NORTH Dakota | Environmental Quality
Be Legendary.™

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April 2019

Lake Isabel

(46.81859 N, -99.74952 W)

Kidder County

- Lake Isabel is a popular natural lake in south-central North Dakota (Figure 1). See map at (https://gf.nd.gov/gnf/maps/fishing/lakecontours/isabel2005.pdf)
- There is one paved, public boat ramp on the northeast side of Lake Isabel.
- The Lake Isabel watershed is about 50,000 acres of mostly grassland/pasture and agricultural land. The most common crops grown are alfalfa, spring wheat and non-alfalfa hay (Table 1).
- Lake Isabel is a Class III fishery, which are "capable of supporting natural reproduction and growth of warm water fishes (e.g., largemouth bass and bluegill) and associated aquatic biota."
- Lake Isabel is managed for northern pike, with fingerlings stocked annually. Walleye, yellow perch and white sucker were also found during the last sample by the ND Game and Fish.
- Lake Isabel was previously assessed in 1992-1993 and 2002-2011, with the latter period being more sporadic as part of a volunteer monitoring project.

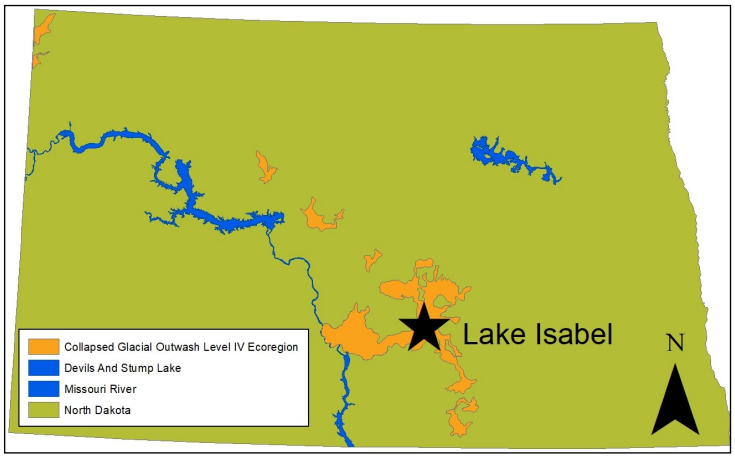

Figure 1. *Location of Lake Isabel within the state*

Table 1. *Percentage of land cover in the watershed and near the lake (NASS, 2015). Value listed of crop type represents percentage of total production.*

Land Cover Type	% in Watershed	% within 500 meters
Grassland/Pasture	59.8%	43.3%
Agriculture	28.4%	21.7%
Other Hay/Non-Alfalfa	*32.9%*	*12.3%*
Alfalfa	*18.8%*	*8.8%*
Spring Wheat	*11.4%*	*9.2%*
Open Water	5.3%	14.2%
Wetlands	3.4%	7.8%
Developed	3.2%	12.9%
Forest	< 0.1%	0.2%

Temperature and Dissolved Oxygen

- Lake Isabel rarely stratifies, with the water column being well-mixed with relatively high dissolved oxygen concentrations.
- There was no thermal stratification in 2016. Temperature change in the water column was 0.27 degrees Celsius (ºC), 0.01ºC and 0.16ºC in May, July and September, respectively.
- All samples showed most of the lake as well-oxygenated.

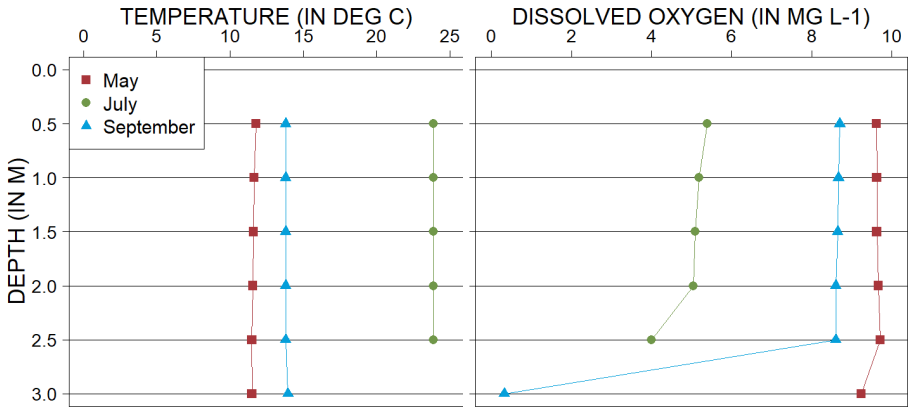

Figure 2. *2016 profiles of temperature (left) and dissolved oxygen (right) in milligrams per liter (mg L^{-1})*

Trophic State Indices

- Trophic state is a measure used by scientists to assess the condition (where lower scores indicate better water quality) of a lake using three common measures: total phosphorus (TP), Secchi disk transparency and chlorophyll-a concentration.
- Lake Isabel is a eutrophic lake (Figure 3) that has moderate nutrient concentrations and moderate algal growth.
- Current trophic state is much lower than historical indices.
- There have been confirmed ***harmful*** algal (cyanobacteria) blooms at Lake Isabel (last in 2018).

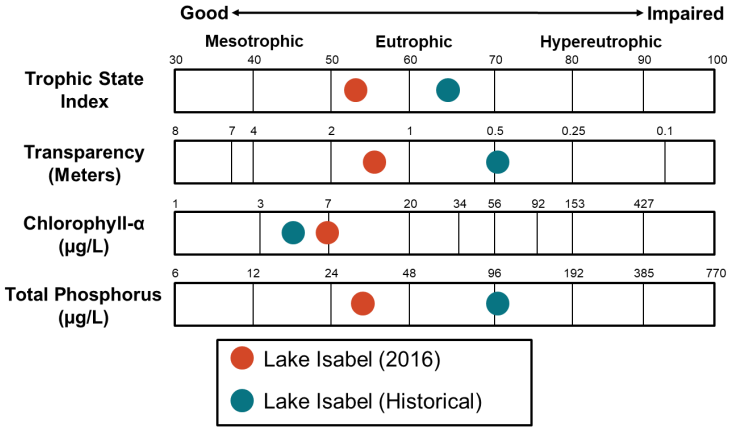

Figure 3. *Trophic state indices for 2016 and historical samples*

Nutrients

- Median concentration of total nitrogen (TN) in 2016 was less than the historical median and less than the median for the Collapsed Glacial Outwash Level IV Ecoregion (hereafter, Glacial Outwash) where Lake Isabel is located (Figure 4).
- Median concentration of dissolved TN was similar to TN.
- Median TP concentration in 2016 was less than the historical median and the median for the Glacial Outwash (Figure 4).
- Median concentration of dissolved phosphorus was slightly less than TP.
- Ammonia was detected in every sample at Lake Isabel in 2016, while there were was one detection of nitrate plus nitrite.

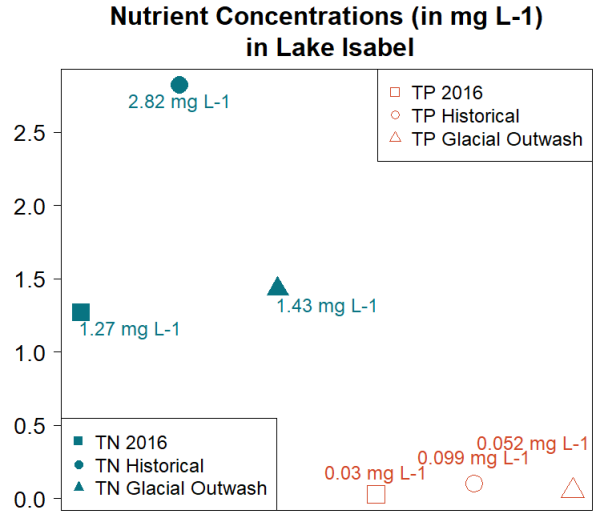

Figure 4. *Median concentrations of TN and TP in mg L^{-1} compared to regional medians*

Water Chemistry

Table 2. *Median concentrations of selected constituents for 2016 and historical samples and from all Glacial Outwash lakes.*

Measure	2016 Median	Historical Median	Ecoregion Median
Alkalinity	446 mg L^{-1}	1,120 mg L^{-1}	466 mg L^{-1}
Bicarbonate (HCO^-_3)	491 mg L^{-1}	836 mg L^{-1}	464 mg L^{-1}
Calcium (Ca^{2+})	30.6 mg L^{-1}	4.5 mg L^{-1}	25.3 mg L^{-1}
Carbonate (CO^{2-}_3)	27 mg L^{-1}	264 mg L^{-1}	58 mg L^{-1}
Conductivity	1,460 µS cm^{-1}	2,842 µS cm^{-1}	1,770 µS cm^{-1}
Dissolved Solids	949 mg L^{-1}	2,060 mg L^{-1}	1,240 mg L^{-1}
Magnesium (Mg^{2+})	79.5 mg L^{-1}	161 mg L^{-1}	88 mg L^{-1}
Sodium (Na^+)	190 mg L^{-1}	451 mg L^{-1}	163 mg L^{-1}
Sulfate (SO^{2-}_4)	327 mg L^{-1}	668 mg L^{-1}	554 mg L^{-1}

- Sulfate and bicarbonate are co-dominant anions in Lake Isabel, while sodium and magnesium are co-dominant cations (Figure 5).
- Median concentrations of most cations and anions are less than the historical median for the lake and less than the median for the Glacial Outwash.

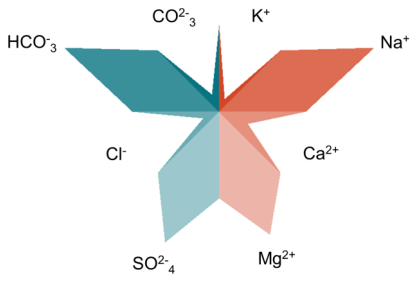

Figure 5. *Maucha diagram showing ionic balance based on 2016 data*