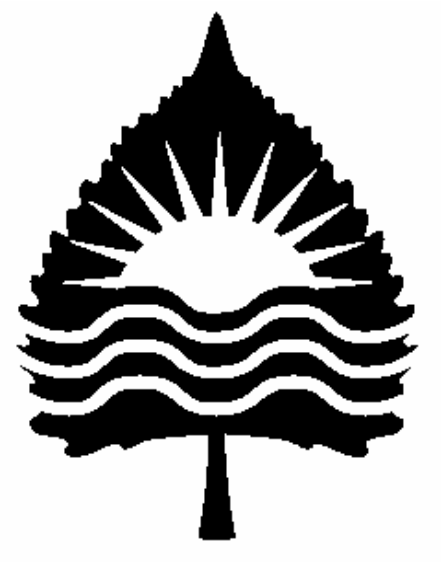

Total Maximum Daily Loads for the Little Blue River Basin

(Segments LB1-10000 and LB2-10000)

Parameters of Concern: Fecal coliform and *E. coli* Bacteria

Nebraska Department of Environmental Quality
Planning Unit, Water Quality Division

February 2005

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Executive Summary

Two segments in the Little Blue River Basin were included in the 2004 Nebraska Surface Water Quality Integrated Report (NDEQ 2004) in Category 5 as impaired by excessive *E.* coli and fecal coliform bacteria. As such, total maximum daily loads must be developed in accordance with the Clean Water Act. Based on the strategy of a basin wide approach as well as the hydrologic connections, TMDLs have been developed and included for both waterbodies. In 2002, the Department opted to convert from fecal coliform to *E.* coli bacteria as the indicator for primary contact recreation assessment. This document presents TMDLs for *E. coli* that are designed to allow the Little Blue River segments to fully support the primary contact recreation beneficial use. The information contained herein should be considered 2 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.
Little Blue River Segments: LB1-10000 and LB2-10000.

2. Identification of the pollutant and applicable water quality standard
The pollutants causing the impairment(s) of the water quality standard and designated beneficial use are fecal coliform and *E. coli* bacteria. Designated uses assigned to the above-identified segments include: primary contact recreation, aquatic life Warmwater class A, agriculture water supply class A and aesthetics (NDEQ 2002b). Excessive fecal coliform and *E. coli* have been determined to be impairing the primary contact recreation beneficial uses. The applicable water quality standards are a seasonal geometric mean of 200/100 ml with <10% of the samples being greater that 400/100ml for fecal coliform and a season geometric mean of 126/100 ml for *E. coli.*

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.

Segment	Fecal coliform - # colonies >200/100 ml	Fecal coliform - % samples > 400/100 ml	*E. coli* - # colonies >126/100 ml
LB1-10000	1295	71%	872
LB2-10000	254	38%	332

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

6. Wasteload allocations for pollutants from point sources.
The wasteload allocations for point source discharges will be equivalent to the water quality criteria associated with the primary contact recreation beneficial use. Therefore, the WLA is a monthly geometric mean of 126/100 ml.

7. Load allocations for pollutants from nonpoint sources.

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

8 A margin of safety.

These TMDLs contain an implicit and explicit margin of safety. Specifically, decay/die-off from the potential source to the recreational segment was not included in the pollutant source evaluation, all point sources were assumed to be discharging the expected concentration. As well, the targeted reduction will be 90% (113/100 ml) of the water quality target

9. Consideration for seasonal variation.

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 these TMDLs.

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 "phased TMDLs" 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 TMDLs 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

Two designated segments within the Little Blue River basin were listed on the 1998 Section 303(d) list of impaired waters (NDEQ 1998) as not supporting the primary contact recreation beneficial use with the pollutant of concern being pathogens (fecal coliform bacteria). The 2002 Section 303(d) list also included these 2 waterbodies on Part 1. Additional information was collected during the 2002 recreation season (May 1 to September 30) as part of the rotating basin monitoring scheme, for additional beneficial use assessments and to support the development of the total maximum daily loads (TMDLs). This new data indicated the primary contact recreation beneficial use remained impaired within both segments. The Nebraska 2004 Surface Water Quality Integrated Report (Integrated Report) included both segments in Category 5 – impaired and needing a TMDL.

Table 1.0 Section 303(d) Listing Summary for the Little River Segments in 1998 and 2002

Segment	1998 303(d) List	2002 303(d) List	2004 Integrated Report
LB1-10000	Yes	Part 1	Category 5
LB2-10000	Yes	Part 1	Category 5

Based on the above, and as required by Section 303(d) of the Clean Water Act and 40 CFR Part 130, TMDLs have been developed for the impaired waters identified in Category 5 of the 2004 Integrated Report. The approach for these TMDLs will be to address all of the identified waterbodies simultaneously or as a watershed. Based on this, the information contained herein should be considered 2 TMDLs.

1.1 Background Information

The Little Blue River Basin, located in south central, Nebraska (Figure 1.1), originates in central NE and extends in a southeastward direction and eventually exits the state into Kansas. Stream flow in the Little Blue basin is dependent upon precipitation and is subject to rapid increases. There are no impoundments on the main segments of the Little Blue River. Several municipalities lie in the basin ranging from first class cities to villages.

1.1.1 Waterbody Information

1.1.1.1 Waterbody Name(s): Little Blue River
Stream Identification Numbers: LB1-10000, LB1-10000.

1.1.1.2 Major River Basin: Kansas

1.1.1.3 Minor River Basin: Little Blue

1.1.1.4 Hydrologic Unit Codes: 10270206 and 10270207.

1.1.1.5 Assigned Beneficial Uses: Source: Title 117 – Nebraska Surface Water Quality Standards

Segment	Primary Contact Recreation	Aquatic Life Use	Agriculture	Aesthetics	Key Aquatic Species
LB1-10000	Yes	Warmwater A	Ag A	Yes	Channel Catfish and Flathead Catfish
LB2-10000	Yes	Warmwater A	Ag A	Yes	Channel Catfish and Flathead Catfish

Major Tributaries: Rose Creek, Big Sandy Creek and Spring Creek

Figure 1.1 Location of Little Blue River Basin

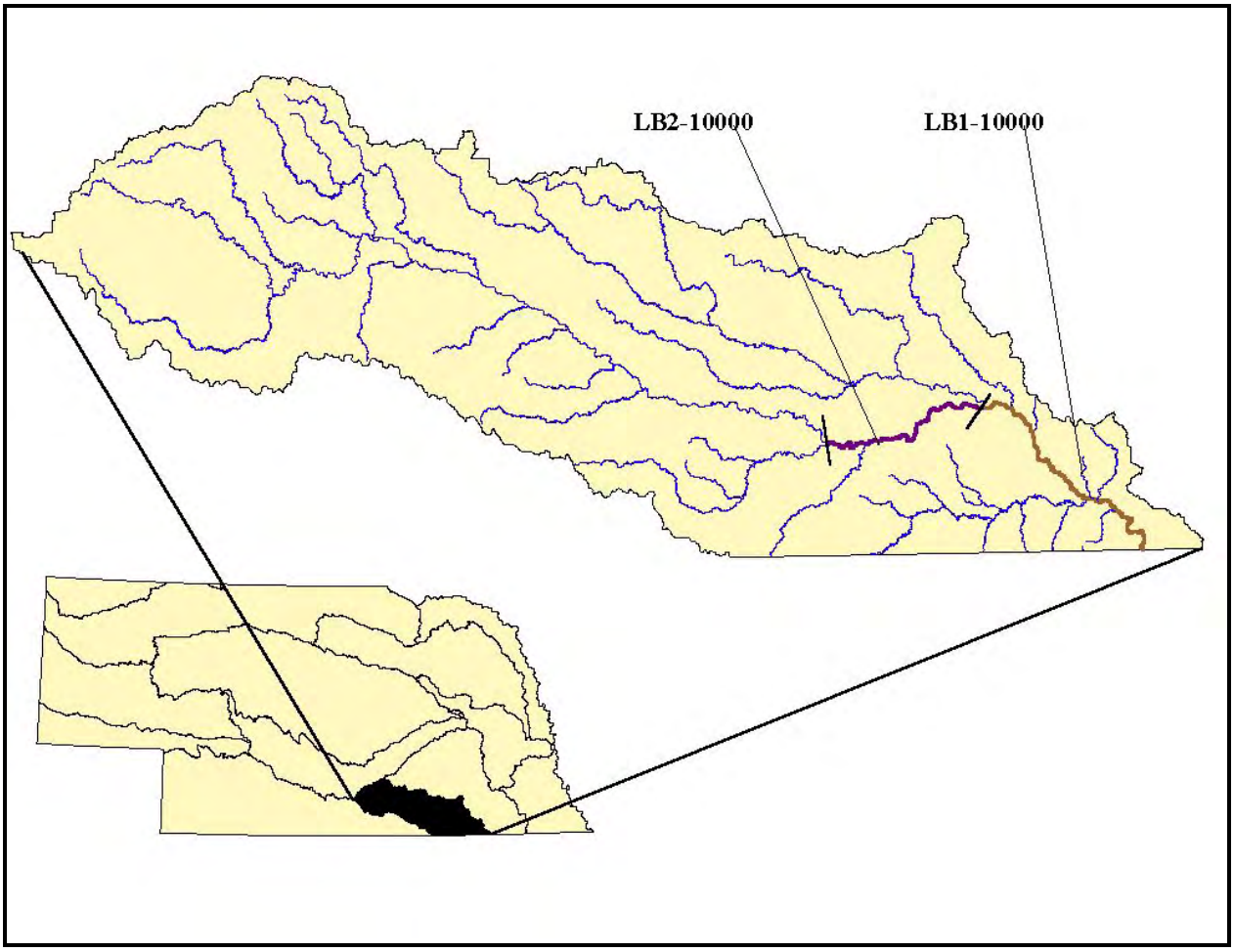


Table 1.1 Physical Description of the Little Blue River Basin

Parameter	Little Blue River
State	Nebraska
Counties (whole or in part)	Jefferson, Saline, Fillmore, Clay, Nuckolls, Adams, Thayer, Webster, Kearney, Franklin
Watershed Area	2,691 mi^2 (approximate)
Sub-basins	2
Designated Stream Segments	38
Stream Miles (designated)	545 miles

1.1.2 Watershed Characterization

1.1.2.1 Physical Features: The Little Blue River basin occupies approximately 2,691 mi^2 in south central Nebraska. The basin originates in southern Kearney and northern Franklin County and extends in a southeasterly fashion. The basin lies in the Central Great Plains ecoregion (Chapman, et. al. 2001). Agriculture dominates the land use of the basin with approximately 1.7 million acres being considered suitable for irrigation. Corn, sorghum, wheat, soybeans and alfalfa are the major crops grown.

Nearly all of the soils of the basin have developed from loess parent material, however there are areas of the lower basin that have developed from sandstone. Six soil associations are found within the basin with the Hastings-Crete soil association being the most extensive. The loess plains of the upper basin are have poorly defined drainage patterns and as the plains give way to gently rolling hills the drainage becomes more defined. Bedrock outcrops are near the surface on the steeper slopes of the lower basin (NNRC 1976).

The presence of the impermeable loess soils allows for little infiltration and thus stream flows are generally low during periods of no run-off and can be large and rapid during precipitation events. There are a few reaches of the Little Blue River where the channel intersects the adjacent sand and gravel aquifer resulting in a relatively high base flow. Irrigation withdrawal and returns can also affect the stream flow volume. The States of Kansas and Nebraska have entered into an agreement of appropriation where Nebraska has full use of the water except during May 1 to September 30 where flows ranging from 45 to 80 cfs must be allowed to pass into Kansas (NNRC 1976).

1.1.2.2 Climate: Precipitation ranges from an annual average of 25 inches in the western basin to 29.7 inches in the eastern end. Typically, a majority of the precipitation occurs as rainfall during the growing season and the distribution may not always favor crop production. Temperatures in the basin range from an average high in the upper 80's and lower 90's during the summer to average lows in the 10's during the winter (NRC Databank).

1.1.2.3 Demographics: Forty-four municipal entities reside either wholly or partially in the Little Blue basin boundaries and range from first class cities to villages to unincorporated communities. Some of the larger communities include: Hastings (24,064), Fairbury (4,262), Minden (2,990) and Hebron (1,565).

1.1.2.4 Land Use: Land use in the basin consists of dryland and irrigated crop ground, pasture, wetlands, forest and reservoirs. Corn, grain sorghum, soybeans and alfalfa are the major crops grown, however lesser amount of other crops can be found. Several sand and gravel operations are scattered among the tributaries of the lower basin along with a few limestone quarries (NNRC 1975). Water used for irrigation is mostly derived from ground water sources; however several surface water rights exist for diversion purposes.

2.0 *E. coli* TMDL

2.1 Problem Identification

Segments LB1-10000 and LB2-10000 were included in Category 5 of the 2004 Integrated Report as having an impaired primary contact recreation beneficial use with the parameter of concern being fecal coliform. This section deals with the extent and nature of water quality impairments caused by excessive bacteria in the Little Blue River Basin.

2.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The *Primary Contact Recreation* beneficial use has been deemed impaired or threatened on the above-identified two 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 2002b).

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 2 or 3 river basins each year with all 13 basins being (partially) examined in a 5 year period. Under the auspice of the rotating basin plan, data was collected from the Little Blue River basin in 1997 and 2002. Data collected in 2002 included stream flow (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 (Title 117) water quality standards, conducted in 2002, the Department proposed and ultimately received EPA approval to add *E. coli* as a parameter to assess primary contact recreation. The change was pursued based on EPA recommendations that States adopt the *E. coli* indicator as the organism is more scientifically defensible that fecal coliform. It is the Department's intention to remove fecal coliform as a Title 117 parameter in the future. Based upon this, *E. coli* data was also collected in 2002, was assessed and will be reported below.

Because fecal coliform will not be a data parameter included in future monitoring and the parameters are considered statistically equivalent, the TMDLs will focus on the *E. coli* data and the reductions necessary to meet these criteria.

2.1.3 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify impaired waters Category 5/impaired waters for the 2004 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 2004 Integrated Report for Nebraska,* October 2003.

The process used in assessing data to determine the use support of the *Primary Contact Recreation* beneficial use can be found in table 2.1.3.

2.1.4 Water Quality Conditions

Fecal coliform and *E. coli* data collected during the 2002 recreation season (May through September) was assessed to determine the beneficial use support for primary contact recreation. Table 2.1.4a presents the fecal coliform results and table 2.1.4b presents the *E coli* results.

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

Parameter	Season Geometric Mean	Single Sample Maximum	Supported	Impaired
Fecal coliform	≤200/100 ml	No more that 10% of Samples >400/100 ml	Season geometric mean ≤200/100 ml or ≤10% of samples exceed 400/100ml	Season geometric mean >200/100 ml and/or >10% of samples exceed 400/100ml
E. coli	≤126/100 ml	235-576/100 ml depending upon frequency of use	Season geometric mean ≤126/100 ml	Season geometric mean >126/100 ml

Table 2.1.4a Little Blue River Basin– 2002 Fecal coliform Data and Assessments

Segment	Site Location	USGS/DNR Gage Associated with Site	Number of Samples	Season Geometric Mean (#/100 ml)	# Samples >400/100 ml	% Samples >400/100 ml
LB1-10000	Little Blue River at Fairbury	06884000	21	1495	17	81%
LB2-10000	Little Blue River near Alexandria	None	21	454	10	48%

Table 2.1.4b Little Blue River Basin– 2002 *E. coli* Data and Assessments

Segment	Site Location	USGS/DNR Gage Associated with Site	Number of Samples	Season Geometric Mean (#/100 ml)
LB1-10000	Little Blue River at Fairbury	06884000	21	998
LB2-10000	Little Blue River near Alexandria	None	21	458

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 Little Blue River basin. Facility types include: municipal wastewater treatment facilities, confined animal feeding operations 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 Little Blue River Basin are shown in Figure 2.1.5.1a.

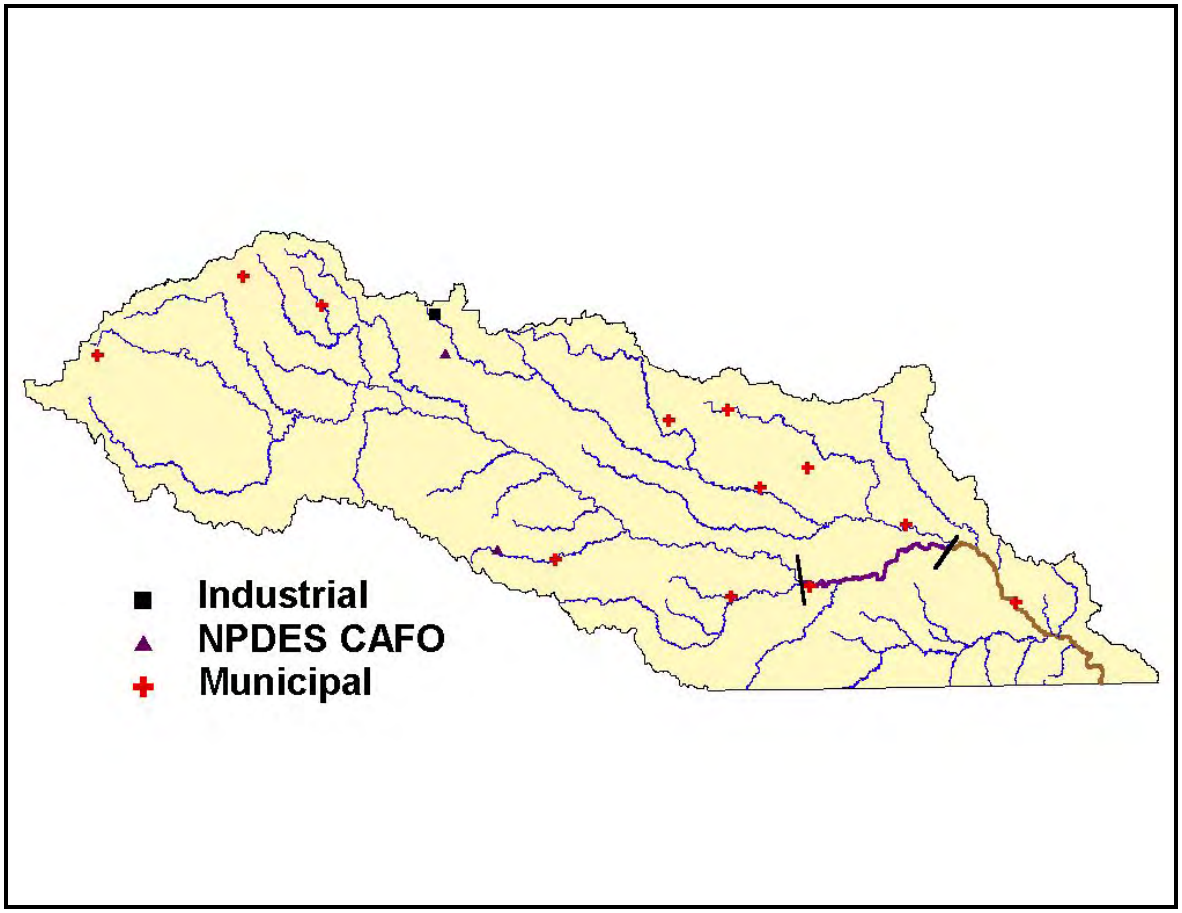
Illicit connections, discharges, combined sewer overflows; sanitary sewer overflows, straight pipes from septic tanks or other on-site wastewater systems can also be sources of *E. coli* bacteria.

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 Little Blue Basin. 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.

2.1.5.2 Nonpoint Sources: Several nonpoint sources of fecal coliform and *E. coli* exist in the Little Blue 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 fecal coliform and *E. coli* is wildlife. A variety of wildlife is native to or have adapted to the diverse habitat of the Little Blue River Basin (NNRC 1976). Big game, upland game, furbearers, waterfowl and non-game species have been documented to reside within the basin.

Figure 2.1.5.1a NPDES Permitted Facilities in the Little Blue 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:

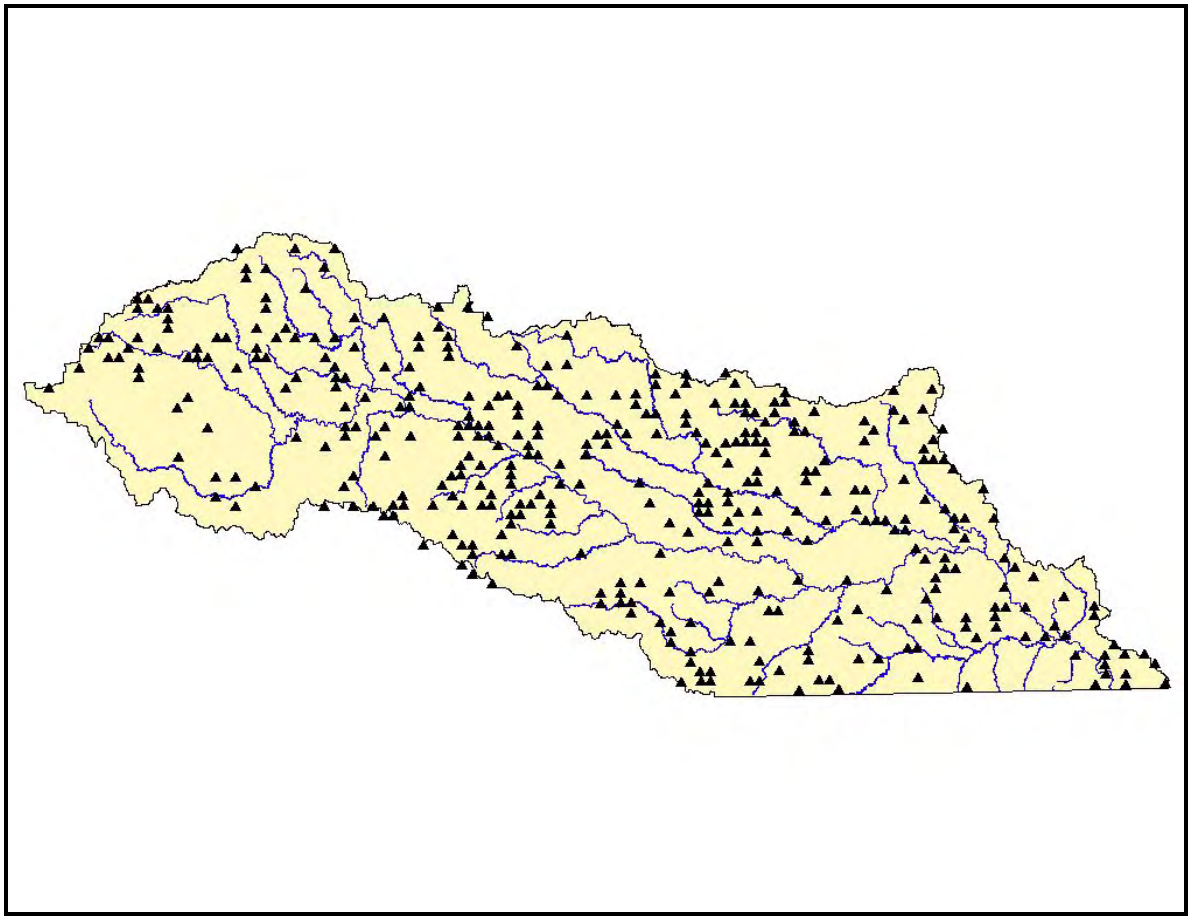
Fecal Coliform
Bacteria of the Fecal coliform group shall not exceed a geometric mean of 200/100 ml, nor exceed 400/100 ml, in more than 10% of the samples. These criteria are based upon a minimum of 5 samples taken within a 30-day period. This does not preclude fecal coliform limitations based on effluent guidelines.

These criteria apply during the recreational period of May 1 through September 30.

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. Single sample minimum allowable densities shall not exceed the following criteria.

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

Figure 2.1.5.1b Animal Feeding Operations in the Little Blue River Basin Issued or Requesting a State Construction or Operating Permit or Requesting an Inspection



The July 9, 2004 *Federal Register* contained information regarding the proposed rule for "Water Quality Standards for Costal and Great Lakes Recreational Waters". This proposed rule includes a discussion on the use of the single season maximum (SSM). Specifically:

"*EPA recognizes that the 1986 bacteria criteria document discusses SSMs solely in the context of beach closures. SSMs are particularly important in this context because States and Territories generally use one or two samples to make beach opening or closure decisions. EPA could thus interpret this 1986 bacteria criteria document as recommending the use of SSMs only for decision related to public health at beaches. Under this interpretation, the SSMs would be part of the water quality criteria, but only used for making beach closure and opening decisions. States and Territories could use only the geometric mean for other CWA purposes, such as NPDES permitting, TMDLs and waterbody assessments.*

Given the uncertainty over 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. The TMDL recognizes 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 load duration curve. Load duration 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:

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

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 load duration 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 load 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.

For segment LB2-10000 currently there is not an active gage recording the daily stream flow volume however, in the past flow was recorded. In order to develop the hydrograph and load curve for LB2-10000 the historic stream flow information and the data collected at the USGS gage located on the Little Blue River at Fairbury (#06884000) was used to extrapolated daily flow values and create the hydrograph for the period lacking data.

2.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the load duration curves (Figure 2.3.1a and 2.3.1b) 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.

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 2002 *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
LB1-10000	998	872
LB2-10000	458	332

Figure 2.3.1a. Load Curve for LB1-10000

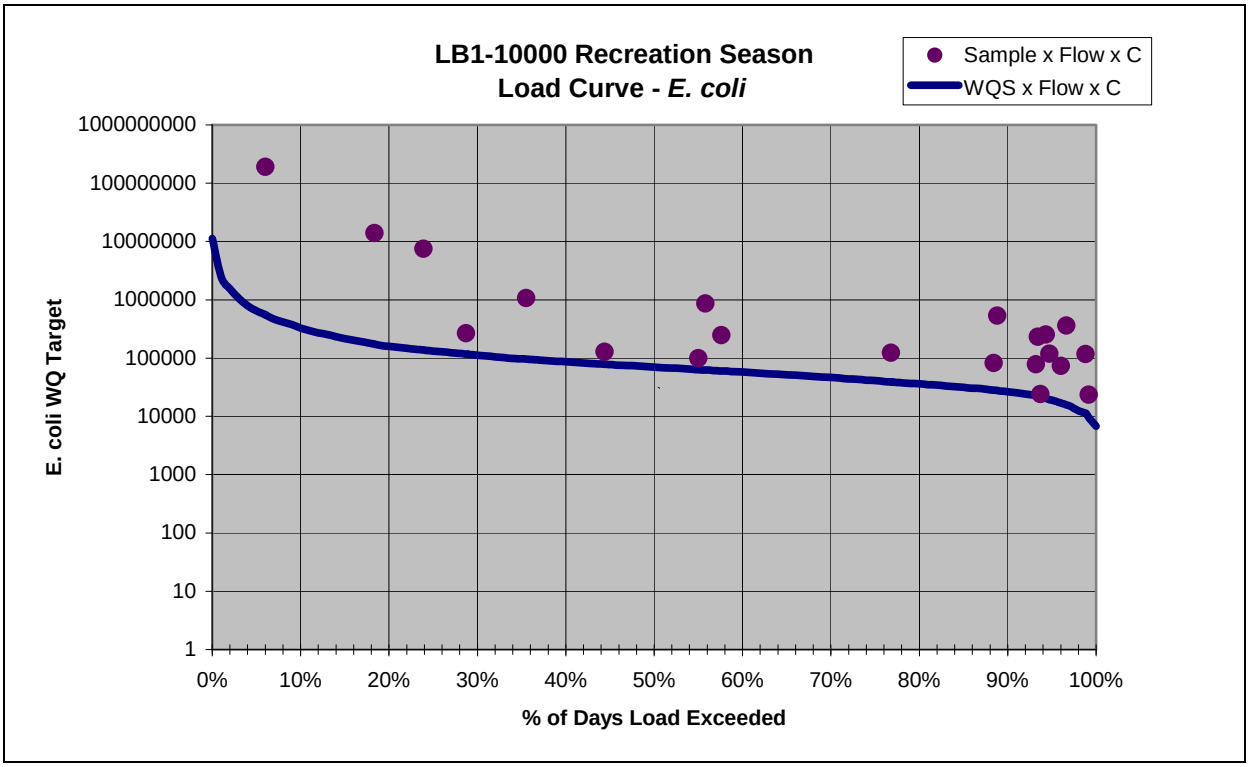
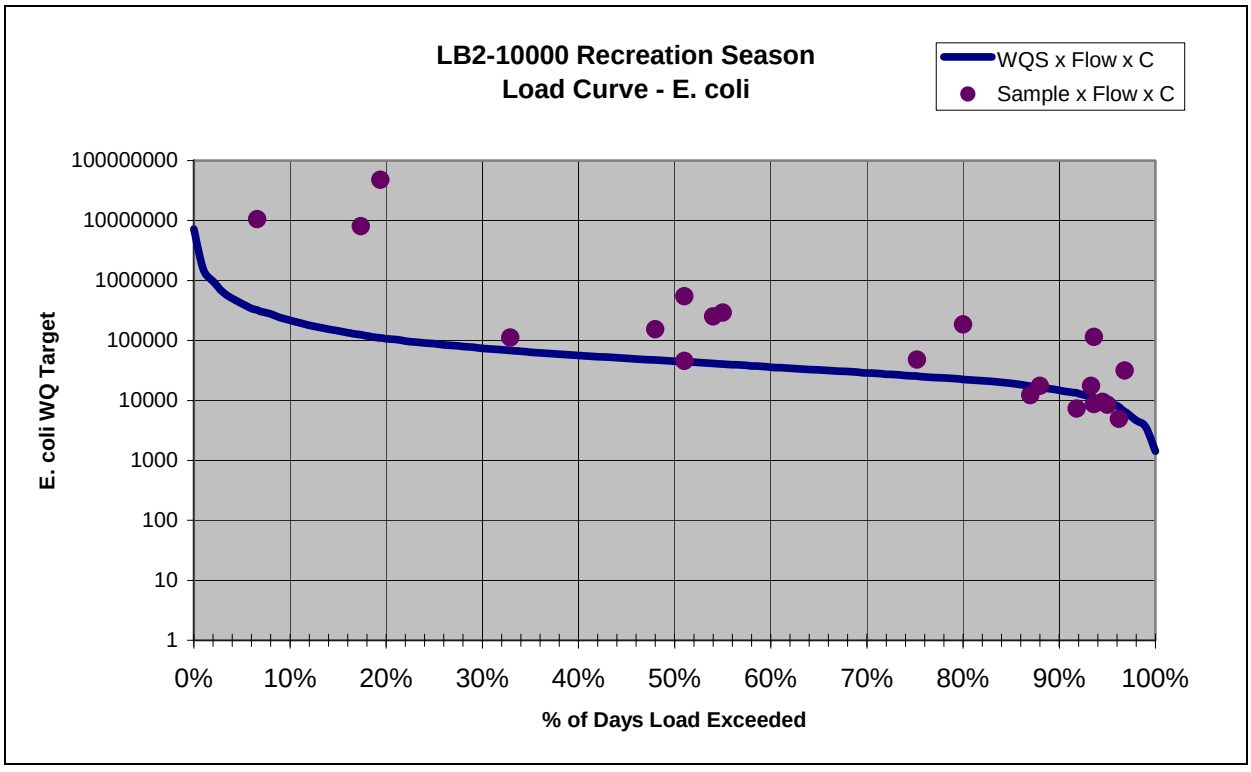


Figure 2.3.1b. Load Curve for LB2-10000



2.3.3 Identification of Pollutant Sources

Both point and nonpoint sources are known to exist along the segments 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
ΣQ_e	= sum of **all** design flows from point sources discharging to the segment (direct or via tributaries)
126/100 ml	= water quality standard

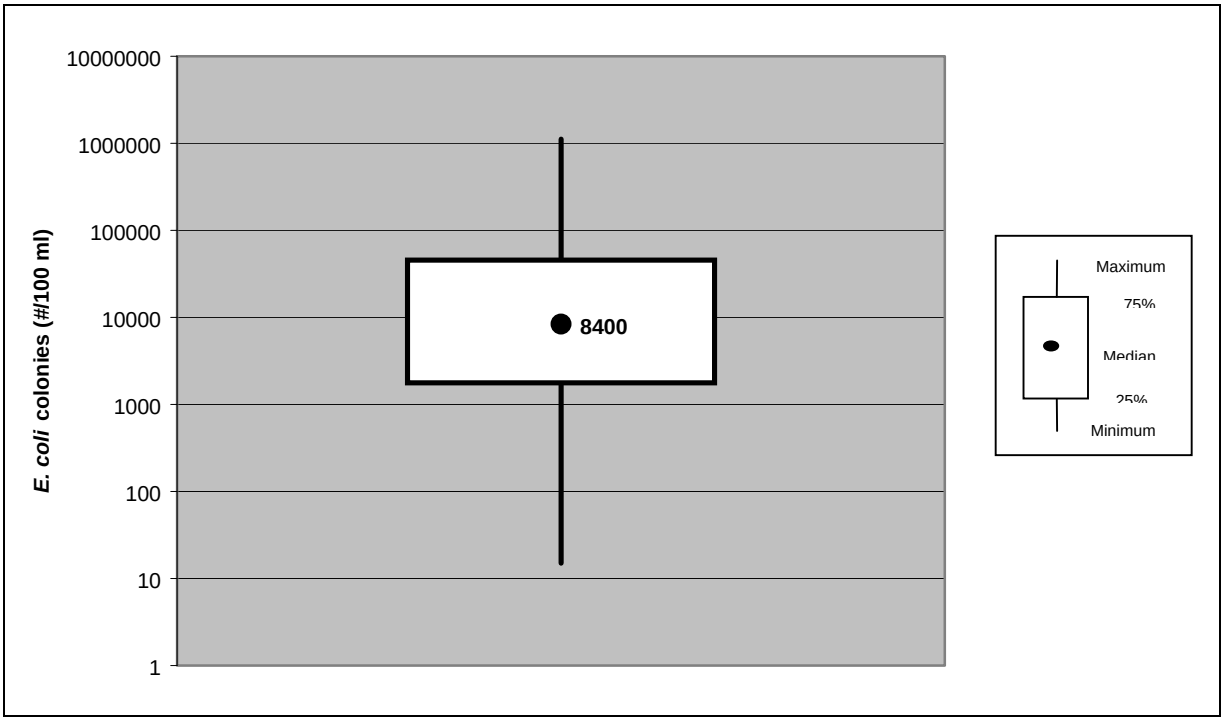
The values for ΣQ_e can be found in Table 2.3.3 as can the boundary flows

Table 2.3.3 Sum of Wastewater Treatment Facility Design Flows in the Little Blue River Basin

Segment	Total Number of Facilities	Sum of Contributing Facility Design Flows	Flow Value for Point vs. Nonpoint Boundary
LB1-10000	7	1.96 cfs	131 cfs
LB2-10000	6	2.31 cfs	154 cfs

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

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



2.3.3.1 Point Sources of *E. coli*: Based upon the load curves and the position of the monitoring data points, it appears point sources are contributing to the *E. coli* impairment within both LB1-10000 and LB2-10000. Several facilities discharge either directly to or into a tributary of the Little Blue River recreation segments and are listed in Table 2.3.3.1.

Other sources that are classified as point sources and will be acknowledged include municipal stormwater discharges, unpermitted (i.e., cross connections or illicit) sanitary or industrial discharges and failing individual treatment systems (e.g., septic tanks, lagoons).

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 lie above the duration curve are considered to be the result of nonpoint and natural background sources.
Along with the use of the load curves to identify the sources, monitoring data collected from selected Little Blue River tributaries has been included in Appendix B.

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 2.3.3b. Identification of Pollutant Sources Using the Load Curve for LB1-10000

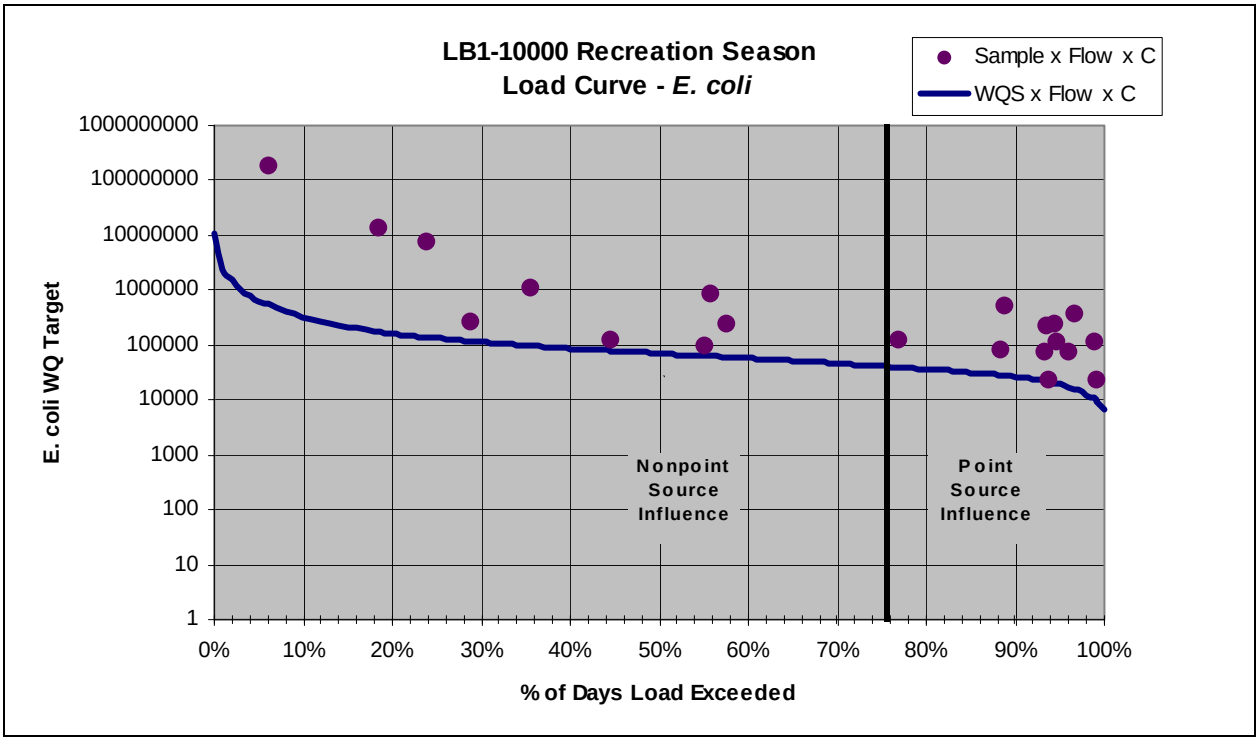
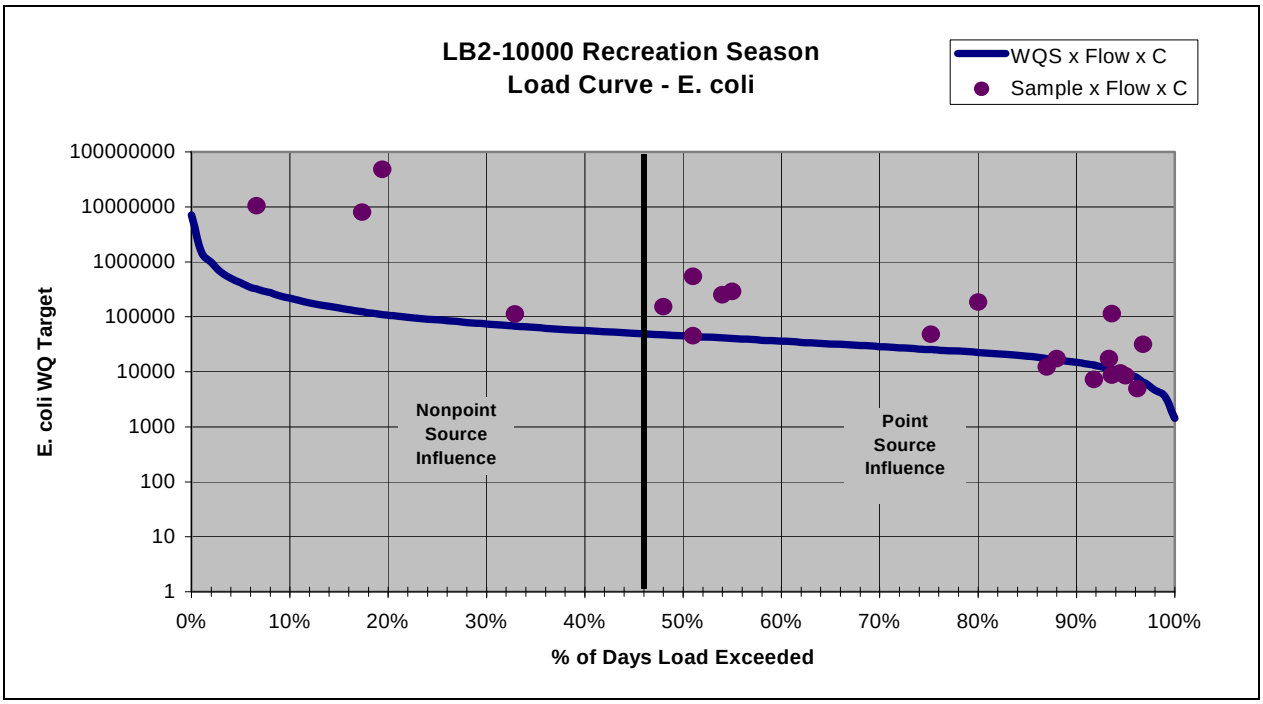


Figure 2.3.3c. Identification of Pollutant Sources Using the Load Curve for LB2-10000



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.

To achieve the desired loading capacities requires the following allocations:

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 of 126/100.

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.

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:

$$LA_i = Q_i*126/100\ ml*C$$

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 Reduction in Nonpoint Source and Natural Background Loads 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 2002 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 with the application of point source controls, if achieved should result in the waterbodies fully supporting the primary contact recreation beneficial use. Reductions include the margin of safety described below.

Table 2.4.2.1 Targeted Nonpoint Source and Natural Background Reductions

Segment	Target NPS Reduction	Expected Season Geometric Mean
LB1-10000	89%	110/100 ml
LB2-10000	76%	110/100 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 a 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.

3.0 Implementation Plan

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

Table 2.3.3.1 NPDES Permitted Discharges to the 303(d) Listed Little Blue Segments

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)	Fecal coliform Limits in NPDES permit?
LB1-10000	LB2-10100	Alexandria WWTF	NE0029238	0.05	No	6.6	No
	Undesignated	Bruning WWTF	NE0045071	0.04	No	26.4	No
	LB2-10200	Carleton WWTF	NE0028291	0.14	No	26.1	No
	LB1-10000	Fairbury WWTF	NE0024384	1.0	**Yes**		Yes
	LB2-10300	Hastings WWTF -Maxon Ave	NE0113298	0.147	No	69.3	No
	LB2-10220	Ong WWTF	NE0023795	0.016	No	41.0	No
	LB2-10110	Shickley WWTF	NE0030767	0.57	No	37.3	No
LB2-10000	LB2-10500	Deshler WWTF	NE0039802	0.65	No	10.5	No
	LB2-10000	Hebron WWTF	NE0024252	0.38	**Yes**		Yes
	LB2-30300	Juniata WWTF	NE0028100	0.144	No	65.8	No
	Undesignated	Kenesaw WWTF	NE0021555	0.175	No	75.0	No
	Undesignated	Minden WWTF	NE0025411	0.4	No	95.0	No
	LB2-20200	Nelson WWTF	NE0048046	0.56	No	29.6	No

3.1 NPDES Permitted Point Sources

Limitations are established in NPDES permits in accordance with Title 121 – Effluent Guidelines and Standards (Title 121). Title 121, Chapter 8 states:

Chapter 8 - TEST PROCEDURES FOR ANALYSIS OF POLLUTANTS

001 All of Title 40 Code of Federal Regulations (CFR) Part 136, July, 1990 edition, pertaining to Guidelines Establishing Test Procedures for the Analysis of Pollutants is hereby adopted and incorporated herein.

Based upon this requirement, all samples used to demonstrate permit compliance (sampling method, transport holding, and analysis) must be in accordance with the procedures established in 40 CFR Part 136. At this time, there is no analytical procedure for *E. coli* included in Part 136. It was for this reason; fecal coliform remained in Title 117 as indicator bacteria for primary contact recreation. Although not as reliable as *E. coli*, fecal coliform should continue to be used in the NPDES permitting process. End-of-pipe limits will be set at a monthly geometric mean of 200/100 ml and a daily maximum of 400/100 ml. Compliance with these values will be considered functionally equivalent to meeting the water quality criteria for *E. coli*.

Facilities that discharge directly to Segments LB1-10000 and LB2-10000 will be required to meet the wasteload allocations – applied as a fecal coliform limit - 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 fecal coliform 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

- Comply with State and local public notice requirements when implementing a public participation program.
- 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.

At this time no MS4 permits have been issued to municipalities residing in the Little Blue Basin. The issuance of future permits will likely be contingent upon the collection of additional data, the future beneficial use status of the impaired segments and the voluntary actions the candidate facilities have taken to minimize pollutants in the stormwater discharges.

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:

> *<u>001</u> 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:*
>
> *<u>001.01</u> Violate or threaten to violate Title 117 (Neb. Administrative Code (NAC)), Nebraska Surface Water Quality Standards;*
> *<u>001.02</u> Violate or threaten to violate Title 118 (NAC), Ground Water Quality Standards and Use Classification;*
> *<u>001.03</u> Discharge into waters of the State; or*
> *<u>001.04</u> Violate The Nebraska Environmental Protection Act.*

<u>002</u> 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 under 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 Little Blue 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 Little Blue 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 Little Blue River. Participation will depend on the agency/organization's program capabilities.

4.0 Future Monitoring

Future monitoring will generally be consistent with the rotating basin monitoring scheme. That is, annually, 2 or 3 river basins in the same geographic location are the focus of the monitoring effort. The Little Blue River Basin was monitored in 2002 and will again be targeted in 2007. 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 the 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 in the Fairbury Journal News, Minden Courier and the Hebron Journal Register with the public comment period running from approximately December 22, 2004 to February 1, 2005. These TMDLs were also made available to the public on the NDEQ's Internet site and announcement letters were mailed to interested stakeholders. No comments were received during the public comment period.

6.0 References

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NDNR. ____. Nebraska Department of Natural Resources Databank, NDNR Internet Site, Nebraska Department of Natural Resources. Lincoln, NE.

NNRC 1976. Little Blue 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 – Fecal Coliform Data Collected in 2002 from Little Blue River Tributaries

Monitoring information collected during the recreation season in 2002 was not only obtained from sites on the segments assigned the recreation beneficial use but also from 2 tributaries. These sites were chosen based upon the location of a USGS or NDNR gage or other project needs. The location of the sites and the area of the basin drainage evaluated by the sites are shown in Figure B1. Table B1 then provides a summary of the tributary monitoring information.

Figure B1. Tributary Monitoring Locations in the Little Blue River Basin

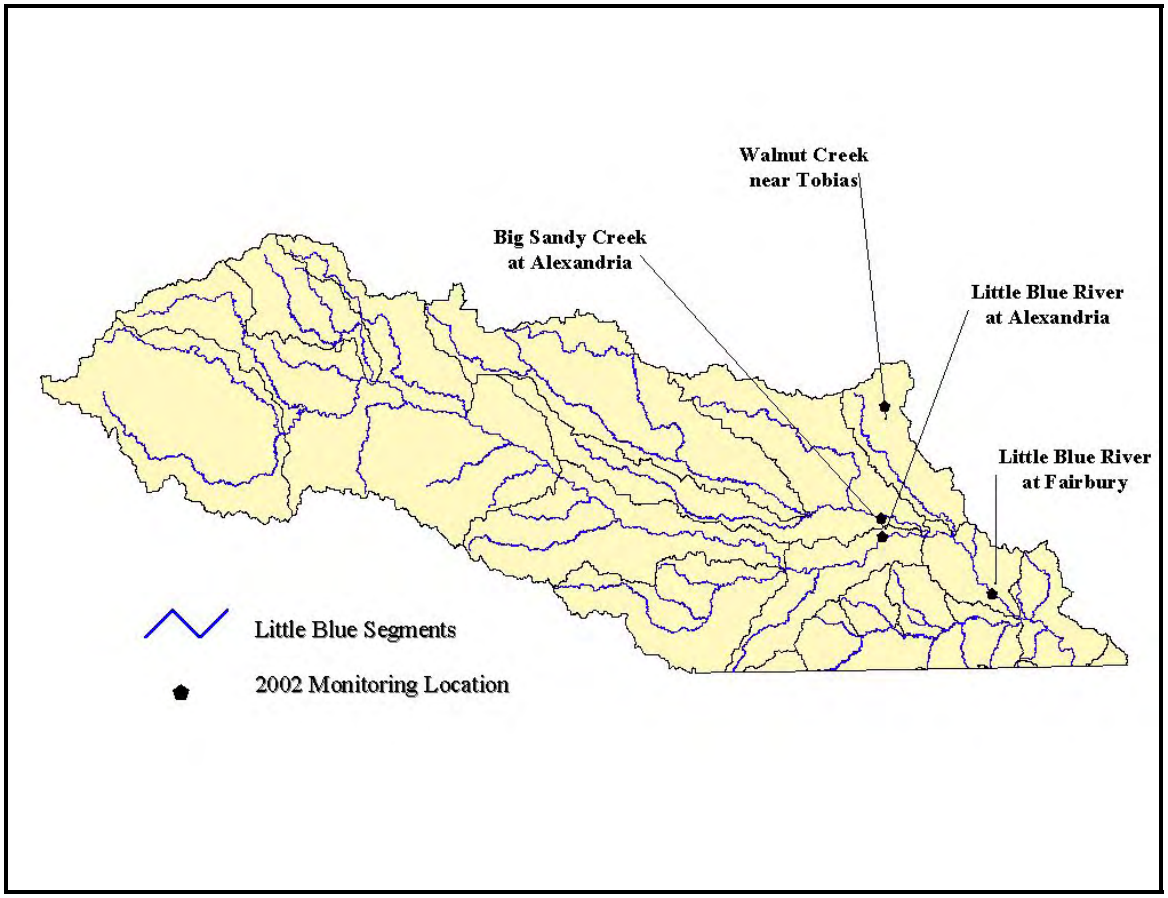

Table B1. Summary of 2002 *E. coli* monitoring from Little Blue Tributaries

Stream	Title 117 Segment Identification	Location	Number of Samples	Recreation Season Geometric Mean (#/100 ml)
Big Sandy Creek	LB2-10100	Near Alexandria	22	778
Walnut Creek	Undesignated	Near Tobias	13	567