High Capacity Well Impacts on Wisconsin Lakes, Streams, and Wetlands

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Summary

Wells pump groundwater. In Wisconsin, groundwater is usually well-connected to local lakes, streams, and wetlands, so when groundwater is pumped from wells, water levels in aquifers (the geology that holds groundwater) drop, as do the levels of connected lakes and wetlands and the flows of connected streams. The effects of pumping on fish, wildlife, and public water rights are a matter of degree: a little pumping may have a barely perceptible impact, but larger amounts can be devastating.

A high capacity well as defined in Wisconsin statutes is one with a "… capacity to withdraw more than 100,000 gallons [of groundwater] per day…" or that "… together with all other wells on the same property, has a capacity of more than 100,000 gallons per day."[1] Wisconsin has some 9500 wells capable of pumping more than 100,000 gallons per day,[2] and only a handful were evaluated for their impacts on lakes, streams, and wetlands before receiving regulatory approval.

High capacity well pumpage is typically about 250 billion gallons per year (reported for 2013, a fairly average weather year), with roughly 40% attributable each for agricultural irrigation and municipal use, and lesser amounts for industry, stock watering, mining, and others.[3]

Wisconsin has been struggling with little success since the 1950s to develop a framework that recognizes and manages pumping impacts. Lately, courts have been relying on constitutional protections under the public trust doctrine to protect surface waters from unlimited high capacity well pumping, while legislative and executive branch actions have sought to reduce protections and streamline processes for more high capacity well approvals.

Groundwater in the Water Cycle

"Groundwater" is the water beneath the earth's surface that saturates pore spaces between sand grains and the cracks in bedrock. This saturated geology is called an "aquifer." Water in a saturated geology is distinguished as groundwater, while water in unsaturated geologic materials, where pore spaces contain both water and air, is termed "vadose water." (Vadose water is experienced in daily life as the moisture contained in garden and field soil.) Groundwater flows naturally under the influence of gravity and pressure, and it can also be pumped by wells.

Groundwater has its ultimate origins from local precipitation, which in Wisconsin averages about 32 inches annually. Generalizing, only a couple inches of precipitation runs across the land surface directly to streams and departs a watershed, while the remainder soaks into the soil. Most soil water is extracted by plant roots, transported to leaves, and lost to the atmosphere in a process termed "evapotranspiration." This evapotranspired water will eventually fall to the earth elsewhere as precipitation. Evapotranspired water amounts to about 22 inches of water a year, which leaves about 8 inches or so of the original 32 inches of precipitation to seep beyond plant roots and become groundwater.

Groundwater flows through aquifers to ultimately discharge at a surface water and leave a watershed (Figure 1, top). Most often that discharge is to a local stream, but sometimes to large lakes (Lakes Winnebago, Michigan, and Superior, for example) or to smaller lakes that have exit streams. Groundwater discharge points, especially when they are visible, are colloquially referred to as "springs." Where the land surface dips below the groundwater surface, lakes and wetlands are formed.

Aquifers in Wisconsin generally range in thickness from tens to hundreds of feet. From recharge to discharge, groundwater might travel laterally only a few feet to 30 miles or more. Common flow distances are 10 miles and less.

Groundwater levels and the levels in groundwater-connected lakes, streams, and wetlands fluctuate over time. Weather and well pumping are two main drivers of water levels. Weather variability through seasons or years causes water level highs and lows. Pumping affects the natural fluctuations by lowering both the highs and the lows.

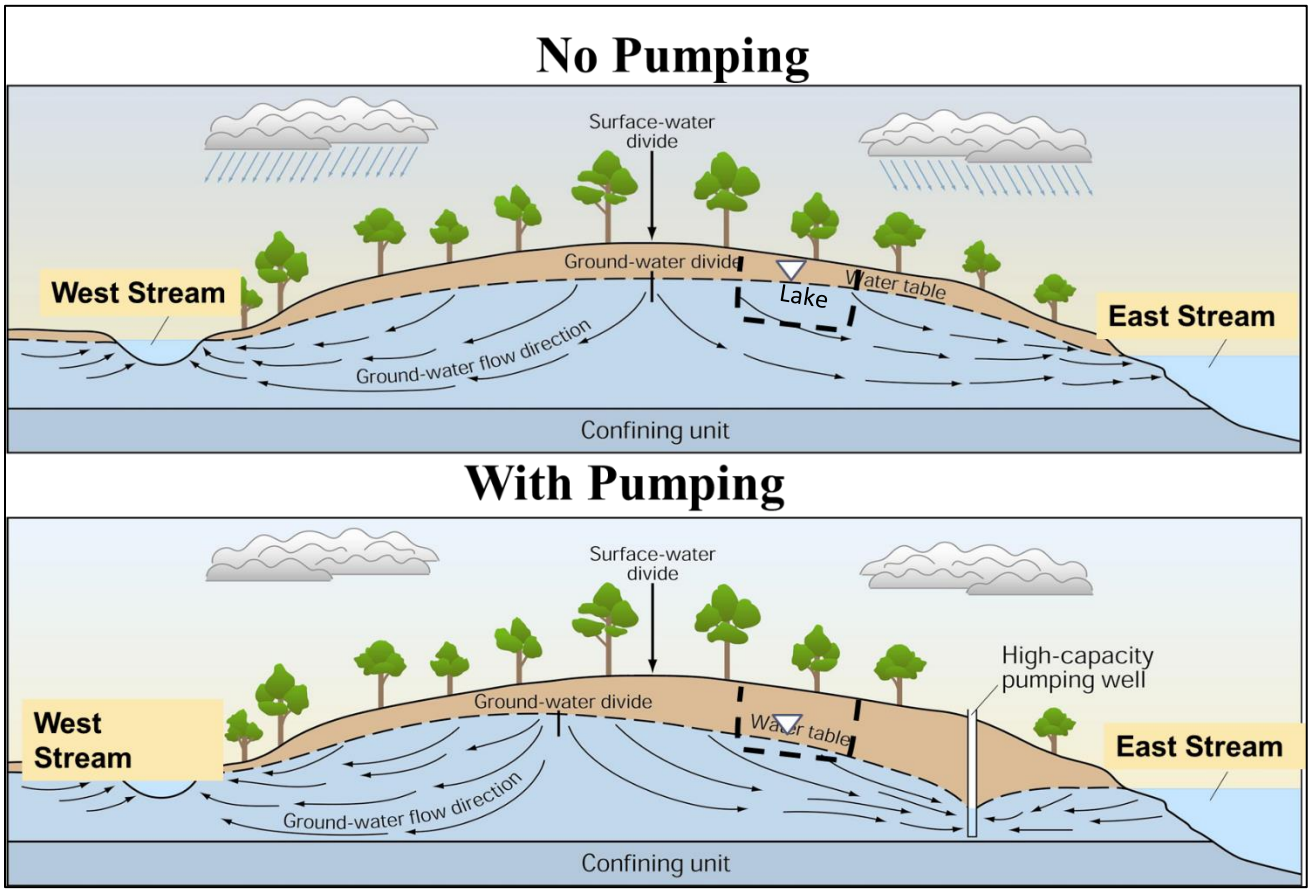

Figure 1. A groundwater flow system under natural (top) and pumping conditions (bottom). Note that the lake is a dip that extends below groundwater levels. The pumping well intercepts water that was going to the East Stream and captures some water from the West Stream as well. Because pumping lowers water levels in the aquifer, lake levels have declined. When wells are located near a stream, the flow of groundwater might be reversed. (Figure modified from Grannemann et al.[4])

High Capacity Well Impacts on Surface Waters

High capacity wells remove groundwater from aquifer storage and usually discharge it to a locale other than where it was naturally heading. Pumped groundwater may be used "consumptively," i.e., lost ultimately into the atmosphere through evaporation and evapotranspiration, or "nonconsumptively," i.e., discharged to a surface water.

Figure 1 (bottom) illustrates the twin effects of groundwater pumping: water level decline and diversion from surface waters. Water levels in aquifers distinctly decline around a pumping well, forming a so-called "cone of depression." This cone is particularly pronounced when a well is actively pumping, and it dissipates when a well is turned off. But even if a well is off for some time and the "cone" has become indiscernible, less water and lower water levels persist in the aquifer compared with pre-pumping times. And because surface waters are often well-connected to groundwater, the lowering of water levels in aquifers may also lower the levels of lakes, streams, and wetlands and reduce groundwater discharge to these features. Years or even decades may be needed for water levels in an aquifer to achieve a new equilibrium level with a new pumping well.

Well pumping diverts water from surface waters because wells intercept and remove groundwater otherwise destined to discharge to surface water. More subtly, a well pumping strongly and near enough to a stream can reverse the flow of water from into the stream to out of the stream. Not only are surface waters downstream of a pumping well affected by pumping, but surface waters upstream as well.

Wisconsin Central Sands

The Wisconsin Central Sands is the most prominent, but not the only, area of Wisconsin where lakes, streams, and wetlands have been greatly diminished by groundwater pumping. Conflict regarding high capacity well pumping and surface water impacts goes back 60 years,[5] and is mainly centered on extraordinary amounts of irrigation pumping for field corn, potatoes, and processing vegetables.

The Central Sands extends across parts or all of seven counties[6,7] spanning 80 miles north-south and 50 miles west-east. The region's geology typically comprises a 100-foot-thick mantle of sandy and gravelly glacial deposits covering a less permeable bedrock. The glacial deposits contain the region's principal aquifer. The coarse surficial materials percolate a large fraction of local precipitation to the aquifer, and this water is in turn transmitted through the aquifer and discharged to local streams. The Central Sands contains some 200 groundwater-connected lakes over 10 acres in size, over 600 miles of groundwater-connected streams, many of them trout waters, and high quality wetlands including rare calcareous fens.

The same sandy and gravelly geology that contributes to the region's rich hydrology also created droughty soils that can benefit from irrigation, and it provides a productive aquifer that can be easily tapped by high capacity wells to supply irrigation water. Thus, the area has become highly developed for irrigation. The Central Sands accounts for more than a quarter of all the groundwater pumped in Wisconsin and contains about 2,500 high capacity wells. About 85% of high capacity well pumping in the Central Sands is for irrigation, with smaller amounts for municipal, industrial, and other purposes.

The groundwater – surface water – pumping connection in the Central Sands has been well studied since the 1960s,[8,9] when researchers warned that surface waters could suffer catastrophically in the absence of a groundwater pumping management plan limiting how much can be pumped and where. These warnings mainly went unheeded while high capacity well numbers increased (and continue to increase) dramatically over time.

Both the research conducted in the 1960s[8,9] as well as modern-day forensic hydrology[6,7,10] identified pumping-induced water level and streamflow impacts. But catastrophic drying during a modest dry spell during 2005-2010 brought the pumping issue to the forefront of public discussion. Substantial surface water drying was experienced in many lakes, streams, and wetlands including: the Plainfield area lakes, Hancock area lakes, Portage County's Pickerel and Wolf Lakes, Adams County's Patrick Lake, the Little Plover River, and Stoltenburg Creek. Deeper water bodies sometimes only experienced water level losses and wider beaches, but shallower lakes were reduced to wetlands or dried completely and some fish kills were catastrophic. Public uses for parks, fishing, and hunting were diminished, as reportedly were property values and property taxes (G. Kraft pers. comm.).

The future for many Central Sands surface waters is dim if groundwater management strategies are not enacted while high capacity well numbers continue to increase. A study in the upper Tomorrow River region in Portage County found that the high capacity well numbers and irrigated acres there have the potential to quadruple, which will cause lakes and streamflows to continue their decline.[11]

The Unsettled Framework of Groundwater Pumping Management

The current state of high capacity pumping management has been shaped by the courts, legislature, and executive administrative actions. Wisconsin statutes (Wis. Stat. § 281.34)provide only minimal protections for a small minority of Wisconsin lakes, streams, and wetlands. Court actions offer some protections from new wells but thus far not where existing wells already have caused significant impacts. Legislative actions and executive actions prior to 2019 have been focused on minimizing the scope of court-mandated protections for impacted surface waters.

<u>Legislative activity has done little to protect surface waters</u>

Protections for surface waters from high capacity well pumping were already being debated in the 1950s. An especially intense period of legislative deliberation prevailed during 1957-1959 and resulted in several proposals, including 1959 Assembly Bill 64, that would have required high capacity wells to be permitted and that permitting to be made contingent on protecting public rights in state waters. It failed.

For the following 40 years, legislative discussions on groundwater pumping management lagged. New interest was piqued by the well-known 1999 Perrier proposal to bottle spring water at the headwaters of the Mecan River in Waushara County and at Big Springs in Adams County. These proposals laid bare the weaknesses of Wisconsin's groundwater pumping laws. Concerns about the statutory shortcomings triggered legislative discussion and the convening of a stakeholder group led by Rep. Dwayne Jonsrud and Sen. Neil Kedzie. The result was 2003 Wisconsin Act 310. It accomplished little for surface water

protection, offering only a few protections to a minority of the state's lakes, streams, and wetlands, but was billed as a "first good step," onto which additional steps would be added.[12]

Attempts to take that "second good step" have thus far failed. After a lengthy process of working with scientific and stakeholder groups, Rep. Corey Mason and Sen. Mark Miller proposed 2009 AB 844/SB 620, which offered some protections for all surface waters as well as a framework for managing groundwater in areas where pumping from multiple wells was impacting water resources. This and similar bills (e.g., 2019 SB 732) failed for not being brought for a floor or committee vote.

Rather than taking the second good step, the legislature has aimed at reducing the scope of court-mandated protections and easing the high capacity well application process. In 2013 Rep. Daniel LeMahieu introduced Motion 375 into the state budget process, which prohibits citizens from challenging applications or permits for high capacity wells based on their cumulative environmental impacts. It passed.

More-recently passed 2017 Wisconsin Act 10[13] notably makes high capacity well approvals effectively permanent. Department of Natural Resources (DNR) staff previously represented that approvals for high capacity wells that were harming lakes, streams, and wetlands could be modified when a well needed replacement or reconstruction or when a property transfer was occurring. 2017 Act 10 eliminated these regulatory tools. Another concern about 2017 Act 10allows high capacity well approvals to be bought and sold with property, effectively allowing groundwater resources to be privatized.

Another provision of 2017 Wisconsin Act 10 called for DNR to study three specified lakes plus other water bodies

> "… for which the department seeks to determine whether existing and potential groundwater withdrawals are causing or are likely to cause a significant reduction of the navigable stream's or navigable lake's rate of flow or water level below its average seasonal levels."

Existing work showed that some 20 lakes and tens of miles of streams are likely significantly impacted in the study area. This work was forwarded to DNR as the basis for what should be studied under Act 10. But DNR did not seek to study these waters, and instead is limiting their efforts to the minimal three lakes and no streams. No explanation has been provided.

Beulah

A true game-changer in Wisconsin groundwater management occurred in 2011 when the Wisconsin Supreme Court decided that DNR is required, when presented with sufficient concrete, scientific evidence

> "to consider whether a proposed high capacity well may harm waters of the state" (*Lake Beulah v. State of Wisconsin DNR*).[14]

For the first time Wisconsin surface waters would receive some protections from new high capacity wells. This decision reversed DNR's long-held position that it lacked authority and responsibility for evaluating and managing harms that accrue from groundwater pumping.

Executive and administrative actions

Executive and administrative actions prior to 2019 have mainly sought to limit court-won protections for surface waters.

After *Beulah*, DNR downplayed the impacts of pumping and held it was not required to consider the cumulative impacts of multiple pumping wells in a 2011-2014 case involving two high capacity wells for a dairy in Adams County. The effect of DNR's position was that any single high capacity well was not permitted to dry a water body, but if one well on top of another on top of another, etc., dried a lake or stream, that was permissible. DNR's position was reversed in an administrative law process, as outside experts showed that DNR inadequately considered existing pumping impacts. In his 2014 decision, the administrative law judge found that DNR has an obligation to consider cumulative impacts, writing[15]

> "The DNR possesses the authority to consider cumulative impacts to the waters of the state caused by high capacity well pumping … when assessing applications for high capacity wells. The failure to consider these impacts is a gap in public trust enforcement…"

Assembly Speaker, Attorney General Schimmel, and DNR apparent coordination to undercut *Beulah*

In an apparent coordinated effort to exempt high capacity well applications from scrutiny, Assembly Speaker Robin Vos in February 2016 requested that Attorney General Brad Schimmel issue an opinion as to whether DNR was prohibited from acting on the Supreme Court's *Beulah* decision by 2011 Wisconsin Act 21. Schimmel in May 2016[16] answered in the affirmative. DNR adopted Schimel's opinion in June 2016 and began issuing approvals for high capacity wells previously deemed too impactful of surface waters and other approvals without any review.

Clean Wisconsin v. Wisconsin DNR challenged eight wells that DNR previously found too impactful to surface waters, and decided in October 2017 that DNR's action (and the Attorney General's opinion) ran afoul of the state constitution.[17] This put DNR back into a position of having to review high-capacity wells for impacts on surface waters. DNR appealed, and in April 2019 the Supreme Court decided to take-up that appeal. The appeal is still pending and not yet scheduled for briefing, argument, and decision.

In the meantime, Attorney General Kaul has replaced Schimmel and in May 2019 reversed the Department of Justice position on this lawsuit.[18] However DNR, citing the pending Supreme Court review, has not similarly reversed its course, and high capacity wells are still not receiving reviews for impacts on surface waters.

June 2 2020 Update: Resulting from Attorney General Kaul's withdrawal of the Schimmel opinion, DNR announced[19] it will once again be reviewing high capacity well applications for environmental impacts on navigable waters which includes most of Wisconsin lakes and streams.

> "In accordance with the Wisconsin Supreme Court's decision in *Lake Beulah Management District v. Wisconsin Department of Natural Resources,* the Department will act pursuant to its duty to protect and preserve navigable waters under the public trust doctrine…."

Protections for navigable waters leaves unprotected other waters of the state such as wetlands and private wells. These were previously protected during the period initially following *Beulah* (A. Freihoefer, pers comm).

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About Wisconsin's Green Fire:

Wisconsin's Green Fire (WGF), is an independent nonpartisan organization. WGF supports the conservation legacy of Wisconsin by promoting science-based management of its natural resources. Members represent extensive experience in natural resource management, environmental law and policy, scientific research, and education. Members have backgrounds in government, non-governmental organizations, universities and colleges and the private sector.

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