in a river. It is tangible, defined, visible, limited. But how can we understand uncontained water, underground, that we can't see? And what does that invisible, uncontained water have to do with that stream, or lake, right over there, that you can see?

I experienced this challenge recently with my Aunt Annette, who lives on a lake in northwest Wisconsin. That part of the state is very dry these days; ponds, lakes and rivers are all visibly low. Auntie Net was worried that their lawn would dry up again, and her son-in-law's solution was to pump water from the lake – an idea she opposed because the lake level was so low. Her solution? Use the well water supplying the house.

#### Auntie Net's Challenge

I tried to explain how pumping water from the well was virtually like pumping it from the lake, but I could see my explanation wasn't sticking. Auntie Net could only see two containers of water: the lake was one, and the water in the well was another distinctly separate container. Here was someone who profoundly loved her lake, and I was unable to explain how the lake and her well were the same water.

There's a paradox to unpack to explain this connection to the public: water is so basic and essential, but where it comes from and how it moves is very complex, and requires sophistication to understand both the phys-

ics and the politics of it. For without public understanding and support for groundwater protection, we will likely deplete this irreplaceable resource, and we'll wonder what happened.

But there are some tangible examples unfolding, and useful lessons to be learned, right now in Wisconsin about the groundwater-surface water connection. People are starting to get it. And along with that understanding comes the sober realization that there are serious limits to water, even here in water-rich Wisconsin.

#### Groundwater Ground Zero: Waukesha

The groundwater-surface water hotspot right now is Waukesha County. Municipal wells there are like deep straws, sucking water that is over 1,000 feet below the surface. There are two big problems for that area: the deep aquifer (rock layers soaked in water) contains radium, and the federal government is requiring the municipalities there to supply their residents with untainted water.

But where to go? If Waukesha were to put the straws of its municipal wells into the shallow aquifer (300-400 feet down) for its drinking water, pumping millions of gallons per day for lawn watering, cappuccino making, car washing and toilet flushing, that aquifer eventually would drain down too. And because the "contained" water that's visible to everyone on the surface as they drive through Waukesha County – Lake Chenequa, Vernon Marsh, the Oconomowoc River – is fed and sustained by the uncontained and invisible water underneath the surface, the fate of the surface water is intricately tied to the pumping of the water underground.

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*Connecting the Drops continues from page 5...*

It is why Waukesha is gazing thirstily at Lake Michigan as a source of water. But that is an option fraught with hydro-geologic and political hazard. Waukesha is struggling to figure out its future water supply, even while Waukesha County executive Dan Vrakas projects a population of over half a million (from 380,000 currently).

### **Can We Put It Back?**

Compounding the problem of as-goes-the-groundwater-so goes-the-rivers-and-lakes is the fact that we simply waste water in this state. Some it is profligate use, such as watering a useless crop like suburban grass or not using water-miser plumbing fixtures. We could mitigate the impending water supply crisis in Wisconsin by simply being more careful with what we have.

That includes, in the memorable words of Bob Zimmerman, the sharp, energetic executive director of the Boston-based Charles River Watershed Association, not “throwing water away.” This occurs when we take water out of the ground in one place, clean it up at the sewage treatment plant, then send it away down a river to a completely different watershed. For Boston or any oceanside city, the waste of fresh water dumped into the ocean is obvious, but the same thing happens in Wisconsin, where our groundwater ends up, once used, either in a Great Lake or the Gulf of Mexico.

Two communities, however, mindful of the groundwater-surface water connection, didn’t want to throw their water away. An innovative cooperative effort between the city of Madison’s sewage district and the city of Verona takes water from one basin (the Upper Sugar), sends it away for treatment to another basin (the Yahara), and sends it back again to the basin of origin.

Planners feared that as west Madison and Verona expanded, the groundwater pumping from the Upper Sugar River basin would deplete the Sugar River itself, which at that point in its early life is almost totally groundwater-fed. So rather than create a water budget deficit for the Sugar, all water that is pumped back from Madison’s sewage treatment plant in the Yahara basin to an outlet at Badger Mill Creek, which flows into the Sugar, thus keeping that water in its “home basin.”

Innovations like these will need to be business-as-usual in the coming years, as the days of wasting water and, worse, not understanding how all water is connected, have to end.



Residents and businesses, like Epic Systems of Verona (background), are big groundwater users, and drawing out groundwater affects flows of nearby streams, like the Sugar River (foreground). *River Alliance photo.*