



IOWA WATER USE PROGRAM

UPDATE FOR JORDAN AQUIFER STAKEHOLDERS

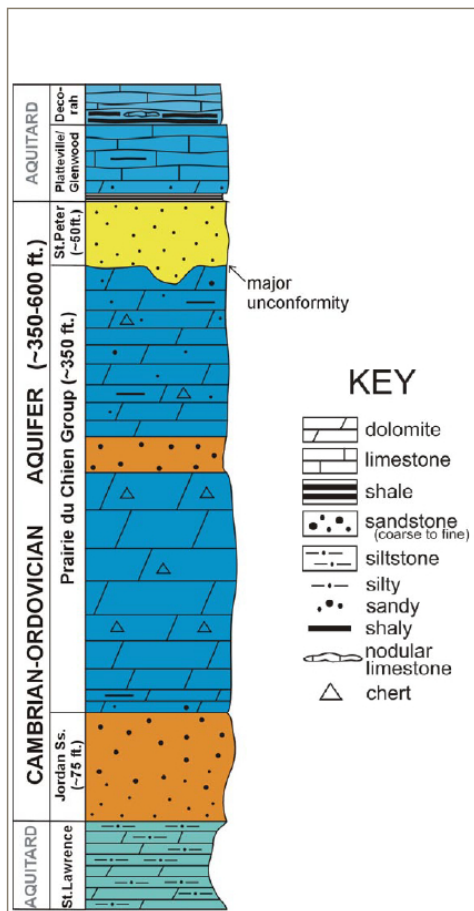
2020

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Jordan Aquifer

The Jordan aquifer, also known as the Cambrian-Ordovician aquifer, or Prairie du Chien aquifer, is the most productive and extensive bedrock aquifer in Iowa. The Jordan aquifer is the most utilized bedrock aquifer in the state, and is the principal source of water for numerous public water supplies and industries.

The Jordan aquifer is typically deep and confined in Iowa. Only in extreme northeast regions of the state are the formations of the Jordan aquifer shallow enough to be exposed near the land surface. In these regions the geologic units that comprise the aquifer form dramatic bluffs along roads, streams and rivers.



There are three distinct geologic units in the Jordan aquifer: from top to bottom, these are the St. Peter Sandstone Formation, the Prairie du Chien Group, and the Jordan Sandstone Formation.

Two aquitards confine the Jordan aquifer throughout most of the state. The Glenwood Shale Formation, a thin, impermeable shale layer, caps the Jordan aquifer from above the St. Peter Sandstone.

The St. Lawrence Formation, a thick unit of siltstone and dolomite is a semi-confining aquitard at the base of the Jordan Sandstone. The total thickness of the Jordan aquifer is generally around 500 feet. The majority of the thickness arises from the fractured dolomite of the Prairie du Chien Group (Figure 1).

Jordan Aquifer Rule

2019 marks the fifth year of implementing Iowa's Jordan aquifer rule, and the seventh year of collecting data to implement the rule. Since 2015, all Iowa water use permits utilizing the Jordan aquifer are regulated using a three-tier classification system. The three-tier system uses well pumping water levels submitted annually to the department and compares these results to the potentiometric surface published by Horick and Steinhilber in 1978. Table 1 below shows the different tier classifications listed in the Jordan Rule.

	Declines from 1978 levels to current pumping levels in Jordan well	
	More than 600 feet of pressure head between aquifer and 1978 potentiometric surface	Less than 600 feet of pressure head between aquifer and 1978 potentiometric surface
Tier 1	< 300 feet	<50 percent
Tier 2	300-400 feet	50-75 percent
Tier 3	>400 feet	>75 percent

Table 1. Tier classification system for Jordan aquifer water use permits.

Once a water use well's pumping water level drops below into Tier 2 or Tier 3, the water use permittee must submit and implement a water use reduction plan that outlines steps the system will take to raise the well's pumping water levels back to Tier 1. These plans can also incorporate well maintenance, pumping management, and other methods in addition water use reduction strategies.

If you are interested in the specific language of Iowa's Jordan aquifer rule, please visit www.legis.iowa.gov/law/administrativeRules/rules?agency=567&chapter=52.

Figure 1: Generalized stratigraphy and thickness of geologic formations that comprise the Jordan (Cambrian-Ordovician) aquifer in Iowa. Included are the aquitards above and below the aquifer (from DNR 2011).

Jordan Water Use Permit Changes

Three Jordan aquifer water use permits were added, and six Jordan aquifer permits were terminated in 2019, giving a current total of 205 water use permits utilizing the Jordan aquifer in Iowa. All three new permits are for agricultural or ag-industrial use. Most of the terminated permits were from community water supplies that inactivated or plugged an older Jordan well from their system's supply.

Only two new Jordan water use wells were drilled in 2019, one for the City of Grimes in Polk County, first permitted in 2018, and one for Cargill in Monroe County, first permitted in 2017 (Figure 2). This is the lowest annual number of new Jordan wells drilled in the water use program since 2014, when only one water use well was drilled in Iowa (also for the City of Grimes). The low number of new Jordan wells in 2019 comes after two consecutive years with record numbers of Jordan aquifer wells drilled- eight and ten wells drilled in 2017 and 2018, respectively.

A total of 18 water use permits were modified, renewed, or updated using the new Jordan rule criteria in 2019. Additional work included the construction of a regional numerical groundwater flow model by the Iowa Geological Survey to assist in accurately predicting water level changes for users near the Des Moines metro area in Polk County. Previous groundwater models have been developed near protected water source areas to address water concerns and better forecast Tier levels.

Water Use Well Trends

Figure 3 shows new Jordan water use wells that have been constructed since the rule took effect. A total of 24 wells have been constructed since 2015, which is 6.8 percent of all currently active water use wells in Iowa. With the exception of Polk County, most new Jordan wells are scattered throughout the state, and are not associated with high use counties.

Only one water use well was drilled in a protected source area, for the city of North Liberty in Johnson County. At three new wells, Polk County had the highest number of recent wells drilled. All three of the new wells were for public water supplies, (Des Moines, West Des Moines, and Grimes).

One of the three new wells, Des Moines Army Post Road, was constructed for aquifer storage and recovery purposes.

Use types show a general trend towards agriculture and industrial construction, only three wells were constructed for existing ethanol production, eight wells for public water supplies.

A majority of new Jordan wells (13 of 24) were constructed for Ag-Industrial use. The varied types of industry in this category includes confined feeding operations, dairies, and food processing facilities.

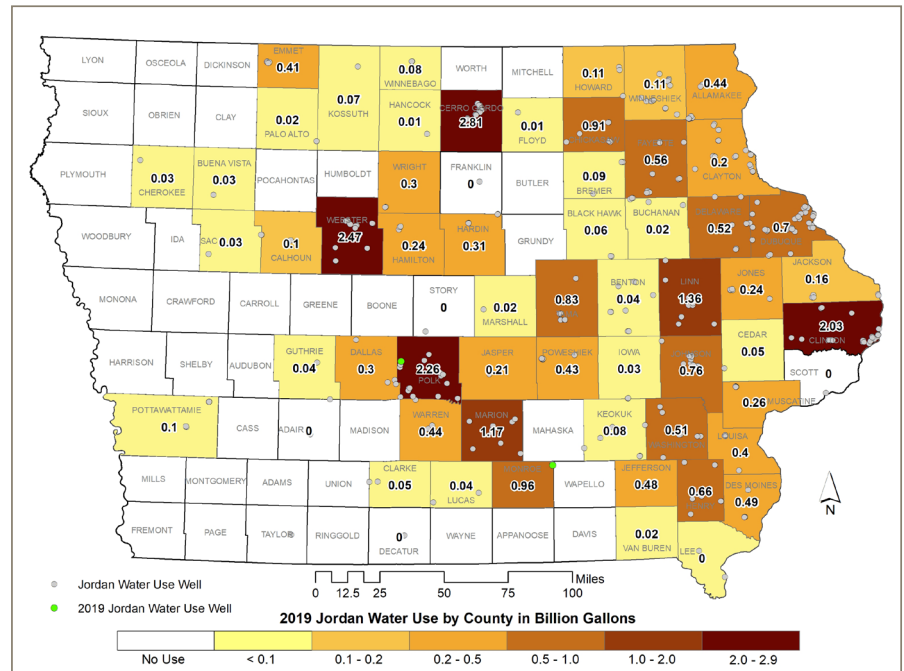


Figure 2: 2019 Jordan water use program wells and Jordan aquifer total withdrawals by county in Iowa.

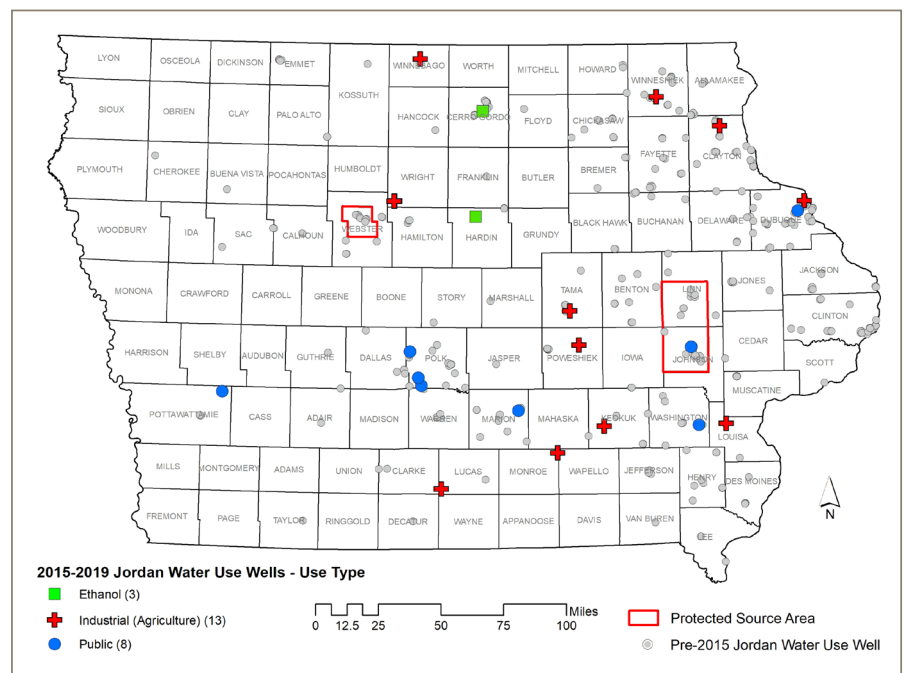


Figure 3: Iowa water use program Jordan wells constructed since rule implementation in 2015.

Jordan Aquifer Water Use

Figure 2 shows the water use by county from the Jordan aquifer in 2019. Just as in 2018, four counties exceeded two billion gallons per year (bg) of Jordan withdrawals in 2019: Webster (2.47 bg), Cerro Gordo (2.81 bg), Polk (2.26 bg), and Clinton (2.03 bg). Three counties had withdrawals that exceeded one billion gallons per year: Linn (1.36 bg), Marion (1.17 bg), and Monroe (1.17 bg).

Water use from each of these high-use counties was comparatively similar to 2018, with the largest change being a substantial 430 million gallon decrease in Webster County.

Statewide, 2019 water withdrawals from the Jordan aquifer remained comparatively steady from previous years, to even slightly declining in areas. Withdrawals decreased by 600 million gallons last year, from the record 25.7 billion gallons in 2018 to 25.1 billion gallons in 2019 (Figure 4).

Most of the decrease can be attributed to public water supplies reducing their use from the Jordan aquifer, most notably the cities of Coralville, Fort Dodge, and Marion, which decreased use by 99, 256, and 210 million gallons respectively in 2019.

Many medium and small public systems also had a decline in water withdrawals. Statewide, over 62 percent of public water supplies either maintained or reduced their use of the Jordan aquifer between 2018 and 2019. Jordan aquifer withdrawals for ethanol production also saw a substantial reduction in 2019. At 2.5 billion gallons, water withdrawals for ethanol production are at the lowest recorded annual rates since detailed records began in 2013. Ag-industrial use from the Jordan aquifer was steady, remaining at 6.5 billion gallons the last two years.

Jordan Aquifer Water Levels

Both static and pumping water levels are required to be submitted to the department every year through the water use program's annual report form. Last year, 275 out of 354 water use Jordan wells, or 78 percent, submitted approved water levels to the program.

To be approved, all Jordan well pumping and static water level readings should be measured and submitted in feet to water (depth) from ground surface. The 78 percent submittal rate is higher than last year's percentage of 75 percent.

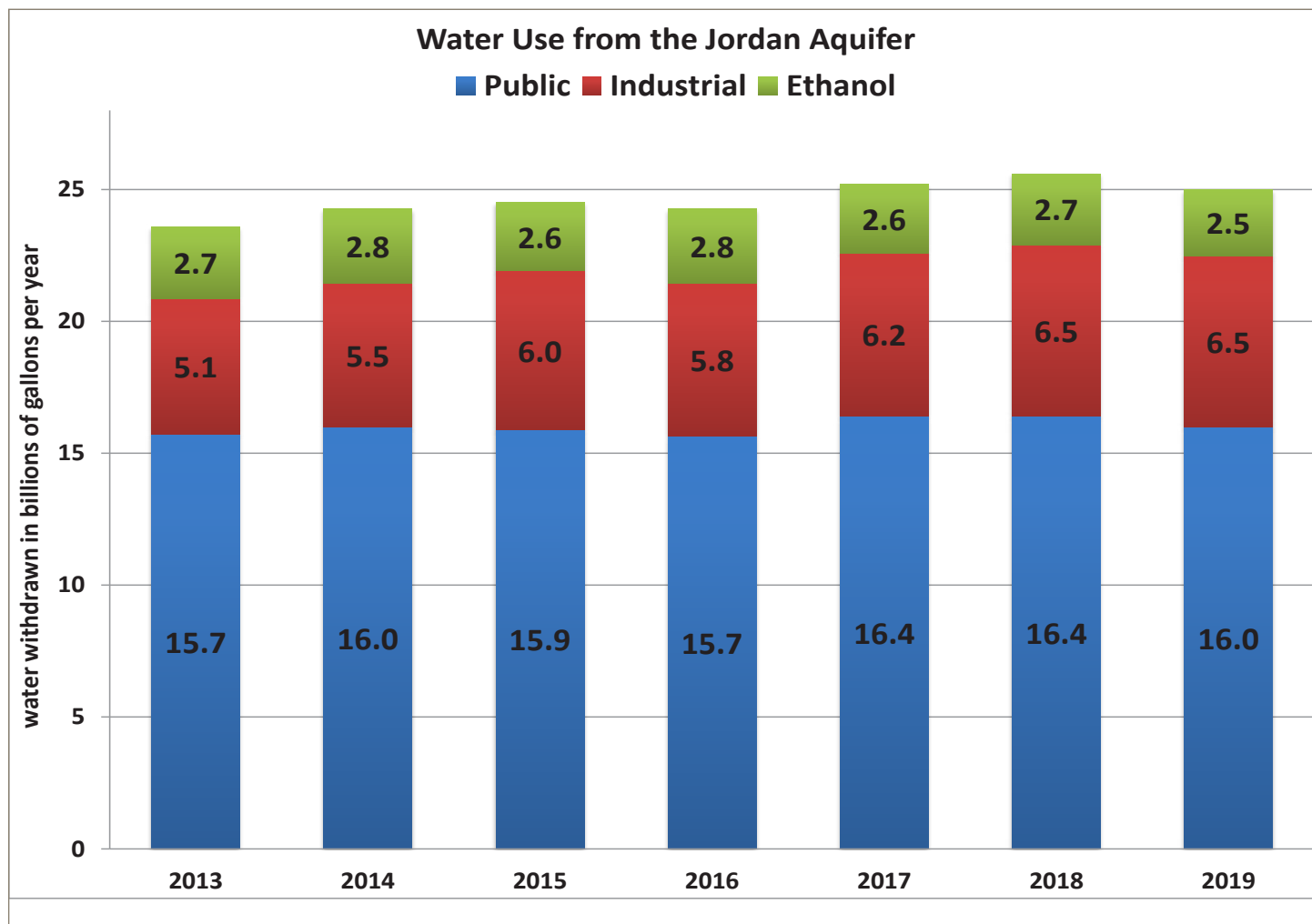


Figure 4. Iowa water use program permitted withdrawals from the Jordan aquifer from 2013 to 2019.

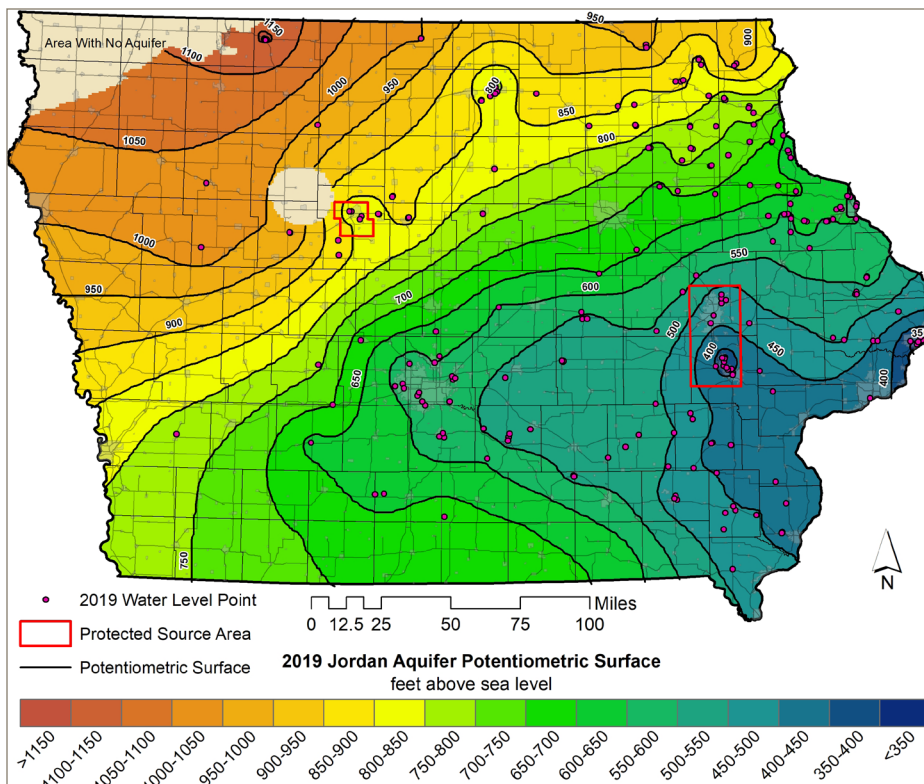


Figure 5. The 2019 potentiometric surface elevation of the Jordan aquifer derived from selected observed static water level information from Jordan water users.

A total of 208 static water level readings were selected from submitted annual reports to make the 2019 potentiometric surface map for Iowa (Figure 5). There are now reliable measurements in southern and western Iowa, highlighting the zone of depression noted to the east of Polk County, roughly along Interstate 80.

The highest potentiometric surface of the Jordan aquifer, as determined by subtracting static water level readings from the land surface elevation, was in Emmet County, where the Jordan potentiometric surface is estimated to be consistently above 1,150 feet above sea level (ft. ASL). The lowest potentiometric surface readings were from Clinton County, where the potentiometric surface is estimated to be below 350 ft. ASL.

In addition to the cones of depression noted around Johnson and Webster counties, new regional cones of depression are developing and expanding around central Iowa in Polk and Marion counties, and in north central Iowa around Cerro Gordo County.

Permits Reaching Tier 2

For the first year since rule implementation, no additional permits reached Tier 2 classification in 2019. The Water Use Program is working with current systems in Tier 2 to develop and implement water use reduction plans aiming to bring the wells and permits back into Tier 1.

References and Additional Resources

Horick, P.J., and Steinhilber, W.L., 1978, Jordan aquifer of Iowa: Iowa City, Iowa Geological Survey Miscellaneous Map Series 6, 3 sheets, scale 1:1,000,000.

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