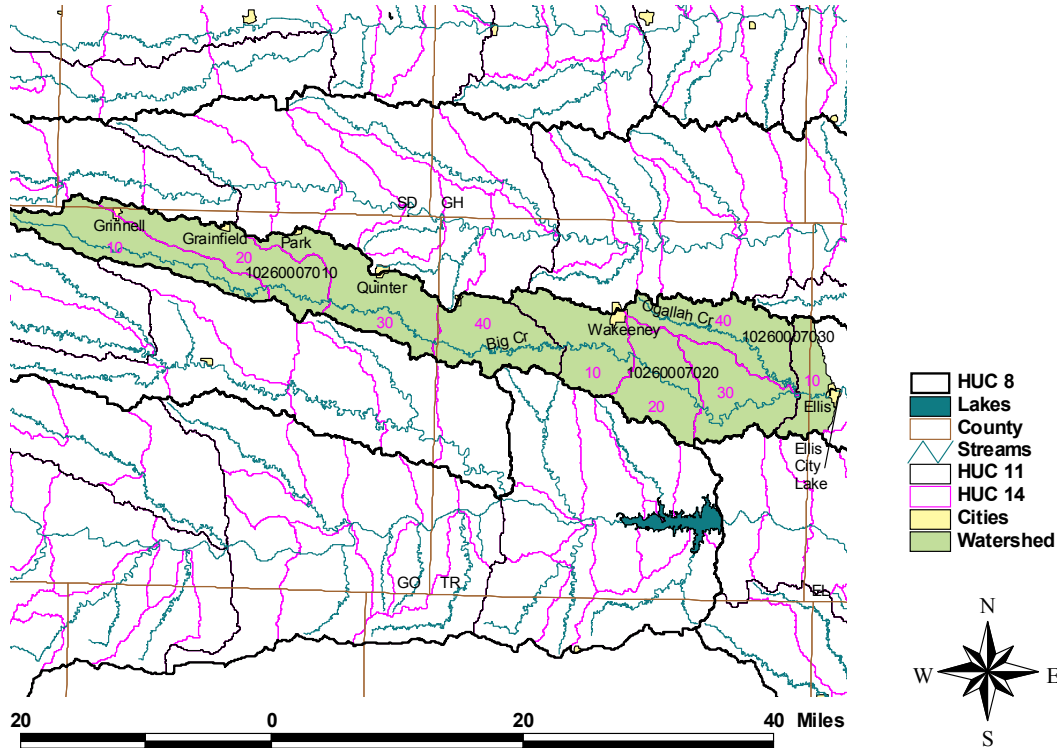


Figure 1

Ellis City Lake TMDL Reference Map



2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Level of Eutrophication: Hypereutrophic, Trophic State Index = 73.33

Monitoring Sites: Station 069601 in Ellis City Lake (Figure 1).

Period of Record Used: One survey during 1989

Current Condition: In 1989, Ellis City Lake had chlorophyll a concentrations averaging 78.2 $\mu\text{g/L}$ and ranging from 75.6 $\mu\text{g/L}$ to 80.8 $\mu\text{g/L}$ (Appendix A). The Secchi Disc Depth was 0.5 meter. Nitrogen and phosphorus concentrations were not measured.

The Trophic State Index is derived from the chlorophyll a concentration. Trophic state assessments of potential algal productivity were made based on chlorophyll a concentrations, nutrient levels and values of the Carlson Trophic State Index (TSI). Generally, some degree of eutrophic conditions is seen with chlorophyll a concentrations over 7 $\mu\text{g/l}$ and hypereutrophy

occurs at levels over 30 $\mu\text{g/l}$. The Carlson TSI, derives from the chlorophyll concentrations and scales the trophic state as follows:

1. Oligotrophic TSI < 40
2. Mesotrophic TSI: 40 - 49.99
3. Slightly Eutrophic TSI: 50 - 54.99
4. Fully Eutrophic TSI: 55 - 59.99
5. Very Eutrophic TSI: 60 - 63.99
6. Hypereutrophic TSI: ≥ 64

Interim Endpoints of Water Quality (Implied Load Capacity) at Ellis City Lake over 2008 - 2012:

In order to improve the trophic condition of the lake from its current Hypereutrophic status, the desired endpoint will be to maintain summer chlorophyll a concentrations below 12 $\mu\text{g/L}$.

Current Condition and Reductions for Ellis City Lake

Parameter	Current Condition	TMDL	Percent Reduction
Total Phosphorus Load (lb/year)	96,163	13,440	86 %
Total Phosphorus Concentration ($\mu\text{g/L}$)*	279.2	42.7	85 %
Chlorophyll a ($\mu\text{g/L}$)	78.2	< 12	85 %

* Predicted Concentrations from CNET model

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: Five permitted waste treatment facilities are located within the watershed (Figure 2). Four are non-overflowing lagoons that are prohibited from discharging and may contribute a nutrient load under extreme precipitation events (flow durations exceeded under 5 percent of the time). Such events would not occur at a frequency or for a duration sufficient to cause an impairment in the watershed. Below is a list of the non-overflowing NPDES facilities.

Non-overflowing Facilities in the Ellis City Lake Watershed

Kansas Permit Number	Facility Name	Type	Wasteload Allocation
M-SH12-NO02	USD #292 GRAINFIELD-WHEATLAND SCHOOL	2-cell Lagoon	0 lbs/day
M-SH12-NR02	KDOT. GOVE CO. REST AREA I-70	2-cell Lagoon	0 lbs/day
M-SH14-NO01	GRINNELL MWTP	2-cell Lagoon	0 lbs/day
M-SH38-NR02	KDOT. TREGO CO. REST AREA	2-cell Lagoon	0 lbs/day

The point source contribution is derived from monitoring data from the waste treatment plants and other point source pollution contributors. When effluent discharge data is not available, the following concentrations are used to calculate the waste load allocations for waste treatment plant lagoons and municipal mechanical plants:

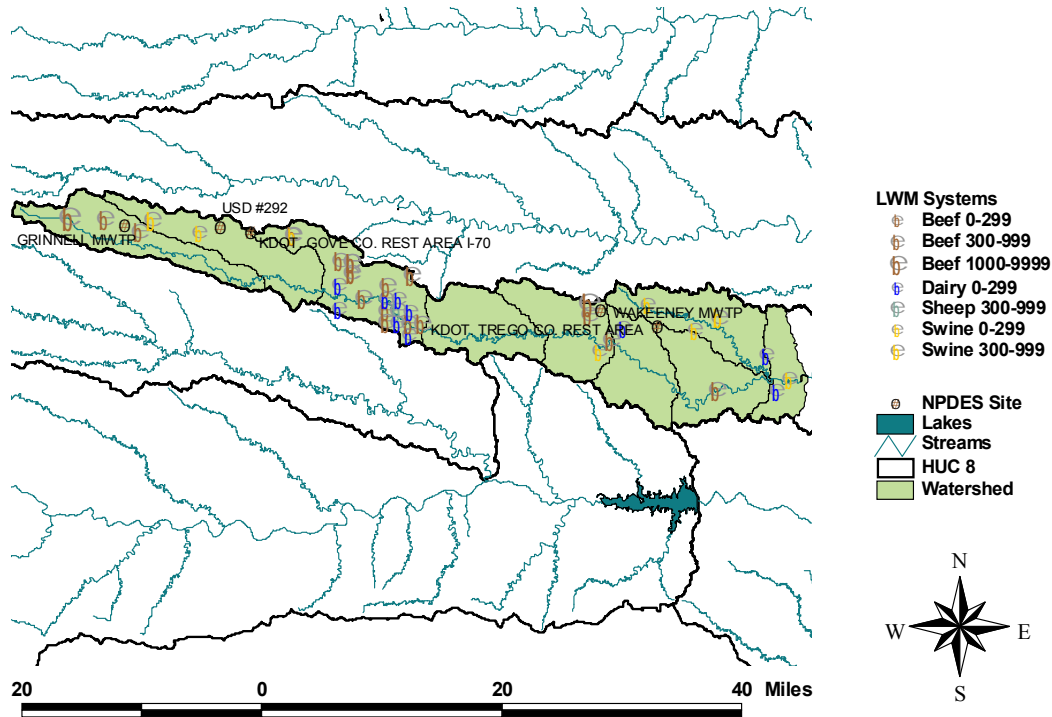
Average Concentration in Municipal Facilities that Meet Baseline Design

Facility Type	Total Phosphorus
Waste Treatment Plant Lagoon	2.0 mg/L
Mechanical Plant	3.5 mg/L

Only the Wakeeney MWTP (Kansas Permit Number: M-SH38-0001) has the potential to contribute to the nutrient load. Based on the design flow of 0.43 MGD and the estimated total phosphorus concentration of 3.5 mg/L from this trickling filter plant, the current total phosphorus load is 4,599 pounds per year as also specified in the Kanopolis Lake Watershed TMDL.

Figure 2

Ellis City Lake NPDES Sites and Livestock Waste Management Systems

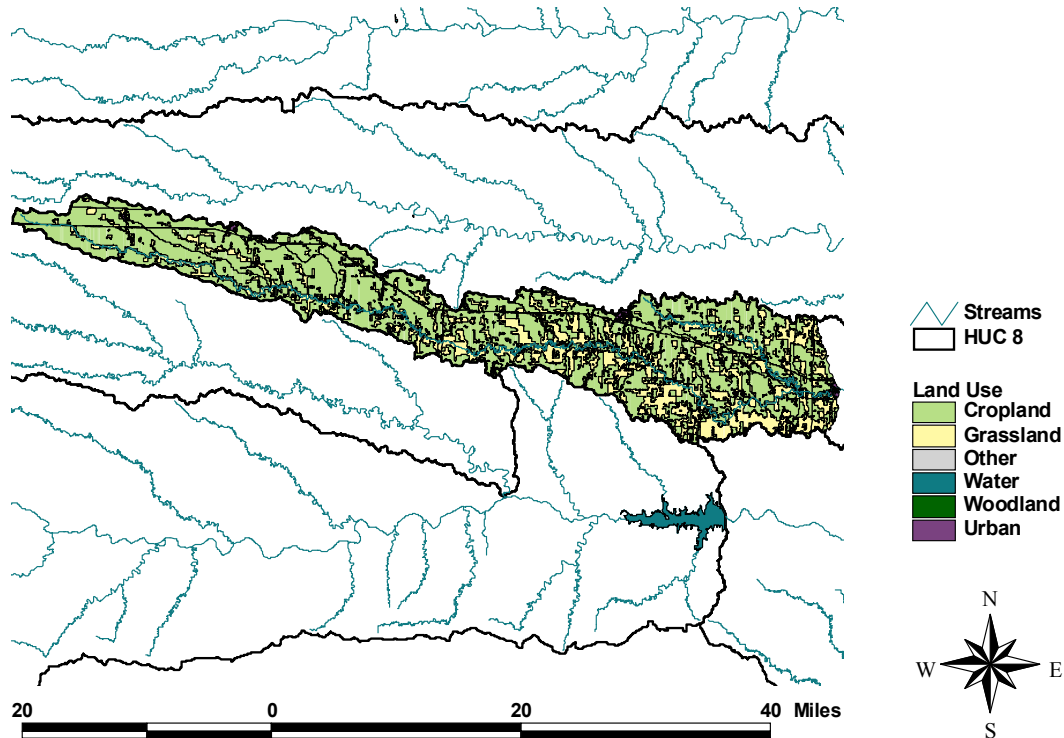


Land Use: The watershed around Ellis City Lake has a high potential for nonpoint source pollutants. An annual phosphorus load of 96,163 pounds per year is necessary to correspond to the concentrations seen in the lake.

One source of phosphorus within Ellis City Lake is probably runoff from agricultural lands where phosphorus has been applied. Land use coverage analysis indicates that 71% of the watershed is cropland (Figure 3).

Figure 3

Ellis City Lake Land Use



Phosphorus from animal waste is a potential contributing factor. Animal waste, from livestock waste management systems, may add to the phosphorus load going into the lake (Figure 2). However, given the controls for the systems, animal waste coming from grazing areas is a more likely contributor. Twenty-eight percent of land around the lake is grassland. There are 19 beef, 8 swine, 10 dairy, and 1 sheep animal feeding operations in the watershed. Three of these facilities are NPDES permitted, non-discharging facilities with 4,000 animal units. All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or detaining runoff emanating from their areas. Such systems are designed to retain the 25 year, 24 hour rainfall/runoff event, as well as an anticipated two weeks of normal wastewater from their operations. Such a rainfall event typically coincides with stream flows which are exceeded 1-5 percent of the time. Therefore, events of this type, infrequent and of short duration, are not likely to add to chronic impairment of the designated uses of the waters in this watershed. Requirements for maintaining the water level of the waste lagoons a certain distance below the lagoon berms ensure retention of the runoff from the intense, local storms events. In Ellis County, where many of the facilities are relatively close to the river, such an event would generate 4.9 inches of rain, yielding 3.8 to 4.6 inches of runoff in a day. Permit compliance data was examined, and no evidence of spills was detected. Potential animal units

for all facilities in the watershed total 18,534 (active: 15,562 animal units; inactive: 2,972 animal units). The actual number of animal units on site is variable, but typically less than potential numbers.

Permitted Livestock Waste Management Systems in the Watershed

Kansas Permit Number	Livestock Waste Management System	Wasteload Allocation
A-SHGO-LA01	Triple J Ranch	0 lb/day
A-SATR-BD01	Wakeeney Livestock Commission	0 lb/day
A-SHGO-C011	* Helendale Ranch	0 lb/day

* The facility is not in compliance with the existing permit. Corrective actions are being taken by the KDHE Livestock Management Program.

Most of the towns in the watershed anticipate a population decline except for Quinter. Less than one percent of the watershed is urban; stormwater runoff and urban fertilizer applications are a minor contributing factor. The average population density in the watershed is 9.7 people per square mile.

Population Trends for Towns in the Watershed

Town	% Change (2000 to 2020)
Ellis	-3.0%
Grainfield	-4.0%
Grinnell	-6.2%
Park	-3.4%
Quinter	8.8%
Wakeeney	-15.1%

A potential source is septic systems located around the lake. Failing septic systems can be a significant source of nutrients. The Ellis County has 1,366 septic systems, accounting for 12% of the sewage systems present in the county.

Contributing Runoff: The watershed’s average soil permeability is 1.5 inches/hour according to NRCS STATSGO database. About 91.4% of the watershed produces runoff even under relatively low (1.5”/hr) potential runoff conditions. Runoff is chiefly generated as infiltration excess with rainfall intensities greater than soil permeabilities. As the watersheds’ soil profiles become saturated, excess overland flow is produced. Generally, storms producing less than 0.5”/hr of rain will generate runoff from 4.9% of this watershed, chiefly along the stream channels.

Background Levels: The atmospheric phosphorus and geological formations (i.e., soil and bedrock) may contribute to phosphorus loads. Nutrients from wildlife waste are another contributing factor.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Total Phosphorus is allocated under this TMDL, because a phosphorus reduction will have a large effect on the managing the algal community. The Load Capacity is 13,440 pounds per year of phosphorus and was calculated using the CNET model. The Ellis City Lake Watershed is a part of the Kanopolis Watershed. The allocations and implementation activities in this TMDL mirror the ones in the Kanopolis Lake Eutrophication TMDL. More detailed assessment of sources and confirmation of the trophic state of the lake must be completed before detailed allocations can be made. The general inventory of sources within the drainage does provide some guidance as to areas of load reduction.

Point Sources: This impairment is associated with the Waste Treatment Plants. Ongoing inspections and monitoring of these NPDES sites will be made to ascertain the contributions that have been made by the source. These Waste Treatment Plants should comply with any future permit limits. The Wasteload Allocation should be at 4,599 pounds of total phosphorus per year. As previously noted in the inventory and assessment section, sources such as non-discharging permitted municipal facilities and livestock waste management systems located within the watershed do not discharge with sufficient frequency or duration to add to an impairment in the lake.

Nonpoint Sources: Water quality violations are partially due to nonpoint source pollutants. Background levels may be attributed to atmospheric deposition and geological sources. The assessment suggests that cropland and animal waste contribute to the elevated total phosphorus concentrations in the lake. Generally a Load Allocation of 7,497 pounds of total phosphorus per year, leading to an 86% reduction, is necessary to reach the endpoint.

Defined Margin of Safety: The margin of safety provides some hedge against the uncertainty of variable annual total phosphorus load and the chlorophyll a endpoint. Therefore, the margin of safety will be 1,344 pounds per year of total phosphorus taken from the load capacity subtracted to compensate for the lack of knowledge about the relationship between the allocated loadings and the resulting water quality.

State Water Plan Implementation Priority: Because of the lack of recent monitoring data, this TMDL will be a Low Priority for implementation.

Unified Watershed Assessment Priority Ranking: Ellis City Lake lies within the Big (HUC 8: 10260007) with a priority ranking of 56 (Low Priority for restoration).

Priority HUC 11s: The HUC 11 (10260007030) is adjacent to Ellis City Lake, and thus the Big subwatershed should take priority.

5. IMPLEMENTATION

Desired Implementation Activities

There is a very good potential that agricultural best management practices will allow full use support to take place in Ellis City Lake. Some of the recommended agricultural practices are as follows:

1. Implement soil sampling to recommend appropriate fertilizer applications on cropland.
2. Maintain conservation tillage and contour farming to minimize cropland erosion.
3. Install grass buffer strips along streams.
4. Reduce activities within riparian areas.
5. Implement nutrient management plans to manage manure application to land.

Implementation Programs Guidance

Nonpoint Source Pollution Technical Assistance - KDHE

- a. Support Section 319 demonstration projects for reduction of sediment runoff from agricultural activities as well as nutrient management
- b. Provide technical assistance on practices geared to establishment of vegetative buffer strips.
- c. Provide technical assistance on nutrient management in vicinity of streams.
- d. Update and implement nutrient and sediment abatement strategies.
- e. Develop a Watershed Restoration and Protection Strategy for HUC 10260007.

Livestock Waste Management - KDHE

- a. Take corrective actions to ensure that facilities comply with existing permits.

Water Resource Cost Share Nonpoint Source Pollution Control Program - SCC

- a. Apply conservation farming practices, including terraces and waterways, sediment control basins, and constructed wetlands.
- b. Provide sediment control practices to minimize erosion and sediment and nutrient transport.

Riparian Protection Program - SCC

- a. Establish or reestablish natural riparian systems, including vegetative filter strips and streambank vegetation.
- b. Develop riparian restoration projects.
- c. Promote wetland construction to assimilate nutrient loadings.

Buffer Initiative Program - SCC

- a. Install grass buffer strips near streams.
- b. Leverage Conservation Reserve Enhancement Program to hold riparian land out of production.

Extension Outreach and Technical Assistance - Kansas State University

- a. Continue to educate residents and landowners about nonpoint source pollution.
- b. Educate agricultural producers on sediment, nutrient, and pasture management.
- c. Educate livestock producers on livestock waste management and manure applications and nutrient management planning.
- d. Provide technical assistance on livestock waste management systems and nutrient management plans.
- e. Provide technical assistance on buffer strip design and minimizing cropland runoff.
- f. Encourage annual soil testing to determine capacity of field to hold phosphorus.

Time Frame for Implementation: Continued monitoring over the years from 2003 to 2008. After 2008, the monitoring results will be evaluated, and the allocations will be adjusted if needed.

Targeted Participants: Primary participants for implementation will be agricultural producers and residents who are within the drainage of the lake. A detailed assessment of sources will be conducted by KDHE over 2003-2008.

Milestone for 2008: The year 2008 marks the midpoint of the ten-year implementation window for the watershed. At that point in time, sampled data from Ellis City Lake will be reexamined to confirm the impaired status of the lake. Should the case of impairment remain, source assessment, allocation, and implementation activities will ensue.

Delivery Agents: The primary delivery agents for program participation will be the City of Ellis. Producer outreach and awareness will be delivered by Kansas State Extension.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities in the watershed to reduce pollutants.

1. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
2. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation and management of soil and water resources in the state, including riparian areas.
3. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.

4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.

5. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*.

6. The *Kansas Water Plan* and the Smoky Hill/Saline Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding: The State Water Plan Fund annually generates \$16-18 million and is the primary funding mechanism for implementing water quality protection and pollutant reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are a Low Priority consideration.

Effectiveness: Nutrient control has been proven effective through conservation tillage, contour farming and use of grass waterways and buffer strips. The key to success will be widespread utilization of conservation farming and installation of buffer strips within the watersheds cited in this TMDL.

6. MONITORING

Additional data, to further determine source loading and mean summer lake trophic condition, would be of value prior to 2008. Further sampling and evaluation should occur twice before 2008.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs in the Smoky Hill/Saline Basin were held January 7 and March 5, 2003 in Hays. An active Internet Web site was established at <http://www.kdhe.state.ks.us/tmdl/> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Smoky Hill/Saline Basin.

Public Hearing: A Public Hearing on the TMDLs of the Smoky Hill/Saline Basin was held in Hays on June 2, 2003.

Basin Advisory Committee: The Smoky Hill/Saline Basin Advisory Committee met to discuss the TMDLs in the basin on October 3, 2002, January 7, March 5, and June 2, 2003.

Discussion with Interest Groups: Meetings to discuss TMDLs with interest groups include:

Smoky Hill River Task Force: January 22, February 27, April 16, and May 28, 2003

Milestone Evaluation: In 2008, evaluation will be made as to the degree of implementation which has occurred within the watershed and current condition of Ellis City Lake. Subsequent decisions will be made regarding the implementation approach and follow up of additional implementation in the watershed.

Consideration for 303(d) Delisting: The lake will be evaluated for delisting under Section 303(d), based on the monitoring data over the period 2008-2012. Therefore, the decision for delisting will come about in the preparation of the 2012 303(d) list. Should modifications be made to the applicable water quality criteria during the ten-year implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

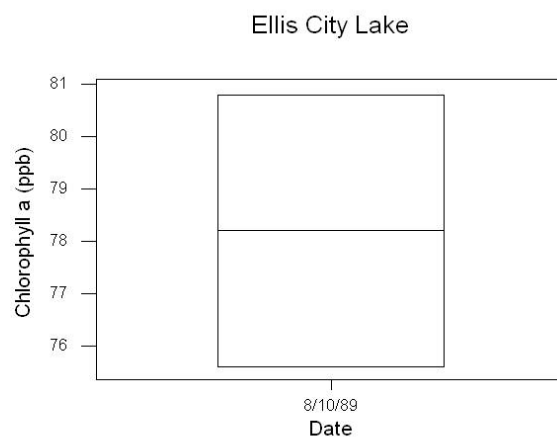
Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision will come in 2004 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2004-2008.

Bibliography

Liscek, Bonnie C. Methodology Used in Kansas Lake TMDLs [web page] Jul. 2001;
<http://www.kdhe.state.ks.us/tmdl/eutro.htm> [Accessed 30 September 2002].

Mankin, Kyle. Smoky Hill River Watershed Assessment Project.

Appendix A - Boxplots



Appendix B - Input for CNET Model

Parameter	Value Input into CNET Model
Drainage Area (km²)	1080.1
Precipitation (m/yr)	0.54
Evaporation (m/yr)	1.6
Unit Runoff (m/yr)	0.03
Surface Area (km²)	0.1
Mean Depth (m)	0.8
Depth of Mixed Layer (m)	0.6
Depth of Hypolimnion (m)	0.2
Observed Phosphorus (ppb)	N/A
Observed Chlorophyl-a (ppb)	78.2
Observed Secchi Disc Depth (m)	0.5

Output from CNET Model

Parameter	Output from CNET Model
Load Capacity (LC)*	13,440 lb/yr
Waste Load Allocation (WLA)	4,599 lb/yr
Load Allocation (LA)	7,497 lb/yr
Margin of Safety (MOS)	1,344 lb/yr

*LC = WLA + LA + MOS

Approved Sep. 30, 2003