

# Caesar Creek Lake (CCK) Water Quality Summary

## Summary of 2020 Water Quality Results

Caesar Creek Lake had two exceedances of OH's water quality criteria for temperature at the tailwater (CCK10000). Total phosphorus and total nitrogen levels at most sample locations exceeded the USEPA nutrient criteria. The mean TSI category for all three indices classified the lake as eutrophic or hypereutrophic, indicating a very high level of biological activity. Finally, our sampling showed cyanobacteria cell counts over 100,000 cells/mL in 9 out of 16 samples. The elevated nutrient levels and eutrophic/hypereutrophic classification indicate there is a high potential for HAB development in the lake.

## 2020 Activities

In 2020, one sampling event was conducted at Caesar Creek Lake. Field data and chemical samples were collected at all nine sites (Figure 1). Chlorophyll and phytoplankton were collected at four sites (however chlorophyll samples were lost during shipping), and zooplankton samples were collected at the damsite (CCK20001).

Additionally, temperature and dissolved oxygen (DO) profiles were collected by the project staff at the damsite and tailwater approximately every two weeks from early May through late December.

## Exceedances of OH State Water Quality Criteria

There were two exceedance events of OH state water quality criteria for temperature at the tailwater. These events occurred December 1 through December 5, and on December 12. There were no other exceedances of Ohio state WQ criteria.

## Tailwater Temperature and DO Conditions

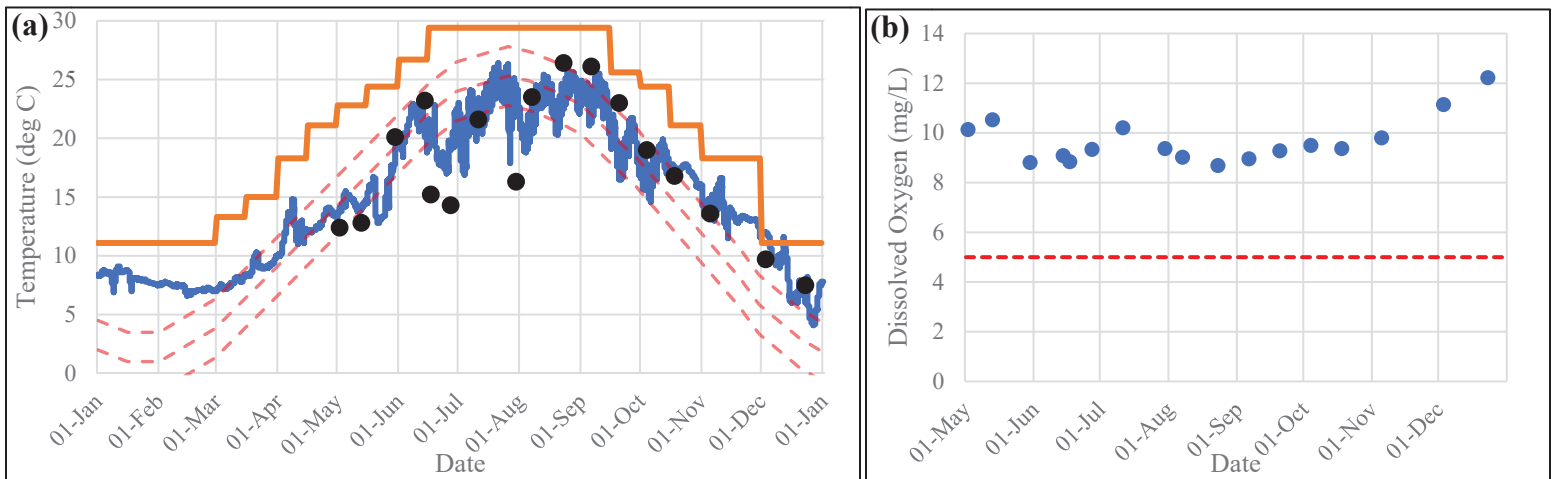


Figure 2. Caesar Creek Lake tailwater temperature and DO data. (a) Tailwater temperature data collected by project staff in 2020 is represented by the black dots. The blue line represents USGS gage data (provisional) from a gage downstream from the project. The temperature guide curve is represented by the dashed red lines, and the orange line represents the OH water quality criteria for temperature. (b) Tailwater dissolved oxygen data collected in 2020 is represented by the blue dots. The OH water quality criteria for DO is represented by the dashed red line.

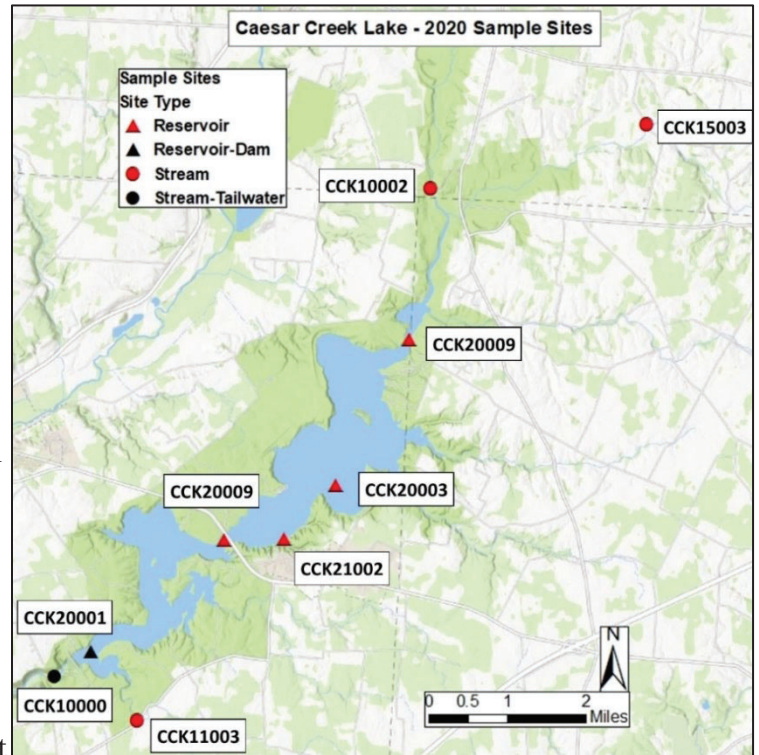


Figure 1. Water quality sampling locations for Caesar Creek Lake in 2020.

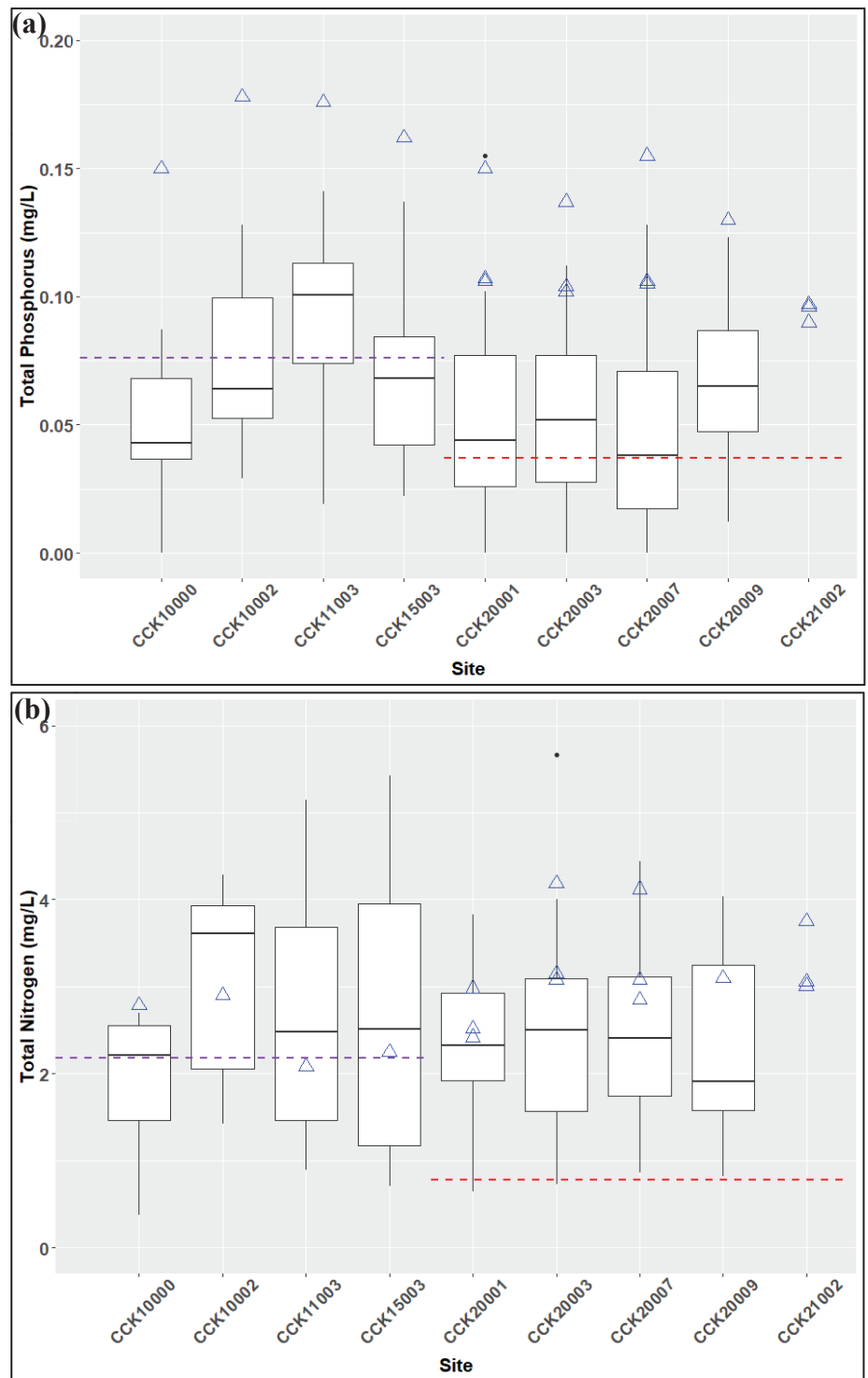
Tailwater data was compared to OH state water quality criteria for temperature and to the Louisville District's temperature guide curve for Caesar Creek Lake (Figure 2a). According to the provisional USGS data, tailwater temperature exceeded the state criteria for temperature December 1 through December 5, and on December 12. During this time, the reservoir was de-stratified; therefore, nothing could be done operationally to prevent these exceedances. Also, tailwater temperatures fell outside the guide curve January through early March, various times in the summer, and mid-October through the end of the year. The WQ Program will use these findings to inform future operational decisions to improve performance of downstream temperature management wherever possible. Tailwater dissolved oxygen levels (Figure 2b) did not exceed state criteria at any time throughout the year.

### Nutrient Analyses

Nutrient data, including total nitrogen (TN) and total phosphorus (TP) data, were collected at all sample sites in 2020. The 2020 TP and TN values were compared to historical data from 2012 through 2019 (Figure 3). The TP and TN values at each site were compared to their respective USEPA recommended criteria. Nutrient levels are an area of concern because elevated nutrients can lead to high biological activity, especially with respect to HABs.

#### Total Phosphorus

2020 TP values from all samples at Caesar Creek Lake were above the historical medians and historical distributions for their respective location. Also, 2020 TP levels at all sample locations were above the USEPA recommended nutrient criteria for the respective locations.



**Figure 3. Comparison of 2020 nutrients data to historical samples and nutrient criteria. Boxplots represent data collected in 2012-2019 and blue triangles represent 2020 data. Purple and red dotted lines represent USEPA recommended nutrient criteria for streams and reservoirs, respectively. (a) Comparison of total phosphorus data. Two outliers (values range from 0.205 to 0.286 mg/L) were excluded to make plot easier to interpret. (b) Comparison of total nitrogen data. One outlier (value = 14.2 mg/L) was excluded to make plot easier to interpret.**

## Total Nitrogen

2020 TN values at Caesar Creek Lake were near or below the historical medians in five samples and were above historical medians in the remaining samples. Also, 2020 TN levels in 16 out of 17 samples were above the USEPA recommended nutrient criteria for the respective locations.

## **Cyanobacteria Data, HABs, and Trophic State Index**

### Cyanobacteria Data

16 phytoplankton samples were collected at various depths from 4 sites. Total cyanobacteria cell counts exceeded 100,000 cells/mL (guideline value for moderate health risk from the World Health Organization's Guidelines for Safe Recreational Water Environments [2003]) in 9 of the samples collected from 3 of the sites. No samples exceeded 1,000,000 cells/mL. These results indicate Caesar Creek Lake had cell count levels potentially indicative of a HAB at the time of sampling.

### Harmful Algal Bloom (HAB) Response

Ohio EPA is the lead agency for HAB response in Ohio. Ohio EPA did not issue any advisories for HABs at Caesar Creek Lake.

### TSI

The trophic state indices for Secchi depth [TSI(SD)], and total phosphorus [TSI(TP)] were calculated for five reservoir sites at Caesar Creek Lake (Table 1; chlorophyll samples were lost during shipping). The mean category of all three indices ranged from eutrophic to hypereutrophic, indicating a high to very high level of biological activity.

**Table 1. Summary of calculated trophic state indices at Caesar Creek Lake.**

	<b>Mean Score (range)</b>	<b>Mean Category (Range)</b>
<b>TSI(SD)</b>	58 (53-69)	<b>Eutrophic</b> (Moderately Eutrophic-Hypereutrophic)
<b>TSI(TP)</b>	72 (70-74)	<b>Hypereutrophic</b>