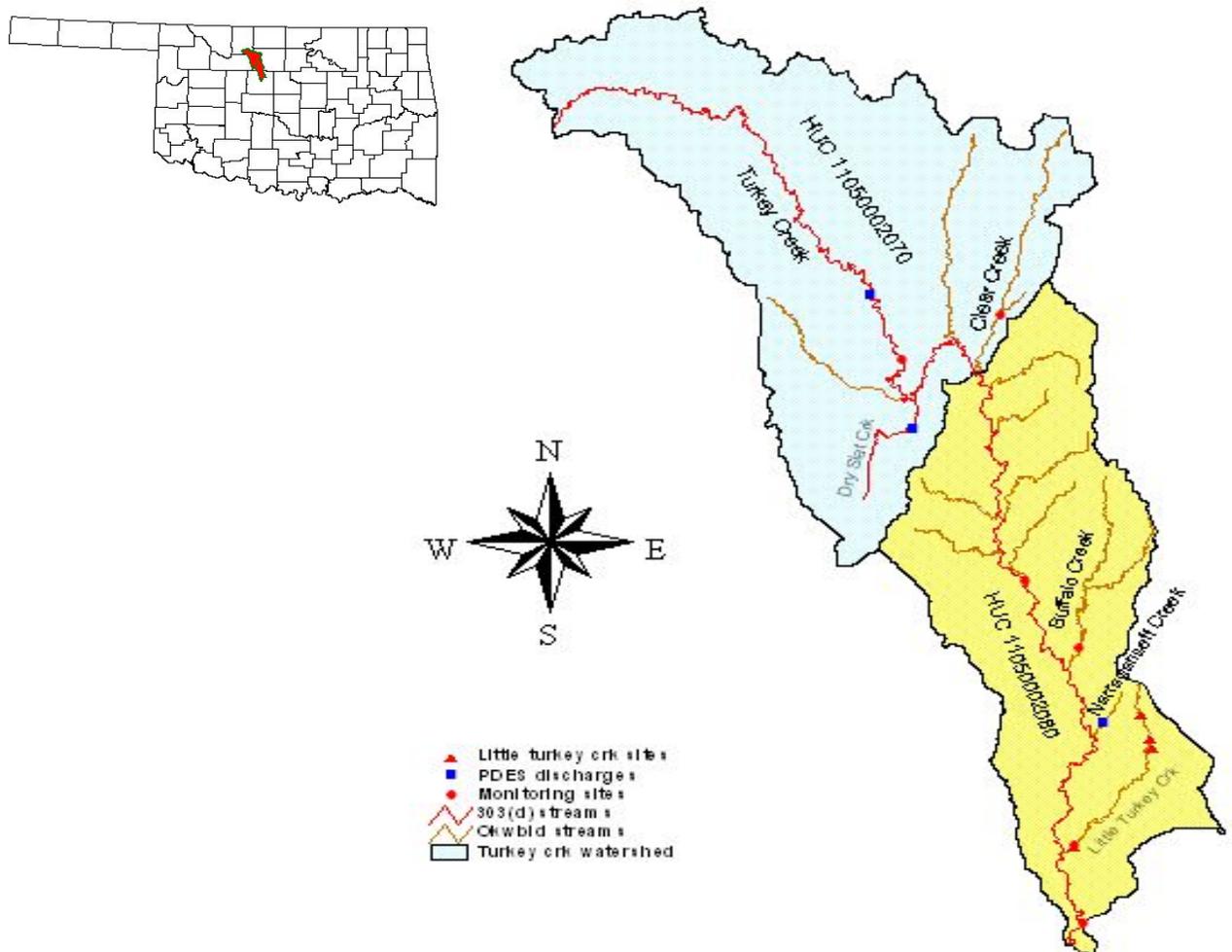


TMDLs for Turkey Creek Watershed (Turkey Creek, Little Turkey Creek, Buffalo Creek, and Clear Creek)

Fact Sheet

Section 303(d) of the Clean Water Act and the U.S. Environmental Protection Agency's Water Quality Planning and Management Regulations require states to develop Total Maximum Daily Loads (TMDLs) for waterbodies that are not meeting water quality standards. A TMDL establishes the amount of a pollutant that a waterbody can assimilate without exceeding its water quality standard for that pollutant. TMDLs provide the scientific basis for a state to establish water quality-based controls to reduce pollution from both point and nonpoint sources to restore and maintain the quality of the state's water resources. The TMDL report does not stipulate specific control actions (regulatory controls) or management measures (voluntary best management practices) necessary to reduce bacteria loadings within each watershed. Watershed-specific control actions and management measures will be identified, selected, and implemented under a separate process.

Figure 1 Location of Impaired Waterbodies



Problem Identification and Water Quality Target

Little Turkey Creek, Buffalo Creek and Clear Creek do not have designated beneficial uses in Oklahoma Water Quality Standards. Warm Water Aquatic Community (WWAC) and Primary Body Contact Recreation (PBCR) beneficial uses are assumed for these streams. WWAC beneficial use is related to turbidity standards and PBCR beneficial use is related to bacteria standards. A decision was made to place the following waterbodies in the Turkey Creek Watershed on the ODEQ 2002 303(d) list because evidence of nonsupport due to Pathogens (fecal coliform) and turbidity was observed (Table ES-1).

Table ES-1 Section 303(d) Listing for Waterbodies in this report (2002 IR, ODEQ)

Oklahoma Waterbody ID	NAME	Stream Miles	Category	Turbidity	Pathogens
OK620910060010	Turkey Creek	83	5	X	X
OK620910060020	Little Turkey Creek	11	5	X	X
OK620910060030	Buffalo Creek	14	5	X	X
OK620910060110	Clear Creek	5	5	X	X

Turbidity Criteria

According to the Oklahoma Water Quality Standards (785:45-5-12(f)(7)), the turbidity criterion for streams with WWAC beneficial use is 50 Nephelometric Turbidity Unit (NTU).

The turbidity of 50 NTU applies only to seasonal base flow conditions. Elevated turbidity level may be expected during, and for several days after, a storm event. Because turbidity cannot be expressed as a mass load, the turbidity TMDL was expressed using total suspended solids (TSS) as a surrogate for turbidity. Historical water quality data for each waterbody was analyzed for relationships between turbidity and TSS, and a regression between turbidity and TSS was developed for that waterbody. A summary of the TSS target for each watershed is included in Table ES-2.

Table ES-2 Total Suspended Solids Targets

Streams	TSS & Turbidity Correlation	TSS Target (mg/L)
Turkey Creek	TSS = 1.12 x turbidity	56.0
Little Turkey Creek	TSS = 0.67 x turbidity	33.5
Buffalo Creek	TSS = 1.04 x turbidity	52.0
Clear Creek	TSS = 1.85 x turbidity	92.5

Pathogen Criteria

According to Oklahoma Water Quality Standards (785:45-5-16(c)), the bacteria of the fecal coliform group shall not exceed a monthly geometric mean of 200/100 ml, as determined by multiple-tube fermentation or membrane filter procedures based on a minimum of not less than five (5) samples collected over a period of not more than thirty (30) days. Further, in no more than 10% of the total samples during any thirty (30) day period shall the bacteria of the fecal coliform group exceed 400/100 ml.

Fecal coliform samples were collected in Turkey Creek, Little Turkey Creek, Buffalo Creek, and Clear Creek. Since samples were collected only once a month, there was not enough data to calculate monthly geometric mean. Therefore, geometric mean of fecal coliform was calculated using all samples. The PBCR beneficial use shall be considered attained if geometric mean of all samples is less than or equal to 200/100ml and no more than 10% of the fecal coliform samples exceed 400/100ml.

This fact sheet presents a summary of the TMDLs that have been developed for the pathogen indicator fecal coliform and TSS for the Turkey Creek Watershed Basin. The data and assessment are in accordance with requirements of Section 303(d) of the Clean Water Act, Water Quality Planning and Management Regulations (40 CFR Part 130), U.S. Environmental Protection Agency (USEPA) guidance, and Oklahoma Department of Environmental Quality (ODEQ) guidance and procedures.

Pollutant Source Assessment

NPDES-permitted facilities are absent from most of the watersheds in the study area, and most point sources are relatively minor and for the most part, tend to meet instream water quality criteria in their effluent. Thus, nonpoint sources are considered to be the major source of the impairment in each watershed. Nonpoint source loading to the receiving streams of each waterbody emanate from a number of different sources. The data analysis and the load duration curves (LDC) demonstrate that exceedances at the WQM stations are the result of a variety of nonpoint source loading. The load allocations (LA), calculated as the difference between the TMDL, the margin of safety (MOS), and the wasteload allocation (WLA), for each WQM station.

Using Load Duration curves to Develop TMDLs

The TMDL calculations presented in this report are derived from LDCs. LDCs facilitate rapid development of TMDLs and as a TMDL development tool, are effective in identifying whether impairments are associated with point or nonpoint sources.

Use of the LDC obviates the need to determine a design storm or selected flow recurrence interval with which to characterize the appropriate flow level for the assessment of critical conditions. For waterbodies impacted by both point and nonpoint sources, the “nonpoint source critical condition” would typically occur during high flows, when rainfall runoff would contribute the bulk of the pollutant load, while the “point source critical condition” would typically occur during low flows, when treatment plant effluents would dominate the base flow of the impaired water.

LDCs display the maximum allowable load over the complete range of flow conditions by a line using the calculation of flow multiplied by the water quality criterion. The TMDL can be expressed as a continuous function of flow, equal to the line, or as a discrete value derived from a specific flow condition.

TMDL Calculations

As indicated above, the bacteria TMDLs for the 303(d)-listed WQM stations covered in this report were derived using LDCs. A TMDL is expressed as the sum of all WLAs (point source loads), LAs (nonpoint source loads), and an appropriate MOS, which attempts to account for uncertainty concerning the relationship between effluent limitations and water quality.

This definition can be expressed by the following equation:

$$***TMDL = \Sigma WLA + \Sigma LA + MOS***$$

For each WQM station the TMDLs presented in this report are expressed as a percent reduction across the full range of flow conditions (See Table ES-2). The TMDL, WLA, LA, and MOS vary with flow condition, and can be calculated for any flow value. The WLA component of each TMDL is the sum of all WLAs within the contributing watershed of each WQM station. The sum of the WLAs can be represented as a single line below the LDC. The LDC and the simple equation of:

$$***Average LA = average TMDL - MOS - \Sigma WLA***$$

can provide an individual value for the LA in counts per day which represents the area under the TMDL target line and above the WLA line. Percent reductions necessary to achieve the water quality target are also provided for all WQM stations as another acceptable representation of the TMDL.

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs include an MOS. The MOS is a conservative measure incorporated into the TMDL equation that accounts for the uncertainty associated with calculating the allowable fecal coliform pollutant loading to ensure WQSs are attained. For the explicit MOS the water quality target was set at 10 percent lower than the water quality criterion for fecal coliform which equates to 360 cfu/100 ml. The net effect of the TMDL with MOS is that the assimilative capacity or allowable pollutant loading of each waterbody is slightly reduced. The fecal coliform TMDLs incorporate an explicit MOS by using a curve representing 90 percent of the TMDL as the average MOS. The TSS TMDLs margins of safety was implicit margin of safety based on the conservative assumptions used in the study. Therefore, no specific numbers were assigned to MOS in the TMDL calculations. A summary of the TMDLs for each waterbody is presented in Table ES-3.

Table ES-3 TMDL Summaries and Percent Reductions Required

Waterbody	Parameter	WLA† (colonies* 10⁶/day)	LA† (colonies* 10⁶/day)	MOS† (colonies* 10⁶/day)	TMDL† (colonies* 10⁶/day)	Reserve Capacity (colonies* 10⁶/day)	Percent Reduction
Turkey Creek	Fecal Coliform	3674	258,190	29,096	290,960	0	98%
Little Turkey Creek	Fecal Coliform	0	11,744	2,396	14,679	0	98%
Buffalo Creek	Fecal Coliform	0	15,658	3,915	19,573	0	96%
Clear Creek	Fecal Coliform	0	13,309	3,327	16,637	0	98%
Waterbody	Parameter	WLA† (lb/day)	LA† (lb/day)	MOS† (lb/day)	TMDL† (lb/day)	Reserve Capacity (lb/day)	Percent Reduction
Turkey Creek	TSS	0	8880.5	Implicit	8970.2	89.7	46 %
Little Turkey Creek	TSS	0	268	Implicit	270.7	2.7	22%
Buffalo Creek	TSS	0	554.7	Implicit	560.3	5.6	51%

† Derived for illustrative purposes at the median flow value

For More Information

EPA seeks input on these proposed TMDLs, including comments, information, and data from the general and affected public. For additional information on this TMDL project, please contact the EPA staff listed below:

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