

Rathbun Lake Water Quality Summary

2003-2013

The **US Army Corps of Engineers (USACE)** Water Quality Program collects monthly water samples at Smithville Lake* April through September while Rathbun Land Water Alliance and Iowa Dept. of Natural Resources (IDNR) work together to sample inflow streams at 14 watershed sites. These figures present data collected between 2003-2012 from lake sites RA3, RA7, RA8, RA25, and the outflow RA28 at the dam. Thirty-four chemical, physical and biological parameters are measured to evaluate water quality. USACE use this data to describe conditions and changes from the inflows, lake, and outflow focusing on eutrophication, nutrients, sediment, herbicides, metals, and contaminants.

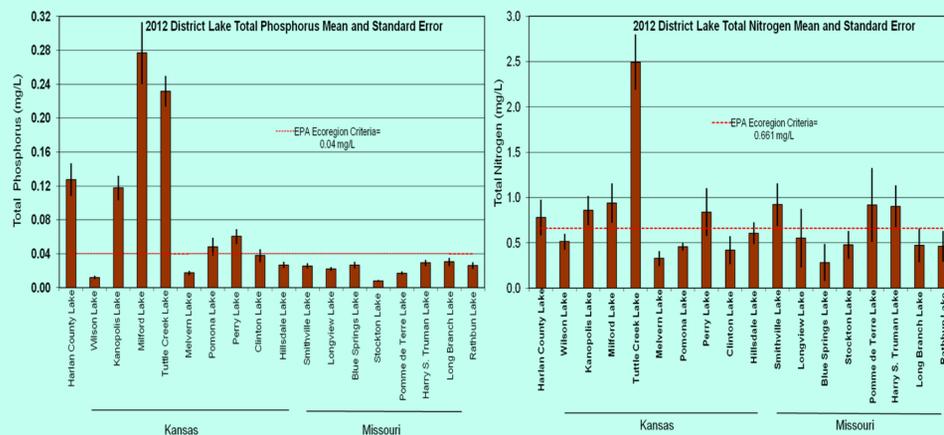
*Note: The term "lake" is substituted for technically correct "reservoir" throughout this document for consistency.

Rathbun Lake

- Built on the Chariton River and filled to multipurpose pool in 1970
- Watershed** = 549 sq miles (351,360 Acres)
- Capacity:**
 - Flood Control: 349,173 Acre Feet (AF)/ 22,452 surface acres (SA)
 - Multipurpose: 221,360 AF / 10,329 SA/ 155 miles of shoreline
- Operating project purposes:** Flood damage reduction, water supply, water quality, recreation, navigation, and fish and wildlife management.
- Avg. annual inflow** (2003-2012)= 358,079 AF; **Inflow 2012**=69,950 AF
- Water Quality** at Rathbun Lake in 2012 was beneficial to operating purposes listed above and measured parameters did not exceed Iowa State WQ Standards for designated uses. Water quality at Rathbun Lake improves as nutrients, herbicides and sediments are removed by settling, dilution, and biological processes as water moves from inflow streams to the dam

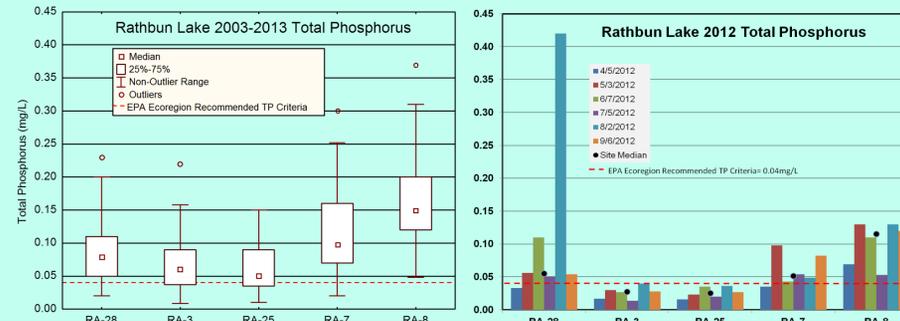
Nutrient enrichment

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. Rathbun Lake has been added to the draft 2010 Iowa 303(d) list of impaired waters due excessive algae and turbidity. EPA and IDNR are working with water quality partners, landowners and Rathbun Land Water Alliance to focus watershed conservation efforts on priority or target areas in the watershed to reduce nutrient and sediment runoff. This approach is designed to improve water quality and reduce designated impairments at Rathbun Lake. In 2012, inflows were 80% below average. Consequently, measured nutrients and TSS were 37%-47% less than 10 year averages at Rathbun Lake and inflow sites. Rathbun Lake average TP and TN measured at the dam (RA3) were below EPA ecoregion recommended criteria. Standard error bars in the graphs below illustrate the variation in sample results from each site in 2012.



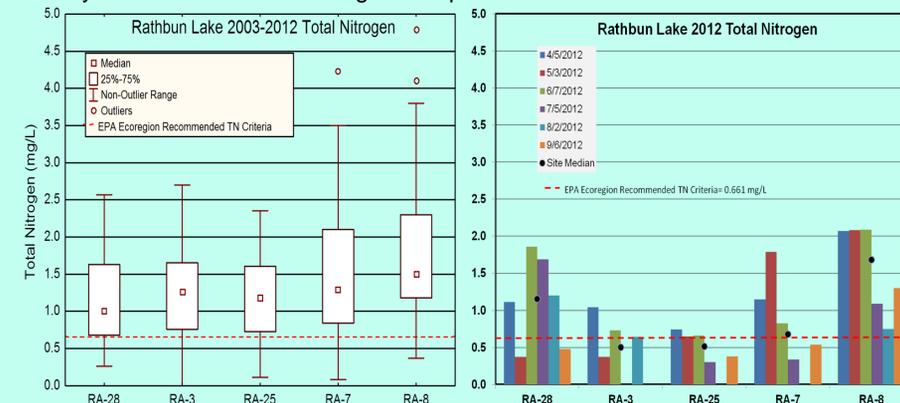
Total Phosphorus

Total phosphorus (TP) from all sample locations at Rathbun Lake exceeded EPA nutrient criteria in 50% or more of samples taken 2003-2012. Average TP from all sites in 2012 were significantly lower ($P < 0.05$) than 10-year averages. External inputs of phosphorus from the watershed are typically the primary source for high TP at Rathbun Lake. Low inflows resulted in less TP measured from all sites. Median TP at all Rathbun Lake sites are in the range of high biological productivity leading to high algae populations and rapid fish growth. Occasional blue green algae blooms occur at Rathbun, but conditions (i.e. nitrogen:phosphorus ratio, turbidity, lake turnover rate) tend to favor beneficial green algae species over toxic blue green species. ($P < 0.05$) than 2003-2012.



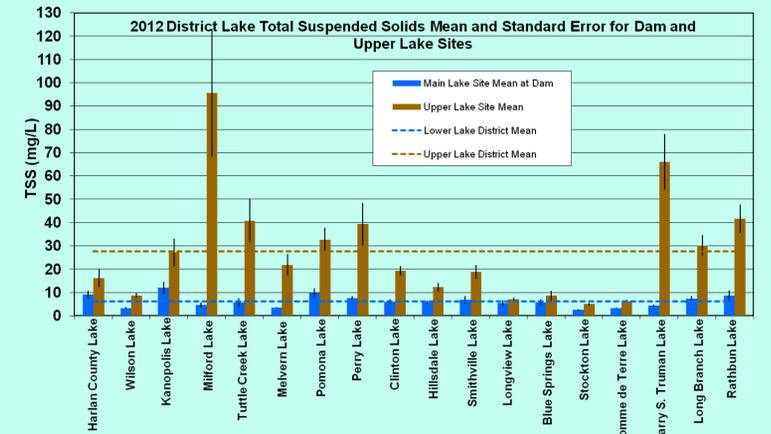
Total Nitrogen

Total nitrogen (TN) calculated from Rathbun Lake are typically near the highest of all District Lakes with seasonal medians twice EPA Ecoregion criteria (0.661 mg/L). Low inflows in 2012 contributed to low TN in 2012. Average TN values in 2012 were significantly ($P < 0.05$) lower at sites RA-3, RA-25, and RA-7 than TN average from 2003-2012. The highest concentrations of TN are typically found at RA-8 (South Fork Chariton Arm). Nitrogen concentrations are highly variable between sites and years mostly related to inflow discharge and upstream land use.



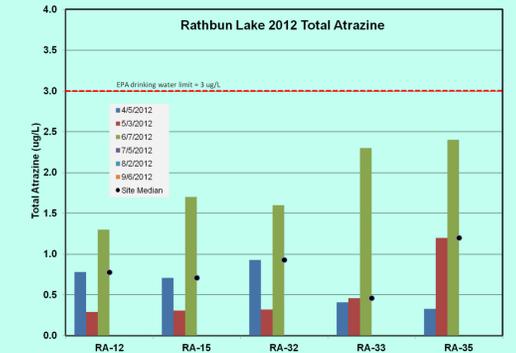
Total Suspended Solids

Total suspended solids (TSS) or filterable solids in streams and lakes is a function of watershed characteristics including soil composition, land use, weather patterns, and characteristics of inflowing streams. TSS is an indicator of erosion in watersheds, sedimentation or filling rates of downstream reservoirs, and is also closely linked to nutrient and contaminant transport through river systems. In 2012, Rathbun Lake TSS values were 47% of the 10-year average, but slightly higher than average for District lakes with 75% of TSS settled out as water moved from the upper lake to the dam.



Atrazine

Atrazine is a widely used and frequently detected herbicide throughout the Midwest. Rathbun Lake concentrations occasionally exceed drinking water standards (3 ug/L) during spring sampling, which coincides with application and runoff. Atrazine is dispersed throughout the water column, and must be removed for drinking water. Peak lake concentrations are typically found at RA-8 (S. Fork Chariton Arm). Low levels of atrazine were found at all sites in 2012.



Water Quality Concerns:

- Sediment inputs
- Algae blooms
- Nutrients
- Pesticides

