

**Executive Summary**  
**Final Total Maximum Daily Load**  
**Dog and Cat Creeks**  
(OKWBID# 121500020360 & OKWBID# 121500020390)  
August 2006

*Table of Contents*

1. Problem Definition .....	2
2. Endpoint Identification .....	3
3. Source Analysis .....	3
3.1 Point Sources .....	3
3.2 Non-point Sources .....	3
3.3 Background .....	4
4. Linkage between Sources and Receiving Water .....	4
4.1. Model Inputs .....	4
4.2. Maximum Assimilative Capacity .....	4
5. Margin of Safety .....	4
6. Allocations .....	5
7. Final Recommendations .....	5
8. Public Participation & TMDL Implementation .....	5

*List of Tables*

Table 1. Maximum Assimilative Capacity .....	4
Table 2. Allocations .....	5

## **1. Problem Definition**

The primary problem is the possibility of low instream dissolved oxygen (DO) due to an existing discharge of treated municipal wastewater from the City of Claremore. Long pools with little summer base flow characterize the receiving streams of Cat and Dog Creeks. Most of the study area is within the 100-year floodplain, and nearly the entire stream channel has dense riparian tree canopy. As a result, the dissolved oxygen budget of Dog and Cat Creeks is driven by oxygen demanding substances (i.e. decay of CBOD, ammonia-N, organic nitrogen and sediment demands) with moderate to poor natural reaeration.

The current (2002) Oklahoma Water Quality Standards (OWQS) designate Dog Creek, Cat Creek (Water Quality Management segment 121500) with the following Beneficial Uses:

- Public and Private Water Supply;
- Warm Water Aquatic Community;
- Agriculture;
- M & I Process and Cooling Water;
- Primary Body Contact Recreation; and
- Aesthetics.

The effluent tributary to Cat Creek (NW 1/4, Sec. 21, T21N, R16E, IM) is listed in the 2002 OWQS for the following Beneficial Uses:

- Emergency Water Supply;
- Habitat Limited Aquatic Community;
- Agriculture;
- M & I Process and Cooling Water;
- Secondary Body Contact Recreation; and Aesthetics.

Among the above designated beneficial uses, only the HLAC and WWAC beneficial uses influence the outcome of this waterbody assessment.

Both Dog Creek (WB Id # 121500-020360) and Cat Creek (WB Id # 121500-020390) are listed on Oklahoma's 2002 Integrated Report as being impaired (Category 5) by Organic Enrichment/Low DO, Pathogens and Cause Unknown. This TMDL has been developed in order to ensure that the limits assigned to the discharge are stringent enough to maintain DO standards under critical conditions and address the 303(d) listing for "Organic Enrichment/Low DO" in Dog and Cat Creeks.

This TMDL also addresses the listing for "Cause Unknown" on Cat Creek attributed to "Municipal Point Source" since the City of Claremore has elected to relocate the point of discharge to the Verdigris River. The "Cause Unknown" attributed to an "Unknown Source" on Dog Creek is likely caused by the impaired waters from Cat Creek and the relocation the Claremore discharge will also resolve this listing.

This waterbody assessment addresses instream organic enrichment and Dissolved Oxygen (DO) through the use of point source wasteload allocations of DO-demanding substances (CBOD and Ammonia). It also accounts for non-point source impacts through the use of conservative kinetic inputs/assumptions and the use of Sediment Oxygen Demand (SOD) to calculate the Load Allocation (LA).

This executive summary addresses the changes in 303(d) listings and TMDL submittal requirements, which have occurred since the completion of the original TMDL by the Indian Nations Council of Governments (INCOG) in August 2002. All maps, modeling detail and other descriptive information can be found in main report.

## **2. Endpoint Identification**

Dog and Cat (410100010010) Creeks have designated beneficial use of WWAC in the OWQS; this use requires the following average instream DO targets:

Summer:	5.0 mg/L
Spring:	6.0 mg/L
Winter:	6.0 mg/L

The effluent tributary to Cat Creek has a designated beneficial use of HLAC in the OWQS; this use requires the following minimum instream DO targets:

Summer:	4.0 mg/L
Spring:	5.0 mg/L
Winter:	5.0 mg/L

Nuisance Condition (zero upstream flow) applies to all streams in this study.

Year-round:	2.0 mg/L
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Oklahoma antidegradation policy (OAC 785:45-3) requires protecting all waters of the state from degradation of water quality. The allocated loadings/concentrations in this report were set with regard for all elements of the Oklahoma Water Quality standards, which includes the antidegradation policy.

## **3. Source Analysis**

### *3.1 Point Sources*

#### **Claremore Wastewater Treatment Facility (WWTF)**

Facility Legal Description: SW<sup>1</sup>/<sub>4</sub>/ SE<sup>1</sup>/<sub>4</sub>/SW<sup>1</sup>/<sub>4</sub> S16 T21N R16E

Current Wasteload Allocation (WLA):

Permitted Flow:	2.76 MGD
Year round:	Secondary, 5 mg/L DO

### *3.2 Non-point Sources*

The modeling for DO focuses on critical conditions (i.e., low-flow and high temperature); therefore, minor impacts are expected from non-point source (NPS) runoff during low flow conditions. The model incorporates a separate safety factor (see below), which should also account for the uncertainties in NPS loadings. It is assumed that the Sediment Oxygen Demand depicts the residual effects from NPS at low flows. The SOD was used in the calculation of the Load Allocation (LA) at low flow.

The Oklahoma Water Resources Board is looking at the NPS contributions upper Dog Creek Watershed and their influences on Claremore Lake. This TMDL will only address the listing for Organic Enrichment/Low DO for Dog and Cat Creeks since the data indicates the cause of the impairment is the Claremore WWTF and is not significantly impacted by NPS pollutants.

### 3.3 Background

The following background conditions were used:

Flow (7Q <sub>2</sub> ):	0.0 cfs
CBOD <sub>U</sub> :	2.0 mg/L
Ammonia:	0.15 mg/L
DO:	85% saturation Dog & Cat Creeks, 80% saturation effluent tributary

## 4. Linkage between Sources and Receiving Water

### 4.1. Model Inputs

The LAQUAL computer model (Version 4.00 December 18, 2000) was selected for modeling Dog and Cat Creeks. LAQUAL is a one-dimensional, steady-state model developed by the Louisiana Department of Environmental Quality. LAQUAL has improved upon the QUAL-TX originally developed by the Texas Water Commission and derived from the original QUAL-II stream model developed by Water Resource Engineers. LAQUAL operates in the Windows operating systems making it more user friendly than QUAL-2E and QUAL-TX which have not yet been fully updated. Detail of the modeling input and assumptions can be obtained from INCOG's TMDL for Dog and Cat Creeks.

### 4.2. Maximum Assimilative Capacity

The model was used to determine the stream's maximum assimilative capacity during various seasons under regulatory flow condition of 1.0 cfs or 7Q<sub>2</sub> whichever is greater. To do this, the concentration of CBOD<sub>5</sub> and NH<sub>3</sub>-N of the point source are increased at the same rate until the predicted instream DO reaches the DO criteria. The resultant mass loading represents the maximum assimilative capacity of the stream for DO-demanding substances. The maximum assimilative capacity is measured in terms of dissolved oxygen as shown in the following table.

**Table 1. Maximum Assimilative Capacity**

Season	Maximum Assimilative Capacity (lbs/day)
Summer (Jun–Oct)	<b>1753.7</b>
Spring (Apr–May)	<b>1536.8</b>
Winter (Nov–Mar)	<b>2971.8</b>

The complete model results are shown in the INCOG TMDL Report.

## 5. Margin of Safety

The CPP specifies a 5% margin of safety (MOS) for calibrated and verified model. The quantified MOS is equal to 5% of maximum wasteload allocations. The MOS, load allocation and wasteload allocation are presented in the next section.

## **6. Allocations**

There are no other wastewater discharges in the vicinity of the Claremore discharge. The allocations of loads calculated are shown in the following table.

**Table 2. Allocations**

<b>Season</b>	<b>Load Allocation (lb/day)</b>	<b>Wasteload Allocation (lb/day)</b>	<b>Reserve Capacity (lbs/day)</b>	<b>MOS (5%) (lbs/day)</b>
<b>Summer</b>	<b>428.8</b>	<b>1169.7</b>	<b>96.7</b>	<b>58.5</b>
<b>Spring</b>	<b>356.1</b>	<b>1084.7</b>	<b>41.8</b>	<b>54.2</b>
<b>Winter</b>	<b>251.0</b>	<b>2554.5</b>	<b>38.7</b>	<b>127.7</b>

## **7. Final Recommendations**

The following changes are recommended for inclusion in the Oklahoma Water Quality Management Plan (208 Plan).

### **WLA, Claremore WWTF**

Proposed Permitted Flow:	4.43 MGD
Summer Limits (Jun–Oct): DO minimum	10 mg/L CBOD <sub>5</sub> , 15 mg/L TSS, 2 mg/L NH <sub>3</sub> -N, 6 mg/L
Spring Limits (Mar–May): DO minimum	9 mg/L CBOD <sub>5</sub> , 15 mg/L TSS, 2 mg/L NH <sub>3</sub> -N, 7 mg/L
Winter Limits (Nov–Feb): DO minimum	15 mg/L CBOD <sub>5</sub> , 20 mg/L TSS, 8 mg/L NH <sub>3</sub> -N, 7 mg/L

## **8. Public Participation & TMDL Implementation**

This is a Final TMDL and has not yet been technically approved. The TMDL and proposed permit limits will be sent for public comments and the public comments process will be completed after technical approval is received.

The proposed limits will be implemented through the OPDES permits for the City of Claremore or by the relocation of the point of discharge. The water quality model in this report shows clearly that the recommended allocation of dissolved oxygen-demanding substances adequately addresses the pollutant for which this stream segment is listed. With the recommended limits in place, the stream will be restored to meet Oklahoma Water Quality Standards.

The City of Claremore is required to submit monthly Discharge Monitoring Reports (DMR) to the Oklahoma Department of Environmental Quality. The DMR will ensure that the beneficial uses will be maintained in Cat Creek.