Total Maximum Daily Loads

For

Little Blue River

Parameter of Concern: Atrazine & *E.Coli*

LB1-10000
LB1-10200
LB2-10000
LB2-10100
LB2-20000
LB2-30000

Nebraska Department of Environmental Quality
Planning Unit, Water Quality Division

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Executive Summary

The Little Blue River (LB1-10000, LB2-10000, LB2-20000), Big Sandy Creek (LB2-10100), and Rock Creek (LB1-10200) were identified as Category 5 streams in Nebraska's 2008 and 2010 Water Quality Integrated Reports (IR) (NDEQ 2008a, NDEQ 2010b). Category 5 waterbodies comprise the Clean Water Act's 303(d) list of impaired waters and are required to have TMDLs. Data collected from 2001-2009 indicate the aquatic life, public drinking water supply, and primary contact recreation beneficial uses are impaired with the parameters of concern being atrazine and *E. coli* respectively.

As such, total maximum daily loads (TMDLs) must be developed for each parameter in accordance with the Clean Water Act. The information contained herein should be considered as eleven (11) TMDLs. It is important to note that the atrazine TMDL developed for LB1-10000 is regarded as two TMDLs since two beneficial uses are being impaired by the same pollutant. 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.

Basin	Stream Name	Segment
LB	Little Blue River	LB1-10000
LB	Rock Creek	LB1-10200
LB	Little Blue River	LB2-10000
LB	Big Sandy Creek	LB2-10100
LB	Little Blue River	LB2-20000
LB	Little Blue River	LB2-30000

2. Identification of the pollutant and applicable water quality standard

Excessive Atrazine has been determined to be impairing the aquatic life and public drinking water supply beneficial uses in these segments. E. Coli has been determined to be impairing the Primary Contact Recreation beneficial use. Designated uses assigned to the above-identified segments can be seen in the table below.

Segment	Primary Contact Recreation	Aquatic Life Class		Water Supply Class		Aesthetics
		Coldwater	Warmwater	Public Drinking Water Supply	Agricultural Water Supply	
LB1-10000	**X (Impaired)**	--	**A (Impaired)**	**X (Impaired)**	A	X
LB1-10200	**X (Impaired)**	--	A	--	A	X
LB2-10000	**X (Impaired)**	--	**A (Impaired)**	--	A	X
LB2-20000	**X (Impaired)**	--	**A (Impaired)**	--	A	X
LB2-10100	**X (Impaired)**	--	**A (Impaired)**	--	A	X
LB2-30000	**X (Impaired)**	--	A	--	A	X

Designated Use by Stream Segment (NDEQ 2010)

Parameter	LB1-10000	LB1-10200	LB2-10000	LB2-20000	LB2-10100	LB2-30000
E. Coli	**X**	**X**	**X**	**X**	**X**	**X**
Atrazine	**X**		**X**	**X**	**X**	

Stream Impairments by Segment (NDEQ 2010)

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:

Loading capacity = WQS x Flow x C

4. Quantification of the amount or degree by which the current pollutant load in the waterbody, including upstream sources that are being accounted for as background loading deviates from the pollutant load needed to attain and maintain water quality standards.

Atrazine TMDLs

Atrazine data for the impaired reaches indicates that several reaches exceed the chronic criteria (12 µg/l) based on the May-June seasonal assessment. The assessment of Atrazine in reach LB1-10000 indicates that concentrations exceed the standard for the public drinking water supply beneficial use (3 µg/l). It should be noted that targeting the water supply beneficial use in LB1-10000 is the critical case; the aquatic life beneficial use will be attained in this reach inherently since the targeted concentrations for water supply are lower than that for aquatic life. A summary of the assessment can be seen in the following table:

Segment	Beneficial Use Governing Standard	Applicable Standard (µg/l)	Number of Samples	Number of Samples > WQS	# Allowed
LB1-10000	Public Drinking Water	3	215	44	27
LB2-10000	Aquatic Life	12	8	3	2
LB2-20000	Aquatic Life	12	53	16	8
LB2-10100	Aquatic Life	12	58	20	9

E. Coli TMDLs

E. Coli data for the impaired reaches indicates that all six impaired reaches in this TMDL exceed the geometric mean standard of 126 cfu/100ml during the recreation season assessed. A summary of the assessment can be seen in the following table.

Impaired Segment	Waterbody Name	2007 Seasonal Geometric Mean (#/100ml)	E.Coli Above WQS (#/100ml)
LB1-10000	Little Blue River	254	128
LB1-10200	Rock Creek	379	253
LB2-10000	Little Blue River	342	216
LB2-10100	Big Sandy Creek	428	302
LB2-20000	Little Blue River	959	833
LB2-30000	Little Blue River	643	517

5. Identification of the pollutant source categories.
The entire Atrazine pollutant source has been determined to originate from nonpoint sources. Both point and nonpoint sources (including natural sources) have been identified to be contributing to the *E. coli* loads being delivered to the Little Blue River segments.

6. Wasteload allocations for pollutants from point sources.
The wasteload allocation for Atrazine will be zero (0) since the entire loading originates from non-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 cfu (colony forming units)/100 ml.

7. Load allocations for pollutants from nonpoint sources.
Load allocations (LA) assigned to these TMDLs will be based upon the stream flow volume, applicable water quality standard and a unit conversion factor (a numeric factor used to multiply or divide a quantity when converting from one system of units to another) and will be defined using the following general formula:

$$LA_i = Q_i \times WQS \times C$$

Where:
LA_i = pollutant load allocation at the i^{th} flow
Q_i = stream flow at the i^{th} flow
WQS = Applicable water quality standard
C = unit conversion factor

Therefore the load allocation assigned to the Atrazine TMDL will be defined as:

$$LA_i = Q_i \times (WQS) \times 0.002446$$

Where:
LA_i = load allocations (in kg) at the i^{th} flow
Q_i = stream flow (in cfs) at the i^{th} flow
WQS = water quality criteria for Atrazine in micrograms/liter (µg/l) based on most protective standard for the assigned beneficial uses (12 µg/l for Aquatic Life use, 3 µg/l for Public Drinking Water Supply use)
0.002446 = constant used to convert cfs times µg/l to kg/day

And the load allocations assigned to the *E. coli* TMDLs will be defined as:

$$LA_i = Q_i \times 35{,}683.2 \text{ cfu/ft}^3 \times 86{,}400$$

Where:
LA_i = load allocations (in cfu/day) at the i^{th} flow
Q_i = stream flow (in cfs) at the i^{th} flow
35,683.2 cfu/ft^3 = 126/100ml (applicable/target water quality criteria for *E. coli* from Title 117) x 283.2 (factor to convert cfu/100ml to cfu/ft^3).
86,400 = value to convert cfs times cfu's to cfu's/day

8. Margin of safety.
For Atrazine the margin of safety will be implicit in that the load reduction calculated is based upon events during the months of May & June. This timeframe represents the critical conditions when runoff of Atrazine is likely to occur. Additionally, the downstream section LB1-10000 has a WQS of 3 μg/l for Atrazine, whereas the rest of the upstream impaired segments have a WQS of 12 μg/l. It is assumed that in order to meet the WQS of 3 μg/l in segment LB1-10000, greater reductions in the contributing segments than indicated by this TMDL would be necessary. In other words, meeting the standard in LB1-10000 would require compliance in the upstream segments.

For *E. coli*, an explicit MOS of 10% will be utilized. Implementation of controls for both parameters will also result in year-round protection of water quality. This will be important should application practices change in the future.

9. Consideration for seasonal variation.
In Nebraska, Atrazine application can occur as early as late April and continues into the month of June. Runoff however is more typical during the May-June timeframe. For Atrazine, assessment and analysis of the data, as well as the TMDL, was based on the May-June timeframe when deviations from the water quality criteria have been historically observed. 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 these TMDLs.

11. Implementation Plan
Reductions of *E. coli* will be targeted through a combination of regulatory and non-regulatory activities. Point sources will be regulated under the auspice of Title 119: National Pollutant Discharge Elimination System (NPDES) (NDEQ 2005) and the Rules and Regulations Pertaining to Title 130: Livestock Waste Control (LWC) (NDEQ 2008b). Nonpoint source pollution will be addressed using available programs, technical advice, information and education and financial incentives such as cost share. The lead agency for water quality pesticide issues in Nebraska is the Department of Agriculture (NDA). Implementation of the reductions for atrazine will be coordinated with the NDA.

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 TMDLs in the future if necessary. A description of the future monitoring (Section 5.0) 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. 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

The Little Blue River (LB1-10000, LB2-10000, LB2-20000, LB2-30000), Rock Creek (LB1-10200), and Big Sandy Creek (LB2-10100) were identified as Category 5 streams in Nebraska's 2008 and 2010 Water Quality Integrated Reports (IR) (NDEQ 2008a, NDEQ 2010b). Category 5 waterbodies comprise the Clean Water Acts 303(d) list of impaired waters and are required to have TMDLs. Data collected from 2001-2009 indicate aquatic life and public drinking water supply beneficial uses are impaired with the parameter of concern being Atrazine.

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 Little Blue River to address Atrazine. Therefore, the information contained herein should be considered eleven (11) TMDLs. Although only the six segments described are considered impaired, the relationship of water quality at the monitoring location and the watershed's contributions will be recognized. Concentration and load reduction activities will not be limited to the segments, rather the watershed as a whole.

1.1 Background Information

The Little Blue River is the major waterway in the Little Blue River Basin of Nebraska. The rivers headwaters originate just west of Axtell, Nebraska and generally flow in an east/southeasterly direction before discharging past the Nebraska/Kansas border just south of Steele City, NE. There are five designated segments of the Little Blue River included in Title 117 – Nebraska Surface Water Quality Standards (NDEQ 2006) along with 18 designated tributaries, and five major tributaries (Figure 1.1).

Big Sandy Creek (LB2-10100) is a major tributary to the Little Blue River within sub-basin 2 of the Little Blue River Basin of Nebraska. The headwaters for Big Sandy Creek originate just east of Hastings Nebraska, and generally flow in a southeasterly direction before the confluence with the Little Blue River east of Alexandria Nebraska. There are three designated segments of Big Sandy Creek included in Title 117, along with three designated tributaries

1.1.1 Waterbody Description

1.1.1.1 Waterbody Name: Little Blue River (LB1-10000, LB2-10000, LB2- 20000), Big Sandy Creek (LB2-10100), Rock Creek (LB1-10200)

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, 10270207

1.1.1.5 Beneficial Uses: Primary Contact Recreation, Warm water Aquatic Life - Class A, Agricultural Water Supply Class A, Public Drinking Water Supply (LB1-10000), and Aesthetics.

1.1.1.6 Major Tributaries: Rock Creek (LB1-10200) Rose Creek (LB1-10400), Spring Creek (LB2-10500), Big Sandy Creek (LB2-10100), Elk Creek (LB2-20100), Liberty Creek (LB2-20500)

1.1.2 Watershed Characterization

1.1.2.1 Physical Features: The Little Blue watershed encompasses approximately 2690 mi^2 (1723140 acres) in the southeastern part of the state. The basin originates in Kearney County just west of Axtel and ends at the Kansas/Nebraska border just south of Steele City. The Little Blue basin lies within the Central Great Plains (Chapman, et. al. 2001).

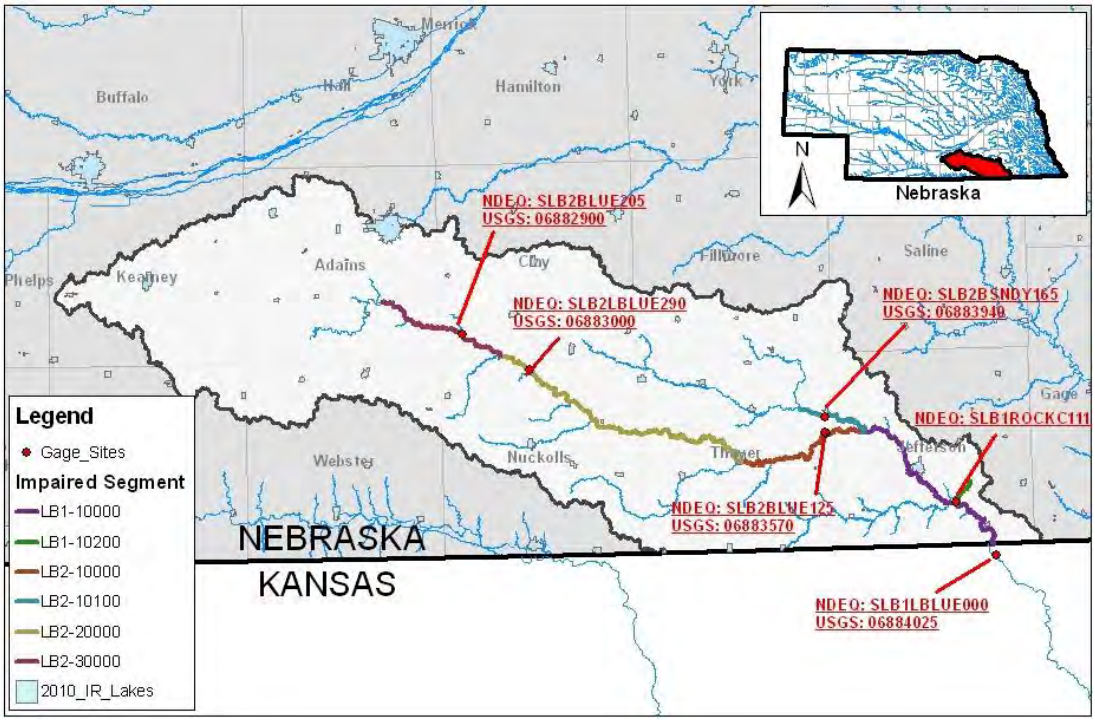

Figure 1.1.2: Little Blue River Watershed in the Little Blue River Basin

The upper portion of the watershed is comprised by the soils in the Hastings and Holder associations which are very deep well drained, low sloped soils. In the middle and lower portions of the watershed, watershed drainage patterns are defined and composed of gently sloping to very steep, loess-covered soils. (USDA 1990).

1.1.2.2 Climate: Based on data from automated weather stations operated at Fairbury, Nebraska, average annual precipitation in the watershed is approximately 30 inches (HPRCC 2010) with a majority of the precipitation occurring during the spring and summer months. On average around 70% of the annual precipitation falls in the spring (April – June) and summer (July – September) months. Temperatures in the basin range from an average high between 90 - 100°F during the summer to average lows between 10 - 20°F during the winter.

1.1.2.3 Demographics: 42 municipal communities reside in the watershed. Incorporated communities include: Hastings -- population 24,907, Fairbury – population 3.942, Hebron – population 1,579, Davenport – population 391, Alexandria – population 177, Endicott – population 132, and several others. Statewide, about 22% of Nebraskans live outside of an incorporated community on ranches, farmsteads, and acreages.

1.1.2.4 Land Uses: Land use in the Little Blue River basin is generally devoted to cultivated croplands, with small areas dedicated to grassland and pasture, particularly in the southern portion of the basin. Table 1.1.2.4 and Figure 1.1.2.4a below summarize land use within the Little Blue River Basin in 2008. Active registered wells from the Nebraska Department of Natural Resources (NDNR 2010) are presented in Figure 1.1.2.4b below.

Table 1.1.2.4: 2008 Land use for Little Blue River Basin (USDA 2010)

General Land Use Class	Area in Acres	Percent of Watershed
Grassland/Pasture/CRP	472,657	27.43%
Cultivated Cropland	1,079,203	62.63%
Roads/Developed	115,795	6.72%
Forest	50,660	2.94%
Open Water & Wetland	4,825	0.28%
TOTALS	**1723140**	**100.00%**

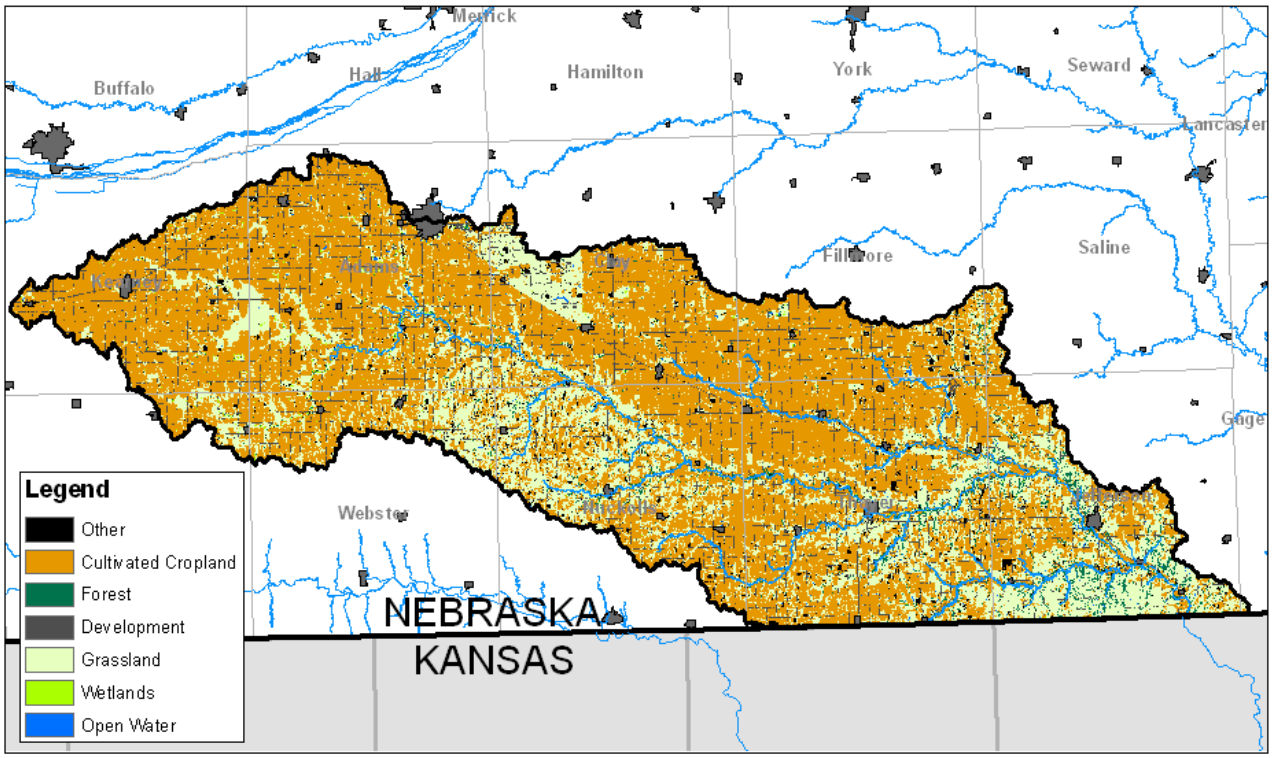

Figure 1.1.2.4a: 2008 Land use in the Little Blue River Basin (USDA 2010)

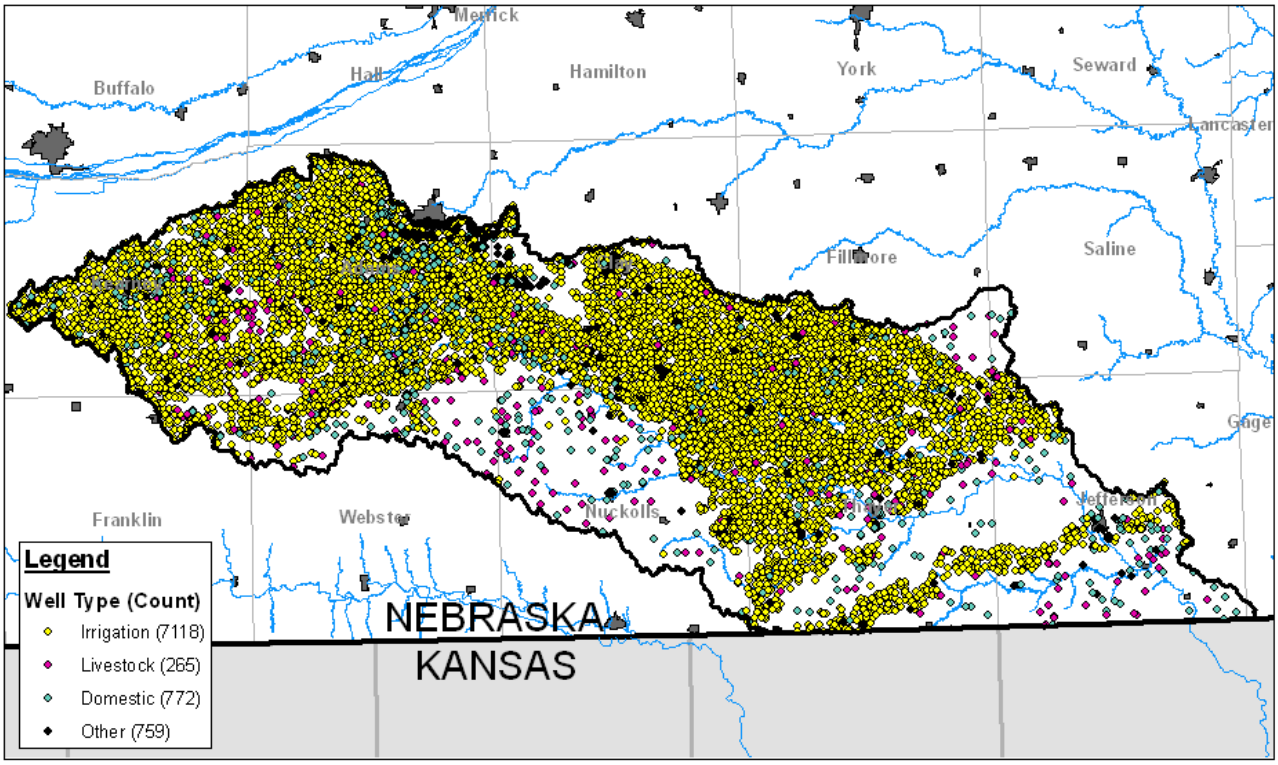

Figure 1.1.2.4b: Registered Wells in the Little Blue River Watershed (NDNR 2010)

1.2 Data Sources

The goal of the TMDL is to quantify pollutant loadings and determine the reductions which would be required to attain water quality standards. In order calculate these loadings, data for flow rate and pollutant concentrations must be known. The sources of data used for the development of this TMDL are outlined below.

1.2.1 Water Quality Data

The Nebraska Department of Environmental Quality 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 visited in a six year period. Under the auspice of the rotating basin plan, data was collected from the Little Blue River Basin in 2007. During basin rotation monitoring samples are collected weekly during the recreation season of May-September.

Several sites within the Little Blue River basin are monitored as part of the Nebraska Ambient Stream Monitoring Network. The intent of these monitoring sites is to monitor and assess long term trends in water quality. As such, data from ambient sites are collected bi-weekly between the months of April and September, and monthly between October and March. Table 1.2.1 outlines the sampling locations for each of the impaired segments discussed in this TMDL. Geographical location of the sites in relation to the impaired streams can be seen in Figure 1.1.2.

Data for atrazine is collected as part of the Ambient and Basin Monitoring Networks. Data collected for *E. Coli* bacteria is limited basin rotation monitoring. Table 1.2.1 outlines the NDEQ water quality monitoring stations used as data sources for the purposes of this TMDL.

Table 1.2.1: Water Quality Monitoring Locations.

Stream Segment	Gage Name	Gage Location	Site Type	Data Range*
LB1-10000	SLB1LBLUE000	Little Blue River near Hollenberg, KS	Ambient	2001-2009
LB1-10200	SLB1ROCKC111	Rock Creek at Endicott, NE	Basin Rotation	2007
LB2-10000	SLB2LBLUE125	Little Blue River at Alexandria, NE	Basin Rotation	2007
LB2-10100	SLB2BSNDY165	Big Sandy Creek at Alexandria, NE	Ambient	2001-2009
LB2-20000	SLB2LBLUE290	Little Blue River at Deweese, NE	Basin Rotation	2001-2009
LB2-30000	SLB2LBLUE205	Little Blue River NW of Deweese, NE	Basin Rotation	2007

*Data for *E. coli* bacteria at all sites was collected as part of Basin Rotation in 2007 only.

1.2.2 Volumetric Flow Rate

Data for flow rate was downloaded from current and historical USGS and Nebraska Department of Natural Resources stream flow gauging stations. In cases where stream flow data was not available for a specific impaired segment, the flow data was estimated using a ratio method based on drainage area.

Furthermore, since the goal of the TMDL is to quantify existing and target pollutant loadings within specific reaches, the entire reach must be considered. Therefore the flow rates used in the calculation of these TMDLs are adjusted to reflect the contributing area at the terminus of each of the impaired segments rather than the area of the gauges themselves. The drainage areas of the segments and gauges were determined using GIS information, and USGS topographical maps. Table 1.2.2 outlines the sites used to obtain or estimate the flow rate data.

Table 1.2.2: Flow Rate Monitoring Locations.

Segment	Flow Data Source	DA at Terminus (mi^2)	DA at Gauge (mi^2)	Estimated?	Ratio	Data Range
LB1-10000	Little Blue River @ Hollenberg, KS	2801.8	2801.8	No	--	1991-2011
LB1-10200	Estimated from Mill Creek @ Washington, KS	27.3	344	Yes	0.08	1992-2011
LB2-10000	Estimated from Little Blue River nr Fairbury	1615	2350	Yes	0.67	1992-2011
LB2-10100	Big Sandy Creek @ Alexandria	632.1	612.7	No	--	1994-2009
LB2-20000	Estimated from Little Blue River nr Deweese	1496	1050.8	Yes	1.42	1991-2011
LB2-30000	Estimated from Little Blue River nr Deweese	1016.5	1050.8	Yes	0.96	1991-2011

For example, using information from the above table, the flow rate collected for segment LB2-20000 will be calculated by multiplying the flow rate from the Little Blue river near Deweese gage by 1.42,

2.0 Atrazine TMDL

2.1 Problem Identification

The Little Blue River (LB1-10000, LB2-10000, LB2-20000) and Big Sandy Creek (LB2-10100) were listed in the 2008, 2010, and 2012 Integrated Reports as having an impaired aquatic life beneficial use with the parameter of concern being Atrazine. Section LB1-10000 was also listed as being impaired for public drinking water supply for Atrazine. This section deals with the extent and nature of the water quality impairments caused by excessive Atrazine in the Little Blue River Basin.

2.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Warmwater A - Aquatic Life beneficial use has been deemed impaired within LB1-10000, LB2-10000, LB2-20000, and LB2-10100. The Warmwater A Aquatic Life beneficial use applies to surface waters which provide, or could provide, a habitat consisting of sufficient water volume or flow, water quality, and other characteristics such as substrate composition which are capable of maintaining year-round populations of Warmwater biota. Warmwater biota are considered to be life forms in waters where temperatures frequently exceed 25^{o}C. (NDEQ 2012).

The Public Drinking Water Supply beneficial use has been identified as impaired within LB1-10000. The Public Drinking Water beneficial use applies to surface waters which serve as public drinking water supplies. These waters must be treated by an applicable drinking water treatment process before it is considered suitable for human consumption.

2.1.2 Data Sources

Data was collected for atrazine in the Little Blue River as part of Nebraska's basin rotation and ambient monitoring network as outlined in Section 1.2.

2.1.3 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5 impaired waters for the 2010 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 2010 Integrated Report for Nebraska* (NDEQ 2009b).

In the assessment process, all data is initially assessed for seasonal variability in concentration or occurrence. This process is accomplished by creating charts of time-series plots for each parameter of interest. These charts are created from data gathered within the most recent 5-year monitoring period, or where continuous datasets exist (i.e., no more than a 2-year gap in data availability) over longer periods of time. If review of these charts reveals that seasonal differences occur, the NDEQ focuses its assessment efforts within the season(s) where parameter concentrations/occurrences are evident. By examining only the timeframe (seasons) where parameters appear in detectable levels, or at or near levels of concern, a waterbody can be more accurately assessed for use support / impairment. In contrast, when seasonal differences are present, but a long-term database is used to assess beneficial use support, the impacts to beneficial uses are underestimated and waters where real seasonal concerns exist may be overlooked.

2.1.4 Water Quality Conditions

Atrazine data collected from 2003-2008 were assessed to determine the beneficial use support for the warmwater B aquatic life, and public drinking water supply designation. Table 2.1.4.1 and Figures 2.1.4.1 – 2.1.4.4 present this information.

Segment	Beneficial Use Governing Standard	Applicable Standard (µg/l)	Number of Samples*	Number of Samples > WQS	# Allowed
LB1-10000	Public Drinking Water	3	215	46	27
LB2-10000	Aquatic Life	12	8	3	2
LB2-20000	Aquatic Life	12	53	16	8
LB2-10100	Aquatic Life	12	58	20	9

* - Samples collected during May-June growing season data, except for segment LB1-10000 which includes data for the entire year.

Table 2.1.4.1: Little Blue River Basin Atrazine Data Assessment

From the data assessment of segments LB1-10000, LB2-10000, LB2-20000, and LB2-10100 a seasonal impairment (May-June) exists for Atrazine, which coincides with observed periods of increased precipitation and application of the herbicide. Because the impairment is seasonal, the TMDL for these segments will focus on that period. Additionally, the data for LB1-10000 indicates impairment to the public drinking water supply beneficial use based on the full 2002-2008 data set, therefore the entire dataset shall be used when developing the TMDL for LB1-10000.

Table 2.1.4.2 below outlines the atrazine concentrations by month, from the table it can be seen that the May-June timeframe can be considered as the critical case.

	LB1-10000			LB2-10000			LB2-10100			LB2-20000		
Month	**Avg Conc. (µg/l)**	**# Above WQS**	**# of Samples**	**Avg Conc. (µg/l)**	**# Above WQS**	**# of Samples**	**Avg Conc. (µg/l)**	**# Above WQS**	**# of Samples**	**Avg Conc. (µg/l)**	**# Above WQS**	**# of Samples**
Jan	0.16	0	8	--	--	--	0.1	0	5	0.1	0	7
Feb	0.2	0	11	--	--	--	0.18	0	8	0.18	0	10
Mar	0.27	0	7	--	--	--	0.31	0	7	0.22	0	9
Apr	1.62	1	25	0.18	0	3	3.86	2	27	0.79	1	20
May	**18.26**	**21**	**28**	**15.31**	**2**	**4**	**22.16**	**16**	**29**	**10.89**	**10**	**26**
Jun	**6.60**	**18**	**27**	**10.89**	**1**	**4**	**4.01**	**4**	**29**	**7.63**	**6**	**27**
July	2.00	4	27	2.13	0	10	1.42	0	32	1.17	0	29
Aug	1.10	0	31	0.99	0	8	0.87	0	32	1.13	0	30
Sept	1.33	2	26	0.76	0	8	0.77	0	27	0.62	0	25
Oct	0.53	0	8	0.57	0	1	0.23	0	8	0.28	0	8
Nov	0.40	0	10	--	--	--	0.24	0	9	0.21	0	4
Dec	0.20	0	7	--	--	--	0.16	0	7	0.18	0	8

Table 2.1.4.2: Seasonal Consideration of Atrazine Concentrations.

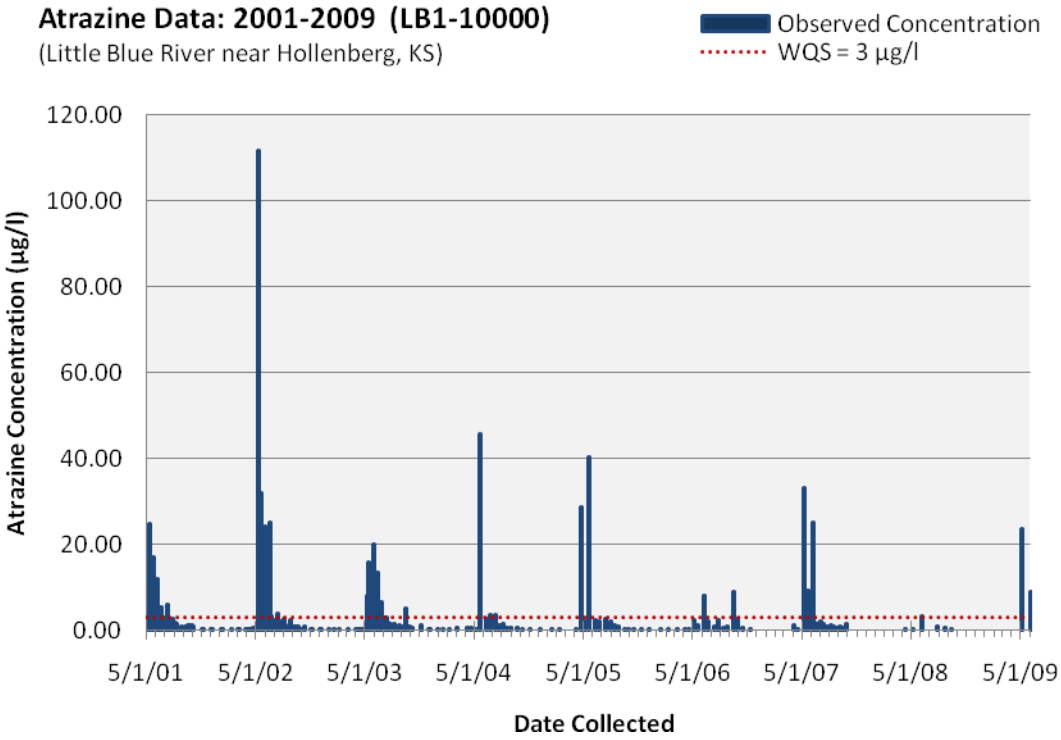

Figure 2.1.4.1: Little Blue River (LB1-10000) Atrazine Data 2001-2009

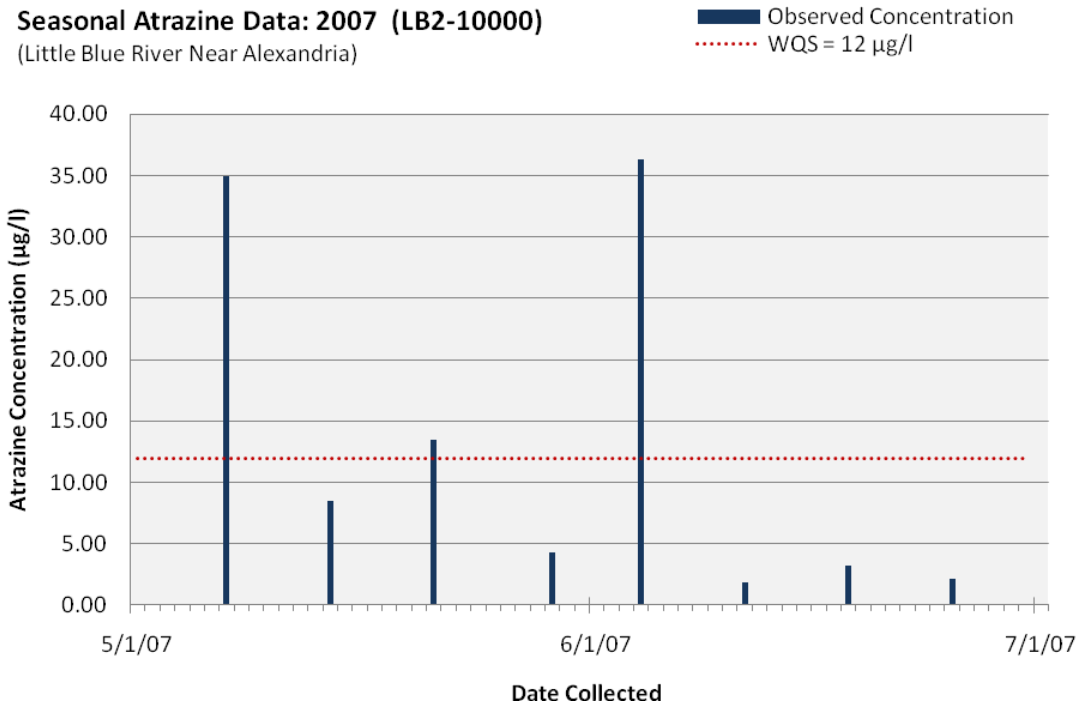

Figure 2.1.4.2: Seasonal Little Blue River (LB2-10000) Atrazine Data 2007

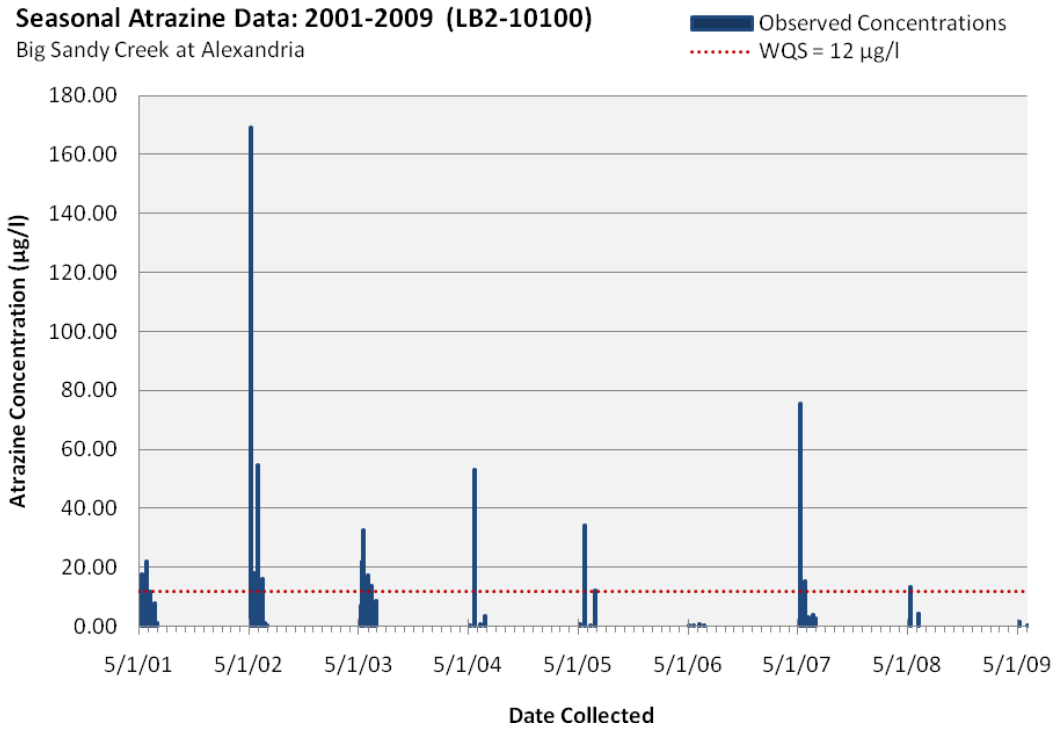

Figure 2.1.4.3: Seasonal Big Sandy Creek (LB2-10100) Atrazine Data 2001-2009

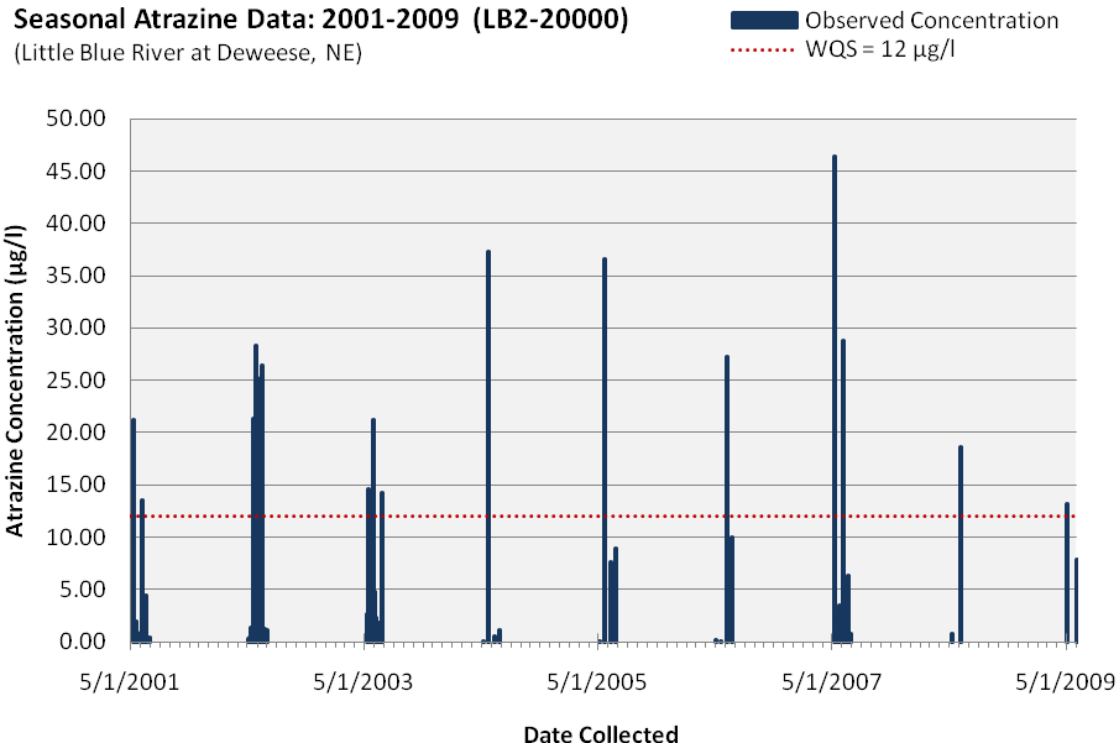

Figure 2.1.4.4: Seasonal Little Blue River (LB2-20000) Atrazine Data 2001-2009

2.1.5 Potential Pollutant Sources

Atrazine is a triazine herbicide currently registered for use against broadleaf and some grassy weeds. Atrazine is registered for use on corn (field and sweet); sorghum; range grasses for the establishment of permanent grass cover on rangelands and pastures under USDA's Conservation Reserve Program (CRP) in OK, NE, TX, and OR; wheat (where application is to wheat stubble on fallow land following wheat harvests; wheat is not the target crop); conifer forests; Christmas tree farms; sod farms; and golf courses (EPA 2006).

Atrazine is one of the most heavily used pesticides in North America (EPA 2003). Given this usage and source, point and natural sources are likely not contributing Atrazine to surface waters in Nebraska. Therefore, for this TMDL the entire load will be considered the result of nonpoint source discharges.

2.2 TMDL Endpoint

The endpoint for these TMDLs will vary by stream segment and will be based on the numeric criteria associated with the strictest standard for the assigned beneficial uses. For segment LB1-10000 the TMDL endpoint is the Public Drinking Water Supply beneficial use standard. The endpoint for segments LB2-10000, LB2-10100, and LB2-20000 the TMDL is the standard associated with the aquatic life beneficial use. Because the required Atrazine concentration for the water supply beneficial use is lower than the required concentration for aquatic life, It is assumed that addressing the water supply beneficial use in LB1-10000 will inherently address the impairment for aquatic life.

2.2.1 Numeric Water Quality Criteria

Water quality criteria established for the Class B – Warmwater Aquatic Life, and Public Drinking Water Supply protection of the beneficial use can be found in Title 117, Chapter 4 (NDEQ 2009). Assessment of the data and the TMDL are based on the chronic criterion of 12 μg/l for Aquatic Life, and 3 μg/l for Public Drinking Water Supply

2.2.2 Selection of Critical Environmental Conditions

The critical environmental conditions for this TMDL have been identified in the assessment process. Specifically, the data and information for LB2-10000, LB2-10100, and LB2-20000 were limited to the May-June timeframe when the deviations from the water quality criteria were observed. For LB1-10000, year-round data have been used for the assessment which is appropriate for the criteria associated with Public Drinking Water Supply.

2.2.3 Waterbody Pollutant Loading Capacity

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

The method chosen to account for the variation in flow is based upon the load duration curve (NDEQ 2002). TMDL curves are initiated by the development of 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. Appendix B provides a table with the 0-100th percentile flow values and associated daily load values for the impaired segments.

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

Loading Capacity = Flow x WQS x C

2.3 Pollution Source Assessment

As indicated in Section 2.1.5, the only source of Atrazine considered for this TMDL is nonpoint source discharges. Although the source has been determined, it is important to illustrate the existing conditions.

2.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the following TMDL curves (Figures 2.3.1.1-2.3.1.4). Points plotted above the acceptable loading indicate a deviance from the water quality criteria. Data for flow rate and Atrazine concentrations were obtained as outlined in Section 2.1.4.

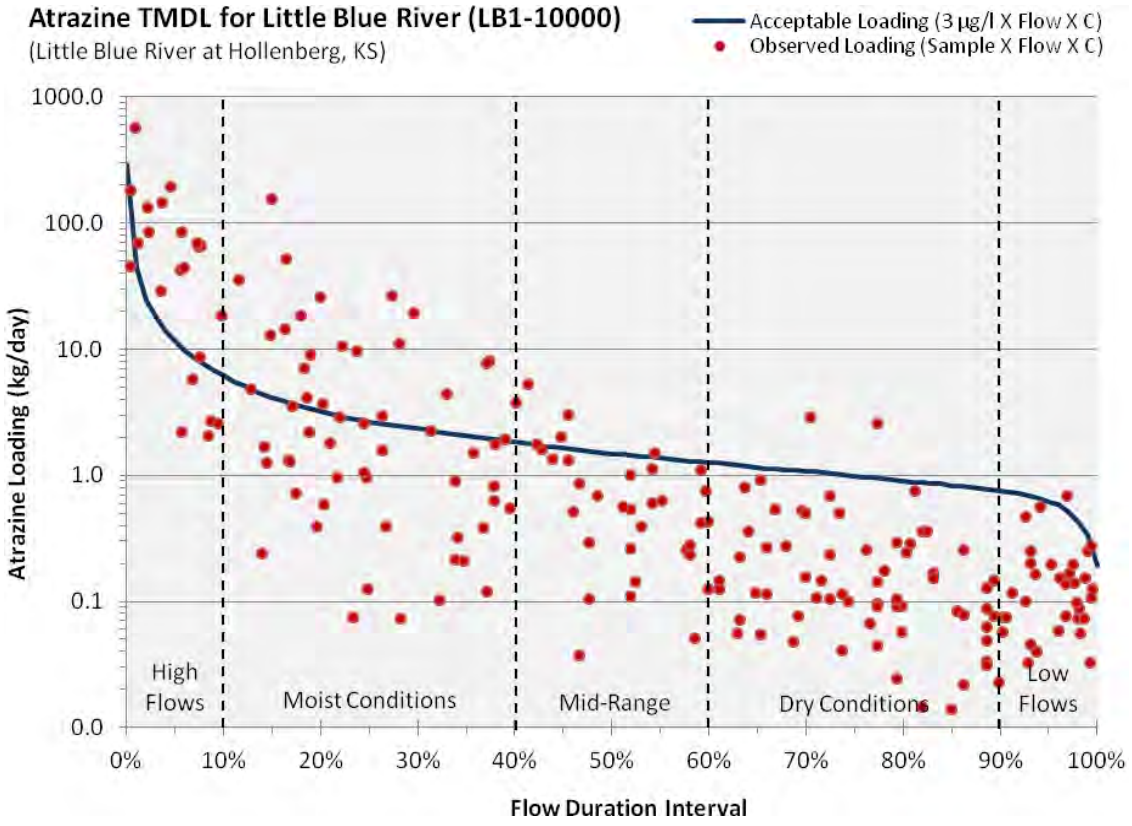

Figure 2.3.1.1: Atrazine TMDL Curve for Little Blue River (LB1-10000) at SLB1LBLUE000

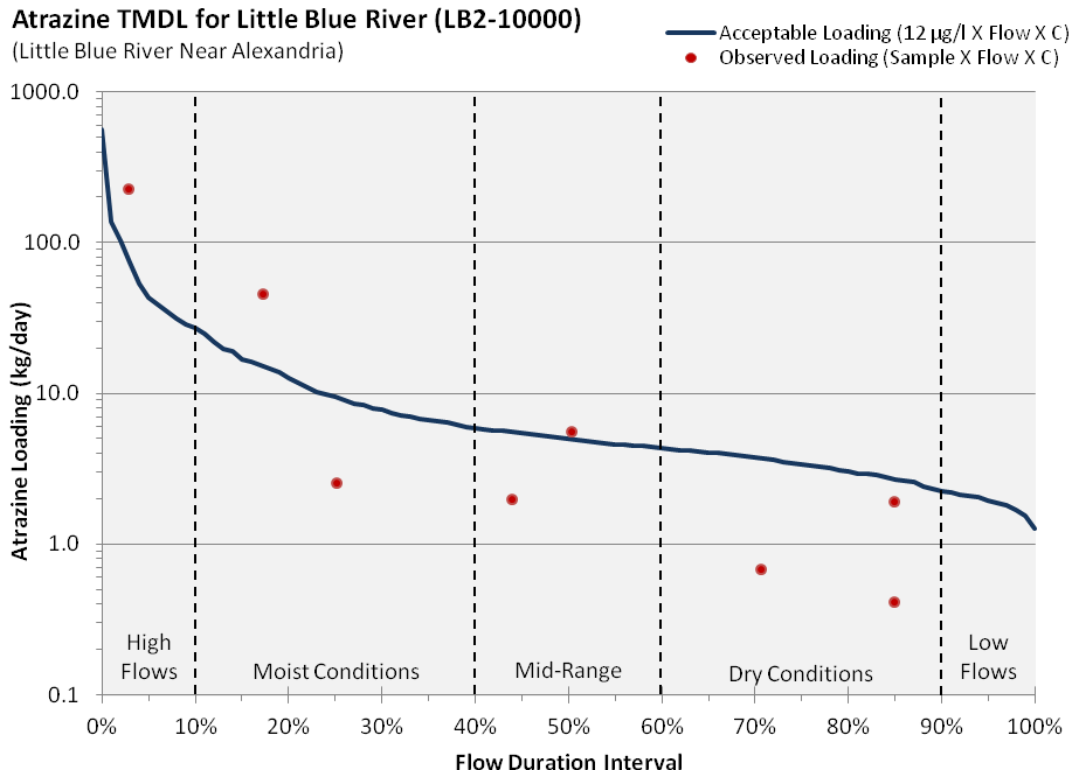

Figure 2.3.1.2: Seasonal Atrazine TMDL Curve for Little Blue River (LB2-10000) at SLB2LBLUE125

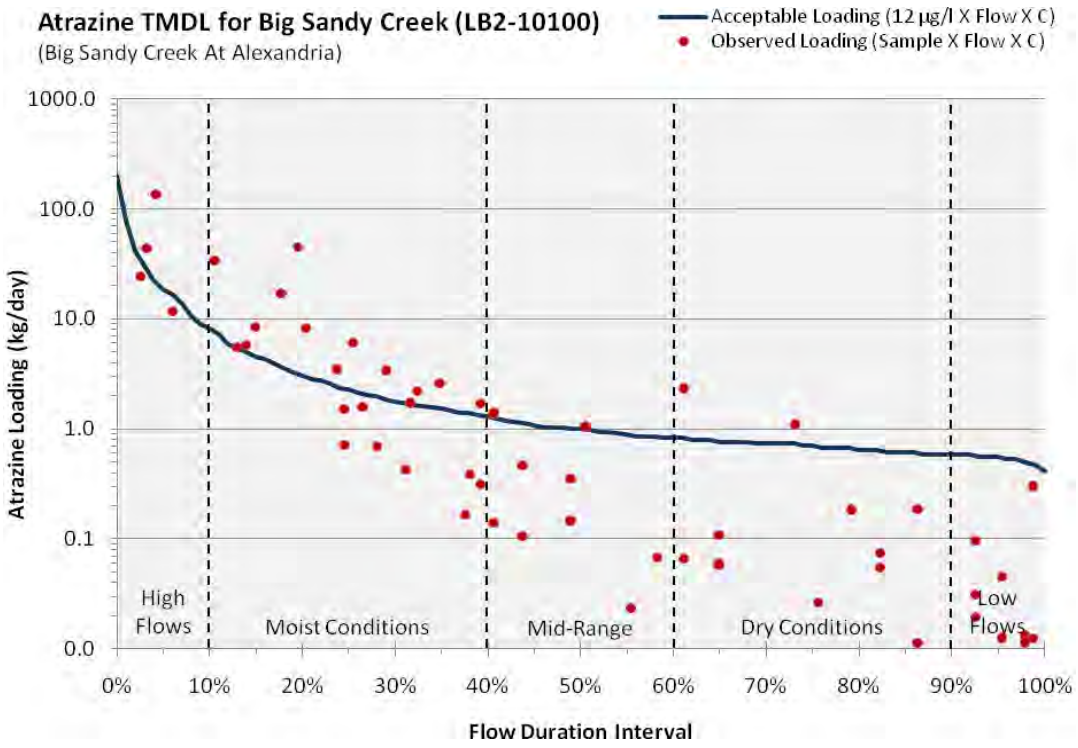

Figure 2.3.1.3: Seasonal Atrazine TMDL Curve for Big Sandy Creek (LB2-10100) at SLB2BSNDY165

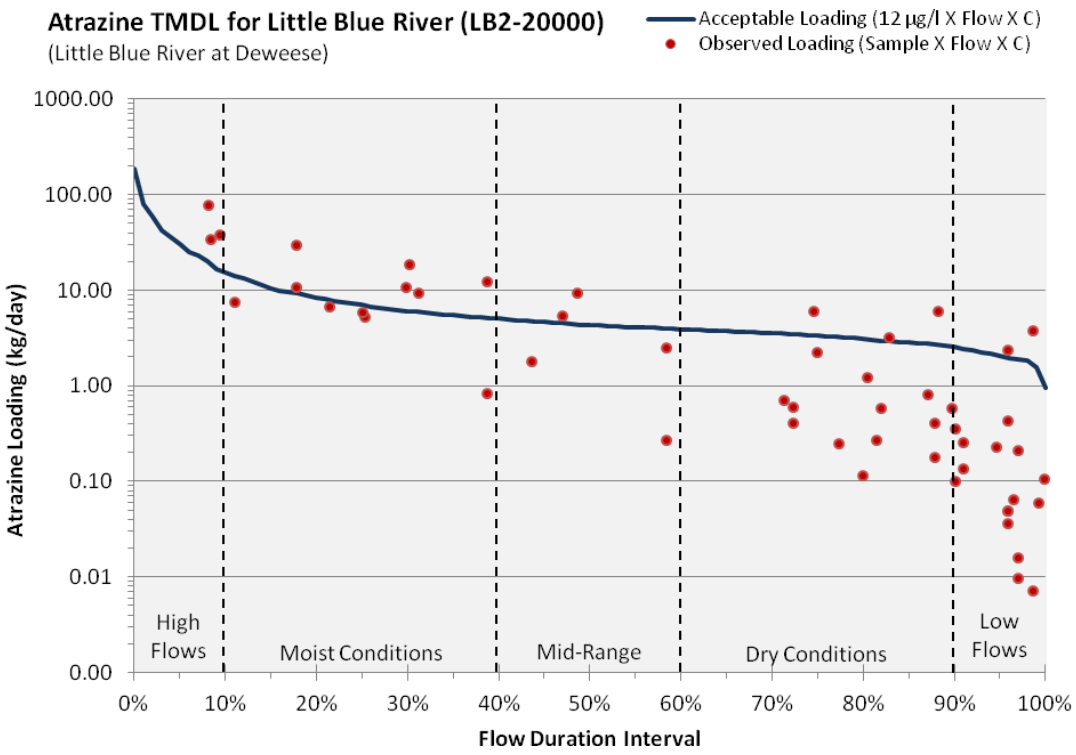

Figure 2.3.1.4: Seasonal Atrazine TMDL Curve for Little Blue River (LB2-20000) at SLB2LBLUE290

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:

Loading Capacity = Flow x WQS x C

Where:

Flow = cfs = Stream flow volume as cubic feet per second
WQS = 12 µg/l (3 µg/l for LB1-10000) = Water quality criteria for Atrazine in micrograms/liter (µg/l) from Title 117
C = 0.002446 = constant used to convert cfs times µg/l to kg/day

2.4.1 Wasteload Allocation

As stated previously, elevated atrazine concentrations are typically not the result of point source discharges. For this TMDL the wasteload allocation (WLA) will be zero (0).

2.4.2 Natural Background

Atrazine does not occur naturally in the environment therefore the allocation for natural background will be zero (0).

2.4.3 Load Allocation

The load allocations (LA) assigned to this TMDL will be based upon the stream flow volume and will be defined as:

For LB1-10000:

$$LA_i = Q_i \times (3\ \mu g/l) \times C$$

For LB2-10000, LB2-10100, LB2-20000:

$$LA_i = Q_i \times (12\ \mu g/l) \times C$$

Where:
LA_i = load allocations at the i^{th} flow
Q_i = stream flow at the i^{th} flow
12 or 3 μg/l = applicable/target water quality criteria for atrazine from Title 117
C = 0.002446 = constant used to convert cfs times μg/l to kg/day

Because the WLA and natural background are zero (0) the entire loading capacity is the LA and can be found in Appendix B.

2.4.4 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 for this TMDL will be implicit.

For atrazine the margin of safety will be implicit in that the load reduction calculated is based upon events with exceedances during the months of May & June. This timeframe represents the critical conditions when runoff and exceedances of atrazine are likely to occur.

Additionally, segment LB1-10000 has a numerical criteria of 3 μg/l while the other impaired segments which are upstream have a numerical criteria of 12 μg/l. Implementation of this TMDL would target the critical case (LB1-10000). Meeting the standard of 3 μg/l at LB1-10000 may require greater reductions in atrazine loading in the upstream segments than this TMDL indicates.

2.4.5 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 data available for each stream segment, which are considered representative information. The targeted reductions provide water quality managers with a quantitative endpoint by which implementation planning can be carried out.

The required loading reductions to meet water quality standards are determined by applying a reduction in atrazine concentrations to the existing water quality data. For each of the flow conditions, the average reduction is increased until all collected samples within that flow condition meet water quality standards. Table 2.4.5 outlines the required reduction to meet water quality standards. These loading reductions, if achieved, would result in the listed waters meeting their assigned beneficial uses for Aquatic Life, and Public Drinking Water Supply.

Flow Condition	Flow Exceedance Range	Maximum Observed Atrazine Concentration (μg/L)	Loading Reduction Required (%)
LB1-10000 Atrazine Target = 3 μg/L			
High Flows	0%-10%	45.7	93.4
Moist Conditions	10%-40%	111.7	97.3
Mid-Range Flows	40%-60%	8.9	66.3
Dry Conditions	60%-90%	8	62.7
Low Flows	90%-100%	3.9	22.9
LB2-10000 Atrazine Target = 12 μg/L			
High Flows	0%-10%	35	65.7
Moist Conditions	10%-40%	36.3	66.9
Mid-Range Flows	40%-60%	13.4	10.7
Dry Conditions	60%-90%	8.5	--
Low Flows	90%-100%	No Observations	No Observations
LB2-10100 Atrazine Target = 12 μg/L			
High Flows	0%-10%	75.4	84.1
Moist Conditions	10%-40%	169.3	92.9
Mid-Range Flows	40%-60%	13.3	9.5
Dry Conditions	60%-90%	34.2	64.9
Low Flows	90%-100%	7.3	--
LB2-20000 Atrazine Target = 12 μg/L			
High Flows	0%-10%	46.4	74.1
Moist Conditions	10%-40%	37.3	67.8
Mid-Range Flows	40%-60%	25.2	52.4
Dry Conditions	60%-90%	26.5	54.7
Low Flows	90%-100%	27.3	56

Table 2.4.5: Loading Reduction Required to Meet Water Quality Standards

2.4.6 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 is based upon the conversion of the targeted concentration of atrazine to kilograms per day. The daily expression for each TMDL segment can be found in Appendix B.

3.0 E. coli TMDL

3.1 Problem Identification

Six segments in the Little Blue River have been identified as impaired for the Primary Contact Recreation beneficial use with the parameter of concern being *E. coli* bacteria (NDEQ 2010). This section deals with the extent and nature of the water quality impairments caused by excessive *E. coli* bacteria in the Little Blue River Basin. TMDLs addressing E. Coli for segments LB1-10000 and LB2-20000 were completed and approved by EPA in 2005, updates to those TMDLs are included in this document and should be considered as Phase II TMDLs.

3.1.1 Water Quality Criteria Violated and/or Beneficial Uses Impaired

The Primary Contact Recreation beneficial use has been deemed impaired on six segments of the Little Blue River identified above. 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 2009).

3.1.2 Data Sources

Data for E. Coli bacteria is collected as part of Nebraska's basin rotation monitoring network as outlined in Section 1.2

3.1.3 Water Quality Assessment

Water quality data assessments were based upon the beneficial use assessment procedures used to identify Category 5 (impaired waters) for the 2010 Integrated Report. A complete description of the water quality data assessment procedures can be found in the *Methodologies for Waterbody Assessments and Development of the 2010 Integrated Report for Nebraska* (NDEQ 2009b).

The details of the assessment process to determine the use support of the Primary Contact Recreation beneficial use can be found in Table 3.1.3.

Parameter	Criteria: Season Geometric Mean	Supported	Impaired
E. coli	≤126/100 ml	Season geometric mean ≤126/100 ml	Season geometric mean >126/100 ml

Table 3.1.3: Assessment of the Primary Contact Recreation beneficial use using *E. coli* bacteria.

3.1.4 Water Quality Conditions

E. coli data collected during the 2007 Recreation season (May 1 through September 30) was assessed to determine the beneficial use support for primary contact recreation. Table 3.1.4 presents this information.

Segment	Station Number	Site Location	Number of Samples	Season Geometric Mean (#/100ml)
LB1-10000	SLB1LBLUE000	Little Blue River near Hollenberg, KS	21	254
LB1-10200	SLB1ROCKC111	Rock Creek at Endicott, NE	20	379
LB2-10000	SLB2LBLUE125	Little Blue River at Alexandria, NE	20	342
LB2-10100	SLB2BSNDY165	Big Sandy Creek at Alexandria, NE	21	428
LB2-20000	SLB2LBLUE290	Little Blue River at Deweese, NE	17	959
LB2-30000	SLB2LBLUE205	Little Blue River NW of Deweese, NE	17	643

Table 3.1.4: 2007 *E. coli* Data and Assessments – Category 4a and 5 waterbodies.

3.1.5 Potential Pollutant Sources

3.1.5.1 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, commercial and industrial facilities. The facilities that have been issued a National Pollutant Discharge Elimination System Permit (according to EPA's Enforcement & Compliance History Online) in the Little Blue River Watershed are shown in Figure 3.1.5.1a.

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, which are 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 3.1.5.1b shows the facilities within the Little Blue River watershed that have been entered into the NDEQ database by a permit being issued or requested. 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. As of June 2010 there were 489 LWC facilities within the Little Blue River watershed. There are no MS4 permits in the watershed

3.1.5.2 Nonpoint Sources: Several nonpoint sources of *E. coli* exist in the Little Blue River watershed. 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.

3.1.5.3 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 Little Blue River watershed. Big game, upland game, furbearers, waterfowl and non-game species have been documented to reside within the basin.

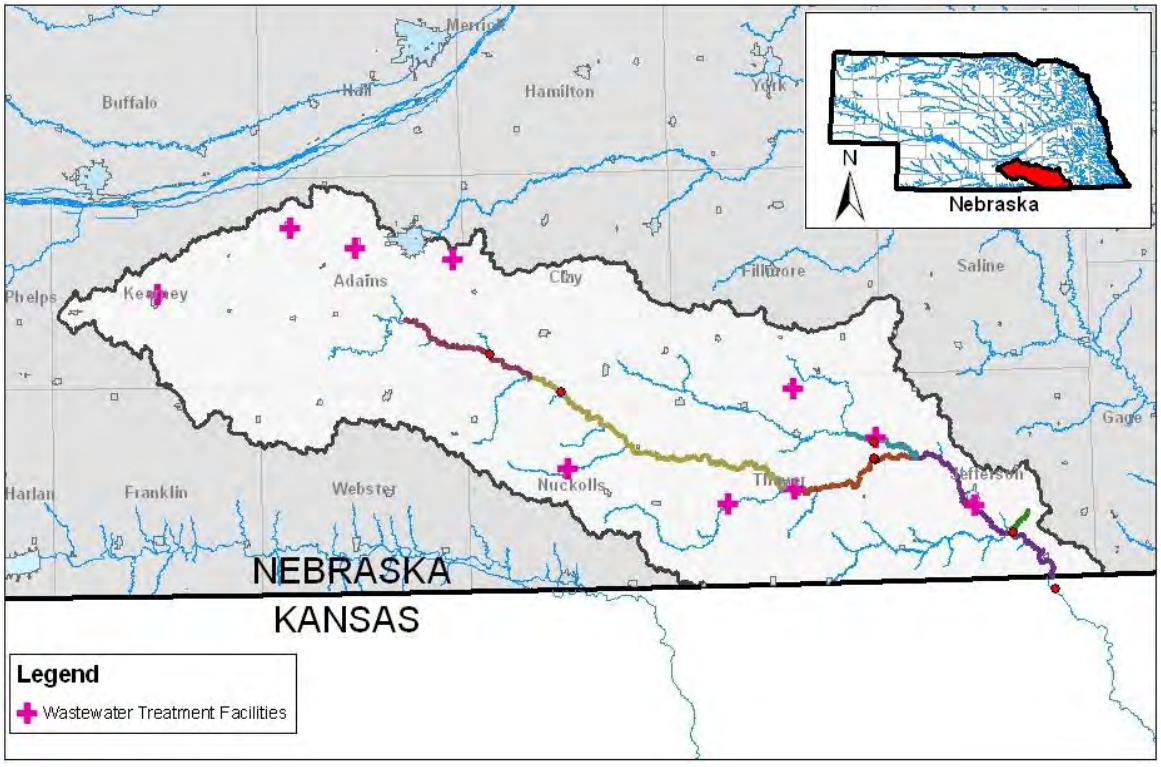

Figure 3.1.5.1a: NPDES Permitted Facilities in Little Blue River Watershed with E.Coli Limits

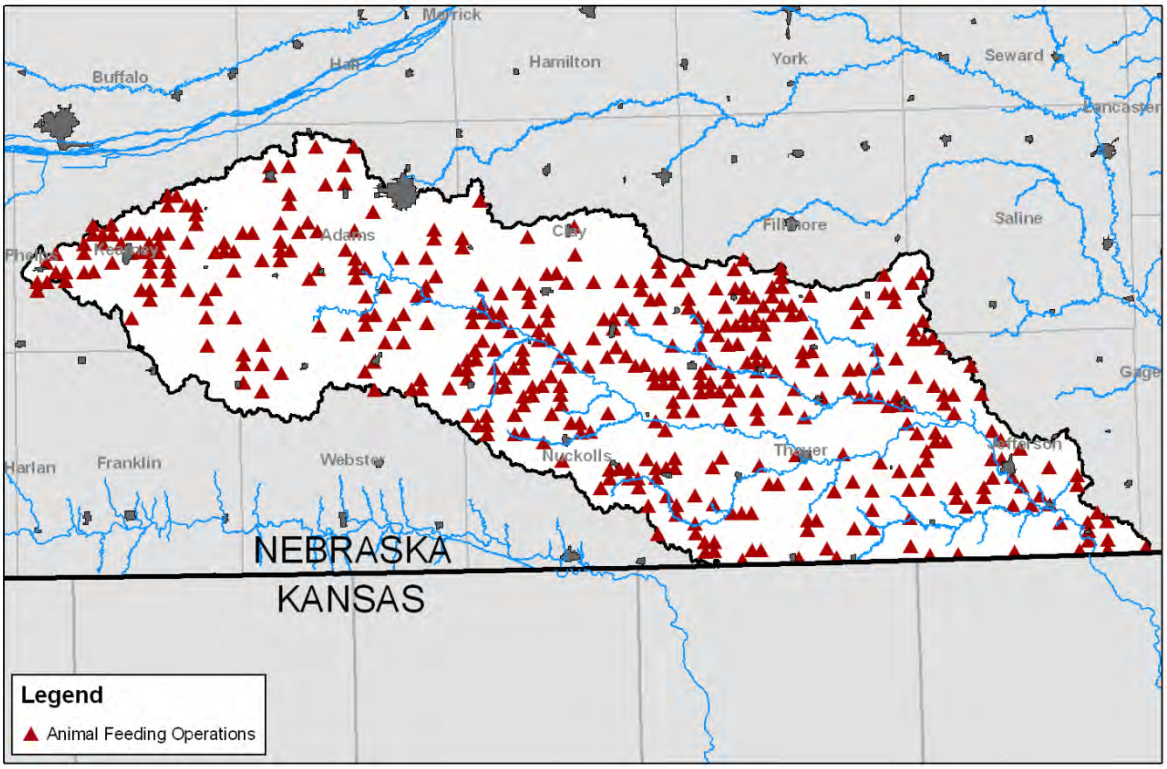

Figure 3.1.5.1b: Active Animal Feeding Operations in the Little Blue River Watershed

3.2 TMDL Endpoint

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

3.2.1 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 applicable between May 1 and September 30th (NDEQ 2012):

> *002.01 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.
>
> 002.01A 235/100 ml at designated bathing beaches
>
> 002.01B 298/100 ml at moderately used recreational waters
>
> 002.01C 406/100 ml at lightly used recreational waters
>
> 002.01D 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.

3.2.2 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.

3.2.3 Waterbody Pollutant Loading Capacity

Defining waterbody pollutant loading capacity implies a steady state. These TMDLs recognize that loadings are dynamic and can vary with stream flow. Additionally, section 3.1.5 above 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:

Loading capacity = WQS x Flow x C

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

3.3 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 2002). 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.

3.3.1 Existing Pollutant Conditions

The existing pollutant conditions are shown in the data assessment curves (Figures 3.3.1a through 3.3.1f) 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. 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.

As previously mentioned, E. Coli TMDLs for segments LB1-10000 and LB2-20000 were approved by EPA in 2005, and thus the TMDLs provided in this document should be considered as Phase II TMDLs.

3.3.2 Deviation from Acceptable Pollutant Loading Capacity

Table 3.3.2.1 describes the deviation from the acceptable water quality standards based upon the 2008 *E. coli* monitoring information.

Impaired Segment	Waterbody Name	2007 Seasonal Geometric Mean (#/100ml)	E.Coli Above WQS (#/100ml)
LB1-10000	Little Blue River	254	128
LB1-10200	Rock Creek	379	253
LB2-10000	Little Blue River	342	216
LB2-10100	Big Sandy Creek	428	302
LB2-20000	Little Blue River	959	833
LB2-30000	Little Blue River	643	517

Table 3.3.2.1: Deviation from the Applicable Water Quality Criteria

Table 3.3.2.2 outlines a comparison of the water quality conditions during Phase I and Phase II of TMDL development to determine what improvements, if any have occurred. Results show that the water quality conditions have been improved since Phase I of TMDL development.

Impaired Segment	2005 Water Quality Conditions E. Coli (cfu/100ml)	Current Water Quality Conditions E. Coli (cfu/100ml)	% Improvement
LB1-10000	998	254	75%
LB2-10000	458	342	25%

Table 3.3.2.2: Phase I and Phase II E. Coli Concentrations

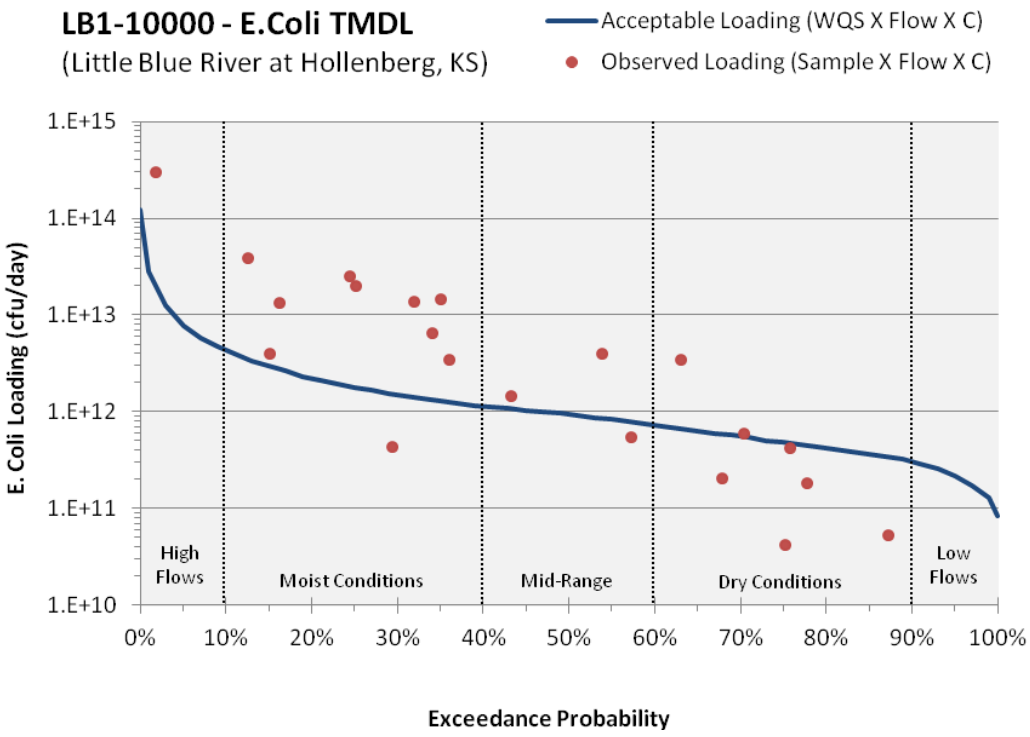

Figure 3.3.1a: Data Assessment Curve for Little Blue River segment LB1-10000

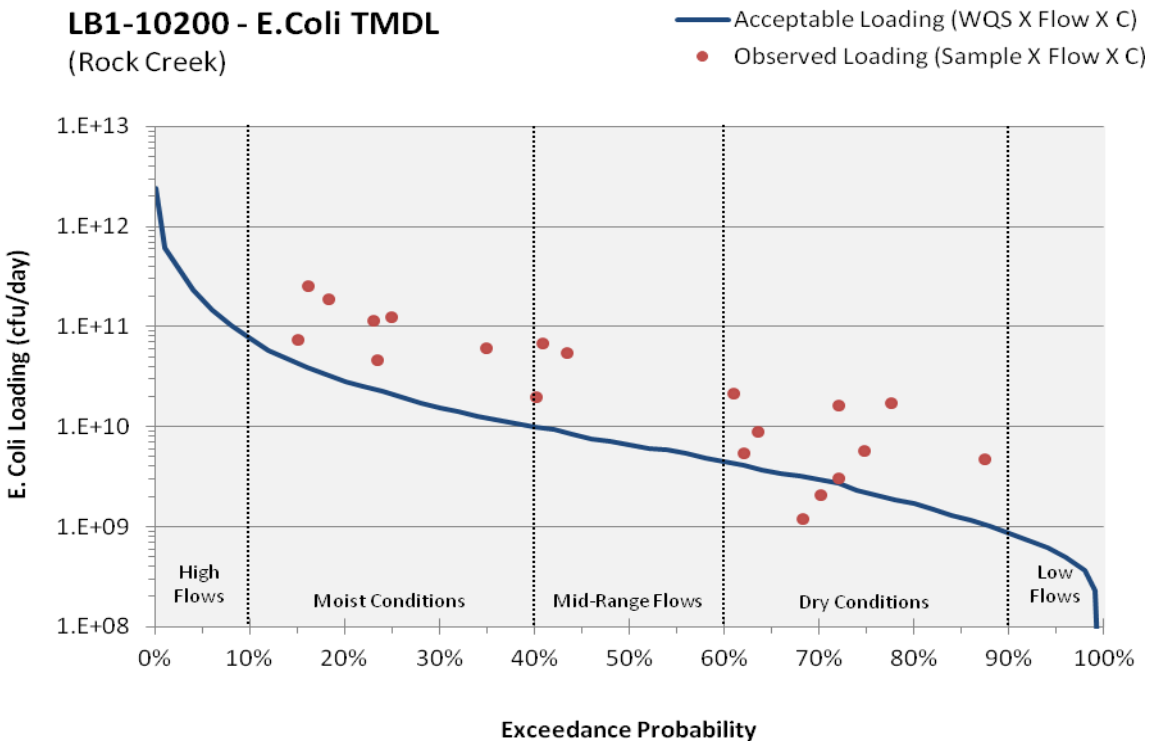

Figure 3.3.1b: Data Assessment Curve for Little Blue River segment LB1-10200

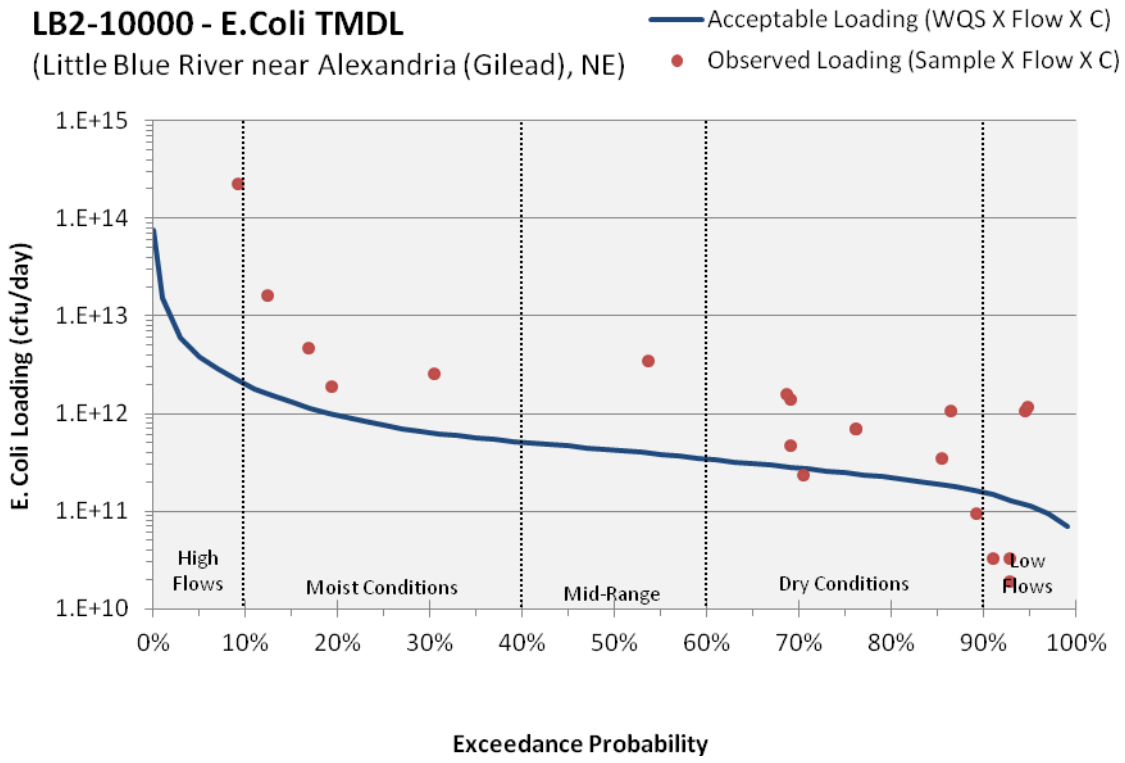

Figure 3.3.1c: Data Assessment Curve for Little Blue River segment LB2-10000

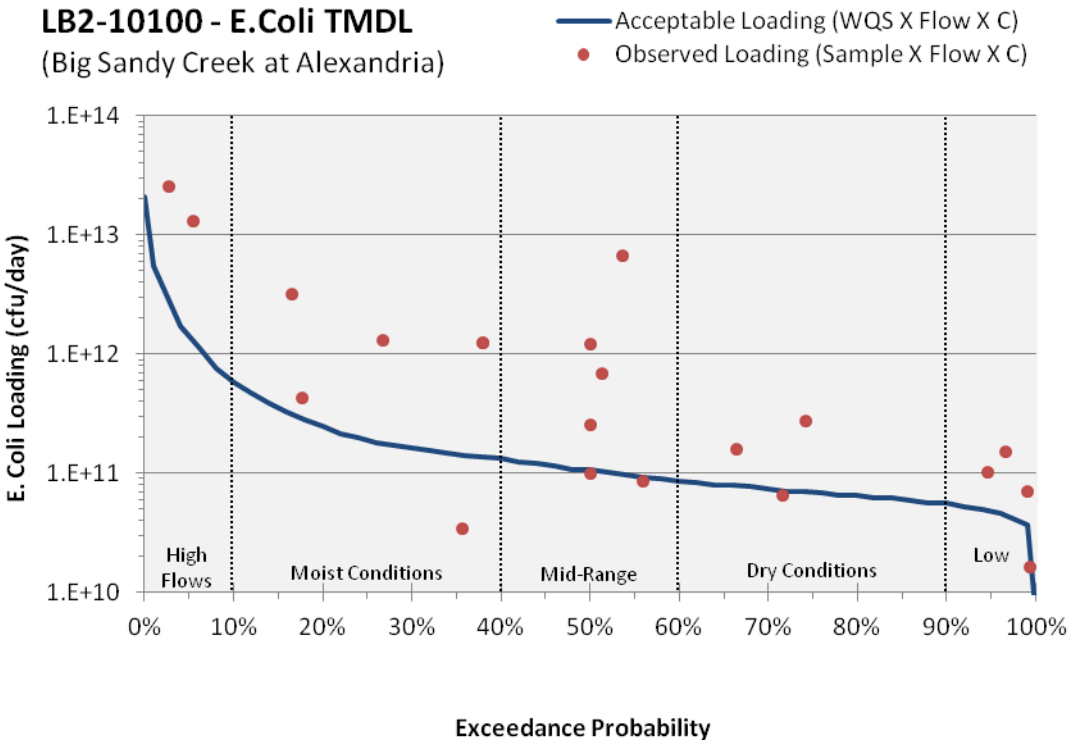

Figure 3.3.1d: Data Assessment Curve for Little Blue River segment LB2-10100

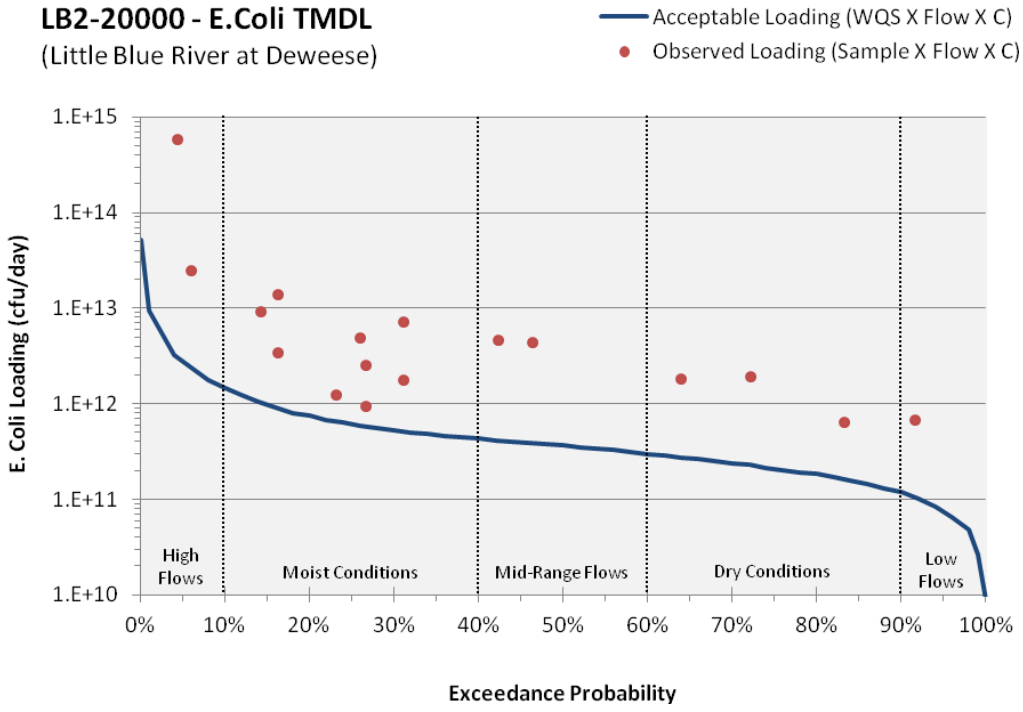

Figure 3.3.1e: Data Assessment Curve for Little Blue River segment LB2-20000

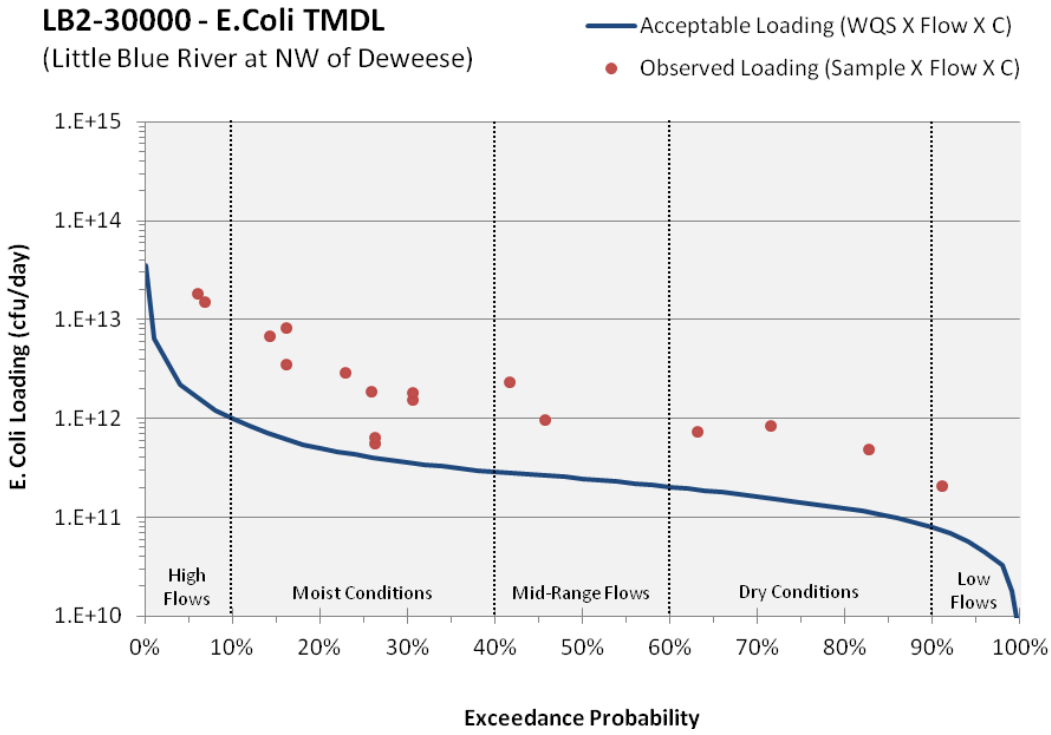

Figure 3.3.1f: Data Assessment Curve for Little Blue River segment LB2-30000

3.3.3 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* (NDEQ 2002).

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 3.3.3a, 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:

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

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 target (with factor of safety

The values for ΣQe as well as the boundary flows can be found in Table 3.3.3b. The identification of pollutant sources and impacts are shown in figure 3.3.3.c. No pollutant source chart will be presented for segment LB1-10200 as there are no point source discharges to the segment.

3.3.3.1 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 in all segments except LB1-10200. Facilities that discharge either directly to or into a tributary of the Little Blue River basin recreation segments that are a potential source are listed in Table 3.3.3.1 below. Note that in 2005 version of the Phase II TMDLs, the WWTF at Carleton, Ong, and Shickley were included. Since then, the permits for these facilities have not been renewed.

3.3.3.2 Nonpoint 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. Mix

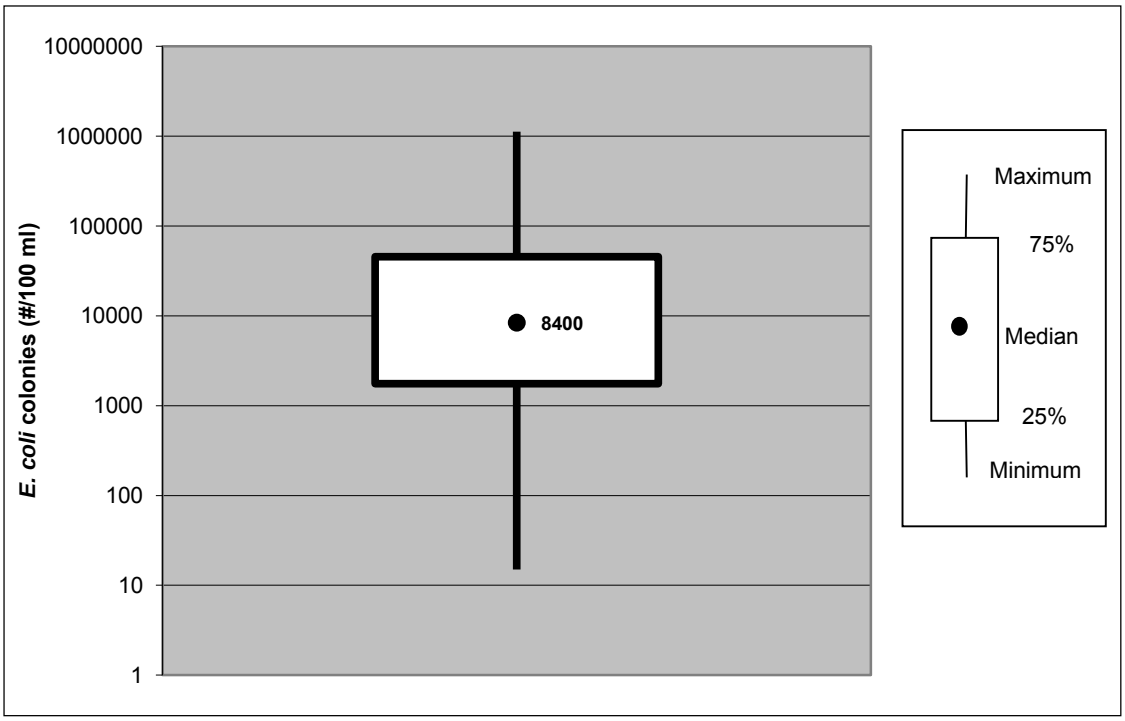

Figure 3.3.3.1: *E. coli* Data from 24 Wastewater Treatment Facilities

Segment	Total Number Of Facilities	Sum of Contributing Facility Design Flows (cfs)	Median Flow Value for Point vs. Nonpoint Boundary (cfs)
LB1-10000	10	5.49	367
LB1-10200	0	--	--
LB2-10000	6	3.57	238
LB2-10100	3	0.37	25
LB2-20000	4	1.98	132
LB2-30000	3	1.11	74

Table 3.3.3.1: Sum of Wastewater Treatment Facility Design Flows in the Little Blue River Basin

Impaired Reach	NPDES Permit #	Facility Name	Receiving Stream	Design Flow (CFS)
LB1-10000	NE0024384	FAIRBURY WWTF	LB1-10000	1.55
	NE0029238	ALEXANDRIA WWTF	LB2-10100	0.08
	NE0045071	BRUNING WWTF	LB2-10110	0.06
	NE0113298	HASTING WWTF MAXON AVE	LB2-10300	0.23
	NE0024252	HEBRON WWTF	LB2-10000	0.59
	NE0039802	DESHLER WWTF	LB2-10500	1.01
	NE0048046	NELSON WWTF	LB2-20200	0.87
	NE0028100	JUNIATA WWTF	LB2-30300	0.22
	NE0025411	MINDEN WWTF	Undesignated	0.62
	NE0021555	KENESAW WWTF	Undesignated	0.27
			Total	**5.49**
LB2-10100	NE0029238	ALEXANDRIA WWTF	LB2-10100	0.08
	NE0045071	BRUNING WWTF	LB2-10110	0.06
	NE0113298	HASTING WWTF MAXON AVE	LB2-10300	0.23
			Total	**0.37**
LB2-10000	NE0024252	HEBRON WWTF	LB2-10000	0.59
	NE0039802	DESHLER WWTF	LB2-10500	1.01
	NE0048046	NELSON WWTF	LB2-20200	0.87
	NE0028100	JUNIATA WWTF	LB2-30300	0.22
	NE0025411	MINDEN WWTF	Undesignated	0.62
	NE0021555	KENESAW WWTF	Undesignated	0.27
			Total	**3.57**
LB2-20000	NE0048046	NELSON WWTF	LB2-20200	0.87
	NE0028100	JUNIATA WWTF	LB2-30300	0.22
	NE0025411	MINDEN WWTF	Undesignated	0.62
	NE0021555	KENESAW WWTF	Undesignated	0.27
			Total	**1.98**
LB2-30000	NE0028100	JUNIATA WWTF	LB2-30300	0.22
	NE0025411	MINDEN WWTF	Undesignated	0.62
	NE0021555	KENESAW WWTF	Undesignated	0.27
			Total	**1.11**

Table 3.3.3.2: NPDES Permitted Facilities with *E. coli* limits in the Little Blue River Basin

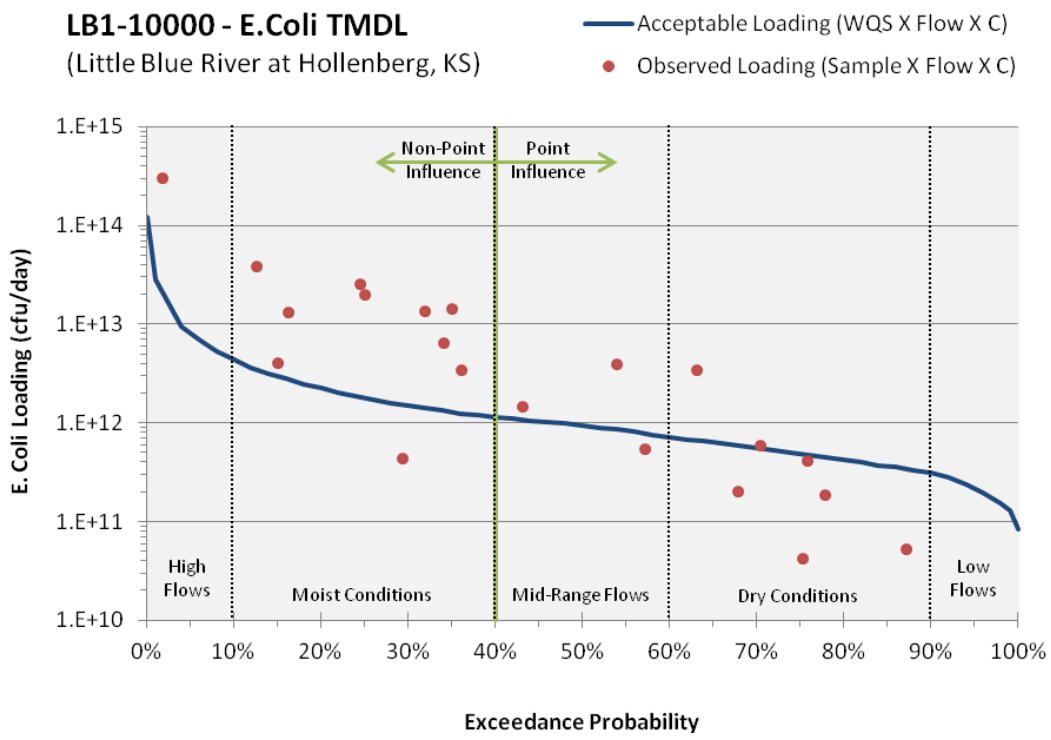

Figure 3.3.3.2: Identification of Pollutant Sources; Data Assessment Curve for LB1-10000

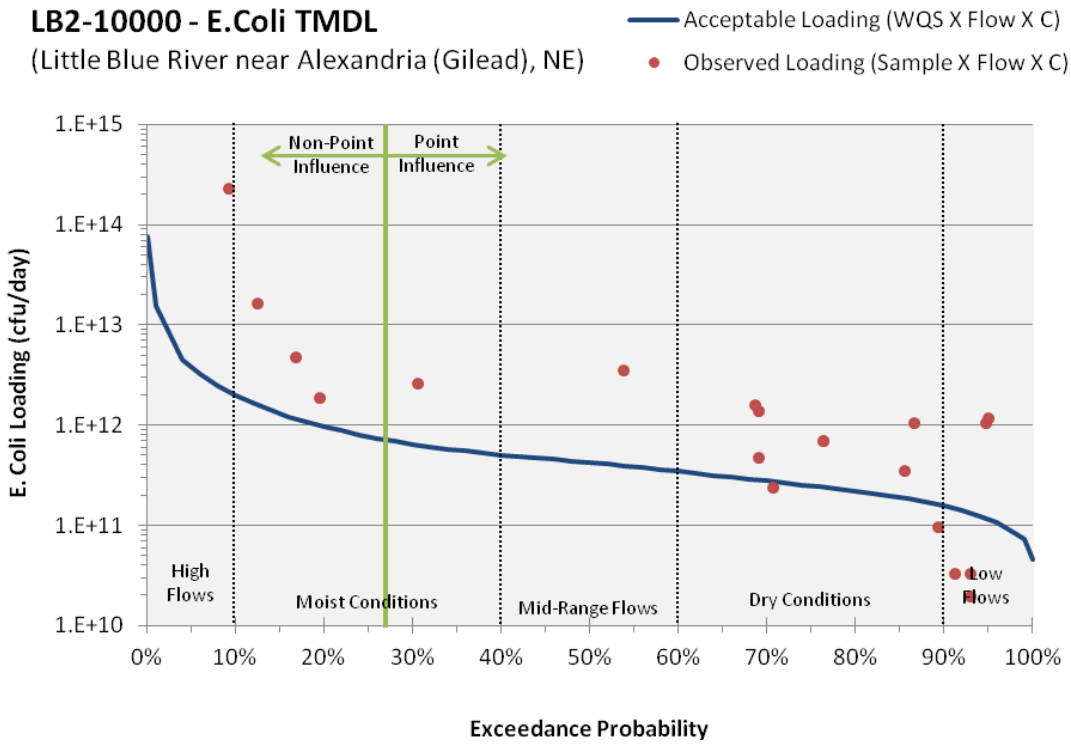

Figure 3.3.3.3: Identification of Pollutant Sources; Data Assessment Curve for LB2-10000

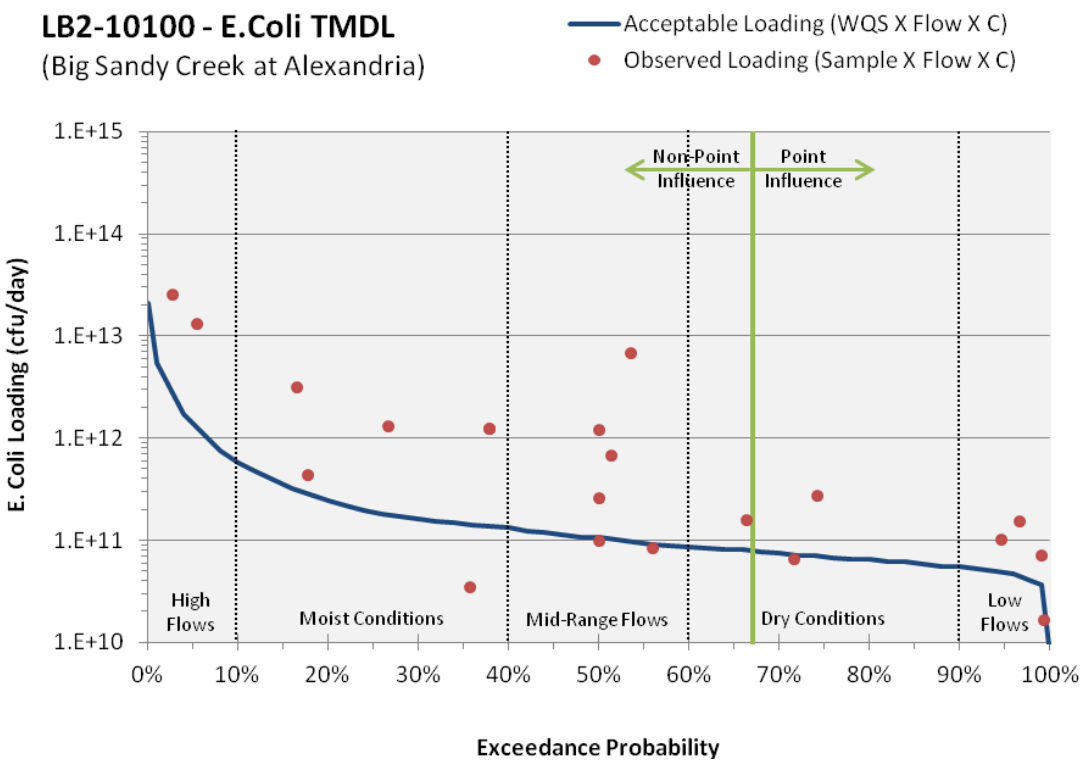

Figure 3.3.3.4: Identification of Pollutant Sources; Data Assessment Curve for LB2-10100

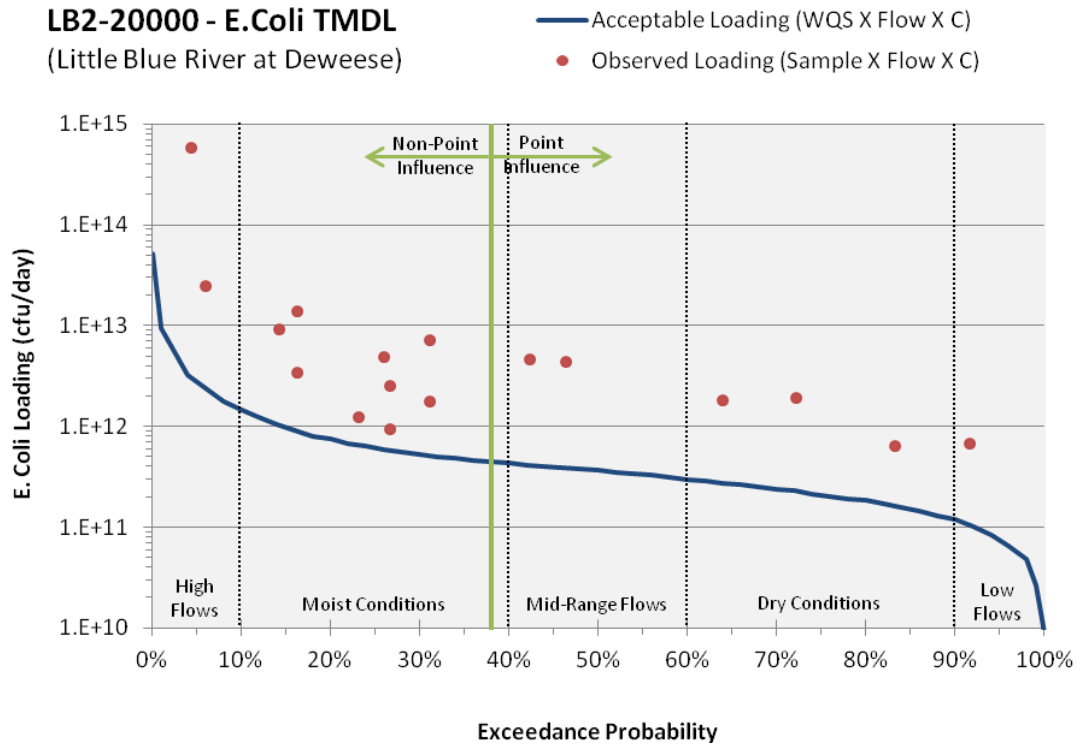

Figure 3.3.3.5: Identification of Pollutant Sources; Data Assessment Curve for LB2-20000

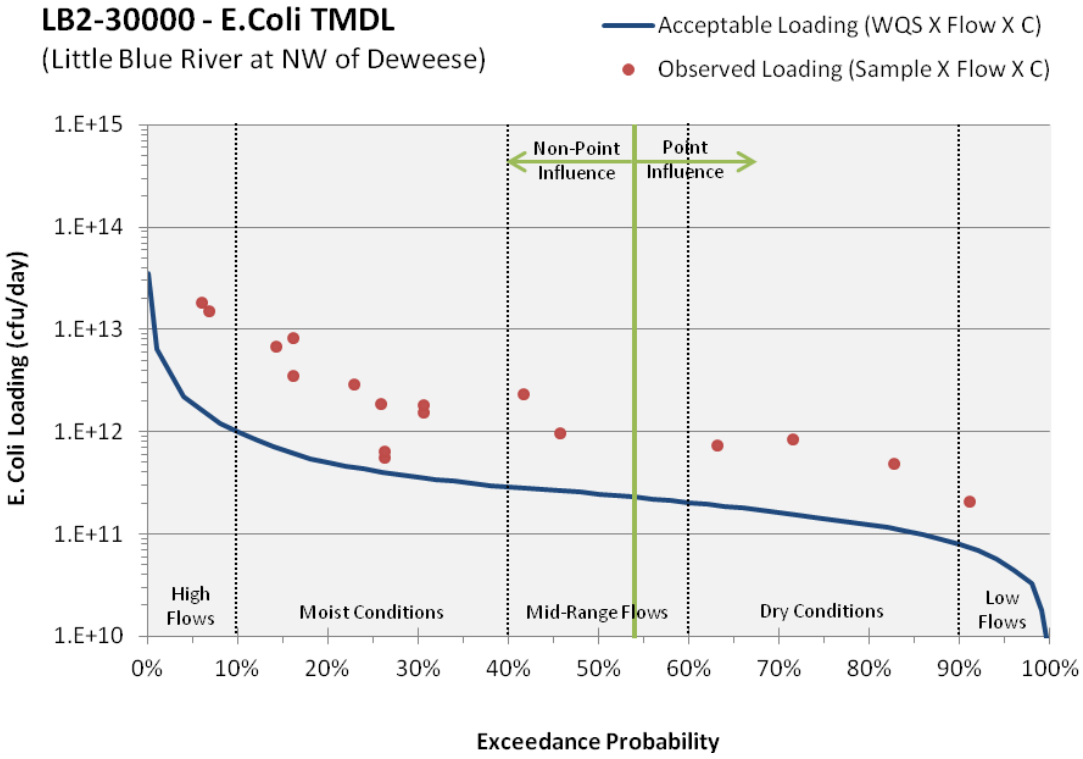

Figure 3.3.3.6: Identification of Pollutant Sources; Data Assessment Curve for LB2-30000

The source identification process was completed 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.

3.4 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 federal 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 conversion factor) 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. The flow hydrographs (0-100th Percentile) used in the *E. coli* TMDLs are provided in Table 3.4.

Percent Exceedance	LB1-10000 (cfs)	LB1-10200 (cfs)	LB2-10000 (cfs)	LB2-10100 (cfs)	LB2-20000 (cfs)	LB2-30000 (cfs)
100%	27	0	15	2	3	2
90%	100	0.28	51	18	38	26
80%	136	0.55	71	21	60	40
70%	181	0.95	90	24	77	52
60%	233	1.4	112	28	97	65
50%	305	2.1	137	35	118	80
40%	370	3.3	163	43	139	94
30%	487	5.0	208	53	172	116
20%	724	9.2	310	80	241	163
10%	1420	25	645	186	474	321
0%	39269	794	24382	6829	16750	11324

Table 3.4: Recreation Season Hydrograph for the Little Blue River Basin *E. coli* TMDLs

To achieve the desired loading capacities requires the following allocations:

3.4.1 Wasteload Allocations

3.4.1.1 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 (lowest stream flow for seven consecutive days that would be expected to occur once in ten years). Therefore, the *E. coli* wasteload allocation established by this TMDL will be the monthly geometric mean 126/100 ml.

The wasteload allocation will initially be applied to all facilities that discharge directly to a recreational segment. Meeting the WLA will be achieved by adhering to the existing compliance schedules for bacteria, included within both communities NPDES permits.

Typically, to achieve NPDES compliance for bacteria, discharging facilities need to provide for some form of disinfection. 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 contributions, upon meeting compliance schedules, is likely to be less than the WLA assigned above (126/100ml). Future monitoring and evaluation will be utilized to determine if *E. coli* limitations are necessary for facilities discharging to the recreation segment's tributaries.

3.4.1.2 Dry Weather Discharges: Dry weather discharges can both 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 0 cfu/100 ml.

3.4.1.3 Non-Discharging Facilities: Several facilities including confined animal feeding operations (CAFOs) 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).

3.4.2 Load Allocations

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

$$LA_i = LC - WLA - MOS = (Q_i \times 126/100 \text{ ml} \times C) - WLA - MOS$$

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

3.4.3 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.

3.4.4 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 2008 data, which is considered representative information. The targeted reductions found in Table 3.4.4 provide water quality managers with a quantitative endpoint by which implementation planning can be carried out. The noted reductions along with 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.

The required loading reductions were determined by applying an average reduction to the existing data set to determine what reduction levels would be required to drop the seasonal geometric average below the water quality standard. Table 3.4.4 outlines the targeted reductions which would be required in the impaired segments to meet water quality standards. These loading reductions, if achieved, would result in the listed waters meeting their assigned Primary Contact Recreation beneficial use.

Segment	*E. coli* Reduction Required to meet Water Quality Standards (%)	Expected Seasonal Geometric Average (cfu/100ml)
LB1-10000	56%	112
LB1-10200	70%	113
LB2-10000	67%	113
LB2-10100	74%	113
LB2-20000	88%	113
LB2-30000	83%	113

Table 3.4.4: Targeted *E. coli* Load Reductions

3.4.5 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 be 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 C.

4.0 Implementation Plan

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

4.1 Nebraska Department of Agriculture

The Nebraska Pesticide Act provides that the Nebraska Department of Agriculture (NDA) shall serve as the lead state agency in matters relating to pesticides as they relate to water quality. It further provides that NDA shall work closely with the Nebraska Department of Environmental Quality, Nebraska Department of Natural Resources, and the Nebraska Department of Health and Human Services in matters relating to water quality.

Since 1995, the NDA has been the lead agency for the regulation of pesticides that might enter or pollute water and is responsible for development and implementation of state management plans for the prevention, evaluation and mitigation of occurrences of pesticides, or pesticide breakdown products, in ground and surface water. By working closely with those state agencies listed above as well as the Natural Resources Districts and others, NDA can be assured that the plans will be more comprehensive and effective in addressing these issues.

The NDA has been consulted in the completion of this TMDL and will be provided a copy upon EPA approval.

4.2 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 atrazine and surface run-off for the proposed projects in the Little Blue River basin. As well, an effort will be made to redirect applicants to develop proposals consistent with the goals of this TMDL.

4.3 USDA - Natural Resource Conservation Service

The USDA-Natural Resource Conservation Service provides 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. The TMDL will be forwarded to NRCS for consideration in the implementation of these programs.

4.4 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.

4.5 NPDES Permitted Point Sources

Facilities that discharge directly to all segments within the Little Blue 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 designated or undesignated tributaries will be evaluated to determine the extent of the effluent's impact on immediate downstream 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 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 than 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 4.7 below, a recommendation will be made that all relevant NPDES permittees adhere to the setback requirements identified in Title 130 Chapter 9 sections 007 for land application activities taking place either during or 10 days prior to the recreation season (May 1 – September 30).

4.6 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.

4.7 Animal Feeding Operations

The Livestock Waste Control Program administers two types of permitting programs, under the authority of Title 130 - Livestock Waste Control Regulations, for livestock waste control facilities in Nebraska: The federal National Pollutant Discharge Elimination System (NPDES) permitting program and the state Construction and Operating Permit program. NDEQ Livestock program issues individual NPDES permits, as well as coverage under a General NPDES permit.

Chapter 2, titled "Animal Feeding Operations: Requirements and Prohibitions" states:

> *<u>001</u> Any small animal feeding operation is exempt from the inspection, and construction and operating permit requirements, unless the animal feeding operation has discharged pollutants to waters of the State, or the Department has determined that such a discharge is more likely than not to occur. Operations with animals that are in contact with, or which have direct access to, surface waters, or operations with a man-made ditch, pipe, or other conveyance from the operation to surface waters are considered to be discharging. Animal feeding operations for other species not listed (e.g. bison, elk) that confine animals with a total animal weight of less than 300,000 pounds are considered small animal feeding operations.*

002 Any person owning or operating a large or medium animal feeding operation that does not have a NPDES permit, construction approval, operating permit or construction and operating permit, has not been notified that no permit is required, or is not exempt under Nebr. Rev. Stat. 54-2422 shall submit an inspection request to the Department on a form provided by the Department (see Appendix A). The inspection fee established in Chapter 3 shall accompany the inspection request.

003 A livestock waste control facility is required for an existing or proposed animal feeding operation when livestock wastes have discharged or have the potential to discharge in a manner that is not lawfully authorized by permit or these regulations.

004 When livestock waste control facilities are required by the Department, the owner or operator of the animal feeding operation is required to apply for construction and operating permit as provided in Chapter 4. In the case of an existing animal feeding operation, the owner or operator will be notified in writing following an inspection by the Department whether or not a facility is required and, if required, the applicant shall submit an application according to the compliance dates in the notification.

And,

008 Any person who owns or operates an animal feeding operation shall not:

008.01 Provide or present false or misleading information to the Department or omit relevant facts when submitting reports or applications to the Department;

008.02 Allow livestock at an animal feeding operation to come into direct contact with waters of the State, apply livestock waste on or into waters of the State, or to otherwise allow or cause a discharge;

008.03 Apply manure, litter, or process wastewater to land in a manner that results in a discharge to waters of the State or that is not in accordance with nutrient management practices that ensure appropriate agricultural utilization of the nutrients in the manure, litter, or process wastewater;

008.04 Stockpile livestock waste in a drainage way or other location where it is likely to impact waters of the State;

Chapter 8, titled "Waste Control Methods: Design Criteria and Construction Requirements" also states:

002.01 For open lot animal feeding operations, the minimum storage period capacity shall be no less than the calculated average runoff for the month of June, runoff from a 25-year, 24-hour rainfall event, and any manure, litter, and process wastewater produced for the month of June.

002.02 The minimum storage period for totally housed operations shall be no less than 180 days. Except, the applicant may request the Director to establish a substantially equivalent alternative storage period which is less than 180 days based upon a satisfactory demonstration that the proposed alternative time period will achieve overall environmental performance which is at least equal to that achieved by providing

adequate storage for the specified 180 days. The Director may require any additional supporting information deemed necessary to support such a request.

005 Surface drainage shall be diverted around the production area and livestock waste control facility to the maximum extent possible by diversion terrace, berm, ditch, or similar diversion, subject to Department approval. Any such diversion shall be designed and constructed to convey at least the runoff and the direct precipitation from the peak discharge of a 25-year, 24-hour rainfall event or a 100-year, 24-hour rainfall event (whichever rainfall event is applicable as identified in Chapter 7). Any open diversion will not be less than 1.5 feet in channel depth.

Meeting these regulation 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 stockpile and application setbacks identified in Title 130 Chapter 9.

007 For large concentrated animal feeding operations, manure, litter, and process wastewater may not be stockpiled or applied closer than 100 feet to any down-gradient surface waters, open tile line intake structures, well heads, or other conduits to surface or ground water, except that one of the following two compliance alternatives may be substituted for the application setback requirement:

007.01 A 35-foot-wide vegetated buffer where the application of manure, litter, or process wastewater is prohibited. For the purposes of these regulations vegetated buffer means a permanent strip of dense perennial vegetation established parallel to the contours of and perpendicular to the dominant slope of the field for the purposes of slowing water runoff, enhancing water infiltration, and minimizing the risk of any potential nutrients or pollutants from leaving the field and reaching surface waters of the state; or

007.02 A satisfactory demonstration that a setback or buffer is not necessary because implementation of alternative conservation practices will provide pollutant reductions equal to or better than reductions that would be achieved by the 100-foot setback.

008 For small and medium concentrated animal feeding operations and animal feeding operations not required to seek permit coverage, manure, litter, and process wastewater may not be stockpiled or applied closer than 30 feet of any streams, lakes and impounded waters identified in Chapter 6 and Chapter 7 of Title 117 (Nebraska Administrative Code) – Nebraska Surface Water Quality Standards, unless in accordance with a Department approved nutrient management plan.

Permitted facilities are also required to follow best management practices (BMPs) for the land application of livestock wastes as defined in Title 130, Chapter 11, and those BMPs include:

001 Animal feeding operations and livestock waste control facilities shall be operated and maintained to prevent water pollution and to protect the environment of the State. Best management practices shall be implemented using the most effective methods based on the best available technology achievable for specific sites to prevent or reduce the discharge of pollutants to waters of the State and control odor where appropriate.

And,

005 All livestock wastes removed from the facility and the animal feeding operation itself shall be land applied or stockpiled in a manner which will not contribute to water pollution. The owner or authorized representative shall remain responsible for wastes removed from the operation to land under his or her control.

Based upon the above regarding land application, 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 River basin, that the application of livestock waste occurring 10 days prior or during the Recreation Season (May 1 – September 30) be consistent with Title 130 Chapter 9 sections 007 and 008 mentioned above with the inclusion of streams identified in Chapter 5 of Title 117. In addition, a recommendation will be made to the NDEQ's Agriculture Section that the application setback be the minimum of 30 feet regardless of the status of the comprehensive nutrient management plan for all small and medium concentrated animal feeding operations. And finally, for all small and medium concentrated animal feeding operations, 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 a minimum setback of 100 feet, or complying with sections 007.01 and 007.02 of Title 130 Chapter 9.

A list of the permit numbers for all the Animal Feeding Operations in the Little Blue River basin are listed by county in Appendix D.

4.8 Exempt Facilities/Other Agricultural Sources

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

- The operation is classified as a small animal feeding operation, and
- There has not been a confirmed discharge to waters of the State, and/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 as a small animal feeding operation. 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.

4.9 Reasonable Assurance

As stated above, the NDA is the lead agency that deals with pesticide water quality issues. This TMDL was provided to the NDA prior to submittal to EPA for approval/disapproval. Once approved, coordination with the NDA will continue, including data collection and prioritization and nonpoint source program administration.

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 contains 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 atrazine and *E. coli* contributions to the Little Blue River basin. Participation will depend on the agency/organization's program capabilities.

5.0 Future Monitoring

Future monitoring will generally be consistent with the ambient monitoring and rotating basin monitoring programs. The Little Blue River Basin was monitored in 2007 and will again be targeted in 2012. An effort will be made to expand the monitoring to isolate areas of concern and to focus resources to address identified problems.

6.0 Public Participation

The availability of the TMDLs in draft form was published on NDEQ's Internet site with the public comment period running from August 6th 2012, to September 4th 2012. Interested stakeholders (Appendix A) were also informed via email of the availability of the draft TMDLs. No comments were received as part of this public notice.

6.0 References

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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

Example of Maximum Daily Loadings for May - June Atrazine at various Little Blue River flow for the impaired segments. Again, given the usage and source of atrazine, point and natural sources are likely not contributing to surface waters in Nebraska. Consequently the WLA and Natural Background for this TMDL are set at zero (0). The entire load below is therefore considered the Load Allocation.

Percent of Flows Exceed	Flow Percentile	LB1-10000 WQS = 3 µg/l		LB2-10000 WQS = 12 µg/l		LB2-10100 WQS = 12 µg/l		LB2-20000 WQS = 12 µg/l	
		Flow (cfs)	TMDL (kg/day)	Flow (cfs)	TMDL (kg/day)	Flow (cfs)	TMDL (kg/day)	Flow (cfs)	TMDL (kg/day)
100	0	26	0.19	43	1.26	14	0.41	33	0.96
90	0.1	102	0.75	76	2.24	20	0.59	88	2.58
80	0.2	123	0.90	101	2.95	22	0.65	104	3.04
70	0.3	146	1.07	126	3.69	25	0.73	121	3.54
60	0.4	171	1.25	146	4.29	28	0.82	132	3.88
50	0.5	201	1.47	168	4.92	33	0.97	146	4.29
40	0.6	250	1.83	197	5.79	42	1.23	169	4.96
30	0.7	320	2.35	253	7.42	58	1.70	203	5.96
20	0.8	439	3.22	397	11.66	97	2.85	274	8.04
10	0.9	838	6.15	844	24.76	246	7.21	486	14.27
0	1	39293	288.33	19027	558.49	6830	200.47	6305	185.06

Table B1: Percentile flows and Maximum Daily Atrazine Loading for the Little Blue River

Appendix C

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

$$Q \times 35683.2 \text{ colony forming unit (cfu)}/ft^3 \times 86400 \text{ seconds/day}$$

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.

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	8.32E+10	1.69E+10	5.80E+10	8.32E+09
90%	3.08E+11	1.69E+10	2.61E+11	3.08E+10
80%	4.19E+11	1.69E+10	3.60E+11	4.19E+10
70%	5.58E+11	1.69E+10	4.85E+11	5.58E+10
60%	7.18E+11	1.69E+10	6.30E+11	7.18E+10
50%	9.40E+11	1.69E+10	8.29E+11	9.40E+10
40%	1.14E+12	1.69E+10	1.01E+12	1.14E+11
30%	1.50E+12	1.69E+10	1.33E+12	1.50E+11
20%	2.23E+12	1.69E+10	1.99E+12	2.23E+11
10%	4.38E+12	1.69E+10	3.92E+12	4.38E+11
0%	1.21E+14	1.69E+10	1.09E+14	1.21E+13

Table C1: Daily TMDL Expression from LB1-10000

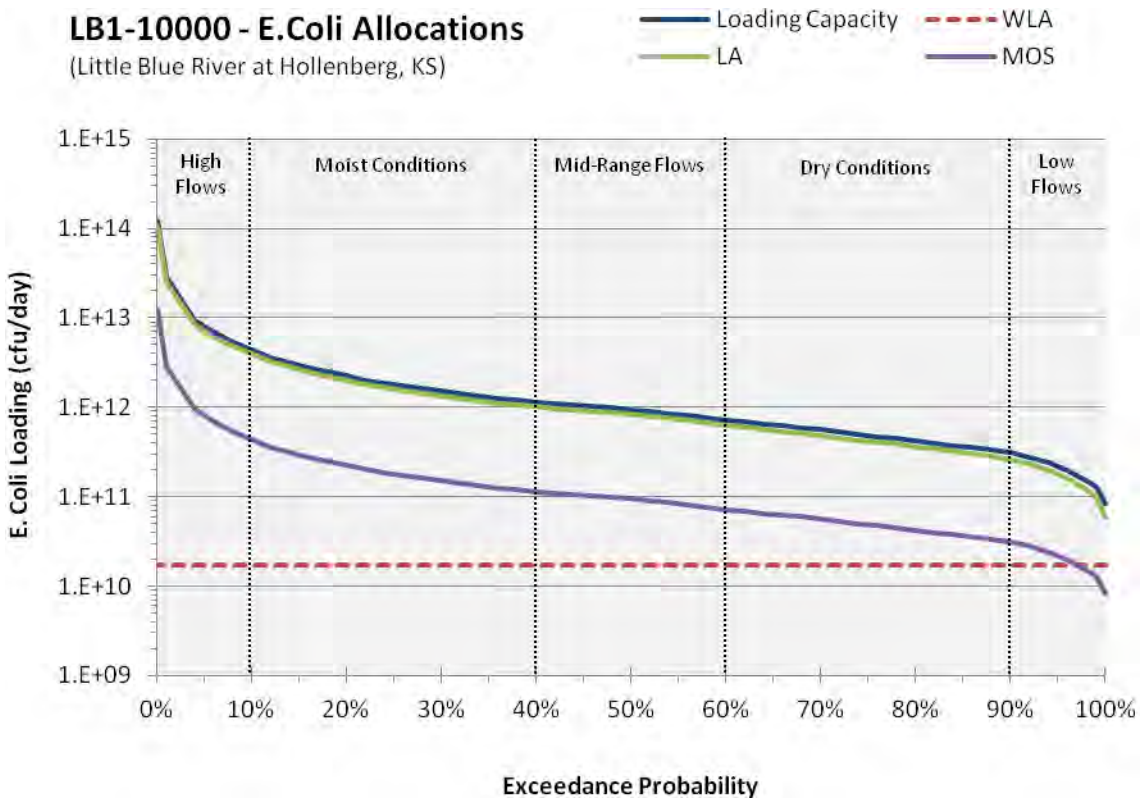

Figure C1: LB1-10000 Daily Load Expression Chart

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	1.50E+06	0.00E+00	1.35E+06	1.50E+05
90%	8.57E+08	0.00E+00	7.71E+08	8.57E+07
80%	1.68E+09	0.00E+00	1.52E+09	1.68E+08
70%	2.94E+09	0.00E+00	2.64E+09	2.94E+08
60%	4.41E+09	0.00E+00	3.97E+09	4.41E+08
50%	6.61E+09	0.00E+00	5.95E+09	6.61E+08
40%	1.00E+10	0.00E+00	9.03E+09	1.00E+09
30%	1.54E+10	0.00E+00	1.39E+10	1.54E+09
20%	2.85E+10	0.00E+00	2.56E+10	2.85E+09
10%	7.60E+10	0.00E+00	6.84E+10	7.60E+09
0%	2.45E+12	0.00E+00	2.20E+12	2.45E+11

Table C2: Daily TMDL Expression from LB1-10200

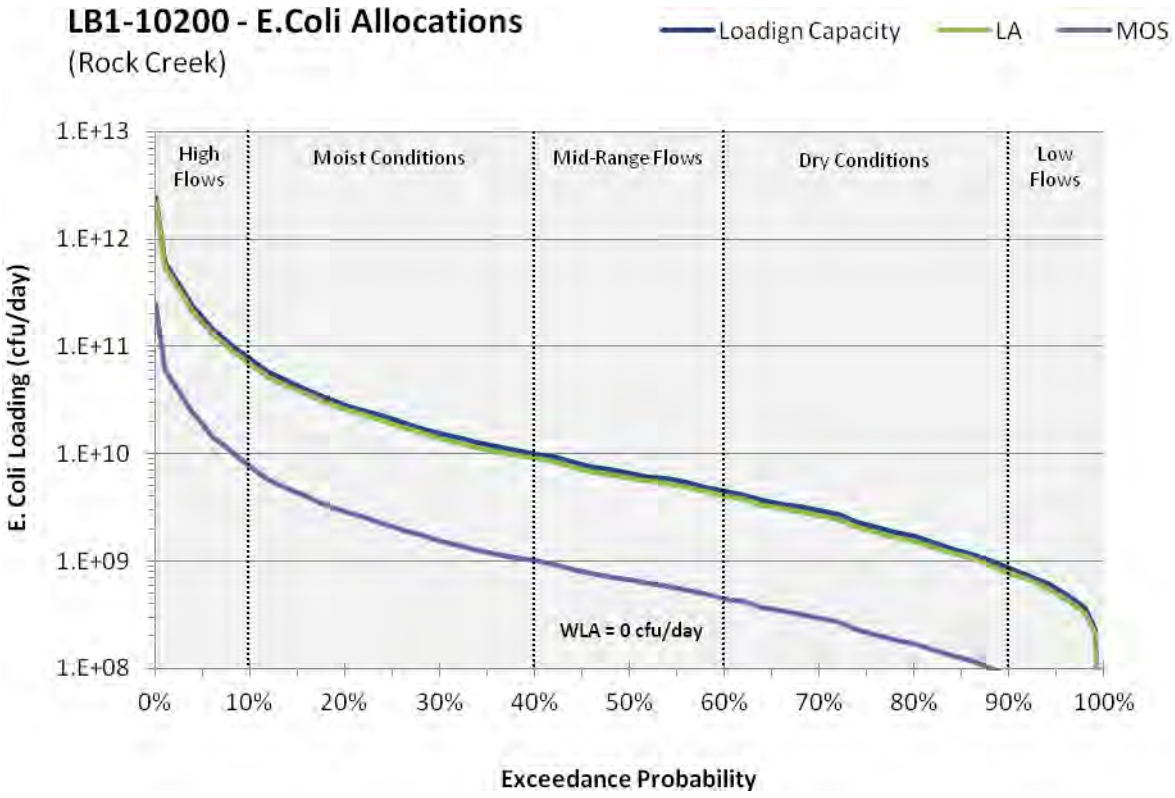

Figure C2: LB1-10200 Daily Load Expression Chart

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	4.54E+10	1.10E+10	2.99E+10	4.54E+09
90%	1.57E+11	1.10E+10	1.30E+11	1.57E+10
80%	2.20E+11	1.10E+10	1.87E+11	2.20E+10
70%	2.77E+11	1.10E+10	2.38E+11	2.77E+10
60%	3.45E+11	1.10E+10	2.99E+11	3.45E+10
50%	4.23E+11	1.10E+10	3.70E+11	4.23E+10
40%	5.04E+11	1.10E+10	4.43E+11	5.04E+10
30%	6.40E+11	1.10E+10	5.65E+11	6.40E+10
20%	9.55E+11	1.10E+10	8.49E+11	9.55E+10
10%	1.99E+12	1.10E+10	1.78E+12	1.99E+11
0%	7.52E+13	1.10E+10	6.76E+13	7.52E+12

Table C3: Daily TMDL Expression from LB2-10000

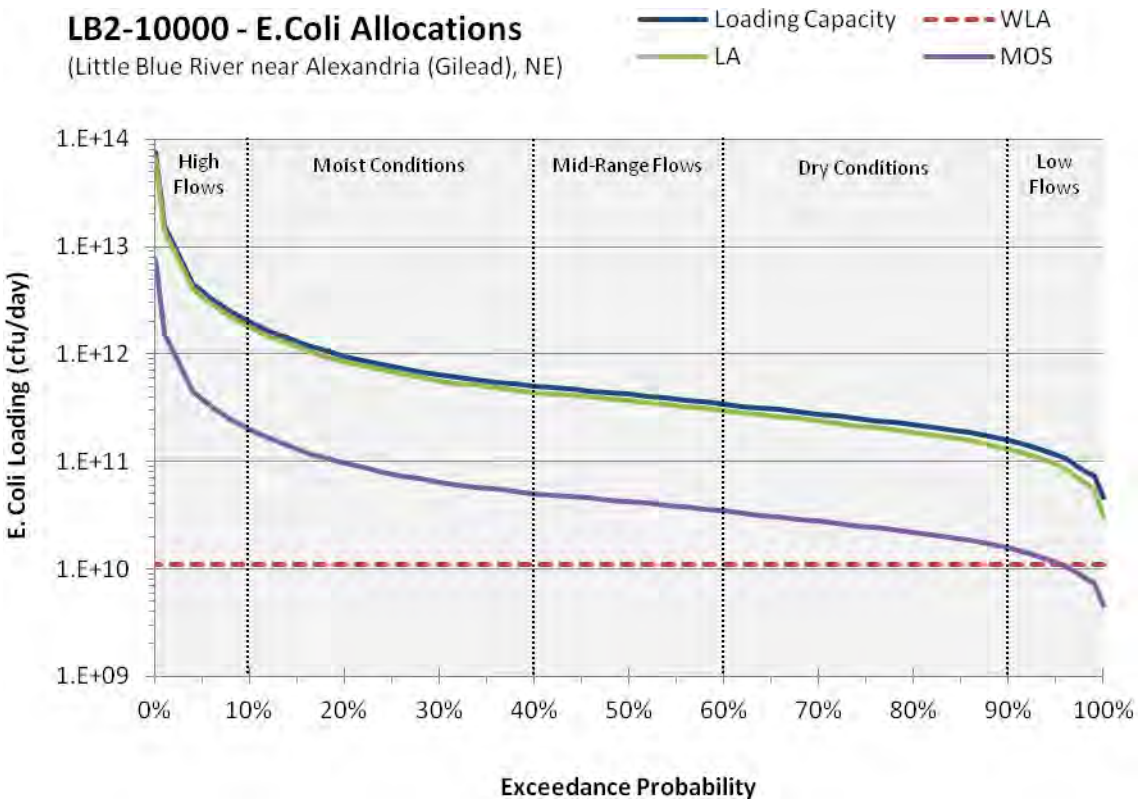

Figure C3: LB2-10000 Daily Load Expression Chart

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	7.40E+09	1.13E+09	5.53E+09	7.40E+08
90%	5.55E+10	1.13E+09	4.88E+10	5.55E+09
80%	6.47E+10	1.13E+09	5.71E+10	6.47E+09
70%	7.40E+10	1.13E+09	6.55E+10	7.40E+09
60%	8.63E+10	1.13E+09	7.66E+10	8.63E+09
50%	1.06E+11	1.13E+09	9.46E+10	1.06E+10
40%	1.33E+11	1.13E+09	1.18E+11	1.33E+10
30%	1.63E+11	1.13E+09	1.46E+11	1.63E+10
20%	2.47E+11	1.13E+09	2.21E+11	2.47E+10
10%	5.72E+11	1.13E+09	5.14E+11	5.72E+10
0%	2.11E+13	1.13E+09	1.89E+13	2.11E+12

Table C4: Daily TMDL Expression from LB2-10100

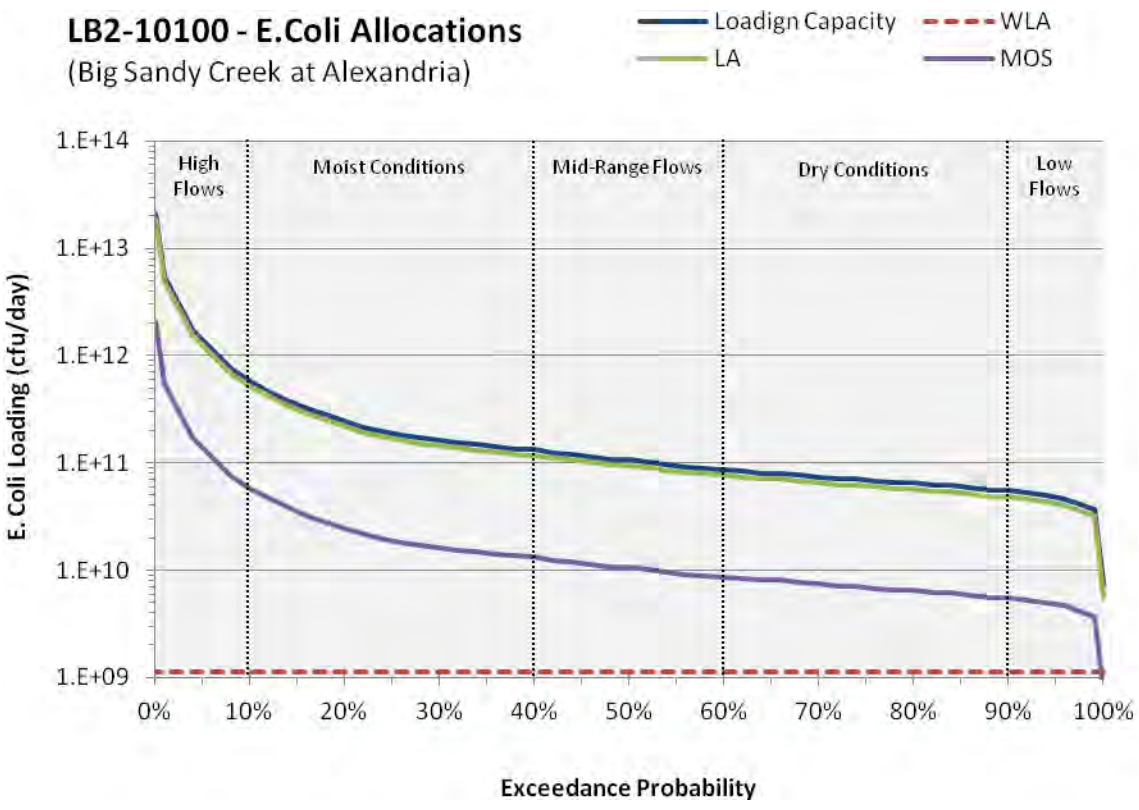

Figure C4: LB2-10100 Daily Load Expression Chart

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	8.89E+09	6.10E+09	1.90E+09	8.89E+08
90%	1.18E+11	6.10E+09	1.00E+11	1.18E+10
80%	1.84E+11	6.10E+09	1.59E+11	1.84E+10
70%	2.36E+11	6.10E+09	2.07E+11	2.36E+10
60%	2.98E+11	6.10E+09	2.62E+11	2.98E+10
50%	3.63E+11	6.10E+09	3.21E+11	3.63E+10
40%	4.29E+11	6.10E+09	3.80E+11	4.29E+10
30%	5.30E+11	6.10E+09	4.71E+11	5.30E+10
20%	7.44E+11	6.10E+09	6.64E+11	7.44E+10
10%	1.46E+12	6.10E+09	1.31E+12	1.46E+11
0%	5.16E+13	6.10E+09	4.65E+13	5.16E+12

Table C5: Daily TMDL Expression from LB2-20000

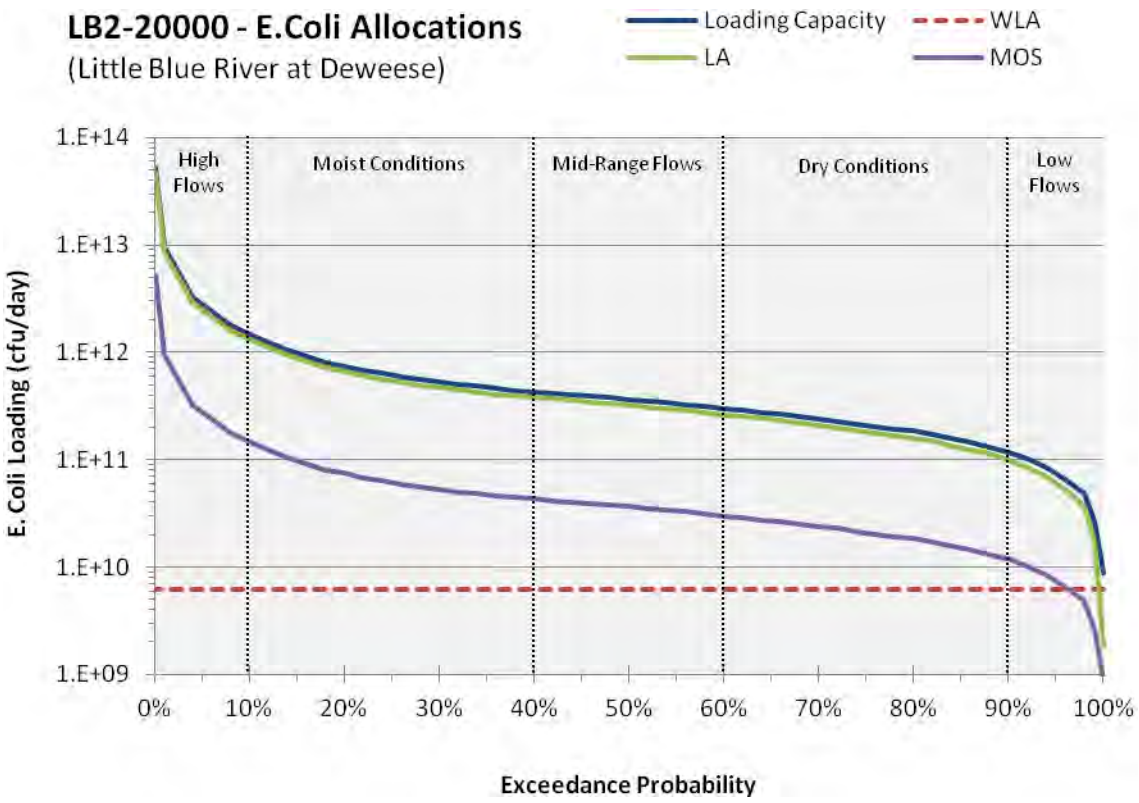

Figure C5: LB2-20000 Daily Load Expression Chart

Percent Exceedance	Loading Capacity (cfu/day)	WLA (cfu/day)	LA (cfu/day)	MOS (cfu/day)
100%	6.01E+09	3.43E+09	1.98E+09	6.01E+08
90%	7.99E+10	3.43E+09	6.85E+10	7.99E+09
80%	1.24E+11	3.43E+09	1.08E+11	1.24E+10
70%	1.60E+11	3.43E+09	1.40E+11	1.60E+10
60%	2.01E+11	3.43E+09	1.78E+11	2.01E+10
50%	2.46E+11	3.43E+09	2.18E+11	2.46E+10
40%	2.90E+11	3.43E+09	2.58E+11	2.90E+10
30%	3.58E+11	3.43E+09	3.19E+11	3.58E+10
20%	5.03E+11	3.43E+09	4.49E+11	5.03E+10
10%	9.89E+11	3.43E+09	8.86E+11	9.89E+10
0%	3.49E+13	3.43E+09	3.14E+13	3.49E+12

Table C6: Daily TMDL Expression from LB2-30000

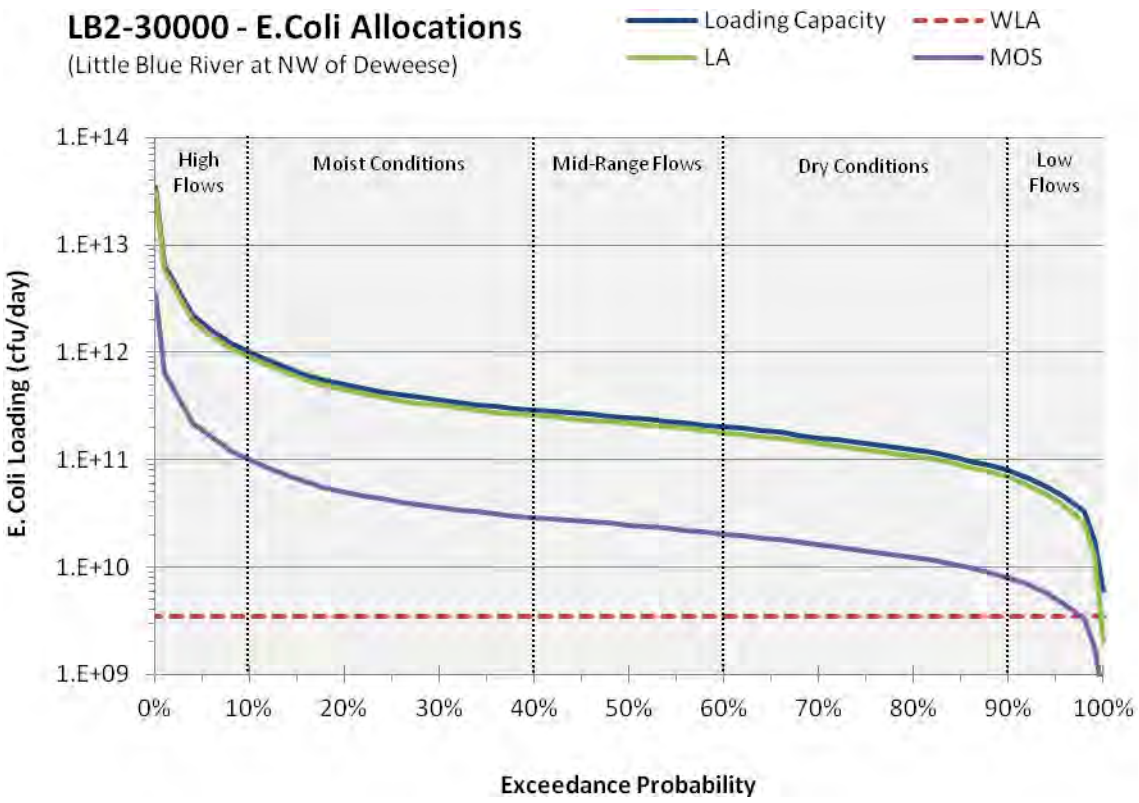

Figure C5: LB2-30000 Daily Load Expression Chart

Appendix D

This data was extracted from NDEQ's IMS website on May 10, 2012 and lists all Livestock Waste Control Facilities within the Little Blue River Basin.

Facility Number	County
67243	Thayer
67244	Thayer
67245	Thayer
67246	Thayer
67247	Thayer
67248	Thayer
67249	Thayer
67250	Thayer
67251	Thayer
67252	Thayer
67253	Thayer
67254	Thayer
67255	Thayer
67256	Thayer
67257	Thayer
67258	Thayer
67259	Thayer
67260	Thayer
67261	Thayer
67262	Thayer
67263	Thayer
67264	Thayer
67266	Thayer
67267	Thayer
67268	Thayer
67269	Thayer
67270	Thayer
67271	Thayer
67272	Thayer
67273	Thayer
67274	Thayer
69455	Thayer
71309	Thayer
73617	Thayer
74237	Thayer
74316	Thayer
74332	Thayer
74333	Thayer
74337	Thayer
74342	Thayer
76934	Thayer
76935	Thayer

Facility Number	County
76936	Thayer
76937	Thayer
76938	Thayer
76941	Thayer
76942	Thayer
76945	Thayer
76980	Thayer
77017	Thayer
77019	Thayer
77052	Thayer
77061	Thayer
77063	Thayer
77064	Thayer
77065	Thayer
77070	Thayer
77080	Thayer
77082	Thayer
77083	Thayer
77086	Thayer
77088	Thayer
77097	Thayer
77100	Thayer
77111	Thayer
77112	Thayer
77114	Thayer
77120	Thayer
77123	Thayer
77126	Thayer
77129	Thayer
77130	Thayer
77131	Thayer
77133	Thayer
78847	Thayer
78917	Thayer
79022	Thayer
79023	Thayer
79024	Thayer
79025	Thayer
79026	Thayer
79027	Thayer
79029	Thayer
79030	Thayer

Facility Number	County
79032	Thayer
79034	Thayer
79035	Thayer
79036	Thayer
79038	Thayer
79040	Thayer
80669	Thayer
81495	Thayer
83815	Thayer
85030	Thayer
85838	Thayer
87753	Thayer
88271	Thayer
90846	Thayer
91838	Thayer
92322	Thayer
92391	Thayer
92520	Thayer
92532	Thayer
92542	Thayer
92543	Thayer
92621	Thayer
92724	Thayer
92755	Thayer
92756	Thayer
92757	Thayer
92823	Thayer
92824	Thayer
92825	Thayer
92826	Thayer
93122	Thayer
119	Adams
465	Adams
531	Adams
756	Adams
65955	Adams
65956	Adams
65957	Adams
65958	Adams
65960	Adams
65961	Adams
65962	Adams
65963	Adams
65964	Adams
65965	Adams
65966	Adams
65967	Adams

Facility Number	County
65968	Adams
65969	Adams
65970	Adams
65971	Adams
71355	Adams
71356	Adams
71378	Adams
72254	Adams
73066	Adams
73326	Adams
74446	Adams
75000	Adams
75083	Adams
75196	Adams
75197	Adams
75199	Adams
75200	Adams
75201	Adams
75202	Adams
75203	Adams
75204	Adams
75205	Adams
75207	Adams
75208	Adams
75209	Adams
75211	Adams
75212	Adams
75213	Adams
75320	Adams
75794	Adams
79236	Adams
79239	Adams
79241	Adams
79244	Adams
79245	Adams
79246	Adams
79293	Adams
79296	Adams
79299	Adams
79301	Adams
79302	Adams
79303	Adams
79304	Adams
79305	Adams
81533	Adams
83066	Adams
84010	Adams

Facility Number	County
88809	Adams
89232	Adams
89992	Adams
90208	Adams
92114	Adams
92764	Adams
5975	Clay
66194	Clay
66195	Clay
66198	Clay
66204	Clay
66207	Clay
66227	Clay
71376	Clay
72650	Clay
73077	Clay
73079	Clay
73082	Clay
73154	Clay
73162	Clay
73167	Clay
74113	Clay
74883	Clay
74887	Clay
74888	Clay
74890	Clay
75222	Clay
75223	Clay
75224	Clay
75226	Clay
75227	Clay
75231	Clay
75234	Clay
75235	Clay
75238	Clay
75240	Clay
75241	Clay
75242	Clay
75249	Clay
75250	Clay
75251	Clay
75256	Clay
79234	Clay
79235	Clay
79243	Clay
79278	Clay
79289	Clay

Facility Number	County
79309	Clay
79313	Clay
79314	Clay
79316	Clay
79318	Clay
79319	Clay
79322	Clay
79325	Clay
79327	Clay
79328	Clay
79329	Clay
79332	Clay
79335	Clay
79482	Clay
88979	Clay
88980	Clay
90937	Clay
90960	Clay
91968	Clay
92115	Clay
92744	Clay
92745	Clay
92746	Clay
92747	Clay
92782	Clay
22417	Fillmore
61206	Fillmore
66743	Fillmore
66751	Fillmore
66753	Fillmore
66758	Fillmore
66762	Fillmore
66769	Fillmore
66770	Fillmore
66772	Fillmore
66776	Fillmore
66777	Fillmore
66788	Fillmore
66789	Fillmore
66795	Fillmore
66808	Fillmore
66811	Fillmore
66812	Fillmore
66816	Fillmore
66823	Fillmore
66824	Fillmore
66827	Fillmore

Facility Number	County
66828	Fillmore
72231	Fillmore
72263	Fillmore
73479	Fillmore
73948	Fillmore
73949	Fillmore
74230	Fillmore
74232	Fillmore
74456	Fillmore
76524	Fillmore
76589	Fillmore
76591	Fillmore
76592	Fillmore
76593	Fillmore
76603	Fillmore
76605	Fillmore
76643	Fillmore
79488	Fillmore
79492	Fillmore
79494	Fillmore
79498	Fillmore
79505	Fillmore
79510	Fillmore
79520	Fillmore
79687	Fillmore
82498	Fillmore
82972	Fillmore
84280	Fillmore
92815	Franklin
66673	Jefferson
66677	Jefferson
66680	Jefferson
66681	Jefferson
66682	Jefferson
66683	Jefferson
66690	Jefferson
66696	Jefferson
66698	Jefferson
66699	Jefferson
66704	Jefferson
66708	Jefferson
66710	Jefferson
66712	Jefferson
66724	Jefferson
66732	Jefferson
66742	Jefferson
66744	Jefferson

Facility Number	County
69691	Jefferson
70926	Jefferson
70926	Jefferson
71241	Jefferson
72233	Jefferson
72234	Jefferson
73407	Jefferson
74889	Jefferson
77263	Jefferson
77267	Jefferson
77280	Jefferson
77282	Jefferson
77292	Jefferson
77297	Jefferson
77299	Jefferson
77300	Jefferson
77303	Jefferson
77316	Jefferson
77317	Jefferson
77318	Jefferson
77324	Jefferson
77329	Jefferson
77334	Jefferson
77336	Jefferson
77337	Jefferson
77338	Jefferson
77340	Jefferson
77341	Jefferson
77342	Jefferson
77344	Jefferson
77698	Jefferson
77702	Jefferson
79661	Jefferson
79671	Jefferson
79672	Jefferson
80625	Jefferson
83070	Jefferson
83405	Jefferson
83405	Jefferson
83933	Jefferson
83963	Jefferson
91161	Jefferson
92531	Jefferson
92819	Jefferson
92857	Jefferson
98869	Jefferson
65838	Kearney

Facility Number	County
68478	Kearney
69899	Kearney
69900	Kearney
70162	Kearney
70163	Kearney
70166	Kearney
70167	Kearney
70169	Kearney
70170	Kearney
70171	Kearney
70172	Kearney
70173	Kearney
70174	Kearney
70177	Kearney
70178	Kearney
70179	Kearney
70569	Kearney
70571	Kearney
70574	Kearney
70575	Kearney
71150	Kearney
71156	Kearney
71812	Kearney
72473	Kearney
72477	Kearney
72493	Kearney
73034	Kearney
74114	Kearney
76228	Kearney
77672	Kearney
77673	Kearney
77686	Kearney
77724	Kearney
77725	Kearney
77731	Kearney
77737	Kearney
79722	Kearney
80077	Kearney
80078	Kearney
80080	Kearney
80082	Kearney
80083	Kearney
80084	Kearney
80085	Kearney
80173	Kearney
80175	Kearney
80177	Kearney

Facility Number	County
80179	Kearney
80180	Kearney
80542	Kearney
80549	Kearney
80574	Kearney
80582	Kearney
80583	Kearney
80584	Kearney
80585	Kearney
80586	Kearney
80635	Kearney
80637	Kearney
80639	Kearney
80641	Kearney
80642	Kearney
80644	Kearney
80645	Kearney
80647	Kearney
80648	Kearney
80651	Kearney
87781	Kearney
14576	Nuckolls
61777	Nuckolls
65664	Nuckolls
66032	Nuckolls
66452	Nuckolls
66453	Nuckolls
66454	Nuckolls
66455	Nuckolls
66456	Nuckolls
66457	Nuckolls
66459	Nuckolls
66461	Nuckolls
66462	Nuckolls
66463	Nuckolls
66468	Nuckolls
66470	Nuckolls
66472	Nuckolls
66475	Nuckolls
66478	Nuckolls
66479	Nuckolls
66480	Nuckolls
66481	Nuckolls
66483	Nuckolls
66484	Nuckolls
66485	Nuckolls
66486	Nuckolls

Facility Number	County
66491	Nuckolls
66493	Nuckolls
67265	Nuckolls
71214	Nuckolls
71418	Nuckolls
71419	Nuckolls
71423	Nuckolls
71433	Nuckolls
71467	Nuckolls
71470	Nuckolls
71476	Nuckolls
73061	Nuckolls
73115	Nuckolls
74007	Nuckolls
74341	Nuckolls
76859	Nuckolls
77537	Nuckolls
77538	Nuckolls
77539	Nuckolls
77540	Nuckolls
77541	Nuckolls
77542	Nuckolls
77543	Nuckolls
77545	Nuckolls
77548	Nuckolls
77568	Nuckolls
77571	Nuckolls
77573	Nuckolls
77577	Nuckolls
77598	Nuckolls
77599	Nuckolls
77604	Nuckolls
77606	Nuckolls
81023	Nuckolls
81024	Nuckolls
81025	Nuckolls
81026	Nuckolls
81032	Nuckolls
81034	Nuckolls
81035	Nuckolls
81198	Nuckolls
81200	Nuckolls
81207	Nuckolls
81213	Nuckolls
81214	Nuckolls
81215	Nuckolls
81220	Nuckolls

Facility Number	County
81223	Nuckolls
81229	Nuckolls
81231	Nuckolls
81237	Nuckolls
81244	Nuckolls
81247	Nuckolls
81252	Nuckolls
81260	Nuckolls
81290	Nuckolls
81291	Nuckolls
81298	Nuckolls
81299	Nuckolls
81300	Nuckolls
81303	Nuckolls
81304	Nuckolls
81305	Nuckolls
81307	Nuckolls
81309	Nuckolls
81310	Nuckolls
81312	Nuckolls
81313	Nuckolls
83735	Nuckolls
92552	Nuckolls
92723	Nuckolls
92753	Nuckolls
92754	Nuckolls
92768	Nuckolls
92854	Nuckolls
66245	Webster
66250	Webster
66251	Webster
66254	Webster
66255	Webster
66258	Webster
66262	Webster
66266	Webster
66267	Webster
66271	Webster
66276	Webster
66277	Webster
66278	Webster
71447	Webster
71475	Webster
72996	Webster
73269	Webster
76170	Webster
76179	Webster

Facility Number	County
76599	Webster
79248	Webster
79250	Webster
86522	Webster
90233	Webster
90276	Webster
91030	Webster
92758	Webster
92829	Webster
92830	Webster
92852	Webster
92853	Webster
92862	Webster
93025	Webster
93047	Webster