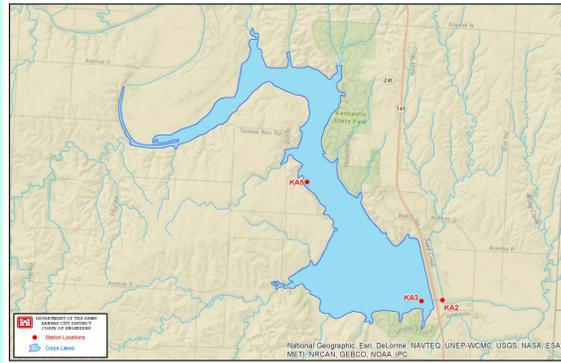


Kanopolis Lake Water Quality Summary

2010-2019

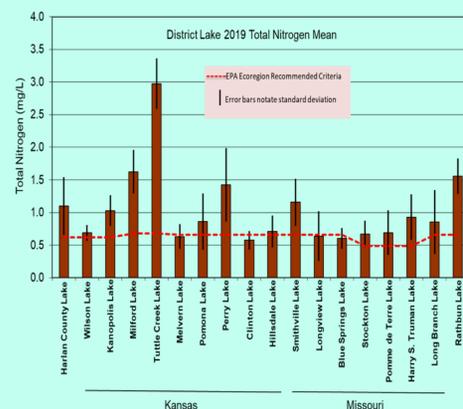
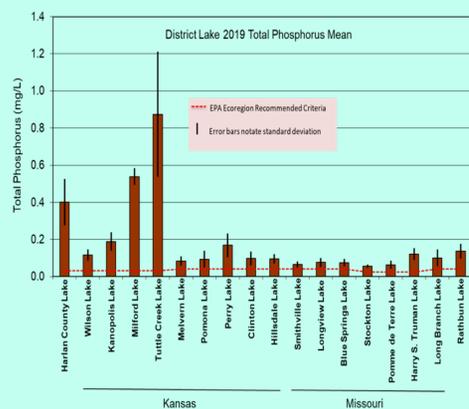


Kanopolis Lake:

- Built on Smoky Hill River reaching full pool in 1948.
- **Watershed** = 5,365 square miles / 3,433,600 Surface Acres (SA)
- **Capacity:** Flood Control: 191,890 A-F / 10,790 surface acres
 - Multipurpose: 143,878 A-F / 3,406 surface acres / 41 miles of shoreline
 - 10-year avg. annual inflow = 166,207 AF; 2019 inflow=702,927 AF
- **Operating project purposes:** flood control, water quality, recreation, fish and wildlife, and water supply.
- **Water Quality** at Kanopolis Lake in 2019 was beneficial for authorized purposes listed above and measured parameters did not exceed Kansas State water quality standards for designated uses.

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 increase the natural aging process in lakes. This rapid aging process, called eutrophication, is responsible for changes in plant and aquatic life in lakes and water bodies including algal blooms resulting in low dissolved oxygen that affects fish survival, and taste and odor issues in drinking water. Kanopolis Lake is listed as "impaired" on the 2020 Kansas 303(d) list due to accelerated eutrophication with a TMDL (total maximum daily load) for phosphorus and nitrogen load reduction since 2003 and has a low priority TMDL (total maximum daily load) for sulfates and chloride. The U.S. Environmental Protection Agency (EPA) and the Kansas Department of Health and Environment are working with water quality partners, landowners and an active Big Creek Middle Smoky Hill River Watershed (Kanopolis Reservoir) Restoration and Protection Strategy (WRAPS) group. Together they provide recommended best management practices to meet long term nutrient reduction goals for the watershed. Working in the watershed to reduce nutrient and sediment runoff will slow the eutrophication process while improving water quality to maintain operating purposes of Kanopolis Lake. In 2019, nutrient concentrations at Kanopolis Lake and most USACE Kansas City District lakes exceeded EPA Ecoregion Recommended Criteria.

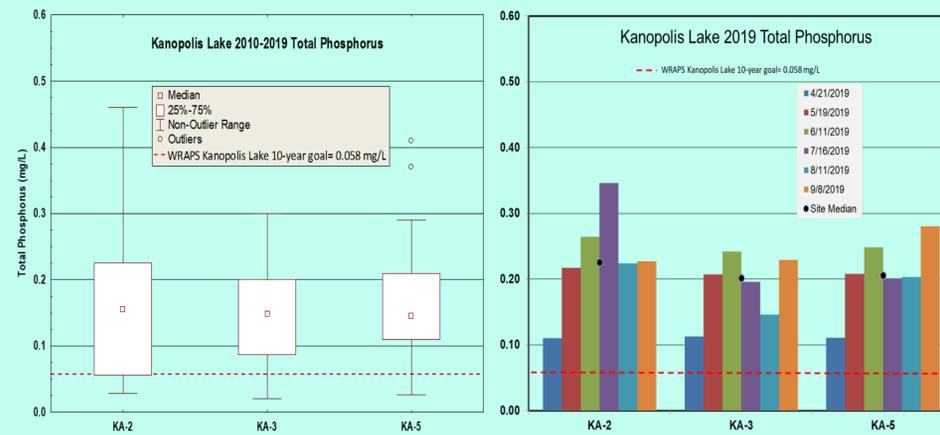


The **US Army Corps of Engineers** (USACE) Water Quality Program collects monthly water samples at Kanopolis Lake* and inflows from April through September. These figures present data collected between 2010-2019 from two lake sites (KA-3, KA-5) and the outflow (KA-2) below the dam. Thirty-four chemical, 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 used rather than the technically correct "reservoir" throughout this report for consistency.

Total Phosphorus

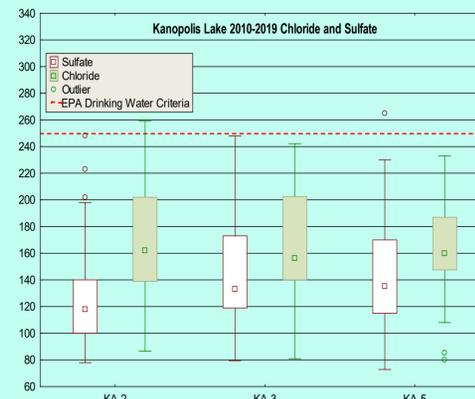
Inflows from Smoky Hill River into Kanopolis Lake in 2019 were 4.2 times higher than the 10-year average. Large inflows carry nutrient rich agricultural runoff. In 2019, Kanopolis Lake median total phosphorus (TP) concentrations were near or exceeded 75% quartiles of all TP data collected from 2010-2019. Median TP from all Kanopolis Lake sites were classified as hypereutrophic indicating excessive nutrients and high biological productivity associated with dense algae production and fast growth rates for warm water fish species. Total phosphorus (TP) median concentrations from 2019 Kanopolis Lake samples were 3 times higher than the WRAPS 10-year lake milestone of 0.058 mg/L. Similar to most impoundments, higher TP concentrations and a wider range of data is usually found in the upper lake sites and inflows due to mobilized nutrients bound to silt particles in moving water and decrease in concentration from biological uptake and nutrients settling out as the water flows through the lake.



Chlorides and Sulfate

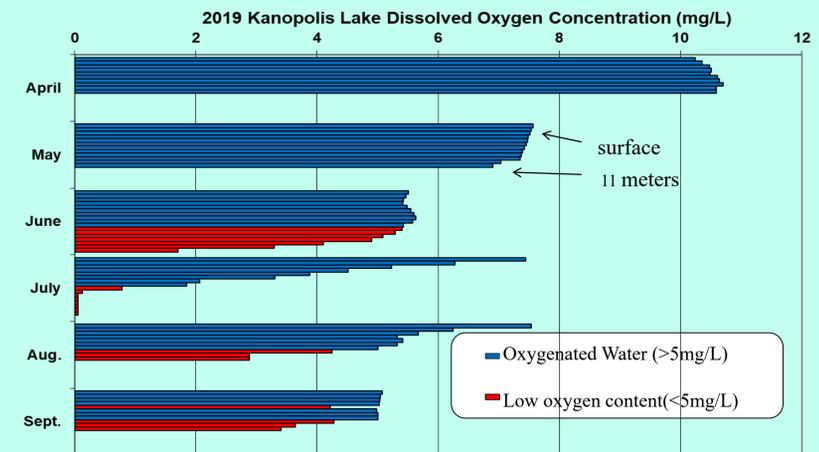
Chloride and sulfate ions occur naturally from soil and groundwater in the watershed. Periods of high flow and high water decrease concentration in Kanopolis Lake from dilution while periods of drought tend to concentrate or increase these compounds.

Both compounds typically exceed KDHE established TMDL targets in inflows, but rarely (less than 1%) exceed EPA drinking water criteria in Kanopolis Lake. These ions comprise some of the salt component measured in salinity. Salinity can negatively impact freshwater fish and invertebrates when concentrations increase or fluctuate. Biological impacts begin to occur when concentrations are at least ten times higher than typically found in Kansas City District lakes.



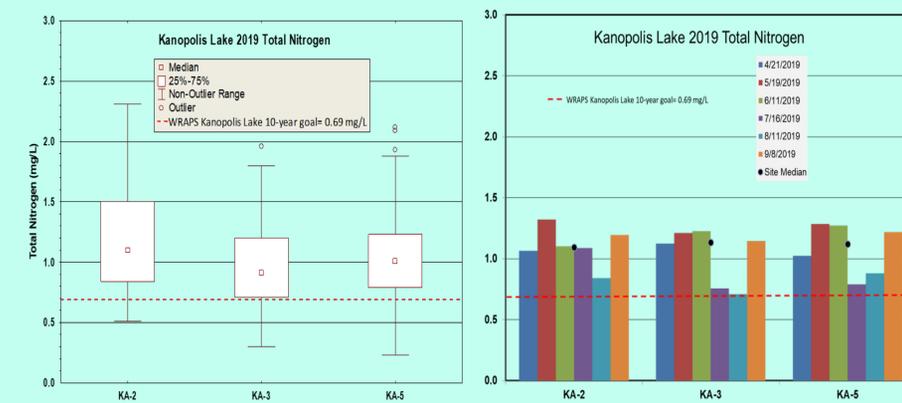
Dissolved Oxygen

Dissolved oxygen (D.O.) is an important factor in aquatic species location, growth, and survival in lakes. The figure below shows dissolved oxygen 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. Low dissolved oxygen (<5 mg/L shown in red) can be a concern due to the shallow average depth of Kanopolis Lake. Kanopolis Lake stratified in July and August with oxygen concentrations optimal for aquatic life in the top 8 meters on sample dates in 2019.



Total Nitrogen

Total nitrogen concentrations exceed WRAPS 10-year lake milestone of 0.69 mg/L and EPA Ecoregion recommended criteria of 0.62 mg/L in 75% or more of samples from all sites from 2010-2019. Median TN concentrations in 2019 were near the 75% quartile of 10-year TN data at lake sites, but similar to the 10-year median at the outflow. TN concentrations typically peak in the spring and are highly variable between sites and years related to inflows, biological activity, and upstream land use. Much of the nitrogen (nitrate) available for plant growth is used up by the healthy algae community through the summer months and cycles between different forms of available and stored nitrogen related to algae uptake and is readily passed through the dam.



Water Quality Concerns:

- Sediment inputs
- Eutrophication
- Dissolved Oxygen
- Sulfate and Chlorides



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Environmental Resources Section
Kansas City, MO