The Oxbow
FROM THE NORTH DAKOTA STATE WATER COMMISSION

Where The Water Is

Isaac Newton said, "If I have seen further, it is by standing upon the sholders [sic] of giants…" In the case of North Dakota's ground water appropriation process, this is especially true.

In many areas throughout the country, water users have been withdrawing ground water over huge areas at a greater rate than it naturally replenishes, in effect "mining" their water resources. Over the short term, this can mean that people will need to drill wells deeper and deeper in order to access ground water. Over the long term, overuse like this can effectively mine the ground water until it is unavailable.

North Dakota is a state that straddles the divide between too much and too little surface water. While this means that in many years there is more than enough to meet the needs of all (sometimes, quite a bit more than anyone wants); the fact remains that there are also times when there is not enough water to meet the needs of all. For those residents of the state who do not live directly along the Missouri River, which supplies the vast majority of the state's surface water, ground water is often the next best available option, and North Dakota has significant ground water supplies, much of it potable.

Finding The Water

Figuring out how much surface water is available can be laborious, but it is not that complicated. Ground water is far more difficult to conceptualize and measure, because it is literally underground, and cannot be observed directly.

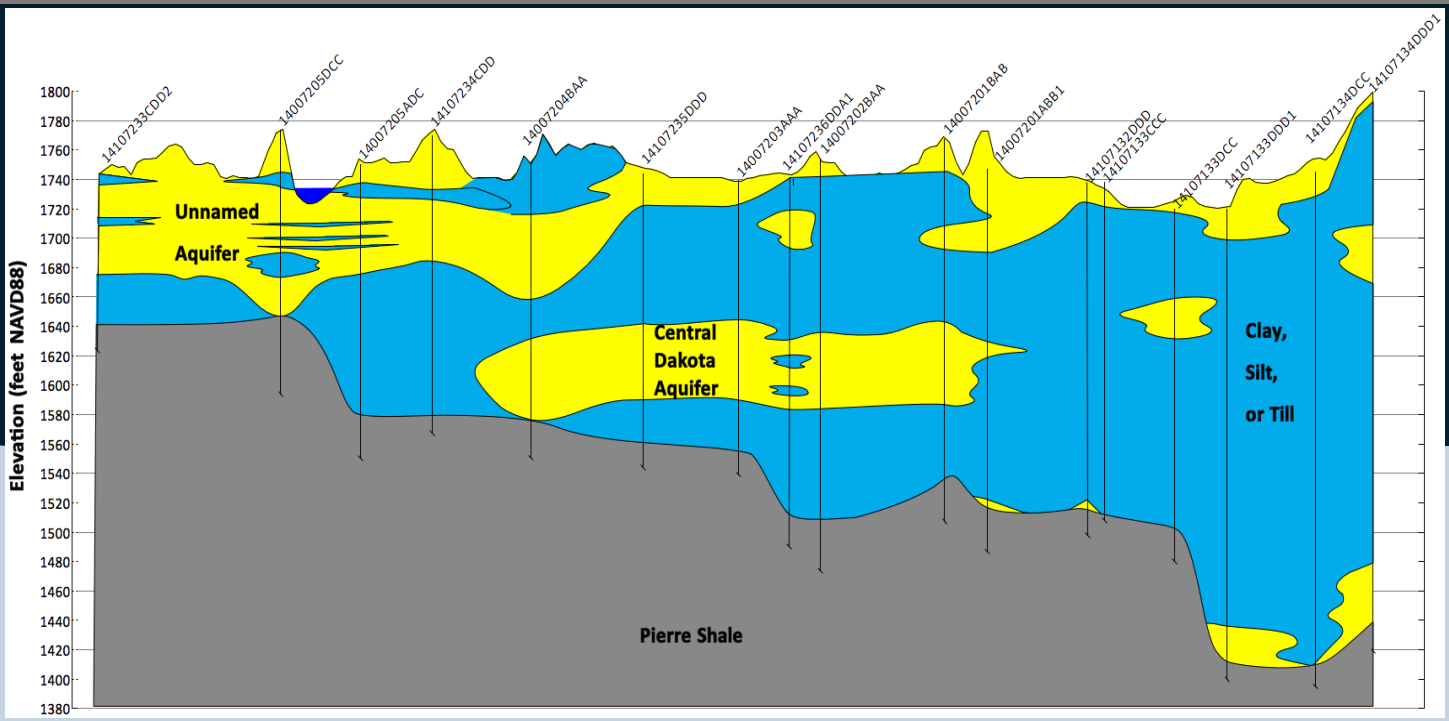
Hydrologists overcome this obstacle by installing observation wells, which tell them how deep and extensive the aquifer is, how much water there is in it, and the quality of that water. In later steps, hydrologists conduct pump tests, develop simple mathematical models, or use complex and powerful computerized models to make sense of those pinhole views of aquifers. As part of that process they can develop an accurate understanding of the amount of water in an aquifer, the extent of that aquifer, where water flows into and out of the aquifer, and how much water a well is able to remove (flow rate). It is a laborious process; like using individual buckets to sample a lake.

Today, when the Office of the State Engineer (OSE) receives a request for a new ground water permit, the first thing a hydrologist will examine is the existing well network and database of existing water permits.

> The OSE/Water Commission currently have 4,351 observation wells across North Dakota, and 3,939 active surface and ground water permits.

After determining what information is available, the hydrologist makes a judgment of whether or not there is sufficient data already available to determine if there is enough water for the entity requesting a water permit.

If the hydrologist is able to determine water availability from existing information, then a permit may be granted, although not necessarily for the amount requested. Sometimes only a portion of the water requested is available for use without causing undue impact. In that case, a portion of the permit could be granted, and the rest could be held in abeyance until more data is collected.



A modeled visualization of the Central Dakota Aquifer in North Dakota, created using observations wells.

If there is insufficient information available, the OSE/ Water Commission drilling crew and hydrologist are dispatched to the area in question to drill additional wells, in order to give a more definitive answer. In some instances, new wells are not required, but more time monitoring water level fluctuations in existing wells can be necessary to determine if additional water is available to be appropriated.

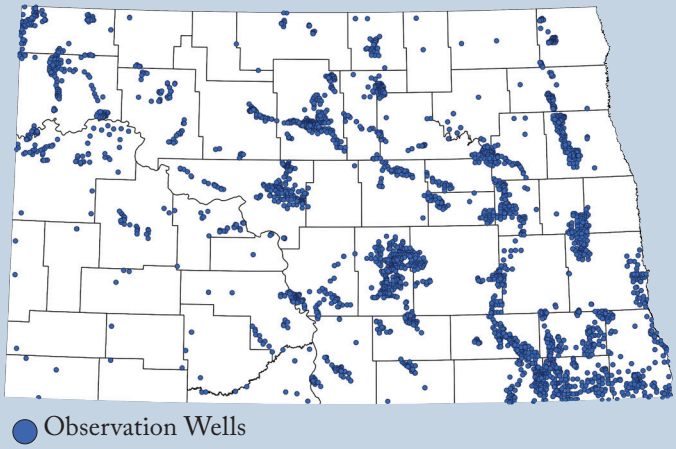
In areas where ground water has been highly appropriated, i.e. the permitted water uses approach what Water Commission hydrologists have determined is close to the limit of sustainable withdrawal, then the level of detail needed to make an accurate and responsible determination increases rapidly. In eastern North Dakota, where irrigation from shallow glacial drift aquifers is common, this can oftentimes be the case. This type of science is in fact complicated, and detailed studies of aquifers can take a while to complete, from months to years.

On The Shoulders Of Giants

North Dakota is fortunate to have in place an extensive and long-running ground water monitoring network throughout the state. This network allows the OSE to effectively and scientifically manage the state's water, but it took nearly a half century of hard work to get to that point.

In the 1950s, visionaries at the OSE and Water Commission laid the groundwork for the extensive monitoring network we have today. In those first decades, that entailed collecting and archiving anecdotal and recorded accounts of wells, successful or otherwise, throughout the state. Knowing where unproductive wells were, and how deep, was as important as knowing where the productive wells were.

From the 1960s through the 1980s, the OSE/State Water Commission joined with the North Dakota Geological Survey and United States Geological Survey to develop and publish County Ground Water Studies that describe the ground water resources in each county of the state. Each study had three parts: Part I described the geology of the county; Part II provided a summary of the basic ground water data in the county, including locations and logs of wells; and Part III summarized the major ground water aquifers. In the process of developing these studies, geologists and hydrologist at the Water Commission and Geological Survey drilled



There are currently 4,351 observation wells maintained by the Office of the State Engineer in North Dakota, from which a wide variety of water data is collected.

hundreds of test holes and installed hundreds of wells across the state, cataloged thousands of private wells and springs, and performed tens of thousands of pumping tests.

Beginning in the 1940s and continuing through present day, the Water Commission also conducts and publishes North Dakota Ground Water Studies for communities around the state. These studies also involve installation of wells and collection of water level and water quality data.

Agency hydrologists continue to work with the drilling crew to install additional observation wells throughout the state to better understand the nature of aquifers where additional appropriations are sought. Over time, the network of wells has grown more and more extensive, and the volume of water level and quality data at hydrologists' disposal has continually increased.

Prior to the adoption of computers, the processing of data needed to better understand an aquifer could take years of work, if not decades, or even a career, as hydrologists relied on hand-drawn maps, graphs, and diagrams, and used mathematical solutions to predict water level response. Since the 1980s, the adoption of personal computers allowed for faster analysis of data and greater graphing and mapping capabilities. Complex ground water flow models can be developed for areas where simple mathematical solutions are not adequate for predicting ground water flows. This dramatically increased the state's ability to develop an accurate picture of the ground water that is present and how it reacts to uses such as well withdrawals.

The Water Commission's Information Technology division has built databases and software to store, tabulate, graph, and map all of the agency's water level, quality, and use data, making it easily accessible for hydrologists. The data is also all publically available through the agency's website, and is used by numerous other state and federal agencies, academic institutions, natural resource professionals, and members of the public.

Today, a half century after the OSE began planning and implementing its extensive ground water monitoring network, the data used to make decisions and better develop the water resources of the state for the betterment of its citizens has resulted in the finest, most thorough, and longest monitored ground water network in the country.

NOTICE: 2016 Commissioner Hosted Meetings

To promote and encourage more local project sponsor participation in water planning and in legislative and agency biennial budgeting efforts, the 2013 Legislative Assembly passed House Bill 1206 (NDCC 61-02-01.3), requiring the Water Commission to schedule commissioner-hosted meetings within six major drainage basins. The meetings will be held in the Red, James, Mouse, lower and upper Missouri River, and Devils Lake basins.

Monday, July 25
Mandan, ND
3:00 p.m.
Baymont Inn
2611 Old Red Trail

Tuesday, July 26
West Fargo, ND
3:00 p.m.
City Office Building
800 4th Ave E.

Wednesday, July 27
Minot, ND
5:00 p.m.
County Administration Building
225 3rd St. SE

Tuesday, July 26
Jamestown, ND
9:00 a.m.
Civic Center
212 3rd Ave NE

Wednesday, July 27
Devils Lake, ND
10:00 a.m.
Ramsey County Courthouse
524 4th Ave. NE Unit 6

Thursday, July 28
New Town, ND
10:00 a.m.
Four Bears Casino
202 Frontage Road

For more information go to the State Water Commission's website at www.swc.nd.gov.

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