

208 Factsheet regarding DO and Turbidity TMDLs for Oologah Lake

Watershed: This TMDL Study Area is located in the Middle Verdigris River (USGS HUC 11070103) basin. The Study Area covers portions of Craig, Nowata and Rogers Counties.

Beneficial Uses in This Watershed: According to Oklahoma's [2014 Integrated Report](#), the designated beneficial uses for Oologah Lake (OK121510010020_00) are Aesthetics (AES), Agriculture (AG), Navigation, Fish & Wildlife Propagation - Warm Water Aquatic Community Subcategory (WWAC), Fish Consumption, Primary Body Contact Recreation (PBCR), and Public & Private Water Supply (PPWS).

Based on an assessment of water quality monitoring data for the 2014 IR, Oklahoma DEQ has determined that Oologah Lake is not supporting its designated uses for Fish and Wildlife Propagation for a WWAC because of high levels of turbidity and low dissolved oxygen (DO).

Waterbody Name	Waterbody ID	Size (acres)	TMDL Date	Priority	Turbidity	DO
Oologah Lake	OK121510010020_00	29,460	2012	1		

Possible Sources of Impairments:

Point Source:

- **OPDES regulated municipal and industrial wastewater treatment facilities:** There are seven facilities in the Study Area (one facility in Oklahoma and six facilities in Kansas). The watershed and lake models include the facilities with the effluent flow rate larger than 0.1 MGD. This can be found in Table 3-1 of the TMDL report. There are no direct NPDES point source discharges of wastewater into Oologah Lake
- **OPDES regulated stormwater discharges:** DEQ regulates stormwater discharges from Municipal Separate Storm Sewer Systems (MS4s), industrial sites, and construction sites.
 - **MS4s:** There are no pollutant contributions from Phase II MS4 permits in the Oklahoma portion of the Study Area. In the Kansas portion of the Study Area, the City of Coffeyville has been issued a Phase II MS4 Stormwater Program permit (KSR440002) by the Kansas Department of Health and Environment (KDHE). The urban stormwater contribution of flow and pollutant loading from Coffeyville is included in the compilation of total nonpoint source loading for the HSPF model domain and will be accounted for by the Load Allocation (LA) estimated for the Oologah Lake TMDL.
 - **Multi-Sector General Permit (MSGP):** There are nine (9) MSGP facilities in the Study Area. These can be found in Table 3-6 of the TMDL report.

- **Construction Sites:** There were six OKR10 permits for construction projects in the Study Area. These can be found in Table 3-5 of the TMDL report..
- **No-Discharge Facilities:** There are seven facilities in the Study Area. For the purposes of these TMDLs, it is assumed that no-discharge facilities (such as towns with total retention lagoons) do not contribute to nutrients or TSS getting into the waterbodies. However, It is possible that the wastewater collection system associated with no-discharge facilities could be a source of pollutant loading to streams, or that discharges from the WWTP may occur during large rainfall events that exceed the storage capacity of the wastewater system.
- **Sanitary Sewer Overflows (SSO):** between 1992 and 2017, 23 SSO occurrences were reported with amounts ranging from 1,000 gallons to greater than 6 million gallons
- **NPDES regulated Animal Feeding Operations (AFOs):** In the Oklahoma portion of the Study Area, there are three (3) PFOS and no CAFOs or SFOs. In the Kansas portion of the Study Area, there are twenty-four active CAFOs and no PFOs or SFOs.

Nonpoint Sources:

- **Watershed Loading** – Streamflow, nonpoint source runoff, and pollutant loading to Oologah Lake are provided as time series output from a watershed model for input to the lake model. Simulated flow and watershed pollutant loading are dependent on land use characteristics, soils, topography, and hydrologic inputs, including point source discharges from NPDES wastewater facilities to tributaries, for each sub-watershed catchment of the watershed model domain. Natural background conditions are not represented as an explicit component of watershed loading to Oologah Lake. All flow and pollutant loading data assigned for input to the lake model are derived from the watershed model.
- **Atmospheric Deposition** – Atmospheric deposition of nitrogen and phosphorus to a waterbody is contributed by both dry and wet deposition. Dry deposition is defined as a mass flux rate (as g/m²-day) for a constituent that settles as dust or is deposited on a dry surface during a period of no precipitation. The mass flux of a constituent from wet deposition is defined by the concentration of the constituent in rainfall and the rate of precipitation.
- **Internal Loading** – Benthic phosphate release rates, characteristic of eutrophic lakes and reservoirs, can also be estimated for Oologah Lake using an empirical methodology developed by Nurnberg (1984). Measured data collected by Dzialowski and Carter (2011) were used to confirm model results simulated by the internally coupled sediment diagenesis sub-model of the EFDC lake model that was developed for Oologah Lake.

TMDL Calculation:

The WLA and LA for TN, TP, TOC and TSS, determined from the lake model response to external load reductions, are based on 40% reduction of the existing 2007 inflow from watershed loads.

Long Term Average (LTA) Load for TN, TP, TOC, and TSS: Existing Conditions and 40% Removal

Water Quality Constituent Oologah Lake	LTA, Existing Annual kg/yr	Load Reduction %	LTA, Reduced Annual kg/yr	LTA, Reduced Daily kg/day
Total Nitrogen (TN)	8,160,833	40%	4,896,500	13,415
Total Phosphorus (TP)	1,214,873	40%	728,924	1,997
Total Organic Carbon (TOC)	33,328,891	40%	19,997,335	54,787
Suspended Solids (TSS)	1,842,230,207	40%	1,105,338,124	3,028,324

Maximum Daily Load (MDL) for TN, TP, TOC and TSS to Meet Water Quality Targets for Turbidity and Dissolved Oxygen

Water Quality Constituent Oologah Lake	LTA, Reduced Daily kg/day	Load CV n=363	Z-Score for 95% Probability	MDL (TMDL) Load kg/day
Total Nitrogen (TN)	13,415	5.362	1.645	50,906
Total Phosphorus (TP)	1,997	6.432	1.645	7,407
Total Organic Carbon (TOC)	54,787	5.415	1.645	207,688
Suspended Solids (TSS)	3,028,324	41.188	1.645	6,524,666

LTA- Long Term Average Load CV- Coefficient of Variation

Maximum Daily Load (MDL), Waste Load Allocation (WLA) and Load Allocation (LA) for TN, TP, TOC and TSS

Water Quality Constituent Oologah Lake	WLA + LA (PS + NPS) %	WLA (PS) %	LA (NPS) %
Total Nitrogen (TN)	100%	0%	100%
Total Phosphorus (TP)	100%	0%	100%
Total Organic Carbon (TOC)	100%	0%	100%
Suspended Solids (TSS)	100%	0%	100%

Water Quality Constituent Oologah Lake	MDL (TMDL) Load kg/day	WLA (PS) kg/day	LA (NPS) kg/day	MOS kg/day
Total Nitrogen (TN)	50,906	0	50,906	Implicit
Total Phosphorus (TP)	7,407	0	7,407	Implicit
Total Organic Carbon (TOC)	207,688	0	207,688	Implicit
Suspended Solids (TSS)	6,524,666	0	6,524,666	Implicit

The Oologah Lake TMDL Report can be found on the following DEQ webpage:
<https://www.deq.ok.gov/water-quality-division/watershed-planning/tmdl/>.

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