

Perry Lake Water Quality Summary 2003-2012

The US Army Corps of Engineers (USACE) Water Quality Program collects monthly water samples at Smithville Lake from April through September. These figures present data collected between 2003-2012 from four lake sites (#2,3,6,13) and the outflow (#1) 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.



Perry Lake:

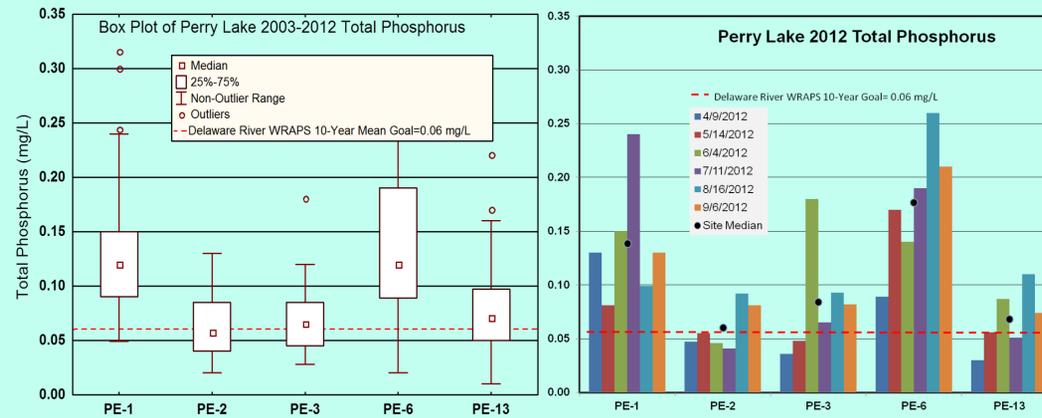
- Built on Delaware River reaching full pool in 1970
- **Watershed** = 1,117 sq miles ; 714,880 Acres (A)
- **Capacity:** Flood Control: 515,795 Acre-Foot (AF)/25,347 Surface-Acre (SA)
- **Multipurpose Pool:** 209,513 AF / 11,146 SA / 160 miles of shoreline
- **Ave. annual inflow** = 431,500 AF, 2012 inflow= 107,754 AF
- **Operating project purposes:** flood control, recreation, water supply, navigation support, water quality, and fish and wildlife habitat
- **Water Quality** at Perry Lake in 2012 was beneficial to operating purposes listed above and measured parameters did not exceed KS 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 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, low dissolved oxygen that affect fish survival, and taste and odor issues in drinking water. Perry Lake is on the 2012 Ks 303(d) list of impaired waters for accelerated eutrophication. KDHE and EPA are working with water quality partners, landowners and an active Delaware River Watershed Restoration and Protection Strategy (WRAPS) group. Working together in the watershed to reduce nutrient and sediment runoff will slow the eutrophication process improving water quality and increasing the life span of Perry Lake. In 2012, Perry Lake ranked near USACE Kansas City District lake average for total phosphorus (0.06 mg/L) and total nitrogen (0.74 mg/L) measured at the site nearest the dam. Standard error bars in the graphs below illustrate the variation in sample results from each site in 2012.

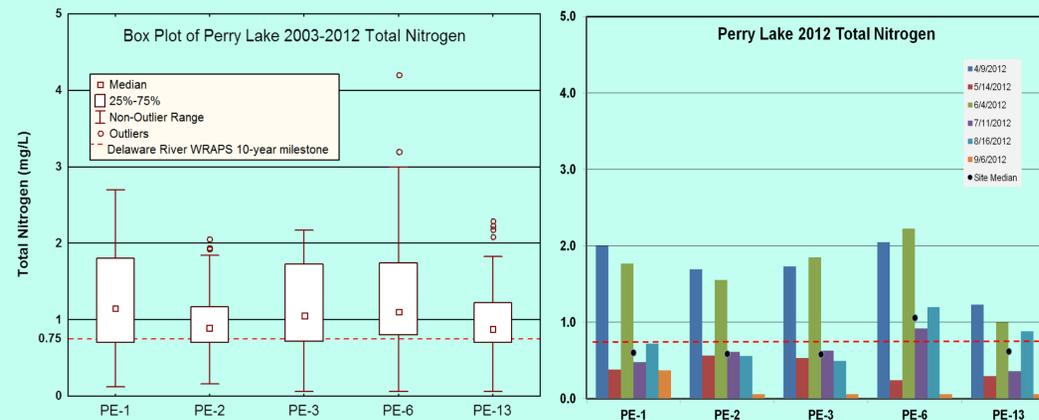
Total Phosphorus

Total phosphorus (TP) median concentrations in 2012 were similar to long-term trends at Perry Lake. TP median concentrations from 2003-2012 lake samples were similar to EPA approved 10-year goals set by Delaware R. WRAPS, except at site PE6 where results were 3 times higher. Phosphorus released by bottom sediments are apparent at PE6 in 2012 as TP levels are higher in the late summer months than spring unrelated to runoff events or inflow. Mixing from nutrient rich bottom sediments and re-suspension of TP by fish, wind, and bacteria drive the internal loading process in the shallow water during the summer months at Perry Lake.



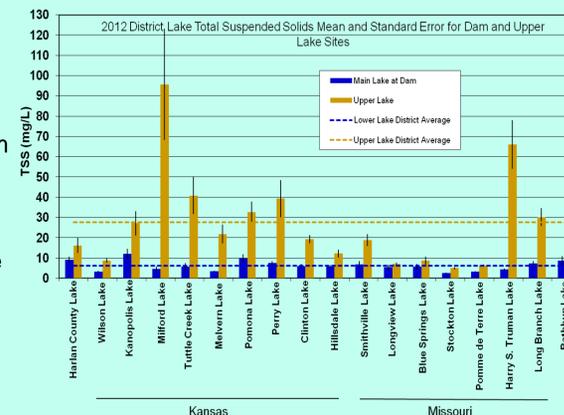
Total Nitrogen

In 2012, median total nitrogen concentrations were slightly higher than 10-year milestones set by Delaware River WRAPS. Drought conditions with low inflow amounts lead to stable or falling water levels and resulting TN levels were slightly lower than 10-year trends. Total Nitrogen concentrations can be highly variable between sites and years and most related to stream discharge and watershed factors (i.e. soils and farming practices), but 2012 proved to be a stable year with reduced impacts from outside sources.



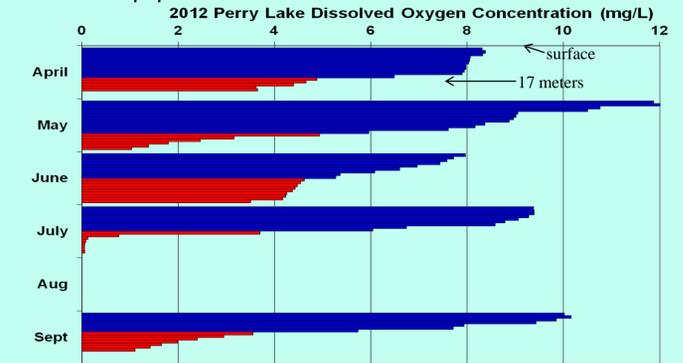
Total Suspended Solids

Total Suspended Solids (TSS) is descriptive of erosion in river basins, sedimentation or filling rates of downstream reservoirs, and is also closely linked to nutrient and contaminant transport through river systems. Perry Lake TSS values in the upper lake were slightly above average for District lakes with 77% of TSS settled out as water moved from the upper lake to the dam.



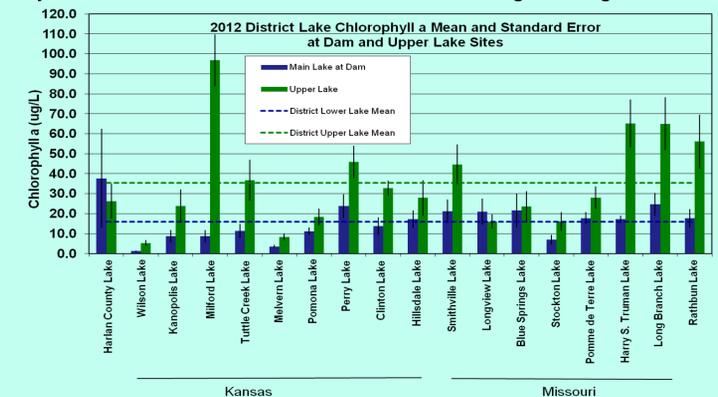
Dissolved Oxygen

Dissolved oxygen is a key factor in aquatic species location, growth, and ultimately survival in lakes. The figure below illustrates 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. Perry Lake stratifies for a short period of the summer, but adequate (5 mg/L) dissolved oxygen is typically available. In 2012, the top 8 meters of the lake was well oxygenated for fish and aquatic life throughout the summer. August profiles were omitted due to equipment failure.



Algae

Algae and green plants are the base of the food chain in a lake 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 algae, aquatic invertebrate production, and fish growth. Perry Lake typically has high levels (e.g. average nearly twice TMDL goals) of chlorophyll a indicating nutrient enrichment. Blue-green algae is present, but not typically dominant and toxic blooms are infrequent. The hypereutrophic conditions found in the upper end of Perry Lake are of concern and lead to toxic blue green algae blooms in 2011.



Water Quality Concerns:

- Eutrophication
- Algae blooms
- Herbicides
- Sediment inputs

