



Council Grove Lake

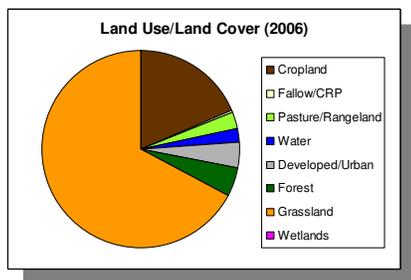
Water Quality Status, Trends, and Management

Location

Council Grove Lake is a 2,589-ac lake, located in the scenic Flint Hills region of Kansas. It was constructed by the Tulsa District Corps of Engineers in 1960, by damming the Neosho River to control flooding, and reached its normal pool level in 1964.

Land Use

Council Grove Lake lies within a 259-sq. mile watershed that is predominantly grassland (67%). Cultivated row crop accounts for 18% of the watershed while pasture/hay occupies 3% of the total land area.



Water Quality's Decline

Council Grove Lake is a Class A primary contact recreational water for public swimming. Other designated uses include aquatic life support, drinking water, industrial water supply, and food procurement.

Water quality data collected from 2000 to 2007 revealed that Council Grove Lake ranks third for total phosphorus (TP) concentration of 24 federal reservoirs in the state. The average concentration is 198 µg/L (ppb), which is 10 times greater than the reference value (19 µg/L) suggested for the Flint Hills region and twice larger than the national average (100 µg/L) of the EPA's Survey of Nation's Lake in recent years.

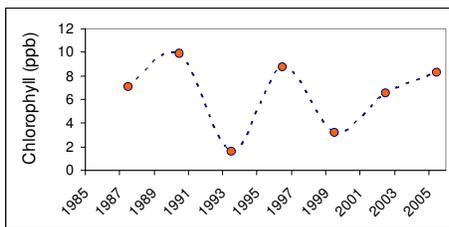
Similar to TP, the total suspended solids (TSS) concentration, indicative of turbid condition, is high and averages about 21 mg/L (ppm).

Lake Name	Chlorophyll a (ppb)	Lake Name	Phosphorus (ppm)	Lake Name	TSS (ppm)
John Redmond	49.40	John Redmond	0.23	John Redmond	34.00
Lovewell	42.73	Tuttle Creek	0.22	Elk City	33.33
Elk City	29.30	Council Grove	0.20	Toronto	29.00
Marion	26.90	Kirwin	0.14	Fall River	22.33
Webster	26.67	Milford	0.13	Webster	21.67
Clinton	21.70	Marion	0.13	Council Grove	20.50
Cheney	21.50	Lovewell	0.12	Marion	19.00
Kirwin	17.10	Sebelius	0.12	Lovewell	16.67
Kanopolis	16.93	Cheney	0.10	Sebelius	16.33
Hillsdale	16.68	Toronto	0.09	Cheney	16.00
Perry	16.37	Perry	0.08	Kanopolis	14.00
Sebelius	14.40	Webster	0.08	Kirwin	13.00
Big Hill	13.60	Kanopolis	0.07	Wilson	13.00
Toronto	13.53	Elk City	0.06	Cedar Bluff	12.00
Milford	10.90	Clinton	0.06	Waconda	10.67
Fall River	9.70	Fall River	0.05	El Dorado	10.00
Pomona	9.22	Pomona	0.05	Perry	9.33
Cedar Bluff	7.77	Hillsdale	0.04	Tuttle Creek	9.33
El Dorado	7.70	Melvorn	0.03	Pomona	8.50
Council Grove	7.40	Cedar Bluff	0.03	Clinton	8.00
Melvorn	7.40	Big Hill	0.02	Hillsdale	6.00
Waconda	7.20	Waconda	0.02	Milford	6.00
Tuttle Creek	6.90	El Dorado	0.02	Melvorn	5.00
Wilson	4.00	Wilson	0.01	Big Hill	4.33

Because of the appearance of high turbidity values, the lake has low water clarity. The average Secchi depth value is 54 cm, ranking 20th among the federal lakes.

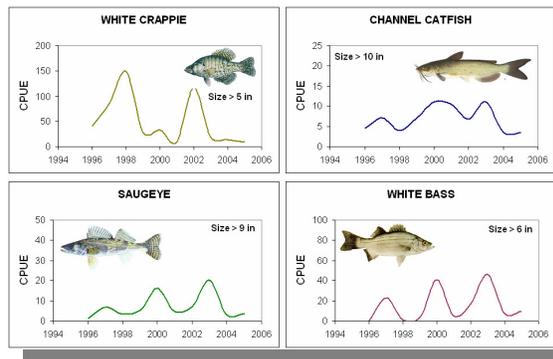
Eutrophication along with siltation is the most concerned water-quality problem in Council Grove Lake and throughout the Midwest. Though eutrophication occurs naturally, it can be accelerated through an anthropogenic process that causes reservoirs to become more productive or eutrophic due to excessive nutrient additions from their associated watersheds.

Chlorophyll *a* (Chla) concentration has been used as a general trophic indicator of a waterbody. The lake's Chla concentrations average 7.4 µg/L, which ranks 20th in the state. The occurrence of low Chla concentrations is closely associated with low water clarity (or high turbidity) conditions. The high turbidity due to suspended particles negatively affects phytoplankton communities and light penetration.



Fish Community

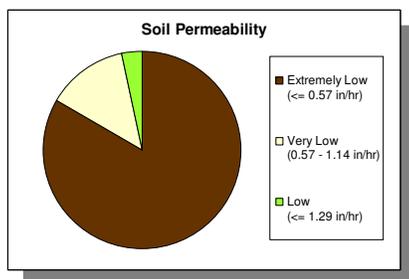
The number stock (or adult) fish captured per unit time effort (Stock CPUE) in 1996-2005 shows that the fish populations fluctuate over time. According to the 2008 fish report of Kansas Department of Wildlife and Parks, the fishery at Council Grove Lake provides a fair rating of fishing opportunities for saugeye, white bass, and white crappie while a good rating condition for channel catfish, perhaps because of the turbid lake conditions.



Runoff Potential

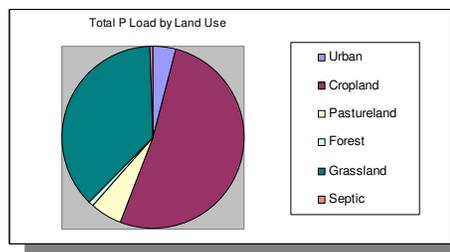
Runoff plays an important role in transporting nutrients and sediment to the lake. It occurs as precipitation is greater than soil permeability. According to the Natural Resources Conservation Service's soil database

(STATSGO), the soils in the watershed all have low permeability values. Eighty-three percent of the soils have permeability ≤ 0.56 in/hr, and the majority (72%) have permeability ≤ 0.20 in/hr. The watershed-average soil permeability is 0.29 in/hr. Analysis of runoff potential based on 1.14 in/hr of rainfall indicates that nearly all of the watershed area (97%) can contribute runoff to Council Grove Lake.



Restoration of Council Grove Lake
Based on the Clean Water Act, a waterbody that does not meet water quality standards is considered “impaired”. The Clean Water Act requires states to develop a clean-up plan for each impairment. The clean-up plan and the process used to develop it is the Total Maximum Daily Load (TMDL).

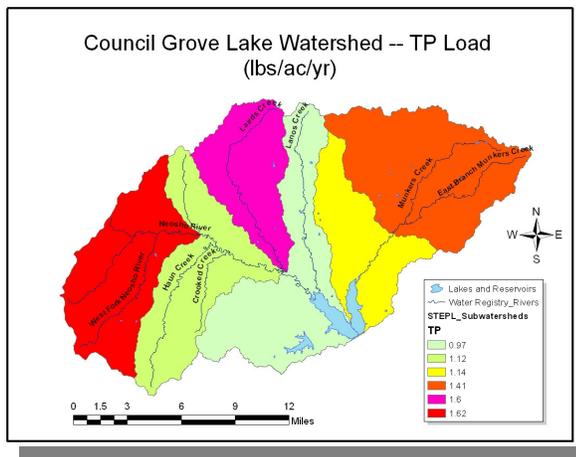
The phosphorus (TP) load to Council Grove Lake from all sources under typical runoff conditions was determined using watershed/lake models. Pastureland, grassland, and in particular cropland are the dominant nutrient source, which they together contribute 74 tons of TP annually to the lake. Urban area and atmospheric deposition contribute 4 tons and 233 lb, respectively.



Among the six HUC14 subwatersheds modeled, the

headwaters of West Fork Neosho River, Lairds Creek, and Munkers Creek are the top 3 subwatersheds that have larger TP loads per unit area, with loading rates of 1.62, 1.60, and 1.41 lbs/ac/yr, respectively, because of the larger cropland areas.

To improve the current water quality, a 32% reduction of TP from the watershed is required.



Implementation of Watershed Management in Reducing Phosphorus Entering the Lake

To abate excessive TP, here are several recommended agricultural practices: (1) Apply nutrient best management practices (BMPs) to reduce nutrient additions from excess fertilization; (2) Promote and adopt continuous no-till cultivation to minimize soil erosion and nutrient transports; (3) Install grass buffer strips along streams; (4) Reduce activities within riparian areas; (5) Setback both confined and non-confined animal feeding operation sites; and (6) Construct ponds/detention basins, erosion control structures and/or wetlands to reduce soil erosion and to trap sediment and lower peak runoff rates.

More Information

- Council Grove Lake Eutrophication TMDL (<http://www.kdheks.gov/tmdl/index.htm>)
- Watershed Restoration and Protection Strategy (<http://www.kswraps.org/>)
- Watershed Management Section, KDHE (<http://www.kdheks.gov/nps/index.html>)
- Handbook for Developing Watershed Plans and Restore and Protect Our Waters (http://www.epa.gov/owow/nps/watershed_handbook/)

FAST FACTS

Water quality standards have been established in Kansas and around the country to protect aquatic ecosystems.

Over the past 10 years, the water quality of Council Grove Lake has declined. Excessive TP, accompanying by suspended sediment, in the water has contributed significant impacts on the value and health of the lake.

In response to improving water quality, a 32% reduction of TP from the watershed is needed.

Implementation should focus on headwaters of West Fork Neosho River, Lairds Creek, and Munkers Creek.

TMDL Dictionary

Secchi depth is a parameter used to determine lake clarity by a 20-cm black and white disk. The disk was created by an Italian astronomer, Angelo Secchi, in 1865. The depth reading is taken by lowering the disk into the water until it is no longer visible.

Eutrophication is excessive enrichment of an aquatic system with nutrients.

Siltation is sedimentation, accumulation of sediments in an aquatic system.

Anthropogenic process is the influence or factor that is induced by human activities on the natural environment.

