# Total Maximum Daily Loads
# For the
# Elkhorn River Basin

**(EL1-10000, EL1-10900, EL1-20000, EL1-20100, EL3-20000, EL4-10000, EL4-20000 and EL4-30000)**

## Parameter of Concern: *E. coli*

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## Executive Summary

Thirteen segments in the Elkhorn River Basin were included in the 2008 Nebraska Surface Water Quality Integrated Report (NDEQ 2008) in Category 5 as impaired by excessive *E.* coli, pH, Dieldrin, PCBs, mercury, selenium and having impaired biological communities due to unknown pollutants. As such, total maximum daily loads must be developed in accordance with the Clean Water Act. Recently, the primary contact recreation beneficial use was added to additional segments in the basin.

The TMDLs in this document will be for *E. coli* and the primary contact recreation beneficial use. Future TMDLs will be prepared or other analysis conducted to address the pH, mercury, selenium and impaired biological communities. Category 4B justification will be prepared to address the Dieldrin and PCB impairments.

The information contained herein should be considered eight TMDLs. These TMDLs have been prepared to comply with the current (1992) regulations found at 40 CFR Part 130.7.

**1. Name and geographic location of the impaired waterbody for which the TMDLs are being developed.**
Elkhorn River Basin: EL1-10000, EL1-10900, EL1-20000, EL1-20100, EL3-20000, EL4-10000, EL4-20000 and EL4-30000.

**2. Identification of the pollutant and applicable water quality standard**
The pollutant causing the impairment(s) of the water quality standards and designated beneficial uses (for which TMDLs will be developed) is *E. coli*. Designated uses assigned to the above-identified segments include: primary contact recreation, aquatic life warmwater class A, agriculture class A water supply and aesthetics (NDEQ 2006). Excessive *E. coli* has been determined to be impairing the primary contact recreation beneficial uses.

**3. Quantification of the pollutant load that may be present in the waterbody and still allows attainment and maintenance of the water quality standards.**
The allowable pollutant load is based upon the available stream flow volume. That is, loading capacities are developed for each flow by multiplying the water quality standard (WQS) by the selected stream flow and a conversion factor (C) with the equation being:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

**4. Quantification of the amount or degree by which the current pollutant load in the waterbody, including upstream sources that is being accounted for as background loading deviates from the pollutant load needed to attain and maintain water quality standards.**
The deviation from the *E. coli* criteria is presented in the table below.

| Segment | #/100 ml Above WQS |
|---|---|
| EL1-10000 | 527 |
| EL1-10900 | 1178 |
| EL1-20000 | 603 |
| EL1-20100 | 1374 |
| EL3-20000 | 2085 |
| EL4-10000 | 450 |
| EL4-20000 | 891 |
| EL4-30000 | 339 |

**5. Identification of the pollutant source categories.**
Both point and nonpoint sources (including natural sources) have been identified to be contributing to the *E. coli* loads being delivered to the Elkhorn River Basin segments.

**6. Wasteload allocations for pollutants from point sources.**
For *E. coli* the wasteload allocations for point source discharges will be equivalent to the water quality criteria associated with the primary contact recreation beneficial use – a geometric mean of 126/100 ml.

**7. Load allocations for pollutants from nonpoint sources.**

The load allocations assigned to the *E coli* TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
$LA_i$ = load allocations at the $i^{th}$ flow
$Q_i$ = stream flow at the $i^{th}$ flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

**8 A margin of safety.**
This TMDL contain an implicit and explicit margin of safety. For *E. coli* the targeted reduction will focus on achieving 90% of the water quality target (≤113/100 ml).

**9. Consideration for seasonal variation.**
For *E. coli* the water quality criteria are only applicable during the Title 117 defined recreation season that starts May 1 and ends September 30. Because of this, the water quality and stream volume data was limited to this time period.

**10. Allowances for reasonably foreseeable increases in pollutant loads.**
There was no allowance for future growth included in this TMDL.

**11. Implementation Plan**
Implementation of the reductions for *E. coli* will be carried out through a combination of regulatory and non-regulatory activities. Point sources will be regulated under the auspice of the National Pollutant Discharge Elimination System and the Rules and Regulations Pertaining to Livestock Waste Control. Nonpoint source pollution will be addressed using available programs, technical advice, information and educations and financial incentives such as cost share.

The TMDLs included in the following text can be considered a "phased TMDL" and as such are an iterative approach to managing water quality based on the feedback mechanism of implementing a required monitoring plan that will determine the adequacy of load reductions to meet water quality standards and revision of the TMDL in the future if necessary. A description of the future monitoring (Section 4.0) that is planned has been included.

Monitoring is essential to all TMDLs in order to:

- Assess the future beneficial use status;
- Determine if the water quality is improving, degrading or remaining status quo;
- Evaluate the effectiveness of implemented best management practices.

The additional data collected should be used to determine if the implemented TMDL has been or is effective in addressing the identified water quality impairments. As well the data and information can be used to determine if the TMDLs have accurately identified the required components (i.e. loading capacity, load allocations, etc.) and if revisions are appropriate

## 1.0 Introduction

Thirteen stream segments within the Elkhorn River basin were listed in Category 5 of the 2008 Nebraska Surface Water Quality Integrated Report (Integrated Report) (NDEQ 2008). Category 5 waterbodies are deemed impaired and in need of a TMDL. Data collected from 2001-2006 indicate the primary contact recreation beneficial use is impaired in eight segments with the pollutant of concern being *E. coli* bacteria and the aquatic life beneficial use is impaired on eleven segments with the pollutants of concern being pH, mercury, Dieldrin, PCBs, selenium and unknown pollutants.

Table 1 below provides information from Category 5 of the 2008 Integrated Report assessments for all of the segments in the Elkhorn River basin.

**Table 1. 2008 Integrated Report Category 5 Stream Segments in the Elkhorn Basin**

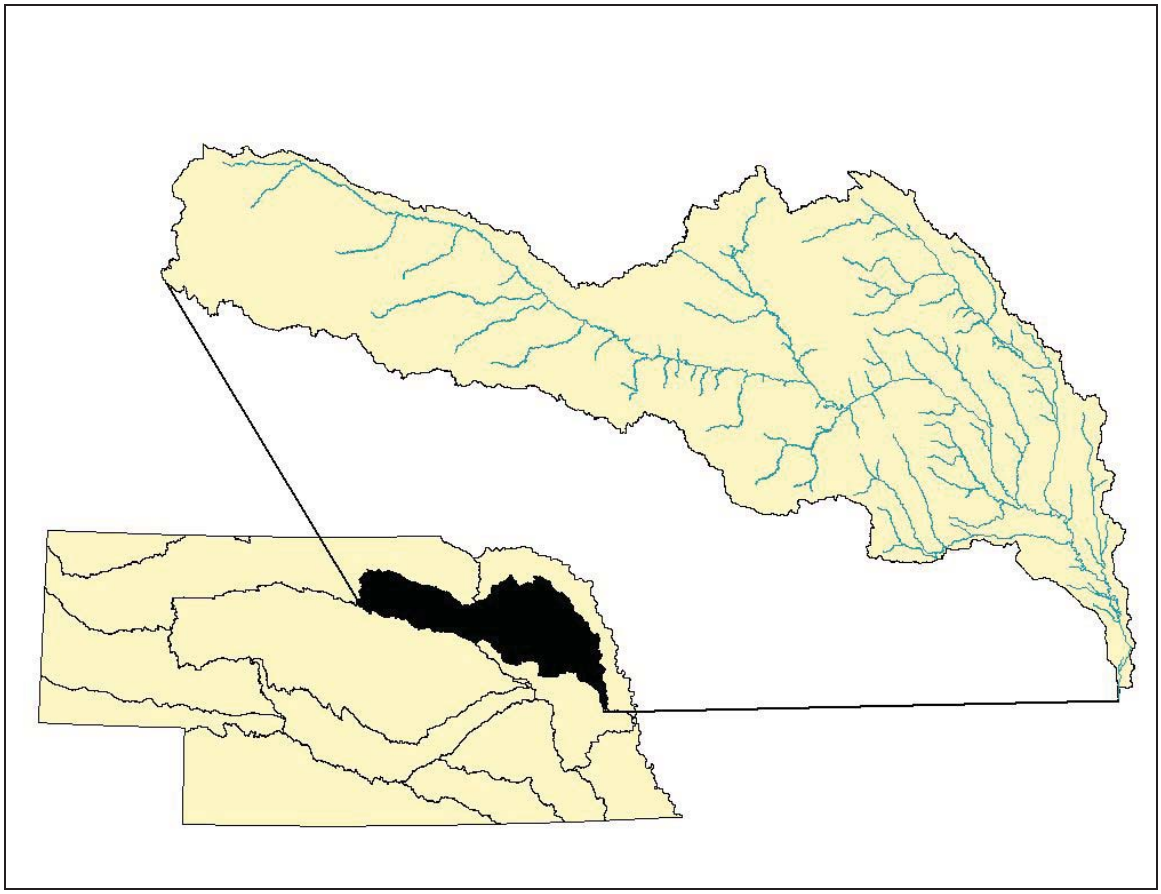
| Segment | Waterbody Name | Parameters of Concern |
|---|---|---|
| EL1-10000 | Elkhorn River | *E. coli*, Selenium, PCBs and Dieldrin |
| EL1-10900 | Maple Creek | *E. coli*, Selenium and Unknown (Impaired Aquatic Community) |
| EL1-10932 | Dry Creek | Unknown (Impaired Aquatic Community) |
| EL1-20000 | Elkhorn River | *E. coli* and Selenium |
| EL1-20100 | Pebble Creek | *E. coli* and Selenium |
| EL1-22100 | Union Creek | Unknown (Impaired Aquatic Community) |
| EL2-10000 | Logan Creek | Selenium, Dieldrin and PCBs |
| EL3-20000 | North Fork Elkhorn River | *E. coli* and Selenium |
| EL4-10000 | Elkhorn River | *E. coli* |
| EL4-20000 | Elkhorn River | *E. coli* |
| EL4-20300 | Clearwater Creek | Unknown (Impaired Aquatic Community) |
| EL4-30000 | Elkhorn River | *E. coli* and Mercury |
| EL4-40000 | Elkhorn River | pH |

In 2005, the NDEQ added the primary contact recreation beneficial used to Maple Creek (EL1-10900), Pebble Creek (EL1-20100) and the North Fork Elkhorn River (EL3-20000) along with several other waterbodies. Assessment of the data collected from Maple Creek, Pebble Creek and the North Fork Elkhorn River in 2005 does indicate each waterbody exceeded the applicable criteria and should be included on Category 5 of the 2008 Integrated Report. Therefore, from the above discussion, eight TMDLs will be prepared and submitted herein.

### 1.1 Background Information

The Elkhorn River Basin located in east-central and northeast Nebraska (Figure 1.1) heads in the Sandhills and flows southeasterly toward the confluence with the Lower Platte River near Omaha. Stream flow in the western portions of the basin are greater influenced by groundwater whereas the eastern portions are a function of surface runoff. Several municipalities reside in the basin ranging from first class city to villages.

**Figure 1.1 Location of the Elkhorn River Basin**



### 1.1.1 Waterbody Description

**1.1.1.1 Waterbody Names and Stream Identification Numbers:** The waterbodies for which TMDLs are being prepared are: Elkhorn River – EL1-10000, Maple Creek – EL1-10900, Elkhorn River – EL1-20000, Pebble Creek – EL1-20100, North Fork Elkhorn River – EL3-20000, Elkhorn River – EL4-10000, Elkhorn River – EL4-20000 and Elkhorn River – EL4-30000.

**1.1.1.2 Major River Basin:** Missouri

**1.1.1.3 Minor River Basin:** Lower Platte

**1.1.1.4 Hydrologic Unit Codes:** 10220001, 10220002, 10220003, and 10220004

**1.1.1.5 Assigned Beneficial Uses:** Source Title 117 Nebraska Surface Water Quality Standards (Title 117)

| Segment | Primary Contact Recreation | Aquatic Life Use | Water Supply | Aesthetics | Key Aquatic Species |
|---|---|---|---|---|---|
| EL1-10000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: i, j |
| EL1-10900 | Yes | Warmwater A | Agriculture A | Yes | Title 117: i |
| EL1-20000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: i, j |
| EL1-20100 | Yes | Warmwater A | Agriculture A | Yes | Title 117: i |
| EL3-20000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: f, i |
| EL4-10000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: f, i, j, n |
| EL4-20000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: f, i, j, n |
| EL4-30000 | Yes | Warmwater A | Agriculture A | Yes | Title 117: 10,13,14, f i, j, n |

**1.1.1.6 Major Tributaries:** Maple Creek, Pebble Creek, Logan Creek, North Fork Elkhorn River, Battle Creek, Cedar Creek, Holt Creek and South Fork Elkhorn River

**1.1.2 Watershed Characteristics**

**1.1.2.1 Physical Features:** The Elkhorn River Basin encompasses approximately 6,953 $mi^2$ in the north-central and northeast portion of the state. The basin includes all of the Elkhorn River and tributaries from the headwaters located in the Sandhills to the confluence with the Lower Platte River in extreme eastern Nebraska. The basin lies in three Level III ecoregions including the Nebraska Sandhills, the Northwest Glaciated Plains and the Western Corn Belt Plains ecoregions (Chapman, et. al. 2001). Drainage in the basin is generally east and southeast. Agriculture is the major land use with approximately 50% of the basin being cultivated (NNRC 1975).

**1.1.2.2 Climate:** Precipitation ranges from an annual average of 24 inches in the northwestern portion of the basin to approximately 30 inches near Waterloo in the southeast corner of the basin. Typically, a majority of the precipitation occurs during the spring and early summer. Temperatures in the basin range from an average high in the upper 80's during the summer to average lows in the 10's during the winter (High Plains Regional Climate Center Database).

**1.1.2.3 Demographics:** Eighty-five municipal communities reside in the Elkhorn River basin boundaries and range from first class cities to unincorporated village villages. Some of the larger communities include: Fremont – 25,174, Norfolk – 23,582, Wayne – 5,587, O'Neill – 3,733, West Point – 3,660, Madison – 2,367, Pierce – 1,774, Neligh – 1,660, Stanton – 1,627, Wakefield – 1,411, Oakland – 1,367, Plainview – 1,353, Wisner – 1,270, Atkinson – 1,244, Arlington – 1,197, Battle Creek – 1,158, Pender – 1,148 and Tilden, 1,078. As well, the basin borders the City of Omaha. Along with the municipal governments, several cluster developments lie in the basin with or without formal governing bodies.

**1.1.2.4 Land Use:** Much of the basin is devoted to agricultural purposes with 50% of the ground being cultivated and suitable for irrigation. The grassland of the Sandhill regions are primarily used as pasture or harvested for hay.

The mineral resources of the basin include sand and gravel operated along the mainstem Elkhorn River with the material being used for concrete aggregate or road surfacing. (NNRC 1975).

**Table 1.1.1.5 Title 117 Key Aquatic Species**

| Species Code | Common Name | Species Code | Common Name |
|---|---|---|---|
| 1 | Lake sturgeon | c | Brook trout |
| 2 | Pallid sturgeon | d | Brown trout |
| 3 | Northern redbelly dace | e | Rainbow trout |
| 4 | Pearl dace | f | Northern pike |
| 5 | Finescale dace | g | Muskellunge |
| 6 | Blacknose shiner | h | Blue catfish |
| 7 | Lake chub | i | Channel catfish |
| 8 | Brook Stickleback | j | Flathead catfish |
| 9 | Iowa darter | k | Striped bass |
| 10 | Johnny darter | l | White bass |
| 11 | Orangethroat darter | m | Rock bass |
| 12 | Blacknose dace | n | Largemouth bass |
| 13 | Grass pickerel | o | Smallmouth bass |
| 14 | Pumpkinseed | p | Spotted bass |
| 15 | Golden shiner | q | Redear sunfish |
| 16 | Common shiner | r | Bluegill |
| 17 | Topeka shiner | s | Black crappie |
| 18 | Sturgeon chub | t | White crappie |
| 19 | Scaleshell mussel | u | Yellow perch |
| a | Shovelnose sturgeon | v | Sauger |
| b | Paddlefish | w | Walleye |

**Table 1.1 Physical Description of the Elkhorn River Basin**

| Parameter | Elkhorn River Basin |
|---|---|
| State | Nebraska |
| Counties (whole or in part) | Antelope, Brown, Boone, Burt, Cedar, Colfax, Cumming, Dixon, Dodge, Douglas, Garfield, Holt, Knox, Madison, Platte, Rock, Stanton, Thurston, Washington, Wayne and Wheeler Sarpy |
| Watershed Area | 6,953 $mi^2$ |
| Sub-basins | 4 |
| Designated Stream Segments | 135 |
| Stream Miles (designated) | 1,736 miles |

## 2.0 *E. coli* TMDL

### 2.1 Problem Identification

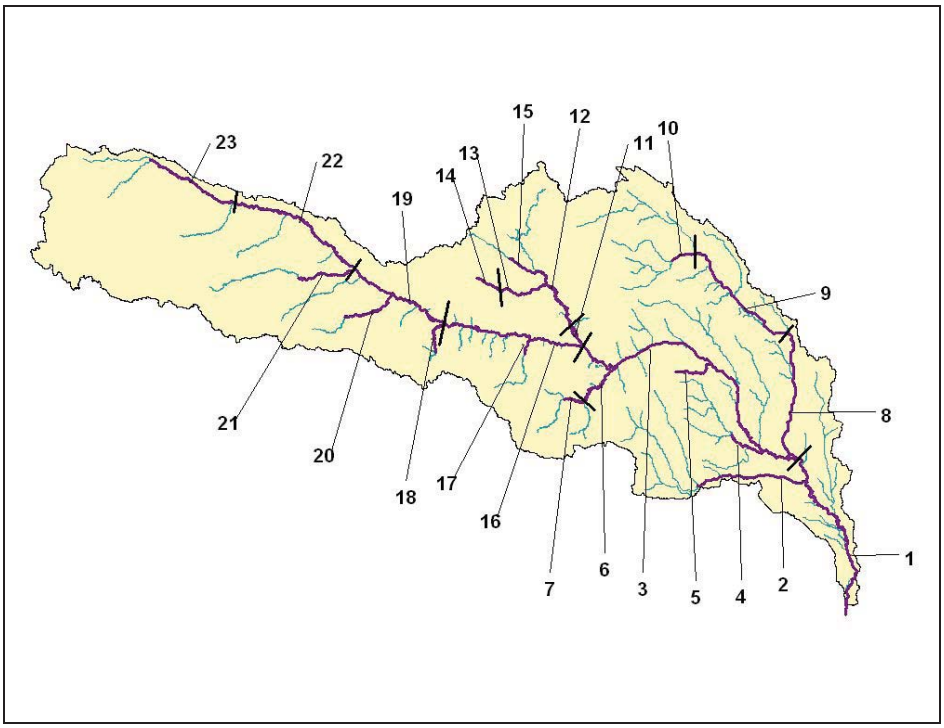
Segments EL1-10000, EL1-10900, EL1-20000, EL1-20100, EL3-20000, EL4-10000, EL4-20000 and EL4-30000 were included in Category 5 of the 2008 Integrated Report as having an impaired primary contact recreation beneficial use with the parameter of concern being *E. coli* bacteria. This section deals with the extent and nature of the water quality impairments caused by excessive *E. coli* bacteria in the Elkhorn River Basin.

### 2.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Primary Contact Recreation beneficial use has been deemed impaired on the above-identified segments. The Primary Contact Recreation beneficial use applies to surface waters which are used or have the potential to be used for primary contact recreation that includes activities where the body may come into prolonged or intimate contact with the water such that water may be accidentally ingested or sensitive body organs (e.g. eyes, ears, nose) may be exposed (NDEQ 2006).

Stream segments assign the primary contact recreation beneficial use in the Elkhorn River basin are found in figure 2.1.1 with the waterbody names and identifications are in table 2.1.1. Although assigned the recreation use in 2005, *E. coli* data is not available for assessment of several segments.

**Figure 2.1.1 Elkhorn River Basin Streams Assigned the Primary Contact Recreation Use**




### 2.1.2 Data Sources

The Nebraska Department of Environmental Quality (NDEQ) monitors surface waters based upon a rotating basin scheme, whereby monitoring is limited to two or three river basins each year with all 13 basins being (partially) examined in a five year period. Under the auspice of the rotating basin plan, data was collected from the Elkhorn River Basin in 2005. Data collected in 2005 included stream discharge (volume) information and will be used for these TMDLs. Stream flow data and information were obtained from the United States Geological Survey (USGS) and Nebraska Department of Natural Resources (NDNR) who operates the monitoring gages.

During the triennial review of Title 117 – Nebraska Surface Water Quality Standards (Title 117), conducted in 2005, removed fecal coliform as a Title 117 parameter for assessing the primary contact recreation in the future.

*E. coli* will be the sole parameter for assessing the primary contact recreation beneficial use.

**Table 2.1.1 Identification of Stream Segments in Figure 2.1.1**

| Map Identification Number | Title 117 Identification Number | Stream Name |
|---|---|---|
| 1 | EL1-10000 | Elkhorn River |
| 2 | EL1-10900 | Maple Creek |
| 3 | EL1-20000 | Elkhorn River |
| 4 | EL1-20100 | Pebble Creek |
| 5 | EL1-21000 | Rock Creek |
| 6 | EL1-21900 | Union Creek |
| 7 | EL1-22000 | Union Creek |
| 8 | EL2-10000 | Logan Creek |
| 9 | EL2-20000 | Logan Creek |
| 10 | EL2-20800 | South Logan Creek |
| 11 | EL3-10000 | North Fork Elkhorn River |
| 12 | EL3-20000 | North Fork Elkhorn River |
| 13 | EL3-20200 | Willow Creek |
| 14 | EL3-20300 | Willow Creek |
| 15 | EL3-20400 | Dry Creek |
| 16 | EL4-10000 | Elkhorn River |
| 17 | EL4-10400 | Battle Creek |
| 18 | EL4-11300 | Cedar Creek |
| 19 | EL4-20000 | Elkhorn River |
| 20 | EL4-20300 | Clearwater Creek |
| 21 | EL4-20700 | South Fork Elkhorn River |
| 22 | EL4-30000 | Elkhorn River |
| 23 | EL4-40000 | Elkhorn River |

## 2.13 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5/impaired waters for the 2008 Integrated Report. The procedures are based on the application of the "binomial distribution" method that applies a confidence interval to the exceedance rate in an effort to determine the true exceedance of the waterbody versus the data set. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development the 2008 Integrated Report for Nebraska*, November 2007.

The details of the assessment process to determine the use support of the Primary Contact Recreation beneficial use can be found in table 2.1.3

**Table 2.1.3 Assessment of the Primary Contact Recreation Beneficial Use Using *E. coli* Bacteria Data**

| Parameter | Season Geometric Mean | Supported | Impaired |
|---|---|---|---|
| *E. coli* | ≤126/100 ml | Season geometric mean ≤126/100 ml | Season geometric mean >126/100 ml |

### 2.1.4 Water Quality Conditions

*E. coli* data collected during the 2005 recreation season (May 1 through September 30) was assessed to determine the beneficial use support for primary contact recreation. Table 2.1.4 presents this information.

**Table 2.1.4 Elkhorn River Basin – 2005 *E. coli* Data and Assessments – Category 5 Waterbodies**

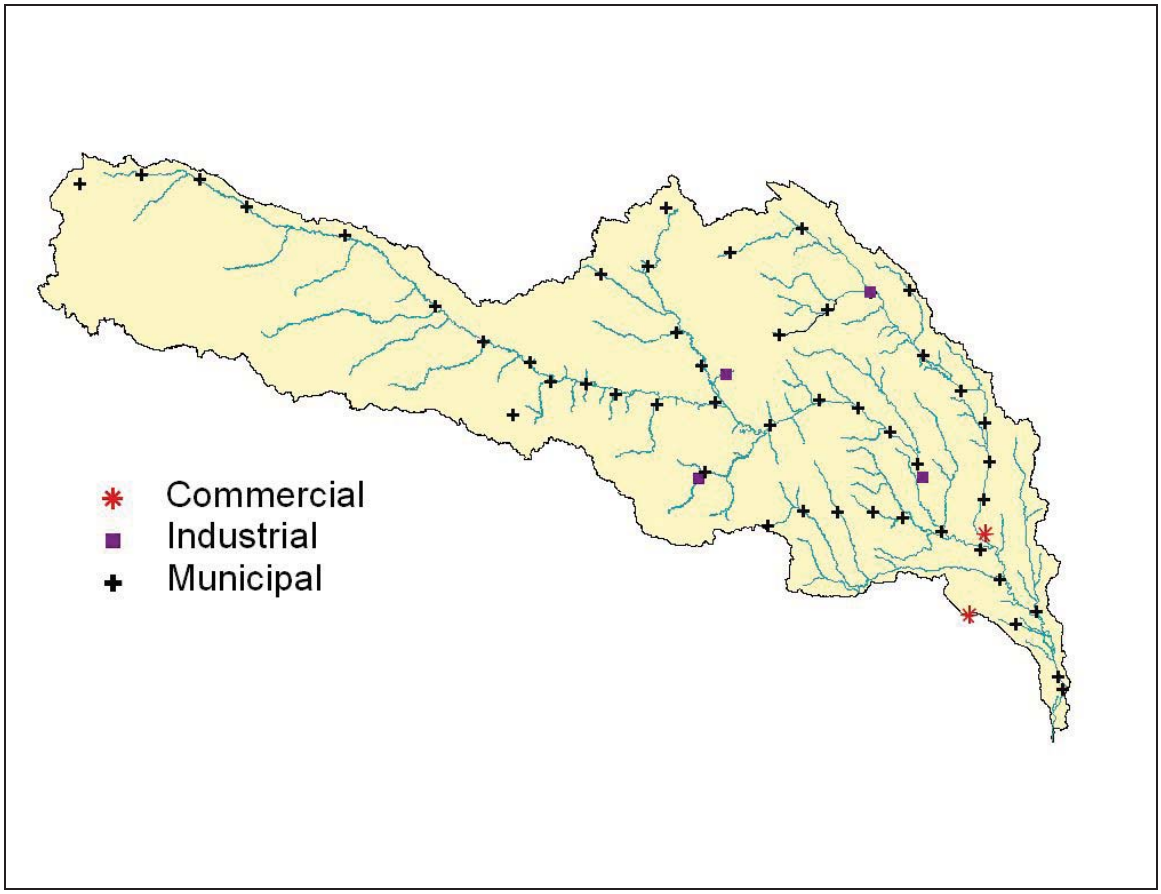
| Segment | Site Location | USGS/DNR Gage Associated with Site | Number of Samples | Season Geometric Mean (#/100 ml) |
|---|---|---|---|---|
| EL1-10000 | Elkhorn River @ Waterloo | 06800500 | 20 | 653 |
| EL1-10900 | Maple Creek @ Nickerson | 06800000 | 22 | 1304 |
| EL1-20000 | Elkhorn River @ West Point | 06799350 | 21 | 729 |
| EL1-20100 | Pebble Creek @ Scribner | 06799385 | 21 | 1500 |
| EL3-20000 | North Fork Elkhorn River @ Pierce | 06799100 | 15 | 2211 |
| EL4-10000 | Elkhorn River @ Norfolk | 06799000 | 18 | 576 |
| EL4-20000 | Elkhorn River @ Neligh | 06798500 | 18 | 1017 |
| EL4-30000 | Elkhorn River @ Ewing | 06797500 | 18 | 465 |

### 2.1.5 Potential Pollutant Sources

**2.1.5.1 Point Sources:** Point sources discharge or have the potential to discharge to waters in the Elkhorn River basin. Facility types include: municipal wastewater treatment facilities, commercial and industrial facilities. The facilities that have been issued a National Pollutant Discharge Elimination System Permit (according to EPA's Permit Compliance System) in the Elkhorn River Basin are shown in Figure 2.1.5.1a.

Illicit connections, discharges, combined sewer overflows; sanitary sewer overflows, straight pipes from septic tanks or other on-site wastewater systems can also be sources of *E. coli* bacteria. Active animal feeding operations that have been issued State of Nebraska permits, required for construction and operation of livestock waste control facilities (LWCF) if the operation has discharged, or has the potential to discharge, livestock waste to waters of the State are also considered potential sources. Figure 2.1.5.1b shows the facilities within the Elkhorn River Basin that have been entered into the NDEQ database by either being issued or requested a permit. These facilities are designed to contain any run-off that is generated by storm events that are less in intensity than the 25 year, 24-hour rainfall.

**Figure 2.1.5.1a NPDES Permitted Facilities in the Elkhorn River Basin**




**2.1.5.2 Nonpoint Sources:** Several nonpoint sources of *E. coli* exist in the Elkhorn River Basin. These sources include: failing septic tanks or other on-site wastewater systems, run-off from livestock pastures, improper or over-application of biosolids (wastewater treatment facility sludge, septage or manure) and urban stormwater runoff not regulated by an NPDES permit.

**2.1.5.3 Natural Sources:** The primary natural source of *E. coli* is wildlife. A variety of wildlife is native to or have adapted to the diverse habitat of the Elkhorn River Basin. Big game, upland game, furbearers, waterfowl and non-game species have been documented to reside within the basin.

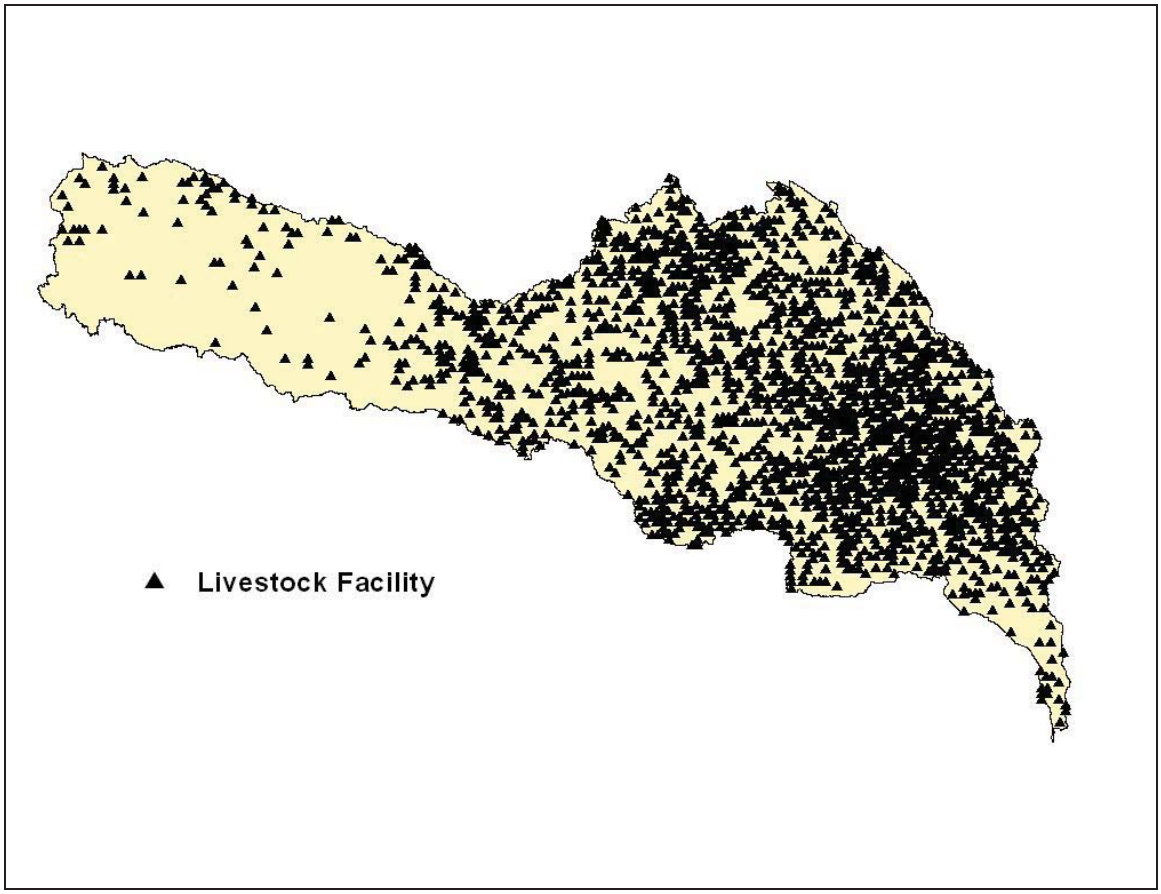
## 2.2 TMDL Endpoint

The endpoint for these TMDLs will be based on the numeric criteria associated with the Primary Contact Recreation beneficial use.

### 2.2.1 Numeric Water Quality Criteria

Water quality criteria established for the protection of the Primary Contact Recreation beneficial use can be found in Title 117, Chapter 4 and are as follows:

**Figure 2.1.5.1b Active Animal Feeding Operations in the Elkhorn River Basin**




**E. coli**

*E. coli* bacteria shall not exceed a geometric mean of 126/100 ml. For increased confidence of the criteria, the geometric mean should be based on a minimum of five samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines. The following single sample maxima shall be used solely for issuing periodic public advisories regarding use of waterbodies for Primary Contact Recreation.

235/100 ml at designated bathing beaches
298/100 ml at moderately used recreational waters
406/100 ml at lightly used recreation al waters
576/100 ml at infrequently used recreational waters

The November 16, 2004 Federal Register (Volume 69, No. 220) contained information regarding the final rule for "Water Quality Standards for Costal and Great Lakes Recreational Waters". This rule includes a discussion on the use of the single season maximum (SSM). Specifically:

*"EPA expects that the single season maximum values would be used for making beach notification and closure decisions. EPA recognizes however that States and Territories also use criteria in their water quality standards for other purposes under the Clean Water Act in order to protect and improve water quality. Other than in the beach notification and closure decision context, the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation and more directly linked to the underlying studies on which the 1986 criteria were based.*

Given this discussion and recommendation regarding the use of single season maximum in TMDLs and waterbody assessments, these TMDLs will focus on meeting the *E. coli* recreation season geometric mean of 126/100 ml.

### 2.2.2 Selection of Critical Environmental Conditions

The water quality criteria associated with the Primary Contact Recreation beneficial use only applies from May 1 through September 30. Therefore, the critical conditions for these TMDLs will be those occurring from May 1 through September 30.

### 2.2.3 Waterbody Pollutant Loading Capacity

Defining waterbody pollutant loading capacity implies a steady state. These TMDLs recognize loadings are dynamic and can vary with stream flow. As well, the above section indicates a wide range of environmental conditions that must be accounted for.

The method chosen to account for the variation in flow is based upon a data assessment (TMDL) curve. Data assessment curves are initiated by the development a stream's hydrograph using the long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values by the water quality standard (WQS) and a conversion factor (C). The acceptable "load" is then plotted graphically.

Therefore, the loading capacity for each of the segments will be defined by:

$$\text{Loading capacity} = \text{WQS} * \text{Flow} * \text{C}$$

The waterbody pollutant loading capacities can be found in Appendix B.

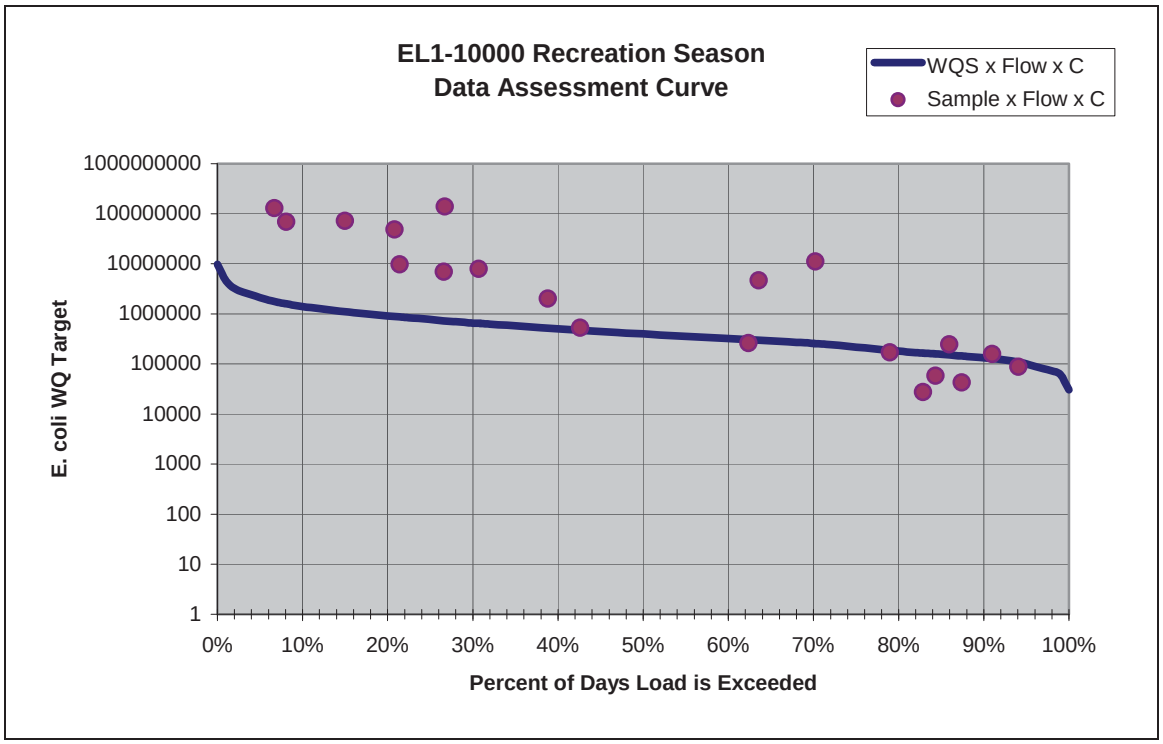
## 2.3 Pollutant Source Assessment

For these TMDLs the source loading is based upon the position of the monitoring data points in relation to the boundary established on the data assessment curve between point source and nonpoint source influences. This process for selecting the load point is described in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology (NDEQ 2002d). In the situation where a boundary has not been included on a data assessment curve, the information indicates no point source facilities discharge to the contributing watershed. For these waterbodies, the pollutant will be considered derived from nonpoint and natural sources.

### 2.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the data assessment curves (Figure 2.3.1a through 2.3.1h) provided for each of the segments where a TMDL is being developed. The points plotted above the acceptable loading indicate a deviance from the water quality criteria. It is recognized that with *E.* coli bacteria a load cannot be calculated. The purpose for inclusion of the data assessment curves for these waterbodies is to present a comparison of the water quality data to the stream flow and attempt to explain the conditions under which the data was collected. The y axis is unitless.

**Figure 2.3.1a. Data Assessment Curve for EL1-10000**




### 2.3.2 Deviation from Acceptable Pollutant Loading Capacity

Table 2.3.2 describes the deviation from the acceptable water quality standards based upon the 2005 *E. coli* monitoring information.

**Table 2.3.2 Deviation from the Applicable Water Quality Criteria**

| Segment | Observed Season Geometric Mean (#/100 ml) | #/100 ml Above WQS |
|---|---|---|
| EL1-10000 | 653 | 527 |
| EL1-10900 | 1304 | 1178 |
| EL1-20000 | 729 | 603 |
| EL1-20100 | 1500 | 1374 |
| EL3-20000 | 2211 | 2085 |
| EL4-10000 | 576 | 450 |
| EL4-20000 | 1017 | 891 |
| EL4-30000 | 465 | 339 |

**Figure 2.3.1b. Data Assessment Curve for EL1-10900**

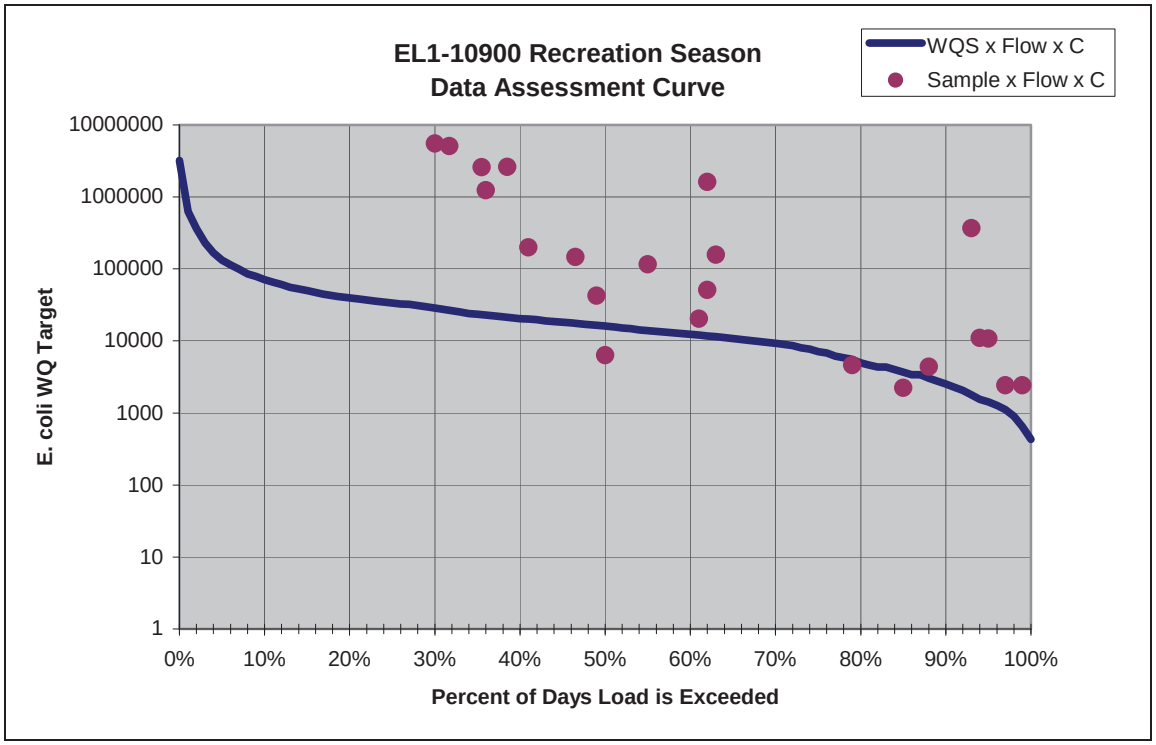



**Figure 2.3.1c. Data Assessment Curve for EL1-20000**

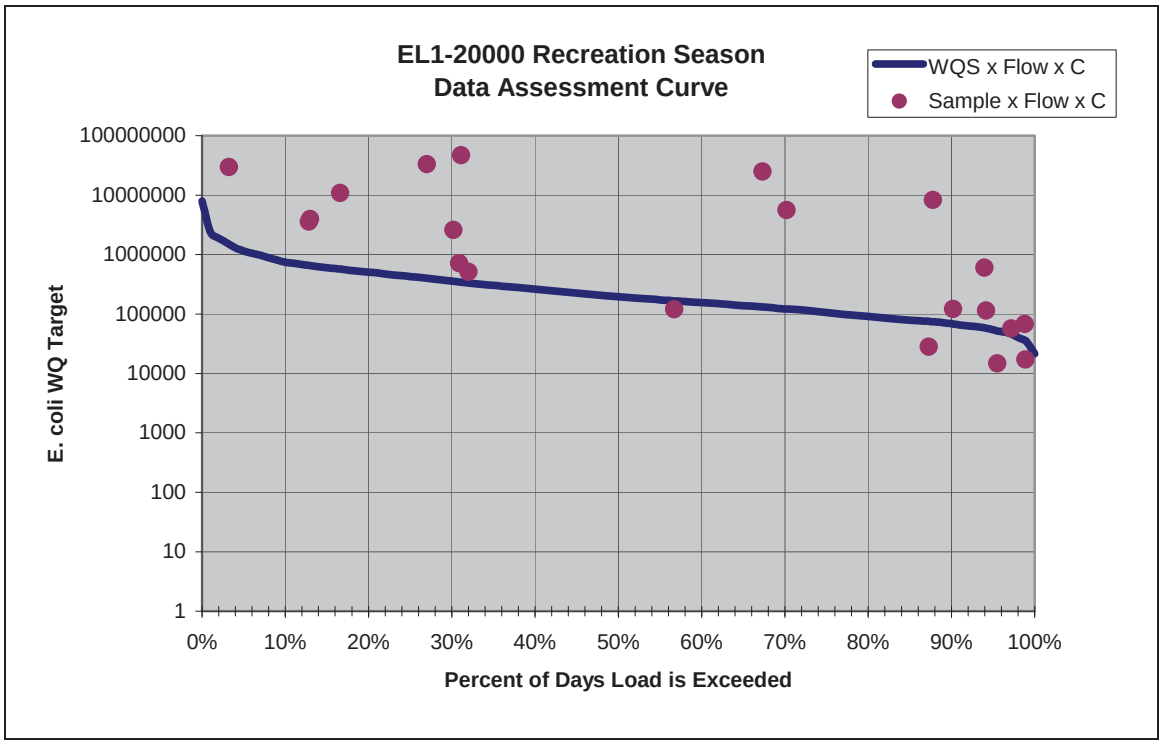


**Figure 2.3.1d. Data Assessment Curve for EL1-20100**

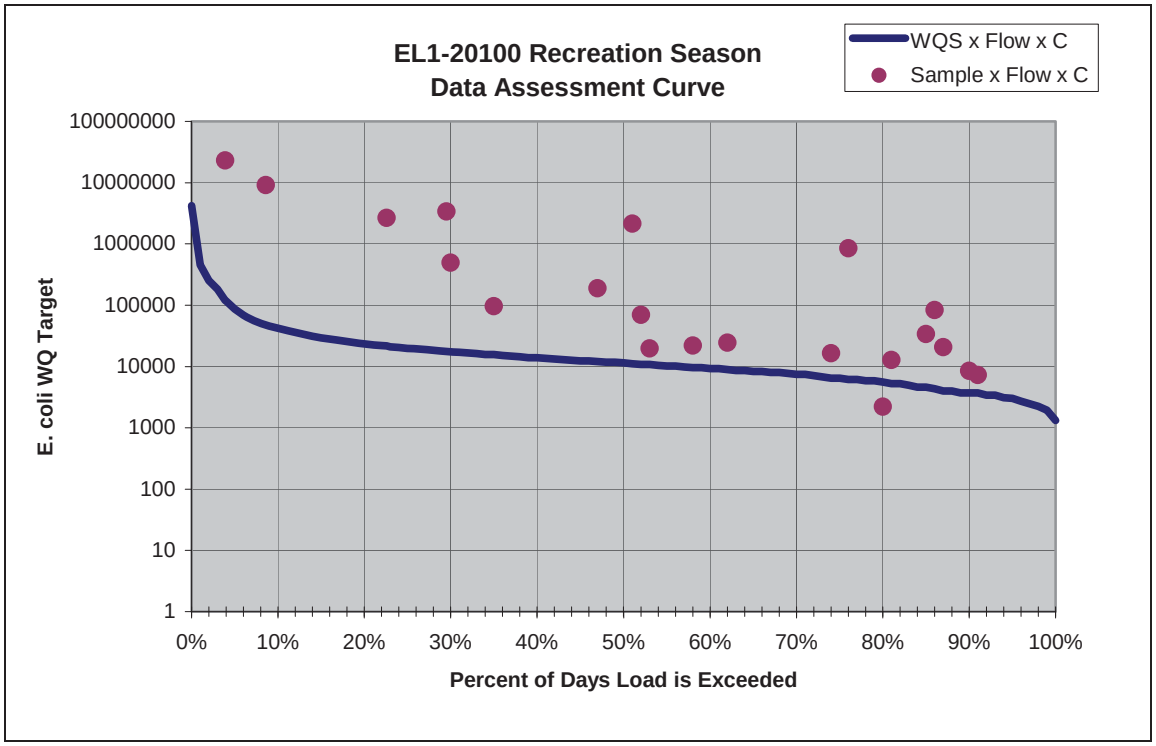



**Figure 2.3.1e. Data Assessment Curve for EL3-20000**

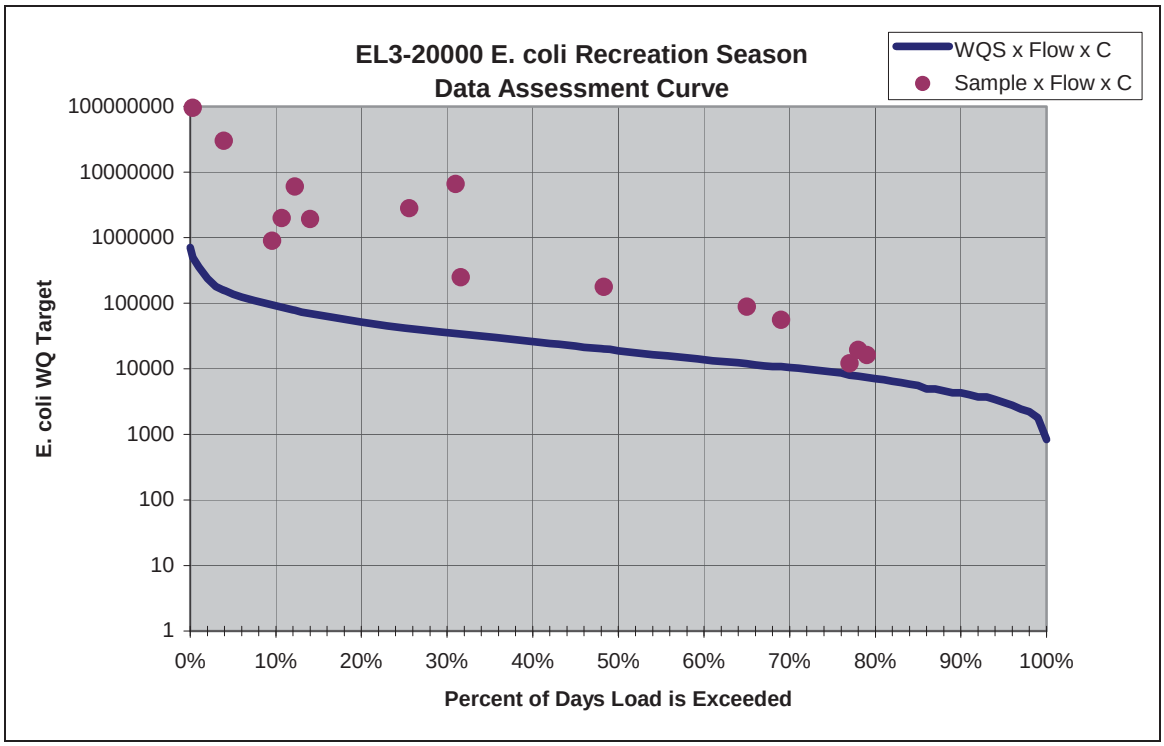


**Figure 2.3.1f. Data Assessment Curve for EL4-10000**

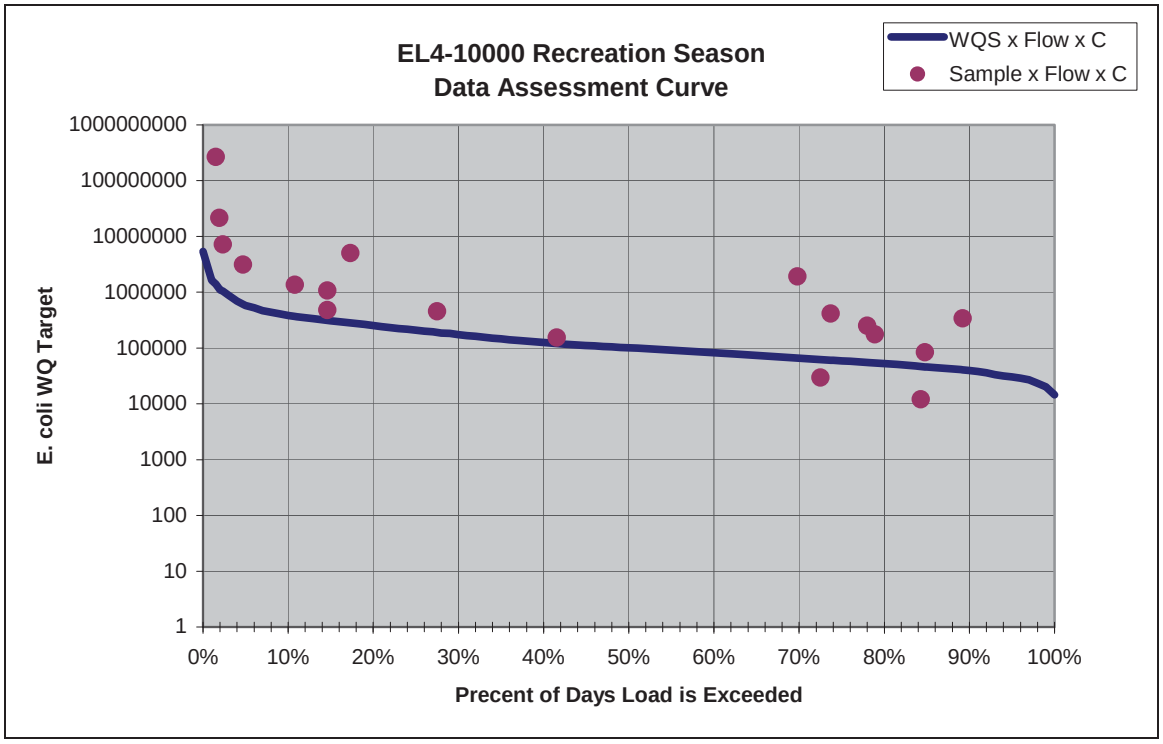



**Figure 2.3.1g. Data Assessment Curve for EL4-20000**

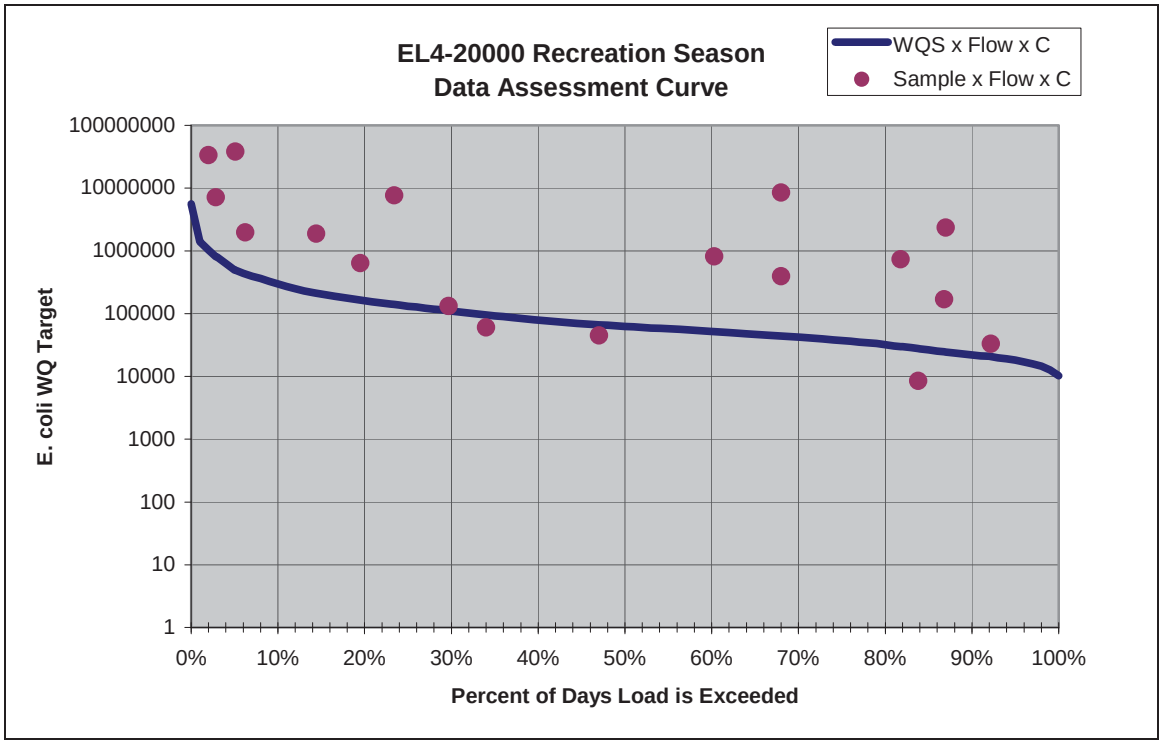
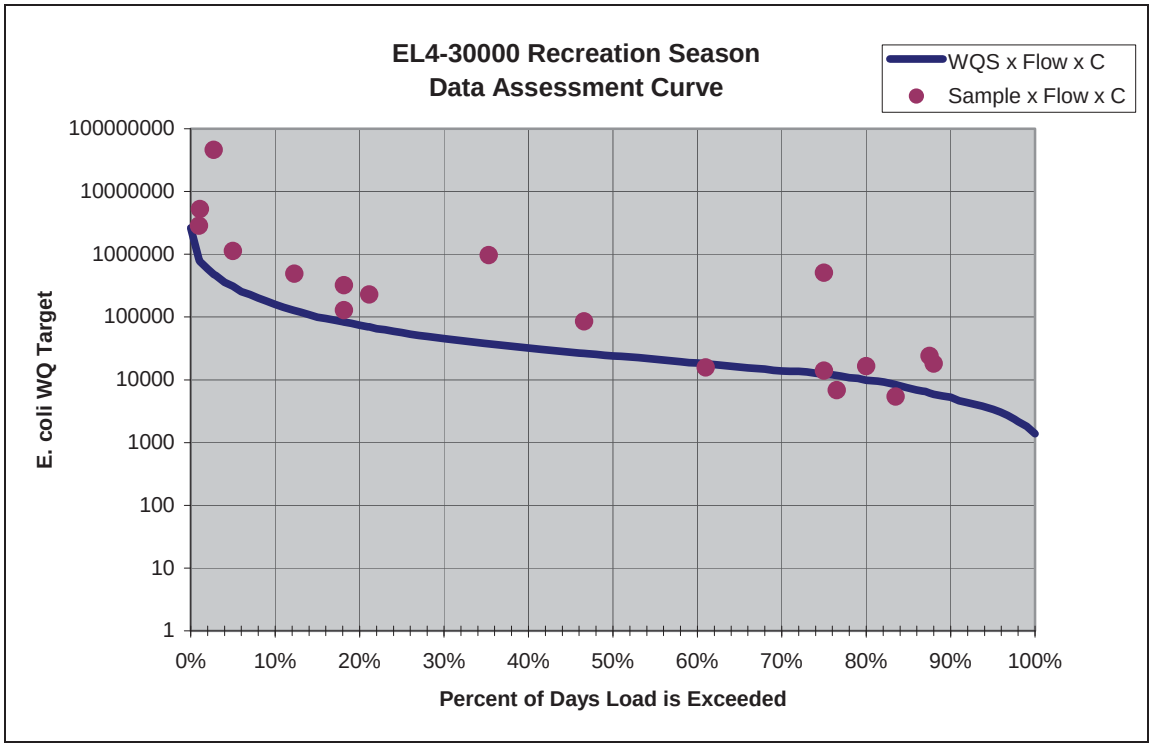


**Figure 2.3.1h. Data Assessment Curve for EL4-30000**




## 2.3.3 Identification of Pollutant Sources

Both point and nonpoint sources are known to exist along the segment and within the contributing watersheds. Due to the size of the watersheds, the somewhat limited data, the delivery methods and the location of the potential sources in relation to the impaired waterbody; it is difficult to definitively identify specific sources. It is important to note that all potential sources may not contribute to the water quality impairments and some sources may contribute at a greater degree than others.

The method utilized to determine the contributions of the sources will be based upon a demarcation where point source discharges are not expected to further impact the waterbody. That is, based on the concept of a continuous and relatively constant effluent volume, a dilution or flow value can be determined where point sources are no longer expected to contribute to water quality excursions. The process is explained in the document entitled Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology.

*E. coli* concentrations in wastewater can vary greatly, depending upon treatment technology, wastewater strength, industrial contributions, treatment efficiency and season. The selection of an all-encompassing effluent density value must then account for these and other variables. To that end, the NDEQ has collected effluent *E. coli* information from several facilities not providing disinfection of the wastewater discharge. The data was obtained from 24 facilities that include both mechanical and lagoon facilities and as seen in Figure 2.3.3a, exhibits a normal distribution. The median value was selected as the input for the "expected pollutant concentration". The equation to determine the point source/nonpoint source boundary then becomes:

$$Q_s = (8{,}400/100 \text{ ml} * \Sigma Q_e)/126/100 \text{ ml}$$

Where:

$Q_s$ = stream flow volume necessary to meet water quality standards

8,400/100 ml = expected *E. coli* coliform density from point sources
$Q_e$ = sum of **all** design flows from point sources discharging to the segment (direct or via tributaries)
126/100 ml = water quality standard

The values for $Q_e$ can be found in Table 2.3.3b as can the boundary flows.

**Table 2.3.3 Sum of Wastewater Treatment Facility Design Flows in the Elkhorn River Basin**

| Segment | Total Number of Facilities | Sum of Contributing Facility Design Flows (cfs) | Flow Value for Point vs. Nonpoint Boundary (cfs) |
|---|---|---|---|
| EL1-10000 | 6 | 16.92 | 1128 |
| EL1-10900 | 3 | 0.28 | 18.4 |
| EL1-20000 | 8 | 5.68 | 378.8 |
| EL1-20100 | 2 | 0.29 | 19.6 |
| EL3-20000 | 3 | 0.32 | 22 |
| EL4-10000 | 4 | 11.71 | 780.8 |
| EL4-20000 | 1 | 0.3 | 39* |
| EL4-30000 | 2 | 1.86 | 123.8 |

***Recreation season 7q10 value**

The identification of pollutant sources and impacts are shown in figures 2.3.3b-2.3.3i.

**2.3.3.1 Point Sources of E. coli:** Based upon the Data Assessment curves and the position of the monitoring data points it appears point sources are contributing to the *E. coli* impairment within segments EL1-10000, EL1-10900, EL1-20000, EL1-20100, EL4-10000 and EL4-30000. The facilities that discharge either directly to or into a tributary of the Elkhorn basin recreation segments that are a potential source are listed in Table 2.3.3.1.

**2.3.3.2 Nonpoint and Natural Sources of *E. coli*:** Due to the diverse nature, distribution and delivery method, nonpoint and natural sources will not be separated. Therefore, the monitoring data that fall to the left of the boundary are considered to be the result of nonpoint and natural background sources.

The source identification process utilized was done so in order to get a general idea of the source category. This simplified numeric process should not be considered exclusive as an overlap of source contributions is recognized during periods where run-off is contributing to stream volume. In the future, expanded sampling may target specific source identification. Future monitoring and assessment will also take into account the controls (i.e. wastewater disinfection) that have been instituted. When considered, the demarcation may fluctuate and the source contributions re-evaluated.

**Figure 2.3.3a. *E. coli* Data from 24 Wastewater Treatment Facilities**

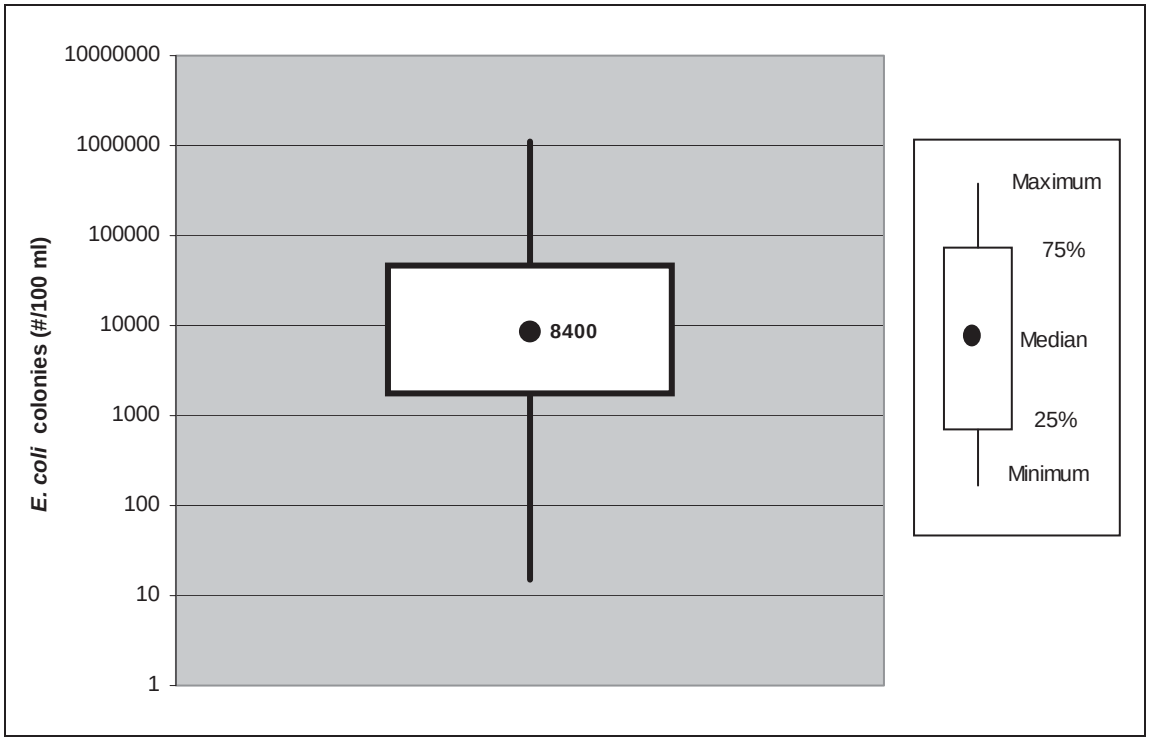



**Figure 2.3.3b. Identification of Pollutant Sources Using the Data Assessment Curve for EL1-10000**

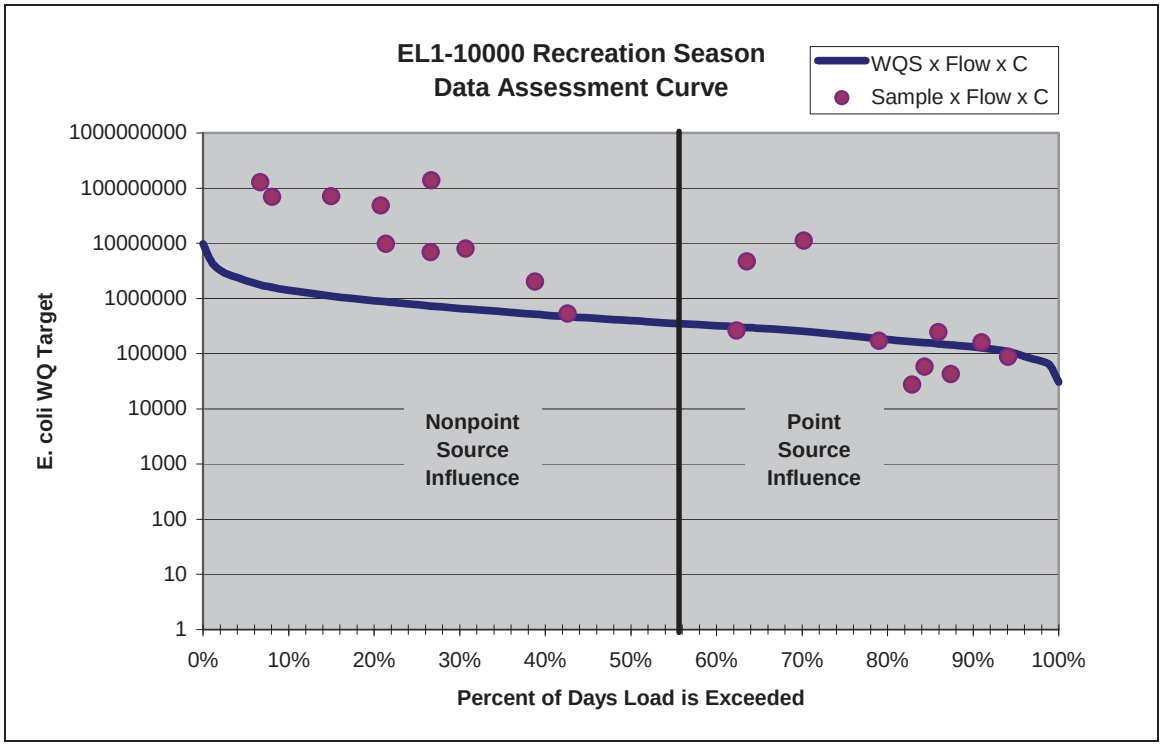


**Figure 2.3.3c. Identification of Pollutant Sources Using the Data Assessment Curve for EL1-10900**

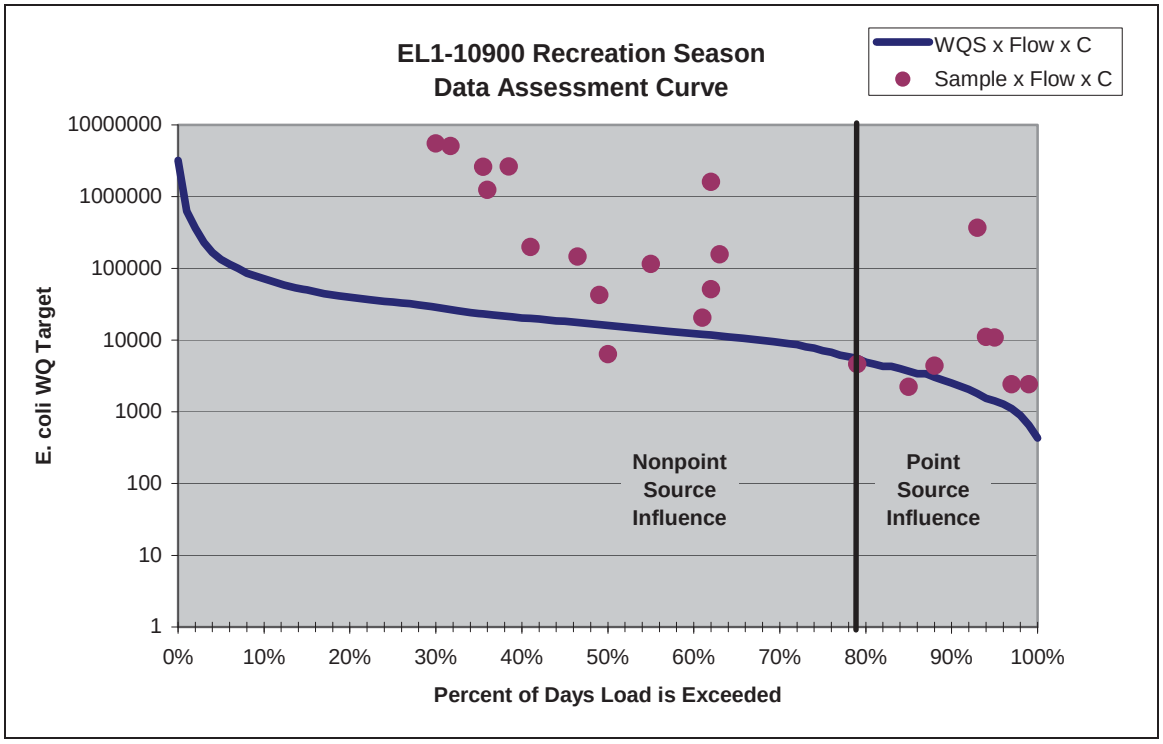



**Figure 2.3.3d. Identification of Pollutant Sources Using the Data Assessment Curve for EL1-20000**

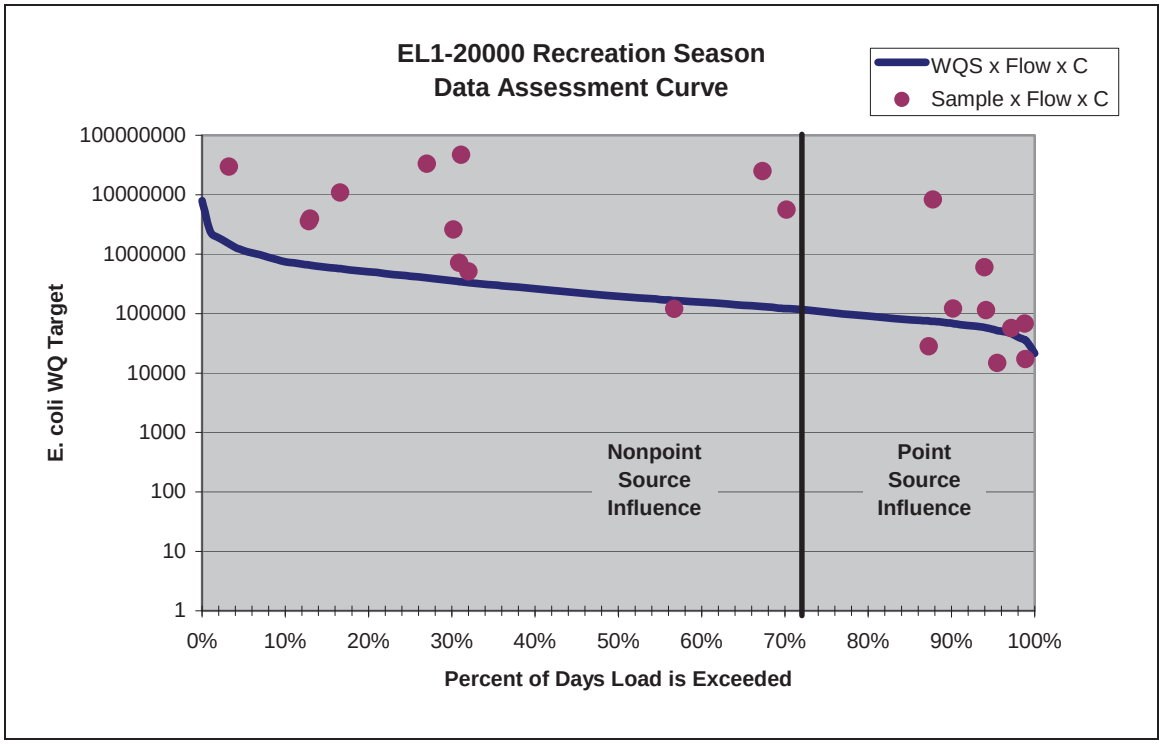


**Figure 2.3.3e. Identification of Pollutant Sources Using the Data Assessment Curve for EL1-20100**

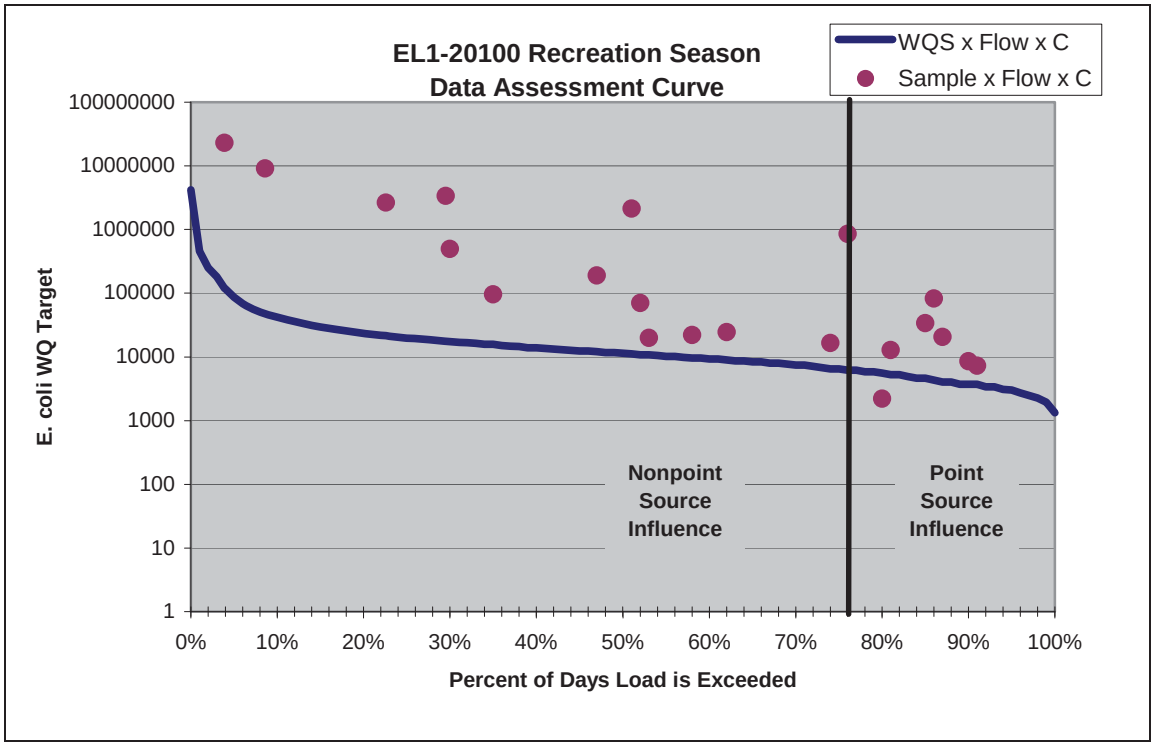



**Figure 2.3.3f. Identification of Pollutant Sources Using the Data Assessment Curve for EL3-20000**

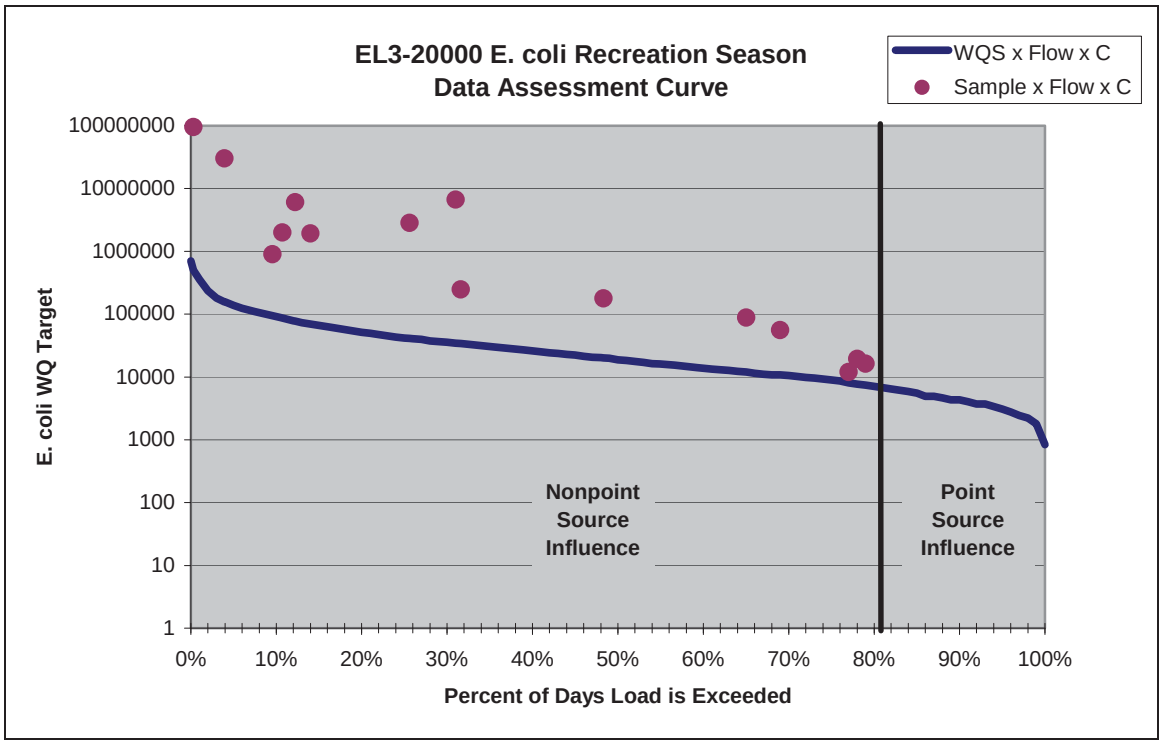


**Figure 2.3.3g. Identification of Pollutant Sources Using the Data Assessment Curve for EL4-10000**

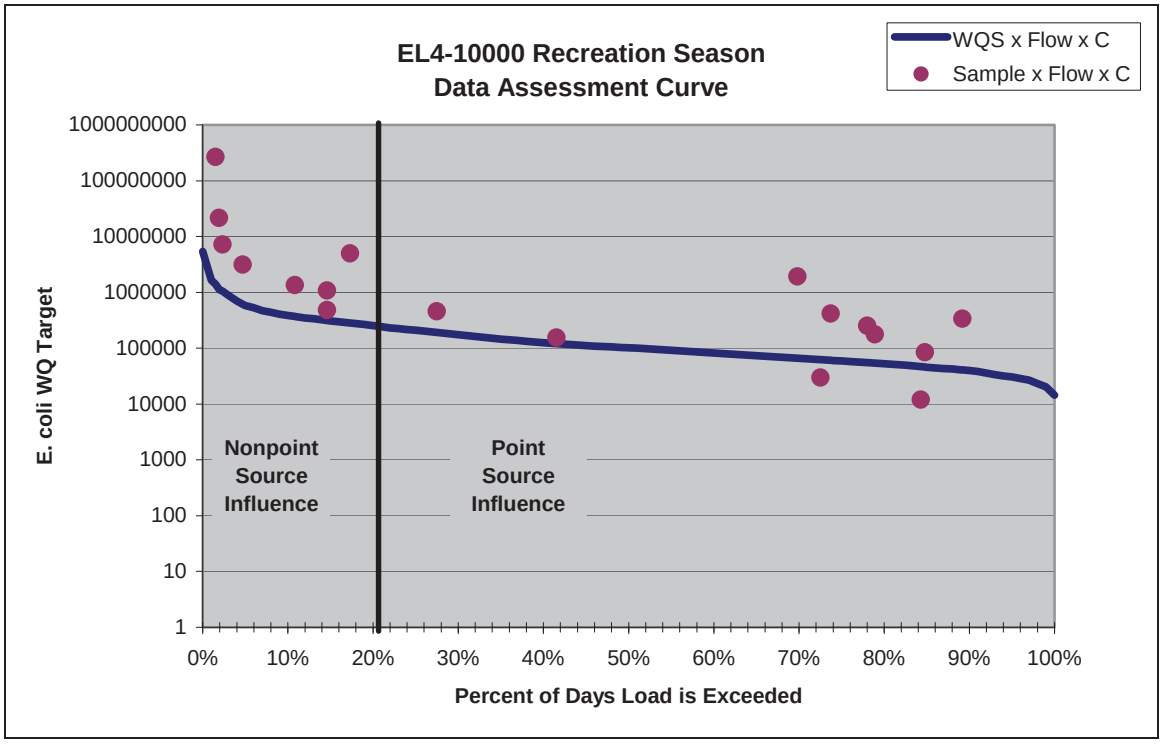



**Figure 2.3.3h. Identification of Pollutant Sources Using the Data Assessment Curve for EL4-20000**

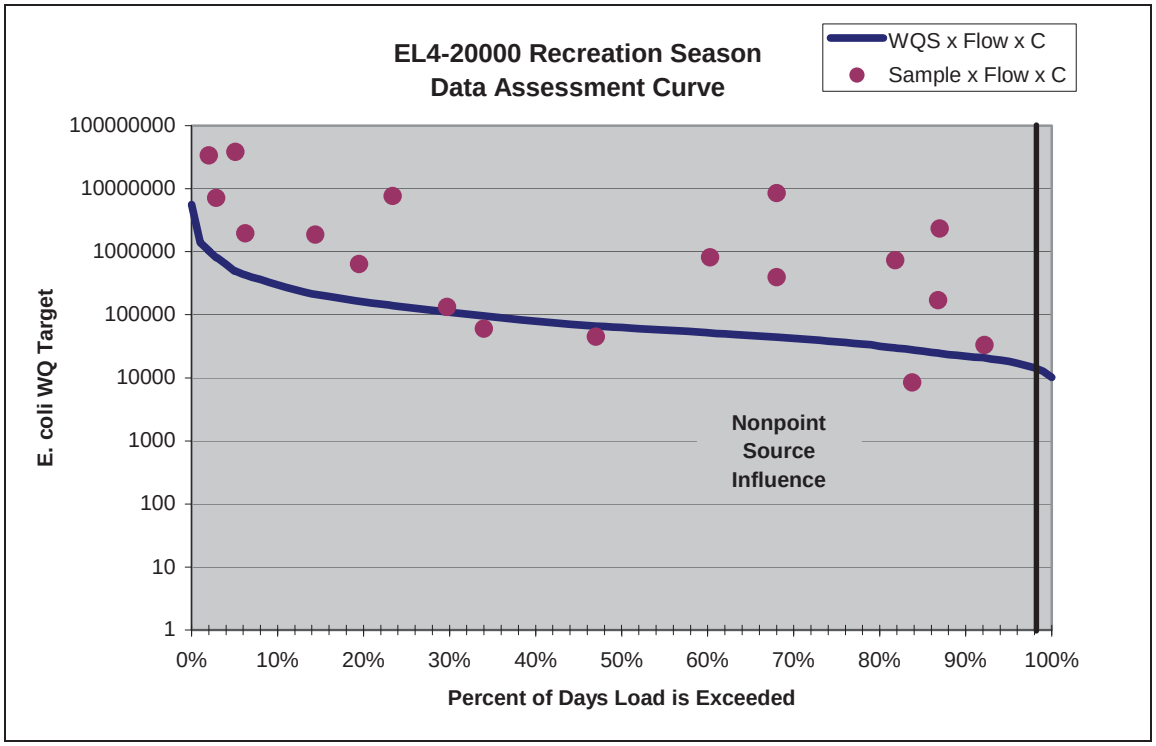
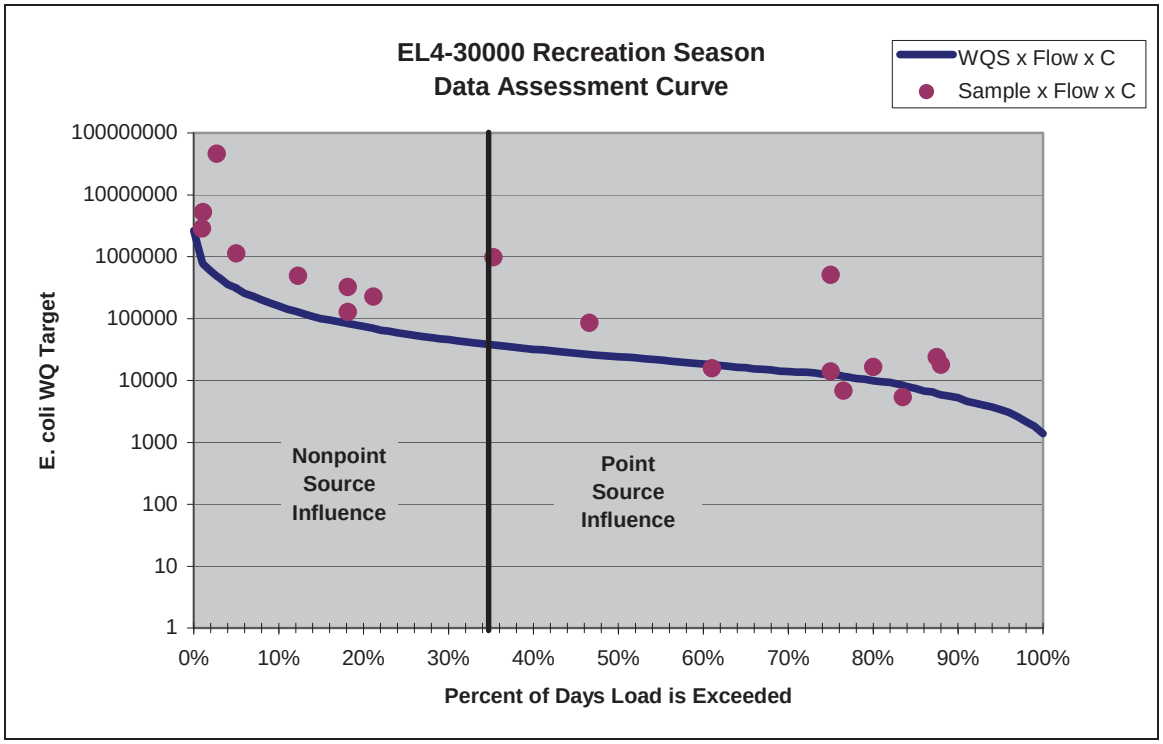


**Figure 2.3.3i. Identification of Pollutant Sources Using the Data Assessment Curve for EL4-30000**




## 2.4 Pollutant Allocation

A TMDL is defined as:

TMDL = Loading Capacity = WLA + LA + Background + MOS

As stated above, the loading capacity is based upon flow position in the hydrograph and is defined by:

Load Capacity = Flow x 126/100 ml x C

Where:

Flow = Stream flow volume (cubic feet per second)
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor.

By regulation, a TMDL requires a loading capacity value for the pollutant of concern. In the case of *E. coli*, a "load" (flow rate x concentration x time) could be calculated, but the approach may not be appropriate for expressing this non-conservative parameter. Therefore, for the purposes of these TMDLs, a loading capacity will not be "calculated" but will be expressed as the water quality standard. Because the water quality is expressed as a concentration, the LC will not equal the WLA + the LA.

The flow hydrographs (0-100$^{th}$ Percentile) used in the *E. coli* TMDL are provided in Table 2.4.

To achieve the desired loading capacities requires the following allocations:

**Table 2.3.3.1 NPDES Permitted Facilities in the Elkhorn River Basin**

| Recreation Segment | Receiving Water | Facility | NPDES Permit Number | Facility Design Flow (cfs) | Facility Discharge Directly to Recreation Segment? | Approximate Distance to Recreation Segment (stream miles) | *E. coli*/ Fecal coliform Limits in NPDES permit? |
|---|---|---|---|---|---|---|---|
| EL1-10000 | EL1-10000 | Nickerson WWTF | NE0024287 | 0.040 | Yes | | Yes |
| | EL1-10000 | Fremont WWTF | NE0031381 | 16.246 | Yes | | Yes |
| | EL1-10000 | Riverside Lakes (SID 177) | NE0112283 | 0.116 | Yes | | Yes |
| | EL1-10000 | Waterloo WWTF | NE0043311 | 0.193 | Yes | | Yes |
| | EL1-10500 | Meadowbrook Mobile Home Park | NE0128881 | 0.070 | No | 18.1 | Yes |
| | EL1-10600 | Arlington WWTF | NE0049166 | 0.255 | No | 1.7 | No |
| EL1-10900 | EL1-10920 | Howells WWTF | NE0046205 | 0.077 | No | 14.5 | No |
| | EL1-10930 | Clarkson WWTF | NE0021164 | 0.128 | No | 23 | No |
| | EL1-10940 | Leigh WWTF | NE0112101 | 0.071 | No | 31.5 | No |
| EL1-20000 | EL1-20000 | Beemer WWTF | NE0046086 | 0.093 | Yes | | Yes |
| | EL1-20000 | Hooper WWTF | NE0049093 | 1.578 | Yes | | **No** |
| | EL1-20000 | Pilger WWTF | NE0027294 | 0.074 | Yes | | Yes |
| | EL1-20000 | Scribner WWTF | NE0023787 | 0.464 | Yes | | Yes |
| | EL1-20000 | Stanton WWTF | NE0029343 | 0.387 | Yes | | Yes |
| | EL1-20000 | Tyson Foods-West Point | NE0000761 | 1.857 | Yes | | Yes |
| | EL1-20000 | West Point WWTF | NE0023965 | 0.890 | Yes | | Yes |
| | EL1-20000 | Wisner WWTF | NE0023957 | 0.340 | Yes | | Yes |
| EL1-20100 | EL1-20120 | Snyder WWTF | NE0046311 | 0.077 | No | | Yes |
| | EL1-20130 | Dodge WWTF | NE0042064 | 0.217 | No | | Yes |
| EL1-22000 | EL1-22000 | Madison WWTF | NE0049174 | 0.503 | Yes | | Yes |
| | EL1-22100 | Tyson Foods-Madison | NE0038363 | 1.083 | No | 2.1 | Yes |
| EL2-10000 | EL2-10000 | Lyons WWTF | NE0049182 | 0.196 | Yes | | **No** |
| | EL2-10000 | Oakland WWTF | NE0024023 | 0.232 | Yes | | **No** |
| | UD to EL2-10000 | Logan View Jr-Sr High School | NE0122009 | 0.062 | No | 1.6 | Yes |
| | EL2-10000 | Uehling WWTF | NE0129445 | 0.062 | Yes | | Yes |
| EL2-20000 | EL2-20000 | Bancroft WWTF | NE0028088 | 0.116 | Yes | | **No** |
| | EL2-20000 | Pender WWTF | NE0040908 | 0.248 | Yes | | Yes |
| | EL2-20000 | Wakefield WWTF | NE0049018 | 0.774 | Yes | | **No** |
| | EL2-20300 | Emerson WWTF | NE0041351 | 0.278 | No | 12.6 | Yes |
| | EL2-40200 | Laurel WWTF | NE0023922 | 3.094 | No | 17.1 | No |
| | EL2-40200 | Randolph WWTF | NE0029149 | 0.155 | No | 33.9 | No |
| EL2-20800 | EL2-20900 | Wayne WWTF | NE0033111 | 1.238 | No | 3.1 | Yes |

| Recreation Segment | Receiving Water | Facility | NPDES Permit Number | Facility Design Flow (cfs) | Facility Discharge Directly to Recreation Segment? | Approximate Distance to Recreation Segment (stream miles) | *E. coli*/ Fecal coliform Limits in NPDES permit? |
|---|---|---|---|---|---|---|---|
| | EL2-21000 | Winside WWTF | NE0043320 | 0.108 | No | 13.9 | No |
| EL3-10000 | EL3-10100 | Nucor Steel | NE0111287 | 0.08 | No | 3.7 | No |
| EL3-20000 | EL3-20100 | Hadar WWTF | NE0024210 | 0.06 | No | 0.9 | No |
| | EL3-40000 | Osmond WWTF | NE0040029 | 0.155 | No | 13.4 | No |
| | EL3-40000 | Wausa WWTF | NE0039861 | 0.108 | No | 27.5 | No |
| EL3-20200 | EL3-20200 | Pierce WWTF | NE0042331 | 0.418 | Yes | | **No** |
| EL3-20400 | EL3-20500 | Plainview WWTF | NE0021741 | 0.201 | No | 8.8 | No |
| EL4-10000 | EL4-10000 | Norfolk WWTF | NE0033421 | 10.985 | Yes | | Yes |
| | EL4-10000 | Tilden WWTF | NE0027910 | 0.294 | Yes | | Yes |
| | EL4-10400 | Battle Creek WWTF | NE0041301 | 0.248 | Yes | | Yes |
| | EL4-10700 | Meadow Grove WWTF | NE0030741 | 0.186 | No | 0.9 | No |
| EL4-11300 | EL4-11300 | Oakdale WWTF | NE0049069 | 0.043 | Yes | | Yes |
| | UD to EL4-11310 | Elgin WWTF | NE0039811 | 0.158 | No | 14.9 | Yes |
| EL4-20000 | EL4-20000 | Neligh WWTF | NE0037010 | 0.302 | Yes | | Yes |
| EL4-30000 | EL4-30000 | Ewing WWTF | NE0043699 | 0.928 | Yes | | Yes |
| | EL4-30000 | O'Neill WWTF | NE0049051 | 0.928 | Yes | | Yes |
| EL4-40000 | EL4-40000 | Atkinson WWTF | NE0021610 | 0.223 | Yes | | **No** |
| | EL4-40000 | Stuart WWTF | NE0023949 | 0.124 | Yes | | **No** |
| | EL4-40200 | Bassett WWTF | NE0112666 | 0.260 | No | 22.6 | No |
| | EL4-40200 | Newport WWTF | NE0114910 | 0.077 | No | 8.7 | No |

### 2.4.1 Wasteload Allocations

**2.4.1.1 NPDES Permitted Facilities:** Title 117 does not allow for the application of a mixing zone for the initial assimilation of effluents in order to meet the criteria associated with the recreation beneficial use. Because of this, the water quality criteria are applied to the "end-of-pipe" concentrations and are applicable at all stream flows >7q10. Therefore, the *E. coli* wasteload allocation established by this TMDL will be a monthly geometric mean 126/100 ml.

The wasteload allocation will initially be applied to all facilities that discharge directly to a recreational segment. Future monitoring and evaluation will be utilized to determine if *E. coli* limitations are necessary for facilities discharging to the recreation segment's tributaries.

**Table 2.4 Recreation Season Hydrograph for Elkhorn River Basin *E. coli* TMDLs (cubic feet/second)**

| Percentile | EL1-10000 | EL1-10900 | EL1-20000 | EL1-20100 | EL3-20000 | EL4-10000 | EL4-20000 | EL4-30000 |
|---|---|---|---|---|---|---|---|---|
| 0 | 99 | 1 | 69 | 4 | 3 | 47 | 33 | 5 |
| 10 | 429 | 8 | 222 | 12 | 14 | 129 | 71 | 17 |
| 20 | 583 | 16 | 296 | 18 | 23 | 171 | 103 | 32 |
| 30 | 832 | 30 | 394 | 24 | 34 | 214 | 136 | 45 |
| 40 | 1040 | 40 | 502 | 30 | 45 | 265 | 169 | 60 |
| 50 | 1290 | 52 | 629 | 37 | 61 | 328 | 203 | 78 |
| 60 | 1620 | 66 | 848 | 45 | 87 | 407 | 256 | 103 |
| 70 | 2120 | 93 | 1160 | 56 | 115 | 566 | 353 | 148 |
| 80 | 2950 | 128 | 1640 | 76 | 167 | 815 | 516 | 241 |
| 90 | 4540 | 230 | 2410 | 135 | 296 | 1250 | 963 | 516 |
| 100 | 31500 | 10400 | 25500 | 13600 | 2280 | 17500 | 18000 | 8480 |

**2.4.1.2 Dry Weather Discharges:** Dry weather discharges can either be from illicit sources, cross-connections or mechanical failure and often exhibit the greatest influence on the base flow conditions of the stream. Thus, it is most appropriate to group these discharges and limit similarly to the WWTFs. Specifically, the wasteload allocations assigned to these discharges shall be a seasonal geometric mean of 126/100 ml.

**2.1.4.3 Non-Discharging Facilities:** Several facilities including confined animal feeding operations and lagoons are designed for "zero" discharge. In the case of animal feeding operations, discharges may only occur as the result of a 25 year 24 hour storm event or a chronic wet period with an accumulative precipitation equivalent to a 25 year 24 hour storm. Based on this permitting provision, the WLA for facilities classified as non-discharging will be zero (0).

**2.4.2 Load Allocations**

The load allocations assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

$$LA_i = Q_i * 126/100 \text{ ml} * C$$

Where:
$LA_i$ = load allocations at the $i^{th}$ flow
$Q_i$ = stream flow at the $i^{th}$ flow
126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117
C = conversion factor

**2.4.2.1 Load Reduction to Meet Water Quality Criteria:** It is important to report the reductions necessary to meet the water quality criteria. The necessary reductions were determined based upon the 2005 data, which is considered representative information. The targeted reductions found in Table 2.4.2.1 provide water quality managers with a quantitative endpoint by which implementation planning can be carried out. The noted reductions along including the application of point source controls if achieved should result in the waterbodies fully supporting the primary contact recreation beneficial use. The reductions stated in the table also include the margin of safety described below.

**Table 2.4.2.1 Targeted *E. coli* Load Reductions**

| Segment | Targeted Reduction | Expected Season Geometric Mean |
|---|---|---|
| EL1-10000 | 83% | 111/100 ml |
| EL1-10900 | 92% | 104/100 ml |
| EL1-20000 | 85% | 109/100 ml |
| EL1-20100 | 93% | 105/100 ml |
| EL3-20000 | 95% | 111/100 ml |
| EL4-10000 | 81% | 109/100 ml |
| EL4-20000 | 89% | 112/100 ml |
| EL4-30000 | 76% | 112/100 ml |

### 2.4.3 Margin of Safety

A margin of safety (MOS) must be incorporated into TMDLs in an attempt to account for uncertainty in the data, analysis or targeted allocations. The MOS can either be explicit or implicit and for these TMDLs are as follows:

- To account for uncertainty in the nonpoint source load reduction, the targeted reductions will be set at 90% of the water quality target (126/100 ml). Specifically the reductions shall be applied to meet a seasonal geometric mean of ≤113/100 ml.
- Decay and/or die off of *E. coli* were not accounted for in either the source assessment or in establishment of the load reduction. That is, the entire concentration/load from the source was assumed to be present within the waterbody and the reductions should focus on the load.
- These TMDLs assumed the effluents discharge the *E. coli* density allowed by the WLA or 126/100 ml. WWTF disinfection systems are often designed and operated to achieve 100% reduction in the indicator bacteria or 0/100ml. Thus, the actual NPDES permitted point source contribution is likely less than expected by the TMDL.

### 2.4.5 Expression of TMDLs as Daily Loads

The April 25, 2006 decision by the U.S. District Court of Appeals for the D.C. Circuit in *"Friends of the Earth, Inc. vs. EPA et. al."* recommends that all TMDLs and associated wasteload allocations and load allocations include a daily expression. The approach for these TMDLs will based upon the conversion of the targeted concentration of E. coli to counts per day. The daily expression for each TMDL segment can be found in Appendix B.

## 3.0 Implementation Plan

The implementation of controls to manage *E. coli* within the Elkhorn River Basin includes but is not limited to:

### 3.1 NPDES Permitted Point Sources

Facilities that discharge directly to all segments within the Elkhorn River basin designated with the primary contact recreation use will be required to meet the wasteload allocations – *E. coli* = 126/100 ml – at the end of the pipe. Facilities discharging to tributaries will be evaluated to determine the extent of the effluent's impact on the recreation segment. If deemed significant, a request will be made to limit the *E. coli* concentration discharged from these facilities in the NPDES permit.

In addition to the permits, in the course of compliance audits, deficiencies in the operation of the WWTF disinfection appurtenances and noncompliance with the NPDES permit limits should be noted and corrective action pursued.

Biosolids (sludge) generated by municipal and industrial facilities are regulated under 40 CFR Part 257 and 40 CFR Part 503, respectively. 40 CFR part 257 requires that facilities and practices not cause nonpoint source pollution of waters of the United States. Part 503 specifically requires that sludge applications be not less that 10 meters from waters of the United States and that the sludge not be applied to frozen, flooded or snow covered ground if the sludge can enter into waters of the United States.

Consistent with Section 3.4 below, a recommendation will be made that all NPDES permittees be required to adhere to items #1and #2 for land application activities taking place either during or 10 days prior to the recreation season (May 1 – September 30). In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with #3

## 3.2 NPDES Storm Water Discharges

The WLA defined in section 2.4.1.1 will be applicable to all NPDES discharges including discharge from regulated stormwater outfall. The NDEQ is responsible for determining the applicability of NPDES stormwater permits for urbanized areas with populations >10,000 but <100,000. As well, other municipal or construction areas can be designated for coverage under an NPDES (stormwater) permit if the NDEQ determines control of the stormwater is necessary.

Facilities discharging stormwater under the authority of a NPDES permit are required to implement the following minimum control measures:

- Implement a public education and outreach program on stormwater impacts
- Develop and enforce a program to detect and eliminate illicit discharges.
- Develop, implement and enforce a program to reduce pollutants from construction activities.
- Develop, implement and enforce a program to reduce pollutants from post construction activities in new or redevelopment projects
- Develop a pollution prevention/good housekeeping program.

Rather than apply numeric limitations on individual stormwater outfalls, the strategy will be to initially allow the municipalities sufficient opportunity to comply with the NPDES requirements; either voluntarily or under the authority of an NPDES permit. In the future, should additional monitoring data indicate the minimum control measures are inadequate or have not been incorporated; consideration will be given to application of wasteload allocations for the outfalls in the area of concern.

## 3.3 Dry Weather Discharges

Title 119 – Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System, Chapter 2 states:

> "All persons discharging pollutants from a point source into any waters of the State are required to apply for and have a permit to discharge."

Discharges not permitted should be required to obtain the proper authorization to discharge. All discharges are then subject to the appropriate limitations consistent with the WLAs established by this TMDL. Elimination of the discharge should be undertaken in the event permitting and control is not feasible.

## 3.4 Animal Feeding Operations

Title 130 – Rules and Regulations Pertaining to Livestock Waste Control states:

> 001 A livestock waste control facility shall be required for an existing or proposed livestock operation of three hundred animal units or larger, when livestock wastes:
>
> > 001.01 Violate or threaten to violate Title 117 (Neb. Administrative Code (NAC)), Nebraska Surface Water Quality Standards;
> > 001.02 Violate or threaten to violate Title 118 (NAC), Ground Water Quality Standards and Use Classification;
> > 001.03 Discharge into waters of the State; or
> > 001.04 Violate The Nebraska Environmental Protection Act.
>
> 002 Any livestock operation less than three hundred animal units is exempt from the permitting process, including the requirement to request an inspection, unless there has been a confirmed discharge into waters of the State, or the Department has determined that because of conditions at the livestock operation there is a high potential for discharge into waters of the State in which case the Department shall notify the owner of the livestock operation by certified mail that the owner is subject to the Livestock Waste Management Act.

When a livestock waste control facility is required the owner/operator must also be issued a construction and/or a state-operating permit. State operating permits require facilities be properly operated and maintained to prevent water pollution and to protect the environment of the State.

Livestock waste control facilities for open lots, by regulation must be designed and constructed to contain all waste generated under conditions less than a 25 year 24 hour precipitation event. Confined animal feeding operations are required to maintain 180 days of storage or a lagoon to treat the waste products. Meeting these permit requirements should equate to "zero" discharge during conditions less than a 25 year 24 hour precipitation event, or a chronic wet period.

Wastewater and biosolids (manure) produced by the animal feeding operations are most often land applied for beneficial reuse. Permitted facilities are required to follow best management practices (BMPs) for the land application as defined in Title 130, Chapter 11. Those BMPs include:

1. Utilize application areas which are under proper conservation treatment to prevent run-off into waters of the State
2. Not apply waste within 30 feet of any stream, lake or impounded waters identified in Chapter 6 and Chapter 7 of Title 117, unless in accordance with an approved comprehensive nutrient management plan
3. When waste is applied within 100 feet of any streams, lakes an impounded waters identified in Chapter 6 and 7 of Title 117, the Department may also require additional buffer and/or vegetative buffers, and that the livestock waste be applied in a manner which reduces potential for run-off of nutrients or pathogens by incorporation, injection of waste or other approved practices.

Based upon the above, it shall be recommended that the NDEQ's Agriculture Section stipulate in the state operating or other permits, for facilities located in the Elkhorn River Basin, that the application of livestock waste occurring during or 10 days prior to the Recreation Season (May 1 – September 30) be consistent with the above #1 and #2 and the application setback be the minimum of 30 feet regardless of the status of the comprehensive nutrient management plan. In those areas where land slope or drainage is such where the application has a greater potential to run-off, or where application has been observed to have run-off, the recommendation will be consistent with the requirements of #3 with the minimum setback being 100 feet.

## 3.5 Exempt Facilities/Other Agricultural Sources

Animal feeding operations are exempt from regulations set forth in Title 130 if:

- The operation is less than 300 animal units

- There has not been a confirmed discharge to waters of the State, or
- The Department has determined that because of conditions at the livestock operation there is **not** a high potential for discharge to waters of the state.

Periodically, the NDEQ will receive a complaint on or a request for an inspection from a facility operating with <300 animal units. Should deficiencies be noted during the on-site visit, the owners/operator will often be given an opportunity to make corrections prior to enforcement or permit action being taken. In the event the efforts at voluntary compliance fail, civil enforcement or the issuance of a permit will be pursued to bring about the necessary corrective measures.

Because these facilities are "non-regulated", it is difficult to assess the impacts to the environment. As well, pastures or other temporary feeding practices may contribute to the *E. coli* impairments if conditions are such that run-off from the site occurs. In lieu of regulatory requirements, the NDEQ will first look to the USDA-Natural Resource Conservation Service for assistance utilizing programs under the control of the Service such as Conservation Reserve Program, Environmental Quality Incentives Program, Conservation Farm Option, Conservation of Private Grazing Land Initiative, the Wetlands Reserve Program and others that aid in the maintenance and improvement of water quality.

### 3.6 Section 319 – Nonpoint Source Management Program

The United States Environmental Protection Agency supplies grant funds to states to aid in managing nonpoint source pollution. When grant applications are submitted for review, an effort should be made to include the control of *E. coli* and surface run-off for the proposed projects in the Elkhorn River Basin. As well, an effort will be made to redirect applicants to develop proposals consistent with the goals of this TMDL. Preference may be given to those projects that will have a direct reduction in the *E. coli* contributions of nonpoint source discharges.

### 3.7 Non-Government Organizations

Several non-governmental organizations with an emphasis on agriculture disseminate information to their members on a regular basis. As well, some of the organizations have established environmental education programs to assist in the understanding of environmental regulations and topics. The NDEQ will communicate with these entities in an attempt to utilize the membership distribution process as a means of providing information on the water quality impairments, the TMDL and suggestions to assist in solving the identified problems.

### 3.8 Reasonable Assurances

The NDEQ is responsible for the issuance of NPDES or state operating permits for industrial and municipal wastewater discharges, regulated stormwater discharges and livestock operations (open lot or confined). Issued permits must be consistent with or more stringent then the wasteload allocations set forth by this TMDL. Compliance with the permit may require construction or modification of a facility and the issued permits may account for this through the inclusion of a compliance schedule or administrative order.

Effective management of nonpoint source pollution in Nebraska necessarily requires a cooperative and coordinated effort by many agencies and organizations, both public and private. Each organization is uniquely equipped to deliver specific services and assistance to the citizens of Nebraska to help reduce the effects of nonpoint source pollution on the State's water resources. While a few of the organizations have been previously identified, Appendix A is a more complete compilation of those entities that may be included in the implementation process. These agencies have been identified as being responsible for program oversight or fund allocation that may be useful in addressing and reducing *E. coli* contributions to the Elkhorn River. Participation will depend on the agency/organization's program capabilities.

## 4.0 Future Monitoring

Future monitoring will generally be consistent with the ambient monitoring and rotating basin monitoring scheme. The Elkhorn River Basin was monitored in 2005 and will again be targeted in 2010. An effort will be made to expand the monitoring to isolate areas of concern and to focus resources to address identified problems.

Periodically, compliance monitoring will be conducted at NPDES permitted facilities to verify permit limitations are being adhered to. Facilities are selected either randomly or in response to inspection or reported information.

As well, the NPDES permits require self-monitoring of the effluent by the permittee with the frequency of the monitoring being based on the discharge characteristics. The data is then reported to NDEQ quarterly, semiannually or annually and entered into the EPA's Permitting Compliance System. The compliance monitoring and self-monitoring information will be used in assessing the success of the TMDL.

Recently, analytical techniques have been introduced that may provide a greater level of confidence in the identification of pollutant sources. These techniques include microbial source tracking and specialized sampling the targets human wastewater. As the science progresses the application of these analytical techniques may become a valuable tool for source identification and pollutant reduction.

## 5.0 Public Participation

The availability of the TMDLs in draft form was published on the Department Internet site with the public comment period running from approximately January 22, 2009 to March 1, 2009. Interested stakeholders were informed via email of the availability of the draft TMDLs. No comments were received in response to the public notice.

## 6.0 References

Chapman, Shannen, S. Omernik, J.M., Freeouf, J.A., Huggins, D.G., McCauley, J.R., Freeman, C.C., Steiner, G.A., Robert, T., Schlepp, R.L., 2001. Ecoregions of Nebraska and Kansas (color poster with map, descriptive text, summary tables and photographs): Reston, Virginia, U.S. Geological Survey

EPA 1999. Protocol for Developing Nutrient TMDLs. United States Environmental Protection Agency. Office of Water, 4503 F, Washington, DC.

NDEQ 2002. Nebraska's Approach for Developing TMDLs for Streams Using the Load Duration Curve Methodology. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2005a. Title 130 – Rules and Regulations Pertaining to Livestock Waste Control. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2005b. Title 119 – Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2006. Title 117 – Nebraska Surface Water Quality Standards. Nebraska Department of Environmental Quality. Lincoln, NE.

NDEQ 2007. Methodologies for Waterbody Assessments and Development the 2008 Integrated Report for Nebraska. Nebraska Department of Environmental Quality. Lincoln, NE.

## 6.0 References (continued)

NDEQ 2008. 2008 Nebraska Water Quality Integrated Report. Nebraska Department of Environmental Quality. Lincoln, NE.

NNRC 1975. Elkhorn River Basin Water Quality Management Plan. Nebraska Natural Resources Commission. Lincoln, NE.

## Appendix A – Federal, State Agency and Private Organizations Included in TMDL Implementation.

**FEDERAL**

- ❑ Bureau of Reclamation
- ❑ Environmental Protection Agency
- ❑ Fish and Wildlife Service
- ❑ Geological Survey
- ❑ Department of Agriculture - Farm Services Agency
- ❑ Department of Agriculture - Natural Resources Conservation Service

**STATE**

- ❑ Nebraska Association of Resources Districts
- ❑ Department of Agriculture
- ❑ Department of Environmental Quality
- ❑ Department of Roads
- ❑ Department of Water Resources
- ❑ Department of Health and Human Services
- ❑ Environmental Trust
- ❑ Game and Parks Commission
- ❑ Natural Resources Commission
- ❑ University of Nebraska Institute of Agriculture and Natural Resources (IANR)
- ❑ UN-IANR: Agricultural Research Division
- ❑ UN-IANR: Cooperative Extension Division
- ❑ UN-IANR: Conservation and Survey Division
- ❑ UN-IANR: Nebraska Forest Service
- ❑ UN-IANR: Water Center and Environmental Programs

**LOCAL**

- ❑ Natural Resources Districts
- ❑ County Governments (Zoning Board)
- ❑ City/Village Governments

**NON-GOVERNMENTAL ORGANIZATIONS**

- ❑ Nebraska Wildlife Federation
- ❑ Pheasants Forever
- ❑ Nebraska Water Environment Association
- ❑ Nebraska Corn Growers Association, Wheat Growers, etc.
- ❑ Nebraska Cattlemen's Association, Pork Producers, etc
- ❑ Other specialty interest groups
- ❑ Local Associations (i.e. homeowners associations)

## Appendix B – Daily Load Expression for Elkhorn Basin TMDLs

Loading capacities and wasteload allocations will be expressed as daily counts using the following equation:

$$Q*35683.2 \text{ cfu/ft}^3*86400 \text{ seconds/day}$$

Daily expression of the margin of safety will be 10% of the loading capacity. The load allocation will be the remaining load available after accounting for the wasteload allocation and the margin of safety.

The tables and charts below are the daily expressions for the TMDLs contained in this document.

**Table B1 Daily TMDL Expression for EL1-10000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 99 | 3.0522E+11 | 5.216E+10 | 3.052E+10 | 2.22533E+11 |
| 90% | 0.1 | 429 | 1.32231E+12 | 5.216E+10 | 1.322E+11 | 1.13791E+12 |
| 80% | 0.2 | 583 | 1.79741E+12 | 5.216E+10 | 1.797E+11 | 1.5655E+12 |
| 70% | 0.3 | 832 | 2.56415E+12 | 5.216E+10 | 2.564E+11 | 2.25557E+12 |
| 60% | 0.4 | 1040 | 3.20635E+12 | 5.216E+10 | 3.206E+11 | 2.83355E+12 |
| 50% | 0.5 | 1290 | 3.97711E+12 | 5.216E+10 | 3.977E+11 | 3.52723E+12 |
| 40% | 0.6 | 1620 | 4.99451E+12 | 5.216E+10 | 4.995E+11 | 4.44289E+12 |
| 30% | 0.7 | 2120 | 6.53602E+12 | 5.216E+10 | 6.536E+11 | 5.83025E+12 |
| 20% | 0.8 | 2950 | 9.09493E+12 | 5.216E+10 | 9.095E+11 | 8.13328E+12 |
| 10% | 0.9 | 4540 | 1.39969E+13 | 5.216E+10 | 1.4E+12 | 1.25451E+13 |
| 0% | 1 | 31500 | 9.71154E+13 | 5.216E+10 | 9.712E+12 | 8.73517E+13 |

**Figure B1 EL1-10000 Daily Load Expression Chart**

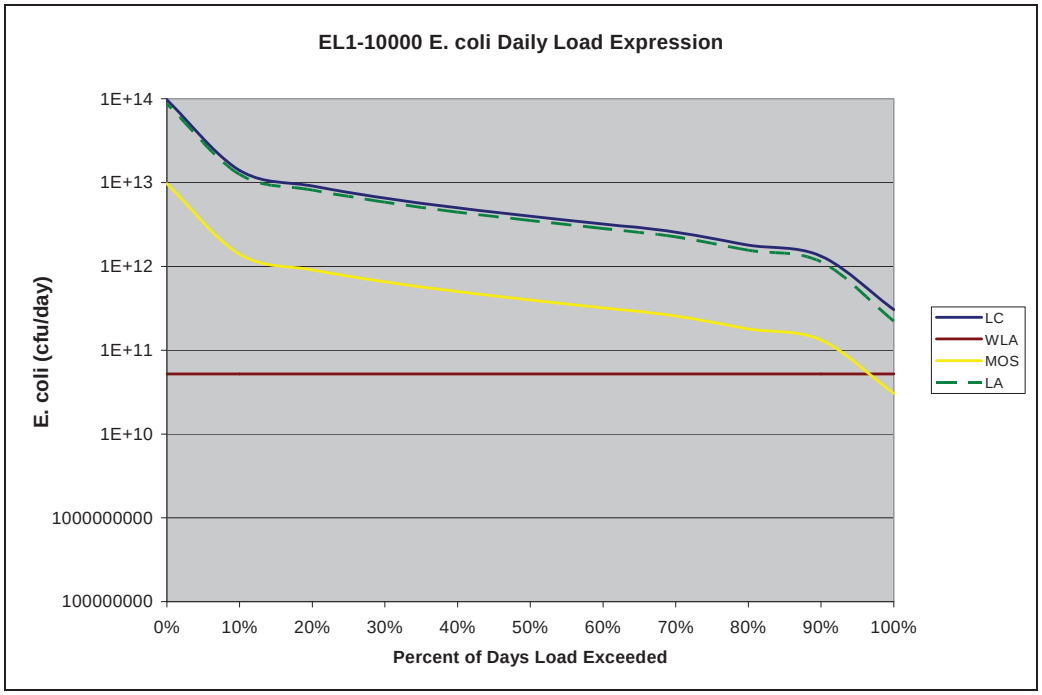


**Table B2 Daily TMDL Expression for EL1-10900**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 1.4 | 4.32E+09 | 8.51E+08 | 4.32E+08 | 3.03E+09 |
| 90% | 0.1 | 8.2 | 2.52E+10 | 8.51E+08 | 2.52E+09 | 2.18E+10 |
| 80% | 0.2 | 16 | 4.93E+10 | 8.51E+08 | 4.93E+09 | 4.35E+10 |
| 70% | 0.3 | 30 | 9.25E+10 | 8.51E+08 | 9.25E+09 | 8.24E+10 |
| 60% | 0.4 | 40 | 1.23E+11 | 8.51E+08 | 1.23E+10 | 1.1E+11 |
| 50% | 0.5 | 52 | 1.6E+11 | 8.51E+08 | 1.6E+10 | 1.43E+11 |
| 40% | 0.6 | 66 | 2.03E+11 | 8.51E+08 | 2.03E+10 | 1.82E+11 |
| 30% | 0.7 | 93 | 2.87E+11 | 8.51E+08 | 2.87E+10 | 2.57E+11 |
| 20% | 0.8 | 128 | 3.95E+11 | 8.51E+08 | 3.95E+10 | 3.54E+11 |
| 10% | 0.9 | 230 | 7.09E+11 | 8.51E+08 | 7.09E+10 | 6.38E+11 |
| 0% | 1 | 10400 | 3.21E+13 | 8.51E+08 | 3.21E+12 | 2.89E+13 |

**Figure B2 EL1-10090 Daily Load Expression Chart**

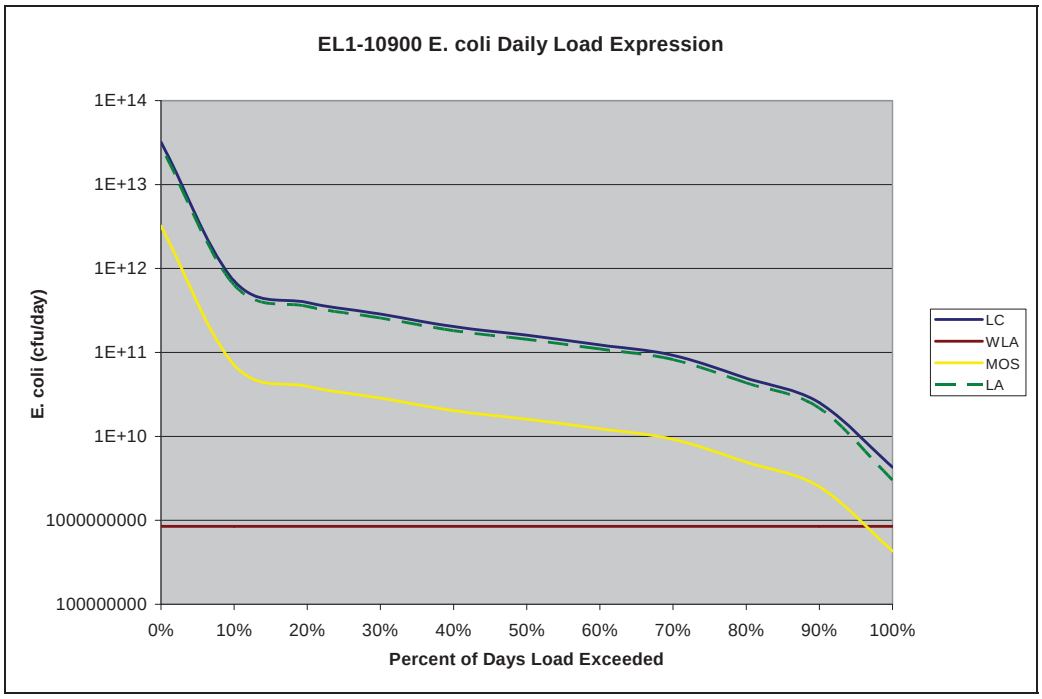


**Table B3 Daily TMDL Expression for EL1-20000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 69 | 2.13E+11 | 1.7512E+10 | 2.13E+10 | 1.74E+11 |
| 90% | 0.1 | 222 | 6.84E+11 | 1.7512E+10 | 6.84E+10 | 5.98E+11 |
| 80% | 0.2 | 296 | 9.12E+11 | 1.7512E+10 | 9.12E+10 | 8.03E+11 |
| 70% | 0.3 | 394 | 1.21E+12 | 1.7512E+10 | 1.21E+11 | 1.08E+12 |
| 60% | 0.4 | 502 | 1.55E+12 | 1.7512E+10 | 1.55E+11 | 1.38E+12 |
| 50% | 0.5 | 629 | 1.94E+12 | 1.7512E+10 | 1.94E+11 | 1.73E+12 |
| 40% | 0.6 | 848 | 2.61E+12 | 1.7512E+10 | 2.61E+11 | 2.34E+12 |
| 30% | 0.7 | 1160 | 3.58E+12 | 1.7512E+10 | 3.58E+11 | 3.2E+12 |
| 20% | 0.8 | 1640 | 5.06E+12 | 1.7512E+10 | 5.06E+11 | 4.53E+12 |
| 10% | 0.9 | 2410 | 7.43E+12 | 1.7512E+10 | 7.43E+11 | 6.67E+12 |
| 0% | 1 | 25500 | 7.86E+13 | 1.7512E+10 | 7.86E+12 | 7.07E+13 |

**Figure B3 EL1-20000 Daily Load Expression Chart**

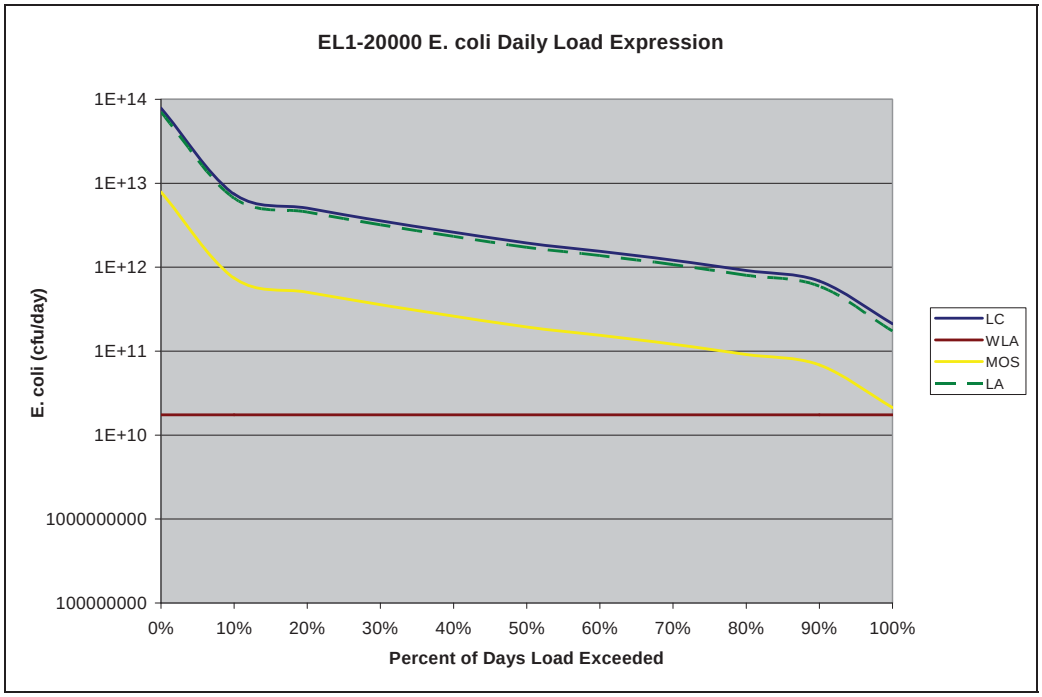


**Table B4 Daily TMDL Expression for EL1-20100**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 4.3 | 1.33E+10 | 9.06E+08 | 1.326E+09 | 1.1025E+10 |
| 90% | 0.1 | 12 | 3.7E+10 | 9.06E+08 | 3.7E+09 | 3.239E+10 |
| 80% | 0.2 | 18 | 5.55E+10 | 9.06E+08 | 5.549E+09 | 4.9039E+10 |
| 70% | 0.3 | 24 | 7.4E+10 | 9.06E+08 | 7.399E+09 | 6.5687E+10 |
| 60% | 0.4 | 30 | 9.25E+10 | 9.06E+08 | 9.249E+09 | 8.2335E+10 |
| 50% | 0.5 | 37 | 1.14E+11 | 9.06E+08 | 1.141E+10 | 1.0176E+11 |
| 40% | 0.6 | 45 | 1.39E+11 | 9.06E+08 | 1.387E+10 | 1.2396E+11 |
| 30% | 0.7 | 56 | 1.73E+11 | 9.06E+08 | 1.726E+10 | 1.5448E+11 |
| 20% | 0.8 | 76 | 2.34E+11 | 9.06E+08 | 2.343E+10 | 2.0997E+11 |
| 10% | 0.9 | 135 | 4.16E+11 | 9.06E+08 | 4.162E+10 | 3.7368E+11 |
| 0% | 1 | 13600 | 4.19E+13 | 9.06E+08 | 4.193E+12 | 3.7735E+13 |

**Figure B4 EL1-20100 Daily Load Expression Chart**

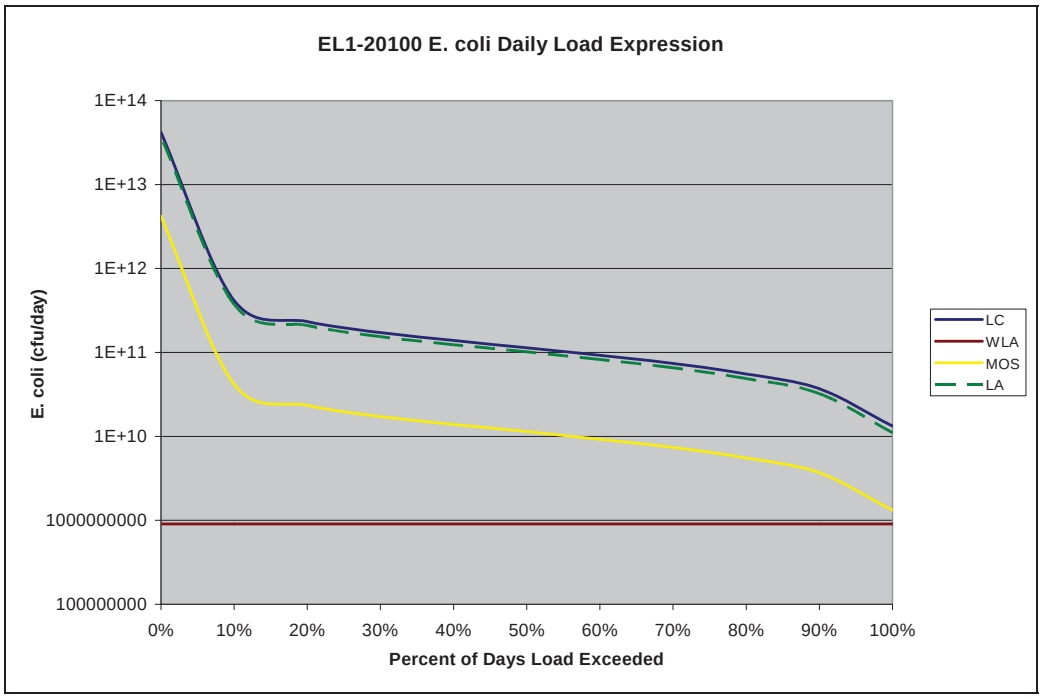


**Table B5 Daily TMDL Expression for EL3-20000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 2.7 | 8.324E+09 | 9.87E+08 | 8.32E+08 | 6.51E+09 |
| 90% | 0.1 | 14 | 4.316E+10 | 9.87E+08 | 4.32E+09 | 3.79E+10 |
| 80% | 0.2 | 23 | 7.029E+10 | 9.87E+08 | 7.03E+09 | 6.23E+10 |
| 70% | 0.3 | 34 | 1.048E+11 | 9.87E+08 | 1.05E+10 | 9.34E+10 |
| 60% | 0.4 | 45 | 1.387E+11 | 9.87E+08 | 1.39E+10 | 1.24E+11 |
| 50% | 0.5 | 61 | 1.881E+11 | 9.87E+08 | 1.88E+10 | 1.68E+11 |
| 40% | 0.6 | 84 | 2.602E+11 | 9.87E+08 | 2.6E+10 | 2.33E+11 |
| 30% | 0.7 | 115 | 3.545E+11 | 9.87E+08 | 3.55E+10 | 3.18E+11 |
| 20% | 0.8 | 167 | 5.149E+11 | 9.87E+08 | 5.15E+10 | 4.62E+11 |
| 10% | 0.9 | 296 | 9.129E+11 | 9.87E+08 | 9.13E+10 | 8.21E+11 |
| 0% | 1 | 2280 | 7.029E+12 | 9.87E+08 | 7.03E+11 | 6.33E+12 |

**Figure B5 EL3-20000 Daily Load Expression Chart**

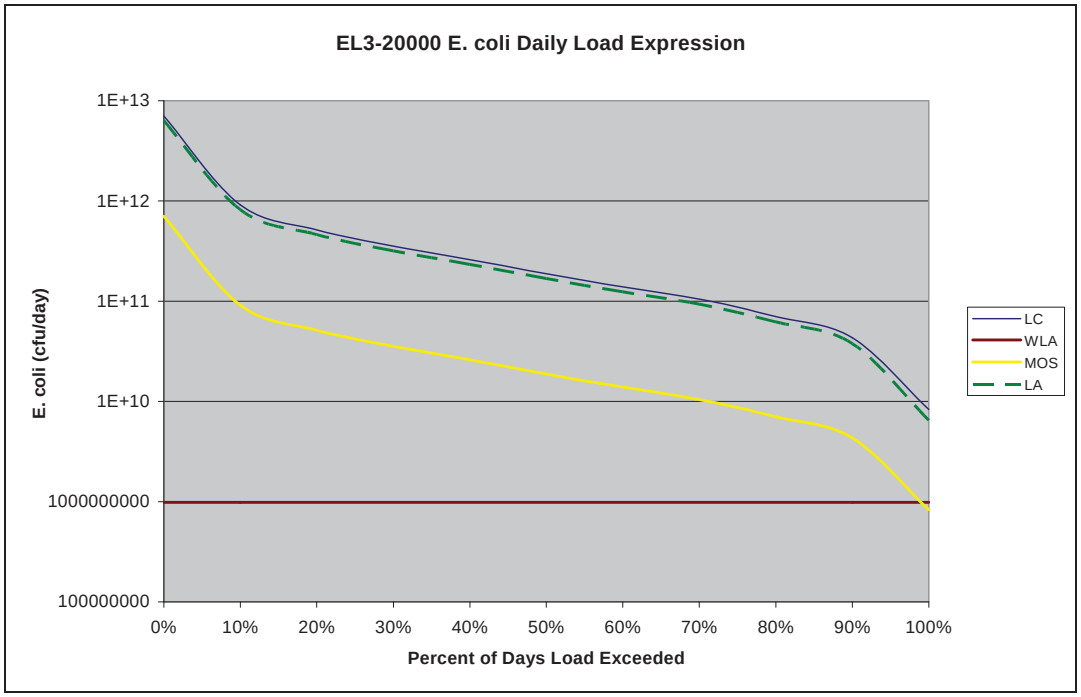


**Table B6 Daily TMDL Expression for EL4-10000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 47 | 1.45E+11 | 3.61E+10 | 1.45E+10 | 9.43E+10 |
| 90% | 0.1 | 129 | 3.98E+11 | 3.61E+10 | 3.98E+10 | 3.22E+11 |
| 80% | 0.2 | 171 | 5.27E+11 | 3.61E+10 | 5.27E+10 | 4.38E+11 |
| 70% | 0.3 | 214 | 6.6E+11 | 3.61E+10 | 6.6E+10 | 5.58E+11 |
| 60% | 0.4 | 271 | 8.36E+11 | 3.61E+10 | 8.36E+10 | 7.16E+11 |
| 50% | 0.5 | 328 | 1.01E+12 | 3.61E+10 | 1.01E+11 | 8.74E+11 |
| 40% | 0.6 | 407 | 1.25E+12 | 3.61E+10 | 1.25E+11 | 1.09E+12 |
| 30% | 0.7 | 566 | 1.74E+12 | 3.61E+10 | 1.74E+11 | 1.53E+12 |
| 20% | 0.8 | 815 | 2.51E+12 | 3.61E+10 | 2.51E+11 | 2.23E+12 |
| 10% | 0.9 | 1250 | 3.85E+12 | 3.61E+10 | 3.85E+11 | 3.43E+12 |
| 0% | 1 | 17500 | 5.4E+13 | 3.61E+10 | 5.4E+12 | 4.85E+13 |

**Figure B6 EL4-10000 Daily Load Expression Chart**

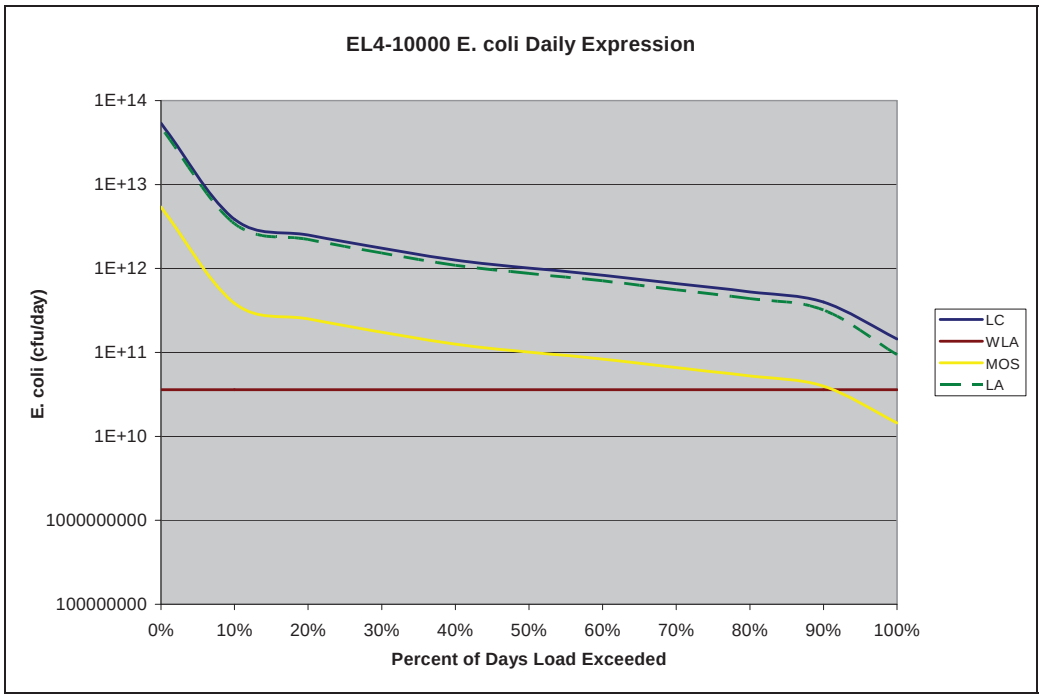


**Table B7 Daily TMDL Expression for EL4-20000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 33 | 1.02E+11 | 9.25E+08 | 1.02E+10 | 9.06E+10 |
| 90% | 0.1 | 71 | 2.19E+11 | 9.25E+08 | 2.19E+10 | 1.96E+11 |
| 80% | 0.2 | 103 | 3.18E+11 | 9.25E+08 | 3.18E+10 | 2.85E+11 |
| 70% | 0.3 | 136 | 4.19E+11 | 9.25E+08 | 4.19E+10 | 3.76E+11 |
| 60% | 0.4 | 169 | 5.21E+11 | 9.25E+08 | 5.21E+10 | 4.68E+11 |
| 50% | 0.5 | 203 | 6.26E+11 | 9.25E+08 | 6.26E+10 | 5.62E+11 |
| 40% | 0.6 | 256 | 7.9E+11 | 9.25E+08 | 7.9E+10 | 7.11E+11 |
| 30% | 0.7 | 353 | 1.09E+12 | 9.25E+08 | 1.09E+11 | 9.79E+11 |
| 20% | 0.8 | 516 | 1.59E+12 | 9.25E+08 | 1.59E+11 | 1.43E+12 |
| 10% | 0.9 | 963 | 2.97E+12 | 9.25E+08 | 2.97E+11 | 2.67E+12 |
| 0% | 1 | 18000 | 5.55E+13 | 9.25E+08 | 5.55E+12 | 4.99E+13 |

**Figure B7 EL4-20000 Daily Load Expression Chart**

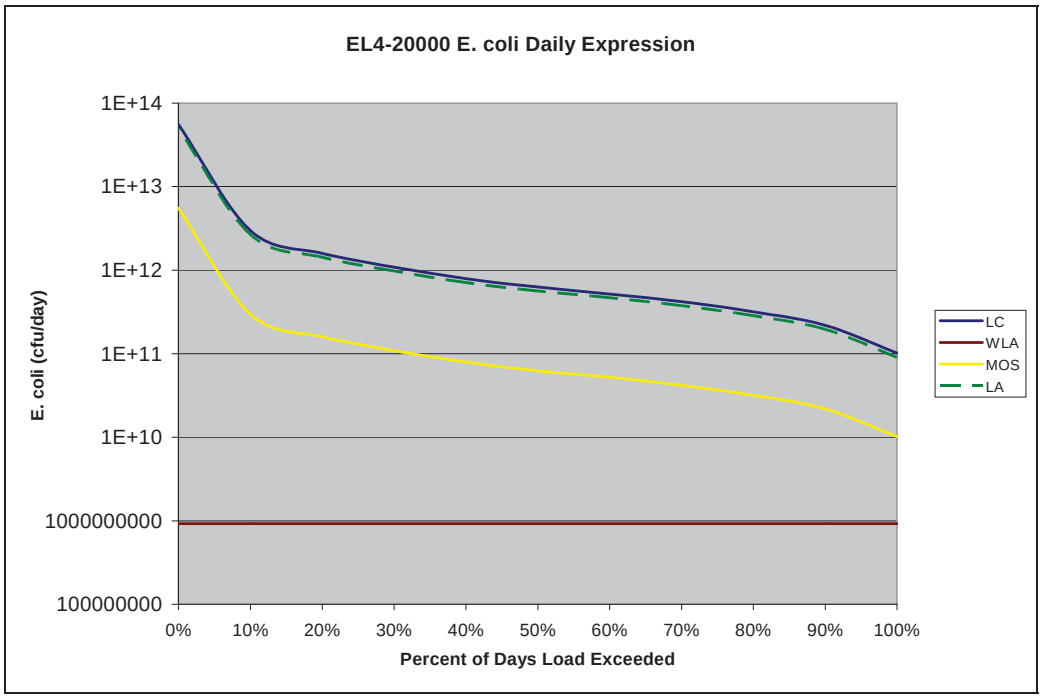


**Table B8 Daily TMDL Expression for EL4-30000**

| Percent of Flows Exceed | 20 Year Flow Percentile | Segment Flow (cfs) | Loading Capacity | Wasteload Allocation | Margin of Safety | Load Allocation |
|---|---|---|---|---|---|---|
| 100% | 0 | 5 | 1.387E+10 | 5.734E+09 | 1.39E+09 | 6.75E+09 |
| 90% | 0.1 | 17 | 5.241E+10 | 5.734E+09 | 5.24E+09 | 4.14E+10 |
| 80% | 0.2 | 32 | 9.866E+10 | 5.734E+09 | 9.87E+09 | 8.31E+10 |
| 70% | 0.3 | 45 | 1.387E+11 | 5.734E+09 | 1.39E+10 | 1.19E+11 |
| 60% | 0.4 | 60 | 1.85E+11 | 5.734E+09 | 1.85E+10 | 1.61E+11 |
| 50% | 0.5 | 78 | 2.405E+11 | 5.734E+09 | 2.4E+10 | 2.11E+11 |
| 40% | 0.6 | 103 | 3.176E+11 | 5.734E+09 | 3.18E+10 | 2.8E+11 |
| 30% | 0.7 | 148 | 4.563E+11 | 5.734E+09 | 4.56E+10 | 4.05E+11 |
| 20% | 0.8 | 241 | 7.436E+11 | 5.734E+09 | 7.44E+10 | 6.64E+11 |
| 10% | 0.9 | 516 | 1.591E+12 | 5.734E+09 | 1.59E+11 | 1.43E+12 |
| 0% | 1 | 8480 | 2.614E+13 | 5.734E+09 | 2.61E+12 | 2.35E+13 |

**Figure B8 EL4-30000 Daily Load Expression Chart**