Charbonneau Aquifer
McKenzie County

Aquifer At-a-Glance

<table>
<thead>
<tr>
<th>Area</th>
<th>12.7 square miles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer Type</td>
<td>Unconfined Surficial</td>
</tr>
<tr>
<td>Major Land Uses over Aquifer (percentage of aquifer area covered in 2017)¹</td>
<td>Crops (54%)</td>
</tr>
<tr>
<td></td>
<td>Grassland/Pasture (25%)</td>
</tr>
<tr>
<td>Depth to Water (2020)*</td>
<td>35-85+ feet</td>
</tr>
<tr>
<td>Total Unique Wells Sampled</td>
<td>5</td>
</tr>
<tr>
<td>Wells Sampled in 2020</td>
<td>4</td>
</tr>
<tr>
<td>Years Sampled</td>
<td>2014, 2016, 2017, 2019, 2020</td>
</tr>
</tbody>
</table>

*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 ancient river valleys carved in the region’s bedrock. The deepest part of the aquifer consists of sand and gravel. Above this is a layer of finer-grained lake bed sediments. Slope-base deposits are found as a top layer in parts of the aquifer.²

- Aquifer deposits average around 50 feet thick. On average, the aquifer is only one mile wide.²

- Domestic and stock wells are common in the aquifer. Several irrigation and industrial wells are also installed in the aquifer.

- In North Dakota, permits are required to withdraw large quantities of groundwater. In 2019, 530 million gallons of permitted water were drawn from the aquifer; irrigation use consumed the largest quantity of water. For more information on water use and permits, contact the North Dakota State Water Commission (swc.nd.gov).

References

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.
**Water Chemistry**

<table>
<thead>
<tr>
<th>Analyte</th>
<th>Result</th>
<th>2020 Median Concentration</th>
<th>Potential Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>Locally</td>
<td>&lt; 0.005 mg/L</td>
<td>Skin or circulatory system damage, increased cancer risk</td>
</tr>
<tr>
<td>Iron</td>
<td>YES</td>
<td>8.68 mg/L</td>
<td>Metallic taste/odor, discoloration of surfaces</td>
</tr>
<tr>
<td>Manganese</td>
<td>YES</td>
<td>0.36 mg/L</td>
<td>Taste, people with certain health conditions may need to limit intake</td>
</tr>
<tr>
<td>Sodium</td>
<td>YES</td>
<td>185 mg/L</td>
<td>Taste/odor, laxative effect for people not used to the water</td>
</tr>
<tr>
<td>Sulfate</td>
<td>Locally</td>
<td>239 mg/L</td>
<td></td>
</tr>
</tbody>
</table>

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).

**Stiff diagram of aquifer median general water chemistry.** Changes in diagram shape represent changes in general chemistry.

**Dominant Water Type**
- Sodium-Bicarbonate

**Water Hardness**
- Very Hard

**Nitrate**

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

- No Nitrate MCL Exceedances

**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**

**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.

Feel free to use this information, but please credit the North Dakota Department of Environmental Quality.