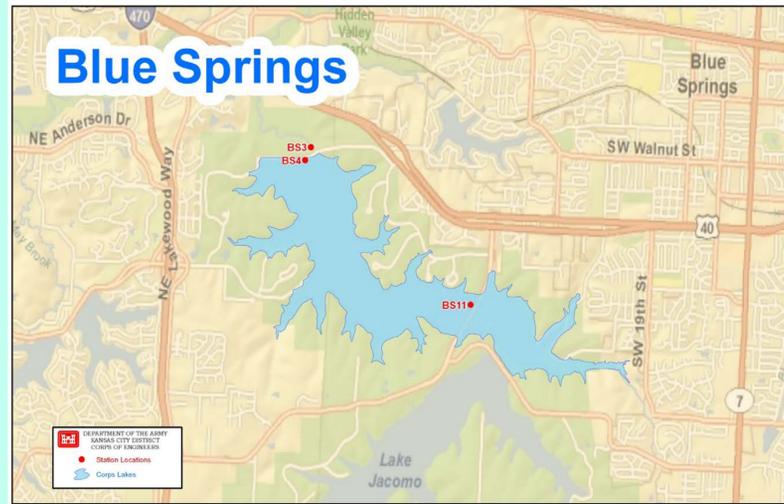


Blue Springs Lake Water Quality Summary

2006-2015

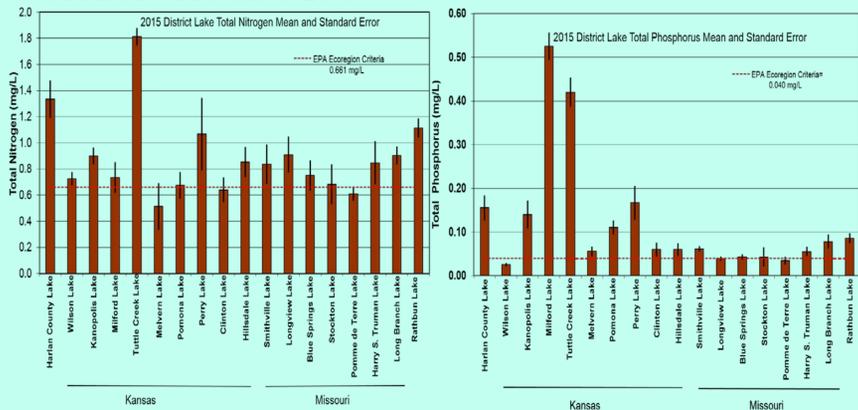


Blue Springs Lake

- Built on East Fork Little Blue River reaching full pool in 1990.
- **Watershed** = 33 square miles/ 21,120 Surface Acres (SA)
- **Capacity:**
 - Flood Control: 15,715 Acre-feet (AF) / 982 SA
 - Multipurpose: 10,842 AF / 722 SA / 15 miles of shoreline
 - Avg. annual inflow (2006-2015): 24,825 AF; 2014 inflow: 32,691 AF
- **Project Operating purposes:** flood control, recreation, and fish and wildlife
- **Water Quality** at Blue Springs Lake in 2015 was beneficial to operating purposes listed above and did not exceed MO State WQ Standards for designated uses. Water quality improves as nutrients, herbicides and sediments are removed by settling, dilution, and biological processes as water moves from inflow streams to the dam.

Nutrient Enrichment

Nutrients (i.e. phosphorus and nitrogen) are essential for aquatic life and are the primary factor driving fish and aquatic plant growth rates and productivity. Excess nutrients from urban, agricultural or natural sources increases the natural aging or eutrophication process in lakes. This can alter plant and aquatic life in lakes and water bodies, cause algal blooms, create low dissolved oxygen that affect fish survival, and lead to taste and odor issues in drinking water. Lake Jacomo upstream of Blue Springs acts as a nutrient sink and moderates nutrient and sediment concentrations in Blue Springs Lake. In 2015, Blue Springs Lake nitrogen sample results were lower than most years and less than average for District Lakes (0.88 mg/L). Total phosphorus was also below average for District Lakes (0.12 mg/L) measured at the site nearest the dam. Summer chlorophyll A values, total phosphorus, and secchi disk measurements indicate that Blue Springs Lake is eutrophic range. Standard error bars in the figures below illustrate the variation in sample results from each site in 2015.

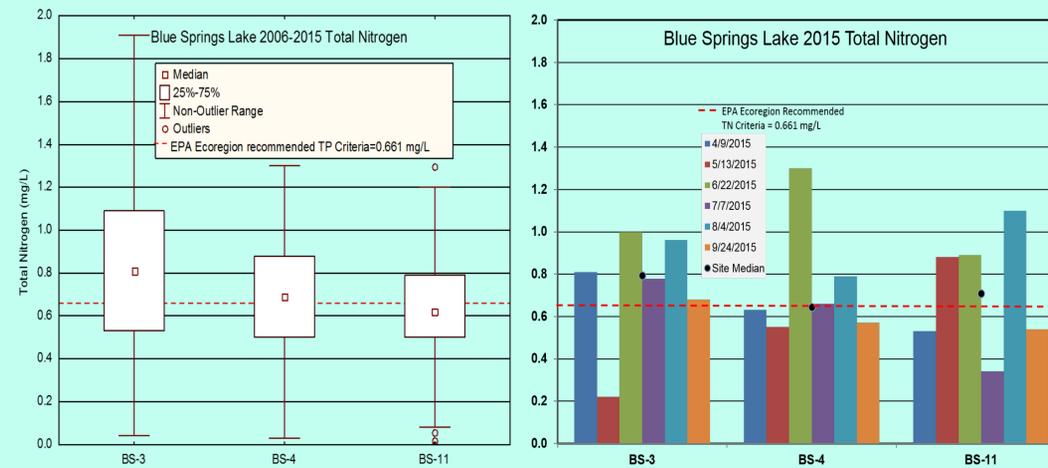


The **US Army Corps of Engineers (USACE)** Water Quality Program collects monthly water samples at Blue Springs Lake* from April through September. These figures present data collected between 2006-2015 from lake sites (#4,11), and the outflow (#3) below the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE uses this data to describe conditions and changes from the inflow streams, within the main lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

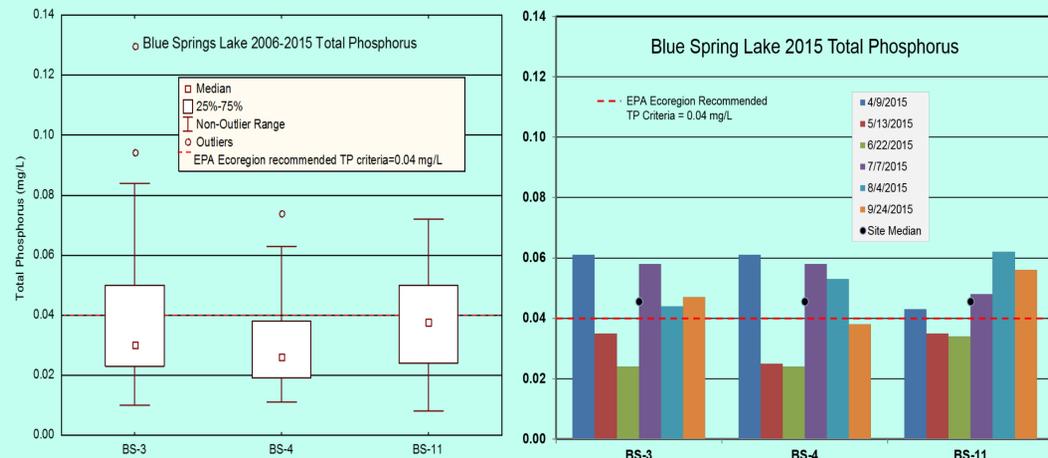
Total Phosphorus

Median total phosphorus (TP) concentrations from 2006-2015 Blue Springs Lake samples were lower than EPA Ecoregion criteria (0.04 mg/L). Total phosphorus at all Blue Springs Lake sites are in the range of moderate biological productivity except late season measurements and a wider range of data are found in the upper lake sites due to mobilized nutrients bound to sediment particles transported in moving water near the inflows and biological uptake or decline of TP as the water moves through the lake. Upstream impoundments reduce this effect at Blue Springs Lake.



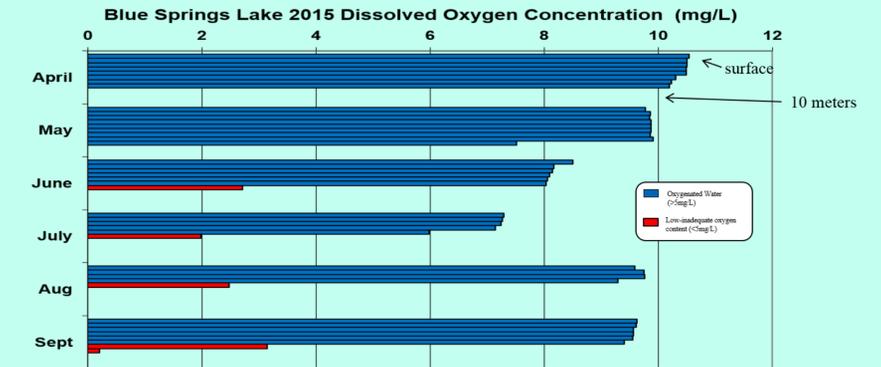
Total Nitrogen

Median total nitrogen concentrations at Blue Springs Lake are near the EPA Ecoregion recommended criteria of 0.661 mg/L from 2006-2015. Monthly peaks in TN observed in April and June at all sites in June and attributed to organic nitrogen sources from algae cells and particulate nitrogen from runoff. TN median concentrations were slightly higher than 10 year medians, but within the 25-75% range of the last 10 year of samples collected. Total nitrogen concentrations are less variable between sites and years at Blue Springs Lake than most lakes due to stable inflow levels and other watershed factors (i.e. stable soils and farming practices).



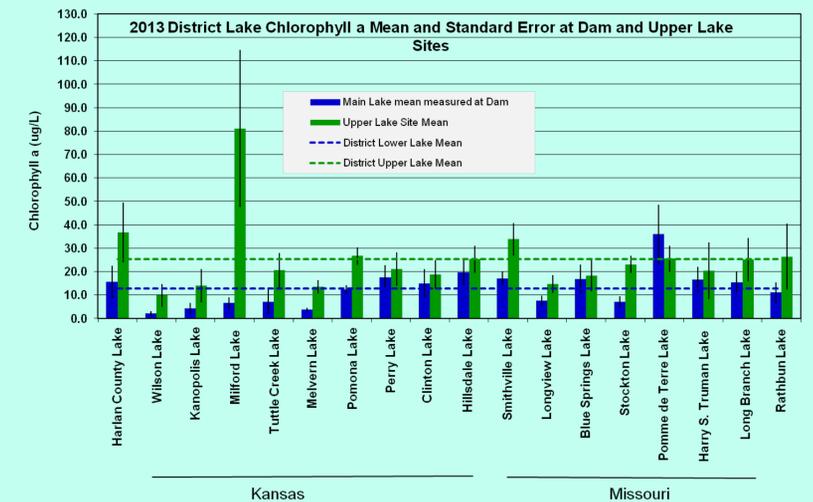
Dissolved Oxygen

Dissolved oxygen is a factor in aquatic species location, growth, and ultimately survival in lakes. The figure below shows dissolved oxygen (D.O.) measured in the water column in one-meter intervals (e.g. each row in each month represents one meter of depth) from April through September. Blue Springs Lake typically stratifies for a short period of the summer, but adequate (5 mg/L) dissolved oxygen is typically available. In 2015, the top 5 meters of the lake was well oxygenated for fish and aquatic life throughout the summer.



Algae

Algae and green plants are the base of the food chain in aquatic food webs and convert nutrients and CO₂ through photosynthesis into biomass for all aquatic life. Chlorophyll a is a measure of the active green pigment present in beneficial algae and harmful blue-green algae (cyanobacteria) active in this process. Chlorophyll a is a critical measurement as it relates nutrients like phosphorus and nitrogen to biological productivity related to algae (good and bad), aquatic invertebrate production, and fish growth. Blue-green algae is occasionally present, but not typically dominant and toxic blooms have not been documented.



Water Quality Concerns:

- Eutrophication
- Nutrients

