

June 2024

Castle Rock Dam

(46.336802 N, -102.398654 W)

Hettinger County

- Castle Rock Dam is a Dam in southwestern North Dakota (Figure 1). See map at (<https://gf.nd.gov/gnf/maps/fishing/lakecontours/castlerock2004.pdf>)
- There is one public boat ramp on Castle Rock Dam on the west side of the lake (slide in metal ramp).
- The Castle Rock Dam watershed drains about 2,500 acres. Land cover in the watershed is largely agricultural land. Agriculture is dominated by wheat, canola, and sunflower (Table 1).
- Castle Rock Dam is a Class IV, marginal fishery, which are “waters capable of supporting a fishery on a short-term or seasonal basis (generally a “put and take” fishery).
- Castle Rock Dam is managed as a rainbow trout fishery and is stocked annually. No ND Game and Fish survey data is available.
- Castle Rock Dam was last sampled in 2006.

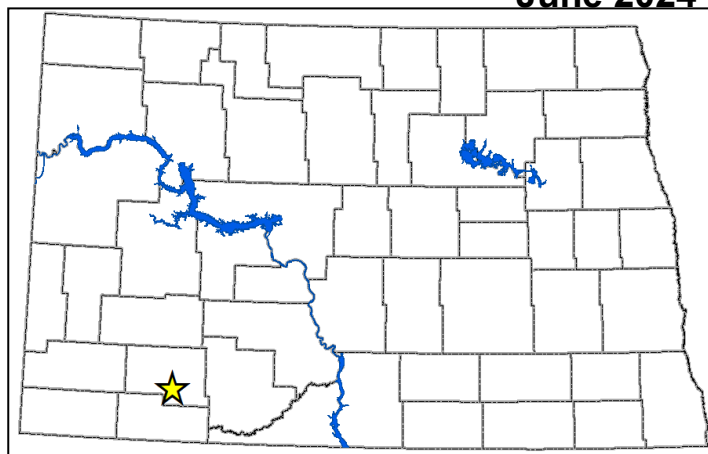


Figure 1. Location of Castle Rock Dam within the state

Table 1. Percentage of land cover in the watershed and near the lake (NASSCDL, 2021). Value listed of crop type represents percentage of total production

Land Cover Type	% in Watershed	% within 500 meters
Agriculture	68.9%	31.88%
Wheat	34.7%	22.7%
Canola	14.1%	0%
Sunflower	11.9%	0.7%
Trees	1.7%	5.6%
Rangeland	24.0%	57.8%
Water	1.2%	2.1%
Bare	3.6%	2.6%

Temperature and Dissolved Oxygen

- Castle Rock Dam stayed stratified throughout most of the sampling season, with warm, well-oxygenated water at the top of the water column, and cold, low-oxygen water near the bottom.
- Thermal stratification took place in May, June, and August. The greatest temperature change in the water column during these months was 3.8 degrees Celsius (°C), 1.8°C, and 1.3°C (Figure 2).
- Dissolved oxygen concentrations were relatively high at the surface, but low to anoxic near the bottom (Figure 2).

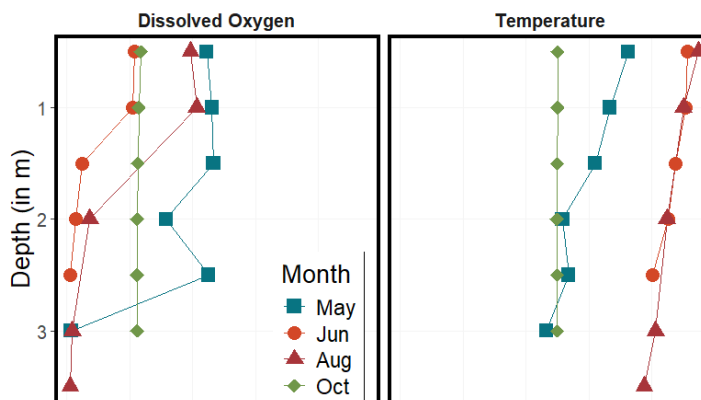


Figure 2. 2023 profiles of dissolved oxygen (left) in milligrams per liter (mg L⁻¹) and temperature (right) in degrees Celsius.

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.
- Castle Rock Dam is a eutrophic lake that has high nutrient concentrations and low to moderate algal and plant growth (Figure 3).
- Trophic state in 2023 was less than the historical condition.

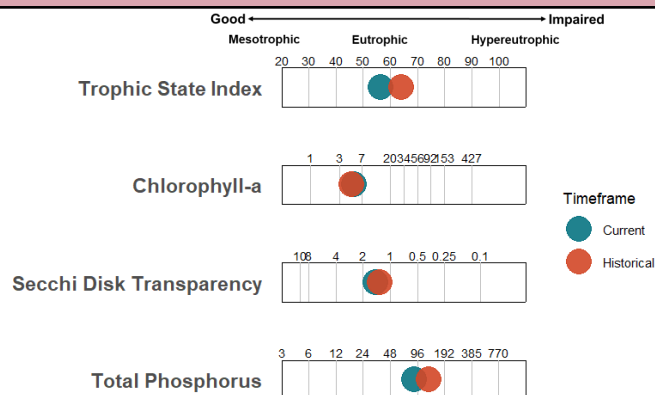


Figure 3. Trophic state indices for 2023 and historical samples

Nutrients

- Median concentration of total nitrogen (TN) in 2023 was greater than the historical median and the median for the Missouri Plateau level IV Ecoregion where Castle Rock Dam is located (Figure 4).
- Median concentration of dissolved TN was less than TN (2023).
- Median TP concentration in 2023 was less than the historical median for the lake and greater than the median for the ecoregion (Figure 4).
- Median concentration of dissolved phosphorus was less than TP.
- Ammonia and nitrate + nitrate were found above their detection limits of 0.03 mg/L in Castle Rock Dam during the 2023 sampling season.

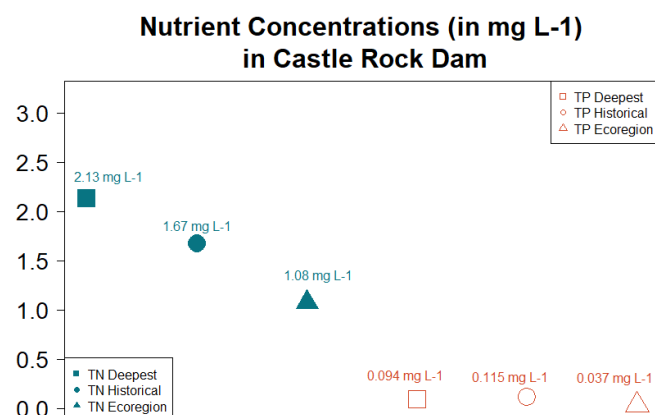


Figure 4. Median concentrations of TN and TP in mg L⁻¹ compared to regional medians

Water Chemistry

Table 2. Median concentrations of selected constituents for 2023, historical samples, and from all ecoregion natural lakes and reservoirs.

Measure	2023 Median	Historical Median	Ecoregion Median
Alkalinity	340.5 mg L ⁻¹	172 mg L ⁻¹	201 mg L ⁻¹
Bicarbonate (HCO ₃ ⁻)	416 mg L ⁻¹	84 mg L ⁻¹	217 mg L ⁻¹
Calcium (Ca ²⁺)	139 mg L ⁻¹	55 mg L ⁻¹	47.5 mg L ⁻¹
Carbonate (CO ₃ ²⁻)	0.5 mg L ⁻¹	55 mg L ⁻¹	11 mg L ⁻¹
Conductivity	1850 µS cm ⁻¹	1590 µS cm ⁻¹	823.5 µS cm ⁻¹
Dissolved Solids	1370 mg L ⁻¹	1210 mg L ⁻¹	521.5 mg L ⁻¹
Magnesium (Mg ²⁺)	155.5 mg L ⁻¹	148 mg L ⁻¹	24.7 mg L ⁻¹
Sodium (Na ⁺)	88 mg L ⁻¹	86.4 mg L ⁻¹	94.4 mg L ⁻¹
Sulfate (SO ₄ ²⁻)	746.5 mg L ⁻¹	741 mg L ⁻¹	206 mg L ⁻¹

- Sulfate is the dominant anion in Castle Rock Dam, while magnesium is the dominant cation (Figure 2).
- 2023 median concentrations of most cations and anions are greater than the historical and ecoregion medians for this lake (Table 2).