

# Barren River Lake (2018)

## Water Quality Takeaways

- High potential for harmful algal blooms
- No exceedances of state water quality criteria

## General Information and Water Quality

Barren River Lake (BRR) was built by the Louisville District US Army Corps of Engineers (LRL) for the primary purpose of flood control. At summer pool, the surface area of BRR is 10,000 acres.

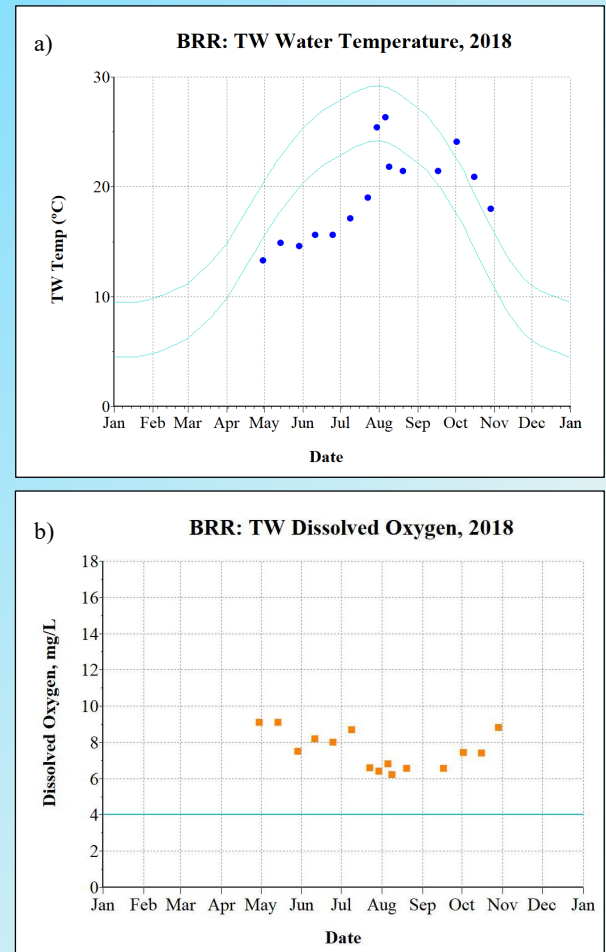
Water quality (WQ) in the tailwater is assessed by analyzing 2018 data for exceedances of WQ criteria established by KDOW. No criteria were exceeded in the tailwater (2BRR10000; Figure 1). However, BRR exceeded the USEPA's recommended criteria for total phosphorus and total nitrogen. This is common among KY lakes but can contribute to harmful algal blooms.



**Figure 1.** BRR sample sites in 2018 for field and chemical data.

## Tailwater Conditions

Temperature and dissolved oxygen (DO) profile data are regularly collected from LRL lakes. This data informs water control engineers on how to best use existing selective withdrawal capabilities to meet downstream water quality (WQ) targets. WQ targets are established by each lake's Water Control Plan (WCP) and state criteria. Figure 2a shows a time series graph of the 2018 tailwater (2BRR10000; Figure 1) water temperature compared with the guide curve from the lake's WCP. Due to infrastructure limitations, BRR did not operate closely to the established temperature guide curve. Figure 2b shows a 2018 time series graph of the lake's tailwater DO data with the applicable state criteria (blue line). BRR met the state's criteria for dissolved oxygen in 2018.



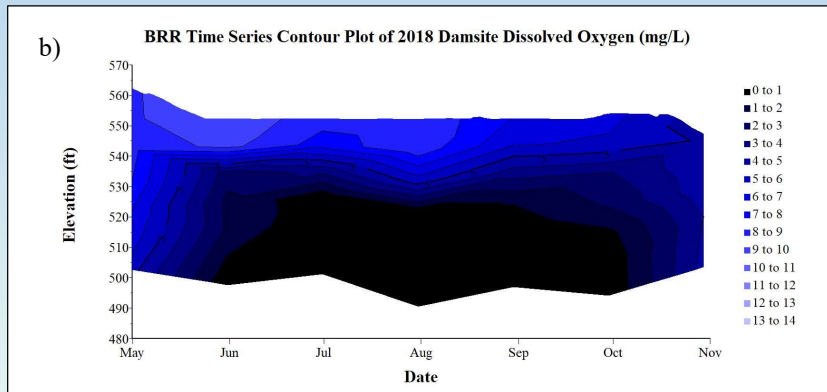
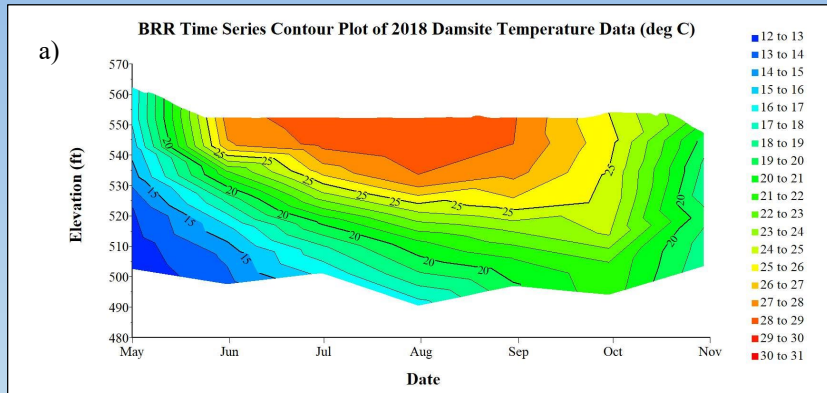
**Figure 2.** BRR time series data collected from the tailwater (2BRR10000; Figure 1): a) water temperature; and b) dissolved oxygen.



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## Reservoir Conditions and Operations

Below (Figures 3a and b) are time series contour plots of BRR profile data collected at the damsite (2BRR20001; Figure 1) in 2018. The figures show the progression of temperature and dissolved oxygen availability in the lake throughout the year. The BRR temperature profile data collected in 2018 (Figure 3a) indicates that the reservoir contained adequate cold water necessary to meet the established temperature guide curve (Figure 2a) in 2018. However, the guide curve was not met due to infrastructure limitations. Additionally, Figure 3b indicates that the reservoir is adequately oxygenated to meet downstream criteria.



**Figure 3.** BRR time series data collected from the damsite (2BRR20001; Figure 1): a) water temperature; and b) dissolved oxygen.

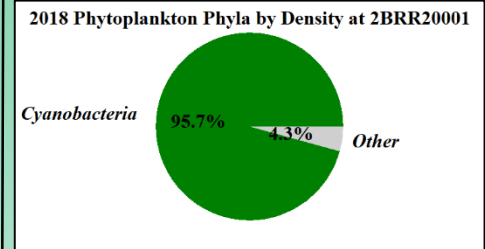
## Reservoir Biological Conditions

Trophic State Index (TSI) was calculated using values from Secchi Depth, Chlorophyll-a, and Total Phosphorus analyses. The TSI values below were calculated for multiple sites with the 2018 data. The results shown in Table 1 suggests that BRR is eutrophic (TSI score from 51-69). This means that BRR has a high concentration of nutrients, which can be detrimental to life in the lake in multiple ways.

**Table 1.** TSI scores and trophic states for samples collected at BRR in 2018.

Site	TSI Score	Trophic State
2BRR20001	60	Eutrophic
2BRR20002	60	Eutrophic
2BRR20004	62	Eutrophic
2BRR20005	64	Eutrophic
2BRR21001	62	Eutrophic
2BRR22001	64	Eutrophic

Phytoplankton (algae and cyanobacteria) and green plants are the base of the food chain in aquatic ecosystems. Phytoplankton also have a large impact on humans via harmful algal blooms (HABs) which are caused by an over-abundance of cyanobacteria.



**Figure 4.** 2018 phytoplankton community at 2BRR20001.

Figure 4 illustrates the abundance of cyanobacteria relative to the other types of phytoplankton collected from the damsite in summer 2018. The chart shows that cyanobacteria dominated the phytoplankton community in density (cells/L). These results indicate that HABs have the potential to be problematic at BRR.

**Harmful Algal Blooms (HABs) in KY** are addressed by the KDOW as they are the lead agency for HAB response in the state. The KDOW has adopted HAB toxin sampling for posting public recreational advisories/cautions. The LRL WQ Program supports the state agency's efforts to implement a statewide HAB response plan. LRL assists the KDOW with implementation by reporting visual HAB indicators and collecting HAB toxin samples as specified by the KDOW.

