NORTH Dakota | Environmental Quality

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Western Groundwater Monitoring Program

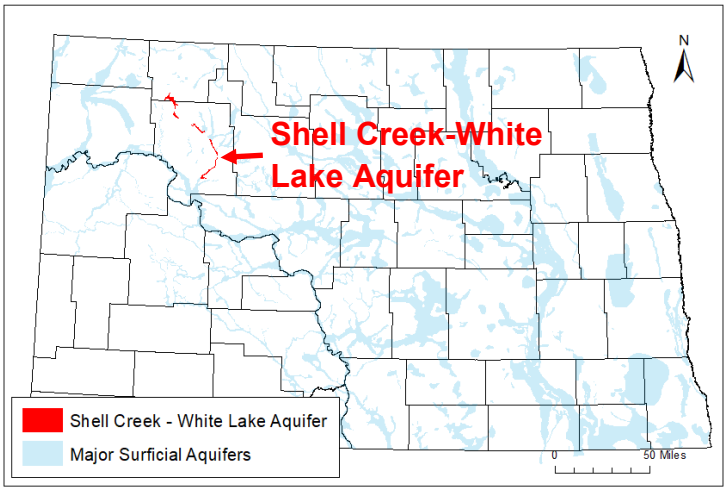
Shell Creek-White Lake Aquifer

Burke and Mountrail Counties

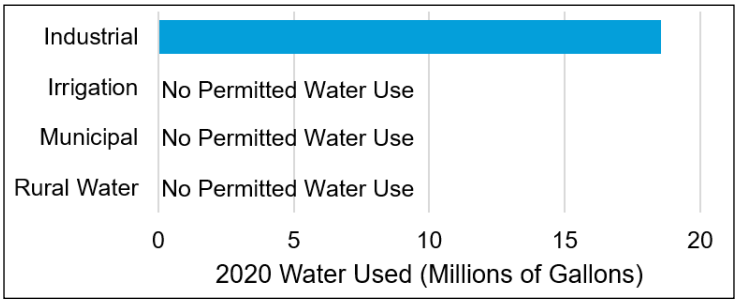
Aquifer At-a-Glance	
Area	39.2 square miles
Aquifer Type	Unconfined and Confined Surficial
Major Land Uses over Aquifer (percentage of aquifer area covered in 2017)[1]	Grassland/Pasture (44%) Open Water/Wetlands (26%)
Depth to Water (2021)*	4-24+ feet
Total Unique Wells Sampled	12
Wells Sampled in 2021	11
Years Sampled	2014, 2016, 2018, 2019, 2021

*Depths to water may vary seasonally, year to year, and across the aquifer

- Aquifer materials consist of sands and gravels that were deposited by streams in an ancient valley carved in the region's bedrock. Many sands and gravels were deposited by streams carrying meltwater away from glaciers. Sections of the aquifer are separated by clay.[2]
- Aquifer deposits are typically 12 to 37 feet thick. For much of its length, the aquifer is only about one-half mile wide.[2]
- Domestic, stock, and industrial wells are installed in the aquifer.
- In North Dakota, permits are required to withdraw large quantities of groundwater. In 2020, 19 million gallons of permitted water were drawn from the Shell Creek aquifer system; industrial use consumed the largest quantity of water. For more information on water use and permits, contact the North Dakota Department of Water Resources (dwr.nd.gov).



2020 Shell Creek aquifer system permitted water use (from North Dakota Department of Water Resources (dwr.nd.gov))



About the Western Groundwater Monitoring Program

- The North Dakota Department of Environmental Quality (NDDEQ) monitors a network of wells in approximately 20 surficial aquifers that are at elevated risk of oilfield contamination.
- Aquifers are sampled on a 1.5-year rotation.
- Monitoring began in 2013.
- The monitored aquifers are all within the oil-producing counties of northwestern North Dakota.
- Water is tested for general chemistry parameters, trace metals, diesel and gasoline range organics, benzene, toluene, ethylbenzene, and xylenes.

References

(1) US Department of Agriculture, 2017, National Agricultural Statistics Service Cropland Data Layer.

(2) Armstrong, C.A., 1971, Ground-Water Resources of Burke and Mountrail Counties, North Dakota. North Dakota State Water Commission County Ground-Water Studies 14-Part 3, North Dakota Geological Survey Bulletin 55.

Water Chemistry

Is Aquifer Water High in…?	Analyte	Result	2021 Median Concentration	Potential Effects
	Arsenic	**YES**	0.035 mg/L	Skin or circulatory system damage, increased cancer risk
	Iron	**YES**	2.76 mg/L	Metallic taste/odor, discoloration of surfaces
	Manganese	**YES**	0.37 mg/L	
	Sodium	**YES**	399 mg/L	Taste, people with certain health conditions may need to limit intake
	Sulfate	**YES**	805 mg/L	Taste/odor, laxative effect for people not used to the water
	For more information about Maximum Contaminant Levels (MCLs), health effects, and treatment options for these contaminants and more, see the NDDEQ's fact sheets (deq.nd.gov/wq/1_Groundwater) or visit the US EPA website (epa.gov/ground-water-and-drinking-water).			

Dominant Water Type	Water Hardness
Sodium-Sulfate	Very Hard

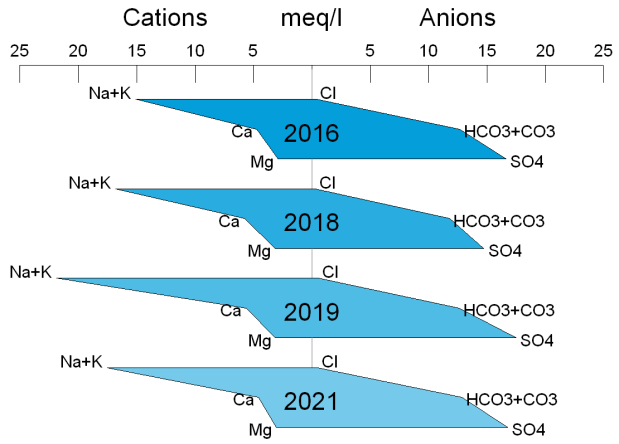
Nitrate

Percentage of Wells Exceeding the Nitrate Maximum Contaminant Level (MCL) (10 mg/L as N).*

No Nitrate MCL Exceedances

Stiff diagram of aquifer median general water chemistry.

Changes in diagram shape represent changes in general chemistry.



Oilfield Compounds

Gasoline and Diesel Range Organics

Gasoline and diesel range organics (GRO and DRO) are groups of chemical compounds containing carbon that are common in either gasoline or diesel fuel. Neither group has a regulatory limit, but the NDDEQ uses a screening level of 500 µg/L. Detections below this may be from other natural carbon sources such as decaying plant matter rather than oil byproducts.

GRO Screening Level Exceedances	**None**
DRO Screening Level Exceedances	**None**

Chloride

Chloride is both a natural component of groundwater and a component of brine (salt water), a byproduct of oil production.

Percentage of Wells Exceeding the Non-regulatory Chloride Secondary Water Quality Standard (250 mg/L).

No Chloride Standard Exceedances

BTEX

Benzene, toluene, ethylbenzene, and xylenes (BTEX) are a group of compounds that are naturally occurring in petroleum. All four have Maximum Contaminant Levels (MCLs)* that can be used as screening levels to determine the severity of any detection.

Benzene Detections	**None**
Toluene Detections	**None**
Ethylbenzene Detections	**None**
Xylenes Detections	**None**

Bromide

Bromide is a natural component of groundwater and can also be introduced through oil and gas extraction.

Wells Exceeding NDDEQ's 3-5 mg/L Screening Level:	**None**

*Note that MCLs are for public drinking water systems; private wells are not regulated in North Dakota. MCLs still provide guidelines for drinking groundwater.