

Calera Public Works Authority

DRAFT WASTELOAD ALLOCATION REPORT

OPDES#: OK0031682

Facility ID #: S10702

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1. Problem Definition

The Calera Public Works Authority (PWA) operates a wastewater treatment plant (WWTP) that serves the citizens of Calera and the surrounding area. The Calera PWA is requesting the design flow be increased from 0.35 million gallons per day (MGD) to 0.48 MGD. This design flow is expected to provide the Town of Calera with adequate capacity for the next 20 years. The facility would discharge 0.48 MGD effluent into the unnamed tributary of Island Bayou (OK410700000040_00). The primary concern of ODEQ is the threat of in-stream organic enrichment and low dissolved oxygen (DO) due to additional discharge of treated municipal wastewater.

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).

Since the unnamed tributary is not listed in Appendix A of the Oklahoma Water Quality Standards (OAC 785:45), it is assumed to have the designated use of Warm Water Aquatic Community (WWAC). Island Bayou is listed in Appendix A of the Oklahoma Water Quality Standards (OAC 785:45) as having the following beneficial uses:

- Agriculture
- Aesthetics
- Warm Water Aquatic Community (WWAC)
- Secondary Body Contact Recreation
- Fish Consumption
- Emergency Water Supply

Island Bayou was last assessed in 2018 and found all beneficial uses to be attained, except Aesthetics beneficial use. Aesthetics beneficial use was assessed as insufficient information. This WLA has been developed to ensure that the limits assigned to the discharge are stringent enough to maintain DO standards under critical conditions.

2. Endpoint Identification

The Oklahoma Water Quality Standards define DO criteria for two flow regimes: critical low-flow and nuisance conditions. The critical low-flow will be either 7Q2 or 1.0 cfs, whichever is greater. Nuisance condition applies only when there is no upstream flow.

The following numerical dissolved oxygen criteria for WWAC apply to the unnamed tributary of Island Bayou:

Critical Low-Flow Condition (7Q2)

Summer (Jun–Oct):	5.0 mg/L
Spring (Apr–May):	6.0 mg/L
Winter (Nov–Mar):	5.0 mg/L

Nuisance Condition (zero upstream flow)

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 regards for all elements of the Oklahoma Water Quality standards that include the antidegradation policy.

3. Source Analysis

3.1. Point Sources

Calera PWA

Facility Legal Description:	SE¼, SW¼, S23 T07S R08E,
Point of Discharge (POD):	NW¼, NE¼, SW¼, S26 T07S R08E., or
Latitude:	33° 55' 29.261" N*
Longitude:	96° 26' 25.108" W*

* 1927 North American Datum

Current Wasteload Allocation (WLA):

Permitted Flow:	0.35 MGD
Summer Limits (Jun–Oct):	12 mg/L CBOD ₅ , 30 mg/L TSS, 5 mg/L NH ₃ -N, 4 mg/L DO (min.) or No Discharge
Spring Limits (Apr–May):	15 mg/L CBOD ₅ , 30 mg/L TSS, 7 mg/L NH ₃ -N, 6 mg/L DO (min.) or No Discharge
Winter Limits (Nov–Mar):	Lagoon Secondary (25 mg/L CBOD ₅ , 90 mg/L TSS) & 3 mg/L DO (min.)

3.2. Non-Point Sources

The allocations in this waterbody assessment are driven by critical instream dissolved oxygen conditions (low-flow and high temperature) as defined in the Oklahoma Water Quality Standards. Low-flow conditions, by definition, assume little or no runoff. This assumption, combined with the use of background loadings from upstream flow and conservative kinetic inputs, accounts for any non-point source (NPS) impact that may exist in the study area.

3.3. Background

The following background conditions of the unnamed tributary of Island Bayou were used:

Flow (7Q2 or 1 cfs):	1.0 cfs
CBOD ₅ :	2.0 mg/L
Ammonia:	0.15 mg/L
DO:	85% saturation at the regulatory seasonal temperature

4. Linkage between Sources and Receiving Water

The links between sources and the receiving streams can be established through typical water quality models such as spreadsheet mass balance, desktop Streeter-Phelps model, modified Streeter-Phelps model (SOD included), QUAL2E, QUALTX, SWAT, and HSPF etc. The more complicated a model becomes, the better it represents the system being studied. However, a complex model also requires more data. According to the complexity of the problem, available data and policy, Oklahoma’s desktop model is chosen for the project.

The Oklahoma’s desktop model is based on the modified Streeter-Phelps equation. The modified Streeter-Phelps model can be found in Oklahoma Continuing Planning Process.

4.1. Model Inputs

The water quality model used to determine the impact of DO-demanding substances on the in stream DO concentration is based on a modified version of the Streeter-Phelps equation. The primary kinetic inputs were derived from literature values and the past WLAs performed by Oklahoma Department of Environmental Quality.

Unnamed Tributary to Island Bayou

Proposed Permitted Flow:	0.480 MGD
CBOD decay rate (K₁):	0.30/day for Summer and Spring, 0.35/day for Winter
Reaeration rate for Reach 1 (K₂):	15.10/day
NBOD decay rate (K_n):	0.30/day
CBOD settling rate (K_s):	0.03/day
Sediment Oxygen Demand (SOD):	0.11 g/ft ² /day

Hydraulic parameters were estimated using topographic map data and general assumptions. They are as follows:

Stream Slope:	7.14 ft/mi
Side Slope:	0.10 ft/ft
Manning’s “n”:	0.06

7Q2 flow for the unnamed tributary of Island Bayou was assigned 1.0 cfs because there is no data available for the stream. The model outputs are included in the Appendix.

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 7Q2 whichever is greater. To do this, the concentration of CBOD₅ and NH₃-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)	597.52
Spring (Apr–May)	712.24
Winter (Nov–Mar)	1,941.88

The complete model results are attached.

5. Margin of Safety

The CPP specifies a 20% margin of safety (MOS) for uncalibrated, simple source models. This is implemented in the model by increasing the inputs of DO-demanding substances (CBOD₅ and NH₃-N) proportionally until the DO criteria are met. The quantified MOS is equal to 20% of maximum wasteload allocations. Together with the MOS, load allocation, wasteload allocation and reserved capacity are calculated in the model and will be presented in the next section.

6. Allocations

The Calera PWA will discharge their wastewater into the unnamed tributary of Island Bayou (OK410700000040_00) about 7.0 miles upstream from the confluence with Moore Creek (OK410700000130_00). In modeling this wasteload allocation, the DO recovers before reaching Moore Creek. The allocation of loads calculated by the desktop model was shown in the following table.

Table 2 Allocations

Season	Load Allocation (lb/day)	Wasteload Allocation (lb/day)	MOS (20%) (lbs/day)	Reserved Capacity (lbs/day)
Summer	256.2	196.6	119.5	25.2
Spring	179.9	258.6	142.4	131.3
Winter	129.1	495.3	388.4	929.1

7. Final Recommendations

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

Calera PWA

- Proposed Design Flow: 0.480 MGD
- Summer Limits (Jun–Oct): 12 mg/L CBOD₅, 30 mg/L TSS, 5 mg/L NH₃-N, 4 mg/L DO (min.) or No Discharge
- Spring Limits (Apr–May): 15 mg/L CBOD₅, 30 mg/L TSS, 7 mg/L NH₃-N, 6 mg/L DO (min.) or No Discharge
- Winter Limits (Nov–Mar): Lagoon Secondary (25 mg/L CBOD₅, 90 mg/L TSS) & 3 mg/L DO (min.)

8. Public Participation

This Draft WLA report will be submitted to EPA for technical approval. After technical approval is received, the proposed permit limits will be sent for public comments. Public comments received during this period will be responded to and become part of the WLA report.

9. References

1. *Title 785, Oklahoma Administrative Code, Chapter 45 Oklahoma's Water Quality Standards*, State of Oklahoma, 2017.
2. *Oklahoma Desktop Model – One Reach, version 3.1*, Watershed Planning Section, Oklahoma Department of Environmental Quality, Oklahoma City Oklahoma, 2008.
3. *Oklahoma Continuing Planning Process, 2012 edition*, Oklahoma Department of Environmental Quality, State of Oklahoma, 2012.



Figure 1 POD for Calera PWA and Receiving Stream (Unnamed tributary to Island Bayou)

Appendix A - Desktop Model

INPUT PARAMETERS FOR MODIFIED STREETER-PHELPS MODEL

CITY: **Calera Public Works Authority**
 PERFORMED BY:
 DATE: **2/17/2021**

I DISCHARGE INFORMATION

LOCATION: **Lat: N33° 55' 29.261"; Long: W96° 26' 25.108"** BASIN: 410700
 COUNTY: **Bryan County**

PROPOSED PERMIT FLOW:

Summer	Spring	Winter
0.480	0.480	0.480

MGD

II RECEIVING STREAM

STREAM NAME: **Unnamed Tributary to Island Bayou (OK410700000040_00)**
 MODELED LENGTH: **7.00** MILES NUMBER OF SEGMENTS: **40**

	Summer	Spring	Winter	
UPSTREAM FLOW (7Q2)	0.00	0.00	0.00	CFS
STREAM SLOPE (S)		7.14		FT/MILE
SIDE SLOPE (P)		0.10		FT/FT
MANNING'S N		0.06		
VELOCITY COEFFICIENT (Cv)		3.194		
DEPTH COEFFICIENT (Ch)		0.136		

		Summer		Spring		Winter	
Upstream Flow	Velocity (fps)	1.0	0.42	1.0	0.42	1.0	0.42
7Q2 (cfs)	Depth (ft)		0.32		0.32		0.32
Upstream Flow	Velocity (fps)	0.0	0.34	0.0	0.34	0.0	0.34
0.0 (cfs)	Depth (ft)		0.23		0.23		0.23

III WATER QUALITY CRITERIA OF RECEIVING STREAM

AQUATIC COMMUNITY FLAG: **2** WARM WATER AQUATIC COMMUNITY
 AVERAGE D.O. REQUIREMENT:
 SUMMER: **5.00** MG/L
 SPRING: **6.00** MG/L
 WINTER: **5.00** MG/L

IV UPSTREAM CONDITIONS

D.O. SATURATION: **85.00** %
 UPSTREAM CBOD5: **2.00** MG/L
 UPSTREAM NH3-N: **0.15** MG/L

V RATE CONSTANTS at 20° C

	Summer	Spring	Winter
CBOD DECAY RATE (K1) (/DAY)	0.3	0.3	0.35
	0.30	0.30	0.35

	SUMMER		SPRING		WINTER	
	UPSTREAM FLOW 1.0 (cfs)	UPSTREAM FLOW 0.0 (cfs)	UPSTREAM FLOW 1.0 (cfs)	UPSTREAM FLOW 0.0 (cfs)	UPSTREAM FLOW 1.0 (cfs)	UPSTREAM FLOW 0.0 (cfs)
REAERATION RATES (K2) 1). TURNEY-HARRIS $K2=1.33*S^{0.32}/n^{0.64}$	15.10	15.10	15.10	15.10	15.10	15.10
2). TEXAS $K2=4.022*V^{0.273}/H^{0.894}$	8.74	10.97	8.74	10.97	8.74	10.97

SELECTED K2 FORMULA

Flag	Formula	Flag	Formula	Flag	Formula
1	TURNEY-HARRIS	1	TURNEY-HARRIS	1	TURNEY-HARRIS
15.10	15.10	15.10	15.10	15.10	15.10

	SUMMER	SPRING	WINTER	
CBOD SETTLING RATE (Ks)	0.03	0.03	0.03	/DAY
KN	0.03	0.03	0.03	/DAY
NBOD DECAY (Kn)	0.3	0.3	0.3	/DAY
KN	0.30	0.30	0.30	/DAY
SEDIMENT OXYGEN DEMAND	0.11	0.11	0.11	G/FT ² /D
SOD	0.110	0.110	0.110	G/FT ² /D

VI PROPOSED WASTELOAD ALLOCATIONS (WLA)

	CBOD5 (MG/L)	NH3-N (MG/L)	EFFLUENT D.O. (MG/L)	TEMP (° C)	MINIMUM D.O. 0.00 CFS	MINIMUM D.O. 7Q2/1.0 CFS	Reserved Capacity?
SUMMER	12.0	5.0	4.0	32	4.00 MG/L	5.26 MG/L	YES
SPRING	15.0	7.0	6.0	25	5.52 MG/L	6.58 MG/L	YES
WINTER	25.0	15.4	3.0	18	3.00 MG/L	5.89 MG/L	YES

VII MARGIN OF SAFETY AND ALLOCATIONS

WLAs and Multiplier

	CBOD5 (MG/L)	NH3-N (MG/L)	D.O. (MG/L)	Factor
SUMMER	12.0	5.0	4.0	1.74
SPRING	15.0	7.0	6.0	2.06
WINTER	25.0	15.4	3.0	3.66

Margin Of Safety

Required MOS

20.0%

Maximum Wasteload Allocations

	Maximum Wasteload (lbs/day)
	Dissolved Oxygen
SUMMER	341.3
SPRING	532.4
WINTER	1812.8

Maximum Assimilative Capacity

	Max Assimilative Capacity (lbs/day)
	Dissolved Oxygen
SUMMER	597.52
SPRING	712.24
WINTER	1,941.88

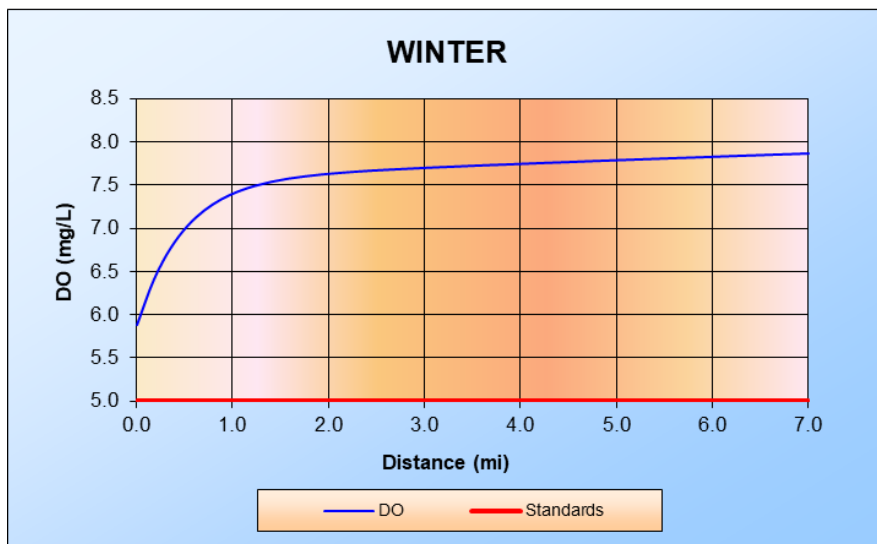
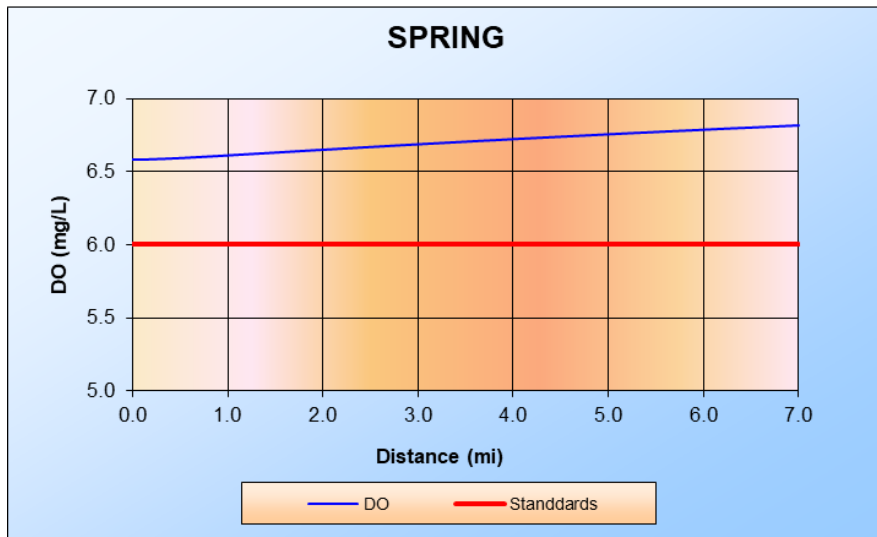
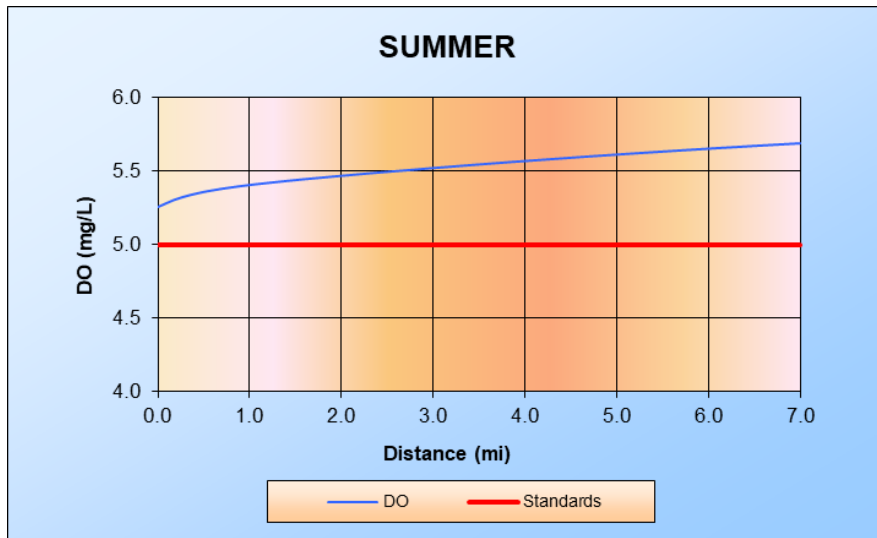
Allocations (in Dissolved Oxygen)

SEASON	Load Allocation (lbs/day)	Wasteload Allocation (lbs/day)	Margin Of Safety (20%) (lbs/day)	Reserved Capacity (lbs/day)
SUMMER	256.2	196.6	119.5	25.2
SPRING	179.9	258.6	142.4	131.3
WINTER	129.1	495.3	388.4	929.1

Locations of D.O. Sags

	MINIMUM D.O.	RIVER MILE	MINIMUM D.O.	RIVER MILE
	0.0 CFS		1.0 CFS	
SUMMER	4.00 MG/L	0.00	5.26 MG/L	0.00
SPRING	5.52 MG/L	0.88	6.58 MG/L	0.00
WINTER	3.00 MG/L	0.00	5.89 MG/L	0.00

At 1.0 cfs conditions



OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

DESKTOP WASTELoad ANALYSIS - SUMMER
Calera Public Works Authority

PROPOSED PERMIT FLOW =	0.48 MGD	1.0 CFS UPSTREAM FLOW	
		32 ° C TEMPERATURE	
INITIAL CONDITIONS ARE AS FOLLOWS.....			
REACH LENGTH (MILES):	7.00	STREAM VELOCITY:	6.88 MILES/DAY
NUMBER OF SEGMENTS:	40	STREAM DEPTH:	0.32 FEET
NUMBER OF REACHES:	1	REACH CL CONC:	150.0 MGL
REACH NUMBER:	1	D.O. SATURATION:	7.29 MGL
BODU/CBOD5 RATIO:	2.30	D.O. TARGET:	5.00 MGL
NODU/CBOD5 RATIO:	4.30		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.65 MGD
EFFLUENT CBOD5:	12.0 MGL	UPSTREAM CBOD5:	2.00 MGL
EFFLUENT NH3N:	5.0 MGL	UPSTREAM NH3N:	0.15 MGL
EFFLUENT D.O.:	4.0 MGL	UPSTREAM D.O.:	6.20 MGL
RATE CONSTANTS(1/DAY, BASE E)			
		20 DEGREES	32 DEGREES
K1:	0.30		1.047
K2: TURNEY-HARRIS	15.10		20.07
KN:	0.30		0.70
KS:	0.03		0.04
SOD (GFT2/DAY):	0.11		0.22

PROPOSED PERMIT FLOW =	0.48 MGD	0.0 CFS UPSTREAM FLOW	
		32 ° C TEMPERATURE	
INITIAL CONDITIONS ARE AS FOLLOWS.....			
REACH LENGTH (MILES):	7.00	STREAM VELOCITY:	5.56 MILES/DAY
NUMBER OF SEGMENTS:	40	STREAM DEPTH:	0.23 FEET
NUMBER OF REACHES:	1	REACH CL CONC:	150.0 MGL
REACH NUMBER:	1	D.O. SATURATION:	7.29 MGL
BODU/CBOD5 RATIO:	2.30	D.O. TARGET:	2.00 MGL
NODU/CBOD5 RATIO:	4.30		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.00 MGD
EFFLUENT CBOD5:	12.0 MGL	UPSTREAM CBOD5:	2.00 MGL
EFFLUENT NH3N:	5.0 MGL	UPSTREAM NH3N:	0.15 MGL
EFFLUENT D.O.:	4.0 MGL	UPSTREAM D.O.:	6.20 MGL
RATE CONSTANTS(1/DAY, BASE E)			
		20 DEGREES	32 DEGREES
K1:	0.30		1.047
K2: TURNEY-HARRIS	15.10		20.07
KN:	0.30		0.70
KS:	0.03		0.04
SOD (GFT2/DAY):	0.11		0.22

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	6.26	14.40	2.22	9.54	5.26	1.13
0.18	6.17	14.20	2.18	9.37	5.31	1.13
0.35	6.09	14.00	2.14	9.20	5.34	1.13
0.53	6.00	13.80	2.10	9.04	5.37	1.13
0.70	5.92	13.61	2.07	8.88	5.39	1.13
0.88	5.83	13.41	2.03	8.72	5.40	1.13
1.05	5.75	13.22	1.99	8.57	5.41	1.13
1.23	5.67	13.04	1.96	8.42	5.43	1.13
1.40	5.59	12.85	1.92	8.27	5.44	1.13
1.58	5.51	12.67	1.89	8.13	5.45	1.13
1.75	5.43	12.49	1.86	7.98	5.46	1.13
1.93	5.35	12.31	1.82	7.84	5.47	1.13
2.10	5.28	12.14	1.79	7.70	5.48	1.13
2.28	5.20	11.97	1.76	7.57	5.49	1.13
2.45	5.13	11.80	1.73	7.43	5.50	1.13
2.63	5.06	11.63	1.70	7.30	5.51	1.13
2.80	4.99	11.47	1.67	7.17	5.52	1.13
2.98	4.91	11.30	1.64	7.05	5.52	1.13
3.15	4.84	11.14	1.61	6.92	5.53	1.13
3.33	4.78	10.99	1.58	6.80	5.54	1.13
3.50	4.71	10.83	1.55	6.68	5.55	1.13
3.68	4.64	10.68	1.53	6.56	5.56	1.13
3.85	4.58	10.53	1.50	6.45	5.57	1.13
4.03	4.51	10.38	1.47	6.33	5.58	1.13
4.20	4.45	10.23	1.45	6.22	5.58	1.13
4.38	4.38	10.08	1.42	6.11	5.59	1.13
4.55	4.32	9.94	1.40	6.01	5.60	1.13
4.73	4.26	9.80	1.37	5.90	5.61	1.13
4.90	4.20	9.66	1.35	5.80	5.61	1.13
5.08	4.14	9.53	1.32	5.69	5.62	1.13
5.25	4.08	9.39	1.30	5.59	5.63	1.13
5.43	4.02	9.26	1.28	5.49	5.64	1.13
5.60	3.97	9.13	1.26	5.40	5.64	1.13
5.78	3.91	9.00	1.23	5.30	5.65	1.13
5.95	3.86	8.87	1.21	5.21	5.66	1.13
6.13	3.80	8.74	1.19	5.12	5.66	1.13
6.30	3.75	8.62	1.17	5.03	5.67	1.13
6.48	3.69	8.50	1.15	4.94	5.68	1.13
6.65	3.64	8.38	1.13	4.85	5.68	1.13
6.83	3.59	8.26	1.11	4.77	5.69	1.13
7.00	3.54	8.14	1.09	4.68	5.69	1.13

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	12.00	27.60	5.00	21.50	4.00	0.48
0.18	11.79	27.12	4.89	21.03	4.08	0.48
0.35	11.58	26.64	4.78	20.57	4.14	0.48
0.53	11.38	26.18	4.68	20.13	4.18	0.48
0.70	11.18	25.72	4.58	19.69	4.22	0.48
0.88	10.99	25.27	4.48	19.26	4.25	0.48
1.05	10.79	24.83	4.38	18.84	4.28	0.48
1.23	10.61	24.39	4.29	18.43	4.31	0.48
1.40	10.42	23.97	4.19	18.03	4.33	0.48
1.58	10.24	23.55	4.10	17.64	4.36	0.48
1.75	10.06	23.13	4.01	17.25	4.39	0.48
1.93	9.88	22.73	3.93	16.88	4.41	0.48
2.10	9.71	22.33	3.84	16.51	4.43	0.48
2.28	9.54	21.94	3.76	16.15	4.46	0.48
2.45	9.37	21.56	3.67	15.80	4.48	0.48
2.63	9.21	21.18	3.59	15.46	4.50	0.48
2.80	9.05	20.81	3.52	15.12	4.52	0.48
2.98	8.89	20.45	3.44	14.79	4.55	0.48
3.15	8.73	20.09	3.36	14.47	4.57	0.48
3.33	8.58	19.74	3.29	14.15	4.59	0.48
3.50	8.43	19.39	3.22	13.85	4.61	0.48
3.68	8.28	19.05	3.15	13.54	4.63	0.48
3.85	8.14	18.72	3.08	13.25	4.65	0.48
4.03	8.00	18.39	3.01	12.96	4.67	0.48
4.20	7.86	18.07	2.95	12.68	4.69	0.48
4.38	7.72	17.75	2.88	12.40	4.70	0.48
4.55	7.58	17.44	2.82	12.13	4.72	0.48
4.73	7.45	17.14	2.76	11.87	4.74	0.48
4.90	7.32	16.84	2.70	11.61	4.76	0.48
5.08	7.19	16.54	2.64	11.36	4.77	0.48
5.25	7.07	16.25	2.58	11.11	4.79	0.48
5.43	6.94	15.97	2.53	10.87	4.81	0.48
5.60	6.82	15.69	2.47	10.63	4.82	0.48
5.78	6.70	15.42	2.42	10.40	4.84	0.48
5.95	6.59	15.15	2.37	10.17	4.85	0.48
6.13	6.47	14.88	2.31	9.95	4.87	0.48
6.30	6.36	14.62	2.26	9.74	4.88	0.48
6.48	6.25	14.36	2.21	9.52	4.90	0.48
6.65	6.14	14.11	2.17	9.32	4.91	0.48
6.83	6.03	13.87	2.12	9.11	4.93	0.48
7.00	5.92	13.62	2.07	8.92	4.94	0.48

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

DESKTOP WASTELOAD ANALYSIS - SPRING
Calera Public Works Authority

PROPOSED PERMIT FLOW =	0.48 MGD	1.0 CFS UPSTREAM FLOW			
		25 ° C TEMPERATURE			
INITIAL CONDITIONS ARE AS FOLLOWS.....					
REACH LENGTH (MILES):	7.00				
NUMBER OF SEGMENTS:	40	STREAM VELOCITY:	6.88 MILES/DAY		
NUMBER OF REACHES:	1	STREAM DEPTH:	0.32 FEET		
REACH NUMBER:	1	REACH CL CONC:	150.0 MGL		
BODU/CBOD5 RATIO:	2.30	D.O. SATURATION:	8.25 MGL		
NODU/CBOD5 RATIO:	4.30	D.O. TARGET:	6.00 MGL		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.65 MGD		
EFFLUENT CBOD5:	15.0 MGL	UPSTREAM CBOD5:	2.00 MGL		
EFFLUENT NH3N:	7.0 MGL	UPSTREAM NH3N:	0.15 MGL		
EFFLUENT D.O.:	6.0 MGL	UPSTREAM D.O.:	7.01 MGL		
RATE CONSTANTS(1/DAY, BASE E)					
		20 DEGREES	25 DEGREES	THETA	
K1:		0.30	0.38	1.047	
K2:	TURNERY-HARRIS	15.10	17.00	1.024	
KN:		0.30	0.43	1.073	
KS:		0.03	0.03	1.024	
SOD	(GFT2DAY):	0.11	0.15	1.060	

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	7.54	17.35	3.07	13.20	6.58	1.13
0.18	7.46	17.17	3.04	13.06	6.58	1.13
0.35	7.39	16.99	3.00	12.92	6.59	1.13
0.53	7.31	16.81	2.97	12.78	6.59	1.13
0.70	7.23	16.63	2.94	12.64	6.60	1.13
0.88	7.16	16.46	2.91	12.50	6.61	1.13
1.05	7.08	16.29	2.88	12.37	6.61	1.13
1.23	7.01	16.12	2.85	12.24	6.62	1.13
1.40	6.94	15.95	2.81	12.10	6.63	1.13
1.58	6.86	15.79	2.78	11.97	6.63	1.13
1.75	6.79	15.62	2.75	11.84	6.64	1.13
1.93	6.72	15.46	2.72	11.72	6.65	1.13
2.10	6.65	15.30	2.70	11.59	6.65	1.13
2.28	6.58	15.14	2.67	11.46	6.66	1.13
2.45	6.51	14.98	2.64	11.34	6.67	1.13
2.63	6.45	14.83	2.61	11.22	6.67	1.13
2.80	6.38	14.67	2.58	11.10	6.68	1.13
2.98	6.31	14.52	2.55	10.98	6.69	1.13
3.15	6.25	14.37	2.53	10.86	6.69	1.13
3.33	6.18	14.22	2.50	10.74	6.70	1.13
3.50	6.12	14.07	2.47	10.62	6.71	1.13
3.68	6.05	13.92	2.44	10.51	6.71	1.13
3.85	5.99	13.78	2.42	10.40	6.72	1.13
4.03	5.93	13.64	2.39	10.28	6.73	1.13
4.20	5.87	13.49	2.37	10.17	6.73	1.13
4.38	5.81	13.35	2.34	10.06	6.74	1.13
4.55	5.75	13.21	2.31	9.95	6.74	1.13
4.73	5.69	13.08	2.29	9.85	6.75	1.13
4.90	5.63	12.94	2.27	9.74	6.76	1.13
5.08	5.57	12.81	2.24	9.64	6.76	1.13
5.25	5.51	12.67	2.22	9.53	6.77	1.13
5.43	5.45	12.54	2.19	9.43	6.77	1.13
5.60	5.40	12.41	2.17	9.33	6.78	1.13
5.78	5.34	12.28	2.15	9.23	6.78	1.13
5.95	5.28	12.15	2.12	9.13	6.79	1.13
6.13	5.23	12.03	2.10	9.03	6.79	1.13
6.30	5.17	11.90	2.08	8.93	6.80	1.13
6.48	5.12	11.78	2.05	8.83	6.81	1.13
6.65	5.07	11.65	2.03	8.74	6.81	1.13
6.83	5.01	11.53	2.01	8.64	6.82	1.13
7.00	4.96	11.41	1.99	8.55	6.82	1.13

PROPOSED PERMIT FLOW =	0.48 MGD	0.0 CFS UPSTREAM FLOW			
		25 ° C TEMPERATURE			
INITIAL CONDITIONS ARE AS FOLLOWS.....					
REACH LENGTH (MILES):	7.00				
NUMBER OF SEGMENTS:	40	STREAM VELOCITY:	5.56 MILES/DAY		
NUMBER OF REACHES:	1	STREAM DEPTH:	0.23 FEET		
REACH NUMBER:	1	REACH CL CONC:	150.0 MGL		
BODU/CBOD5 RATIO:	2.30	D.O. SATURATION:	8.25 MGL		
NODU/CBOD5 RATIO:	4.30	D.O. TARGET:	2.00 MGL		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.00 MGD		
EFFLUENT CBOD5:	15.0 MGL	UPSTREAM CBOD5:	2.00 MGL		
EFFLUENT NH3N:	7.0 MGL	UPSTREAM NH3N:	0.15 MGL		
EFFLUENT D.O.:	6.0 MGL	UPSTREAM D.O.:	7.01 MGL		
RATE CONSTANTS(1/DAY, BASE E)					
		20 DEGREES	25 DEGREES	THETA	
K1:		0.30	0.38	1.047	
K2:	TURNERY-HARRIS	15.10	17.00	1.024	
KN:		0.30	0.43	1.073	
KS:		0.03	0.03	1.024	
SOD	(GFT2DAY):	0.11	0.15	1.060	

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	15.00	34.50	7.00	30.10	6.00	0.48
0.18	14.81	34.06	6.91	29.70	5.76	0.48
0.35	14.62	33.62	6.81	29.30	5.64	0.48
0.53	14.43	33.19	6.72	28.91	5.57	0.48
0.70	14.24	32.76	6.63	28.52	5.54	0.48
0.88	14.06	32.34	6.55	28.14	5.52	0.48
1.05	13.88	31.92	6.46	27.77	5.53	0.48
1.23	13.70	31.51	6.37	27.40	5.54	0.48
1.40	13.52	31.10	6.29	27.03	5.55	0.48
1.58	13.35	30.70	6.20	26.67	5.56	0.48
1.75	13.18	30.31	6.12	26.32	5.58	0.48
1.93	13.01	29.92	6.04	25.96	5.60	0.48
2.10	12.84	29.53	5.96	25.62	5.61	0.48
2.28	12.68	29.15	5.88	25.28	5.63	0.48
2.45	12.51	28.78	5.80	24.94	5.65	0.48
2.63	12.35	28.41	5.72	24.61	5.66	0.48
2.80	12.19	28.04	5.65	24.28	5.68	0.48
2.98	12.04	27.68	5.57	23.95	5.70	0.48
3.15	11.88	27.33	5.50	23.63	5.71	0.48
3.33	11.73	26.97	5.42	23.32	5.73	0.48
3.50	11.58	26.63	5.35	23.01	5.74	0.48
3.68	11.43	26.28	5.28	22.70	5.76	0.48
3.85	11.28	25.95	5.21	22.40	5.78	0.48
4.03	11.14	25.61	5.14	22.10	5.79	0.48
4.20	10.99	25.28	5.07	21.80	5.81	0.48
4.38	10.85	24.96	5.00	21.51	5.82	0.48
4.55	10.71	24.64	4.94	21.22	5.84	0.48
4.73	10.57	24.32	4.87	20.94	5.85	0.48
4.90	10.44	24.01	4.80	20.66	5.86	0.48
5.08	10.30	23.70	4.74	20.39	5.88	0.48
5.25	10.17	23.39	4.68	20.11	5.89	0.48
5.43	10.04	23.09	4.62	19.84	5.91	0.48
5.60	9.91	22.79	4.55	19.58	5.92	0.48
5.78	9.78	22.50	4.49	19.32	5.93	0.48
5.95	9.66	22.21	4.43	19.06	5.95	0.48
6.13	9.53	21.93	4.37	18.81	5.96	0.48
6.30	9.41	21.64	4.32	18.56	5.97	0.48
6.48	9.29	21.37	4.26	18.31	5.99	0.48
6.65	9.17	21.09	4.20	18.06	6.00	0.48
6.83	9.05	20.82	4.14	17.82	6.01	0.48
7.00	8.94	20.55	4.09	17.58	6.02	0.48

OKLAHOMA DEPARTMENT OF ENVIRONMENTAL QUALITY

DESKTOP WASTELOAD ANALYSIS - WINTER
Calera Public Works Authority

PROPOSED PERMIT FLOW =	0.48 MGD	1.0 CFS UPSTREAM FLOW	
		18 ° C TEMPERATURE	
INITIAL CONDITIONS ARE AS FOLLOWS.....			
REACH LENGTH (MILES):	7.00	STREAM VELOCITY:	6.88 MILES/DAY
NUMBER OF SEGMENTS:	40	STREAM DEPTH:	0.32 FEET
NUMBER OF REACHES:	1	REACH CL CONC:	150.0 MGL
REACH NUMBER:	1	D.O. SATURATION:	9.45 MGL
BODU/CBOD5 RATIO:	2.30	D.O. TARGET:	5.00 MGL
NODU/CBOD5 RATIO:	4.30		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.65 MGD
EFFLUENT CBOD5:	25.0 MGL	UPSTREAM CBOD5:	2.00 MGL
EFFLUENT NH3N:	15.4 MGL	UPSTREAM NH3N:	0.15 MGL
EFFLUENT D.O.:	3.0 MGL	UPSTREAM D.O.:	8.03 MGL
RATE CONSTANTS(1/DAY, BASE E)			
		20 DEGREES	18 DEGREES
K1:	0.35		0.32
K2:	TURNERY-HARRIS	15.10	14.40
KN:	0.30		0.26
KS:	0.03		0.03
SOD	(GFT2/DAY): 0.11		0.10

PROPOSED PERMIT FLOW =	0.48 MGD	0.0 CFS UPSTREAM FLOW	
		18 ° C TEMPERATURE	
INITIAL CONDITIONS ARE AS FOLLOWS.....			
REACH LENGTH (MILES):	7.00	STREAM VELOCITY:	5.56 MILES/DAY
NUMBER OF SEGMENTS:	40	STREAM DEPTH:	0.23 FEET
NUMBER OF REACHES:	1	REACH CL CONC:	150.0 MGL
REACH NUMBER:	1	D.O. SATURATION:	9.45 MGL
BODU/CBOD5 RATIO:	2.30	D.O. TARGET:	2.00 MGL
NODU/CBOD5 RATIO:	4.30		
EFFLUENT FLOW:	0.48 MGD	UPSTREAM FLOW:	0.00 MGD
EFFLUENT CBOD5:	25.0 MGL	UPSTREAM CBOD5:	2.00 MGL
EFFLUENT NH3N:	15.4 MGL	UPSTREAM NH3N:	0.15 MGL
EFFLUENT D.O.:	3.0 MGL	UPSTREAM D.O.:	8.03 MGL
RATE CONSTANTS(1/DAY, BASE E)			
		20 DEGREES	18 DEGREES
K1:	0.35		0.32
K2:	TURNERY-HARRIS	15.10	14.40
KN:	0.30		0.26
KS:	0.03		0.03
SOD	(GFT2/DAY): 0.11		0.10

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	11.80	27.15	6.65	28.60	5.89	1.13
0.18	11.70	26.91	6.61	28.41	6.41	1.13
0.35	11.60	26.67	6.56	28.22	6.77	1.13
0.53	11.50	26.44	6.52	28.04	7.03	1.13
0.70	11.39	26.21	6.48	27.85	7.21	1.13
0.88	11.29	25.98	6.43	27.67	7.34	1.13
1.05	11.19	25.75	6.39	27.48	7.43	1.13
1.23	11.10	25.52	6.35	27.30	7.49	1.13
1.40	11.00	25.29	6.31	27.12	7.54	1.13
1.58	10.90	25.07	6.27	26.94	7.58	1.13
1.75	10.80	24.85	6.22	26.76	7.60	1.13
1.93	10.71	24.63	6.18	26.59	7.63	1.13
2.10	10.61	24.41	6.14	26.41	7.64	1.13
2.28	10.52	24.20	6.10	26.24	7.66	1.13
2.45	10.43	23.99	6.06	26.06	7.67	1.13
2.63	10.34	23.77	6.02	25.89	7.68	1.13
2.80	10.25	23.56	5.98	25.72	7.69	1.13
2.98	10.16	23.36	5.94	25.55	7.70	1.13
3.15	10.07	23.15	5.90	25.38	7.71	1.13
3.33	9.98	22.95	5.86	25.21	7.72	1.13
3.50	9.89	22.74	5.82	25.05	7.73	1.13
3.68	9.80	22.54	5.79	24.88	7.73	1.13
3.85	9.72	22.35	5.75	24.72	7.74	1.13
4.03	9.63	22.15	5.71	24.55	7.75	1.13
4.20	9.55	21.95	5.67	24.39	7.76	1.13
4.38	9.46	21.76	5.63	24.23	7.76	1.13
4.55	9.38	21.57	5.60	24.07	7.77	1.13
4.73	9.29	21.38	5.56	23.91	7.78	1.13
4.90	9.21	21.19	5.52	23.75	7.79	1.13
5.08	9.13	21.00	5.49	23.60	7.79	1.13
5.25	9.05	20.82	5.45	23.44	7.80	1.13
5.43	8.97	20.63	5.42	23.29	7.81	1.13
5.60	8.89	20.45	5.38	23.13	7.81	1.13
5.78	8.81	20.27	5.34	22.98	7.82	1.13
5.95	8.74	20.09	5.31	22.83	7.83	1.13
6.13	8.66	19.92	5.27	22.68	7.83	1.13
6.30	8.58	19.74	5.24	22.53	7.84	1.13
6.48	8.51	19.57	5.20	22.38	7.85	1.13
6.65	8.43	19.39	5.17	22.23	7.85	1.13
6.83	8.36	19.22	5.14	22.08	7.86	1.13
7.00	8.28	19.05	5.10	21.94	7.87	1.13

RESULTS ARE AS FOLLOWS....

DISTANCE (MILES)	CBOD5 (MGL)	ULT BOD (MGL)	NH3-N (MGL)	ULT NOD (MGL)	D.O. (MGL)	FLOW (MGD)
0.00	25.00	57.50	15.40	66.22	3.00	0.48
0.18	24.73	56.87	15.27	65.68	4.08	0.48
0.35	24.46	56.25	15.15	65.14	4.78	0.48
0.53	24.19	55.64	15.03	64.61	5.23	0.48
0.70	23.93	55.03	14.90	64.08	5.52	0.48
0.88	23.67	54.43	14.78	63.56	5.72	0.48
1.05	23.41	53.84	14.66	63.04	5.85	0.48
1.23	23.15	53.26	14.54	62.52	5.94	0.48
1.40	22.90	52.67	14.42	62.01	6.01	0.48
1.58	22.65	52.10	14.30	61.51	6.06	0.48
1.75	22.41	51.53	14.19	61.00	6.10	0.48
1.93	22.16	50.97	14.07	60.50	6.13	0.48
2.10	21.92	50.42	13.96	60.01	6.16	0.48
2.28	21.68	49.87	13.84	59.52	6.19	0.48
2.45	21.44	49.32	13.73	59.03	6.21	0.48
2.63	21.21	48.79	13.62	58.55	6.23	0.48
2.80	20.98	48.25	13.51	58.07	6.26	0.48
2.98	20.75	47.73	13.39	57.60	6.28	0.48
3.15	20.53	47.21	13.29	57.13	6.30	0.48
3.33	20.30	46.69	13.18	56.66	6.32	0.48
3.50	20.08	46.19	13.07	56.20	6.34	0.48
3.68	19.86	45.68	12.96	55.74	6.36	0.48
3.85	19.65	45.18	12.86	55.28	6.38	0.48
4.03	19.43	44.69	12.75	54.83	6.40	0.48
4.20	19.22	44.20	12.65	54.38	6.42	0.48
4.38	19.01	43.72	12.54	53.94	6.44	0.48
4.55	18.80	43.25	12.44	53.50	6.46	0.48
4.73	18.60	42.78	12.34	53.06	6.47	0.48
4.90	18.40	42.31	12.24	52.63	6.49	0.48
5.08	18.20	41.85	12.14	52.20	6.51	0.48
5.25	18.00	41.39	12.04	51.77	6.53	0.48
5.43	17.80	40.94	11.94	51.35	6.55	0.48
5.60	17.61	40.50	11.84	50.93	6.57	0.48
5.78	17.41	40.05	11.75	50.51	6.58	0.48
5.95	17.23	39.62	11.65	50.10	6.60	0.48
6.13	17.04	39.19	11.56	49.69	6.62	0.48
6.30	16.85	38.76	11.46	49.28	6.63	0.48
6.48	16.67	38.34	11.37	48.88	6.65	0.48
6.65	16.49	37.92	11.27	48.48	6.67	0.48
6.83	16.31	37.51	11.18	48.08	6.69	0.48
7.00	16.13	37.10	11.09	47.69	6.70	0.48