



EPA Region 7 TMDL Review

TMDL ID: NE-EL1-10000

State: NE

Document Name:

ELKHORN RIVER BASIN

Basin(s): ELKHORN RIVER BASIN, MISSOURI

HUC(s): 10220001, 10220002, 10220003

Water body(ies): ELKHORN RIVER, MAPLE CREEK, N.FK. ELKHORN RIVER, PEBBLE CREEK

Tributary(ies): MAPLE CREEK, NORTH FORK ELKHORN RIVER, PEBBLE CREEK

Pollutant(s): E. COLI

Submittal Date: 4/6/2009

Approved: Yes

Submittal Letter

State submittal letter indicates final Total Maximum Daily Load(s) (TMDL) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act [40 CFR § 130.7(c)(1)]. Include date submitted letter was received by EPA, date of receipt of any revisions, and the date of original approval if submittal is a phase II TMDL.

The TMDLs for the Elkhorn River Basin were formally submitted by the Nebraska Department of Environmental Quality (NDEQ) in a letter received by the U.S. Environmental Protection Agency (EPA) on April 6, 2009. Revisions to the Elkhorn River Basin TMDL were submitted by e-mail on May 20, 2009.

Water Quality Standards Attainment

The water body's loading capacity (LC) for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards (WQS) [40 CFR § 130.7(c)(1)]. A statement that WQS will be attained is made.

The LC was developed using data assessment curves and the stream's hydrograph and long-term gage information. The flow information (curve) was then translated into a load curve by multiplying the flow values (flow) by the WQS and a conversion factor (C). The acceptable "load" was then plotted graphically. Therefore, the LC for each of the segments was defined by:

$$LC = WQS * Flow * C$$

In the case of *E. coli*, a "load" (flow x concentration x time) can be calculated but is inappropriate for expressing this non-conservative parameter. Therefore, in this TMDL the LC will not be calculated and will be expressed as the WQS (*E. coli* bacteria recreation season geometric mean less than or equal to (≤) 126/100 milliliters (ml)). Because the water quality is expressed as a concentration, the LC will not equal the WLA + LA.

Table 1. Targeted *E. coli* Bacteria Load Reductions

Segment	Targeted Reduction
EL1-10000	83%
EL1-10900	92%

EL1-20000	85%
EL1-20100	93%
EL3-20000	95%
EL4-10000	81%
EL4-20000	89%
EL4-30000	76%

The endpoint for these TMDLs will be based upon the numeric criteria associated with the Primary Contact Recreation beneficial use for *E. coli*.

EPA agrees that achievement of the endpoints indicates loads are within the LC and WQS will be attained.

Numeric Target(s)

Submittal describes applicable WQS, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Beneficial Uses:

Primary Contact Recreation
 Aquatic Life Warm Water Recreation Class A
 Agriculture Class A Water Supply
 Aesthetics

The submittal states that the Primary Contact Recreation beneficial use is impaired by *E. coli* bacteria on all segments. The Primary Contact Recreation beneficial use applies to surface waters which are used or have the potential to be used for primary contact recreation that includes activities where the body may come into prolonged or intimate contact with the water such that water may be accidentally ingested or sensitive body organs (e.g. eye, ears, nose) may be exposed.

E. coli bacteria WQS (Title 117 – Nebraska Surface WQS):

E. coli bacteria shall not exceed a geometric mean of 126/100 ml during the recreation season of May 1 through September 30.

Data collected from 2001-2006 indicate the primary contact recreation beneficial use is impaired in all eight segments with the pollutant of concern being *E. coli* bacteria. The 2008 Nebraska Surface Water Quality Integrated Report listed EL1-10000, EL1-20000, EL4-10000, EL4-20000, and EL4-30000 in Category 5 as impaired with the pollutant of concern being *E. coli*. Category 5 of the 2008 Integrated Report is considered the 2008 303(d) list. In 2005, the NDEQ added the Primary Contact Recreation beneficial use to Maple Creek (EL1-10900), Pebble Creek (EL1-20100) and the North Fork Elkhorn River (EL3-20000). Assessment of the data collected in 2005 from Maple Creek, Pebble Creek, and the North Fork Elkhorn River indicated each exceeded the applicable criteria and were included on Category 5 of the 2008 Integrated Report. Therefore, TMDLs were prepared and submitted for all eight water body segments.

Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety (MOS) that do not exceed the LC. If submittal is a phase II TMDL there are refined relationships linking the load to WQS attainment. If there is an increase in the TMDL there is a refined relationship specified to validate the increase in TMDL (either load allocation (LA) or waste load allocation (WLA)). This section will compare and validate the change in targeted load between the versions.

This TMDL uses a direct link to the impairment. The TMDL target was based on the numeric water quality criteria for *E. coli* bacteria recreation season geometric mean of $\leq 126/100$ ml.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed,

population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, nonpoint and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered. If this is a phase II TMDL any new sources or removed sources will be specified and explained.

Point Sources:

The facility types that discharge or have the potential to discharge to waters in the Elkhorn River basin include: municipal wastewater treatment facilities (WWTF), commercial, and industrial facilities. The facilities that have been issued a National Pollutant Discharge Elimination System (NPDES) permit (according to EPA's Permit Compliance System) in the Elkhorn River Basin are shown in Table 2 below. Eighty-five municipal communities are within the Elkhorn River Basin boundaries with populations ranging from a little over 25,000 to 1,000 residents. The basin also borders the City of Omaha and has several cluster developments. 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.

Table 2. NPDES Permitted Facilities in the Elkhorn River Basin

Segment	Receiving Water	Facility	NPDES Permit Number	Facility Design Flow (cfs)	Facility Discharge Directly to Recreation Segment?	Approximate Distance to Recreation Segment (stream miles)	E. coli/ Fecal coliform Limits in NPDES permit?
EL1-10000	EL1-10000	Nickerson WWTF	NE0024287	0.040	Yes		Yes
	EL1-10000	Fremont WWTF	NE0031381	16.246	Yes		Yes
	EL1-10000	Riverside Lakes (SID 177)	NE0112283	0.116	Yes		Yes
	EL1-10000	Waterloo WWTF	NE0043311	0.193	Yes		Yes
	EL1-10500	Meadowbrook Mobile Home Park	NE0128881	0.070	No	18.1	Yes
	EL1-10600	Arlington WWTF	NE0049166	0.255	No	1.7	No
EL1-10900	EL1-10920	Howells WWTF	NE0046205	0.077	No	14.5	No
	EL1-10930	Clarkson WWTF	NE0021164	0.128	No	23	No
	EL1-10940	Leigh WWTF	NE0112101	0.071	No	31.5	No
EL1-20000	EL1-20000	Beemer WWTF	NE0046086	0.093	Yes		Yes
	EL1-20000	Hooper WWTF	NE0049093	1.578	Yes		No
	EL1-20000	Pilger WWTF	NE0027294	0.074	Yes		Yes
	EL1-20000	Scribner WWTF	NE0023787	0.464	Yes		Yes
	EL1-20000	Stanton WWTF	NE0029343	0.387	Yes		Yes
	EL1-20000	Tyson Foods-West Point	NE0000761	1.857	Yes		Yes
	EL1-20000	West Point WWTF	NE0023965	0.890	Yes		Yes
	EL1-20000	Wisner WWTF	NE0023957	0.340	Yes		Yes
EL1-20100	EL1-20120	Snyder WWTF	NE0046311	0.077	No		Yes
	EL1-20130	Dodge WWTF	NE0042064	0.217	No		Yes
EL1-22000	EL1-22000	Madison WWTF	NE0049174	0.503	Yes		Yes
	EL1-22100	Tyson Foods-Madison	NE0038363	1.083	No	2.1	Yes
EL2-10000	EL2-10000	Lyons WWTF	NE0049182	0.196	Yes		No
	EL2-10000	Oakland WWTF	NE0024023	0.232	Yes		No
	UD to EL2-	Logan View Jr-					

	10000	Sr High School	NE0122009	0.062	No	1.6	Yes
	EL2-10000	Uehling WWTF	NE0129445	0.062	Yes		Yes
EL2-20000	EL2-20000	Bancroft WWTF	NE0028088	0.116	Yes		No
	EL2-20000	Pender WWTF	NE0040908	0.248	Yes		Yes
	EL2-20000	Wakefield WWTF	NE0049018	0.774	Yes		No
	EL2-20300	Emerson WWTF	NE0041351	0.278	No	12.6	Yes
	EL2-40200	Laurel WWTF	NE0023922	3.094	No	17.1	No
	EL2-40200	Randolph WWTF	NE0029149	0.155	No	33.9	No
EL2-20800	EL2-20900	Wayne WWTF	NE0033111	1.238	No	3.1	Yes
	EL2-21000	Winside WWTF	NE0043320	0.108	No	13.9	No
EL3-10000	EL3-10100	Nucor Steel	NE0111287	0.08	No	3.7	No
EL3-20000	EL3-20100	Hadar WWTF	NE0024210	0.06	No	0.9	No
	EL3-40000	Osmond WWTF	NE0040029	0.155	No	13.4	No
	EL3-40000	Wausa WWTF	NE0039861	0.108	No	27.5	No
EL3-20200	EL3-20200	Pierce WWTF	NE0042331	0.418	Yes		No
EL3-20400	EL3-20500	Plainview WWTF	NE0021741	0.201	No	8.8	No
EL4-10000	EL4-10000	Norfolk WWTF	NE0033421	10.985	Yes		Yes
	EL4-10000	Tilden WWTF	NE0027910	0.294	Yes		Yes
	EL4-10400	Battle Creek WWTF	NE0041301	0.248	Yes		Yes
	EL4-10700	Meadow Grove WWTF	NE0030741	0.186	No	0.9	No
EL4-11300	EL4-11300	Oakdale WWTF	NE0049069	0.043	Yes		Yes
	UD to EL4-11310	Elgin WWTF	NE0039811	0.158	No	14.9	Yes
EL4-20000	EL4-20000	Neligh WWTF	NE0037010	0.302	Yes		Yes
EL4-30000	EL4-30000	Ewing WWTF	NE0043699	0.928	Yes		Yes
	EL4-30000	O'Neill WWTF	NE0049051	0.928	Yes		Yes
EL4-40000	EL4-40000	Atkinson WWTF	NE0021610	0.223	Yes		No
	EL4-40000	Stuart WWTF	NE0023949	0.124	Yes		No
	EL4-40200	Bassett WWTF	NE0112666	0.260	No	22.6	No
	EL4-40200	Newport WWTF	NE0114910	0.077	No	8.7	No

Note: Two permit numbers listed above appear to have the wrong NPDES permit numbers according to EPA NPDES permit databases. Tyson Foods Madison is listed above as NE0038363 but EPA databases indicate it is NE0028363, and Uehling WWTF is listed above as NE000129445 but EPA databases indicate it is NE0023779. This is not an approvability issue. Text in bold denotes facilities that discharge directly into a segment designated for recreational use whose NPDES permits do not contain E. coli/ fecal coliform limits.

Most of the basin is agricultural with 50 percent being cultivated and suitable for irrigation. Those areas within the Sandhill grassland region are primarily used for pasture or hay production. Active animal feeding operations that have been issued state of Nebraska permits are also considered potential sources. These permits 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. Figure 1 shows the facilities within the Elkhorn River Basin that have been entered into the NDEQ database by either being issued or requesting a permit. These facilities are designed to contain any run-off that is generated by storm events that are less intense than the 25-year, 24-hour rainfall.

Nonpoint Sources:

Sources accounted for as NPS for purposes of this TMDL include failing septic tanks or other on-site wastewater systems, runoff from livestock pastures, improper or over-application of biosolids (wastewater treatment facility sludge, septage, or manure) and urban stormwater runoff not regulated by a NPDES permit.

An array of wildlife have been documented to reside in the Elkhorn River Basin: big game, upland game, furbearers, waterfowl, and non-game species. The primary natural source of *E. coli* bacteria is wildlife. Due to the diverse nature, distribution and delivery method, nonpoint and natural sources will not be separated.

In the absence of an NPDES permit, the discharges associated with sources were applied to the LA, as opposed to the WLA for purposes of this TMDL. The decision to allocate these sources to the LA does not reflect any determination by EPA as to whether these discharges are, in fact, unpermitted point source discharges within this watershed. In addition, by establishing these TMDLs with some sources treated as LAs, EPA is not determining that these discharges are exempt from NPDES permitting requirements. If sources of the allocated pollutant in this TMDL are found to be, or become, NPDES-regulated discharges, their loads must be considered as part of the calculated sum of the WLA in this TMDL. WLA in addition to that allocated here is not available.

EPA agrees the submittal considers all known sources.

Allocation - Loading Capacity

Submittal identifies appropriate WLA for point, and load allocations for nonpoint sources. If no point sources are present the WLA is stated as zero. If no nonpoint sources are present, the LA is stated as zero [40 CFR § 130.2 (i)]. If this is a phase II TMDL the change in LC will be documented in this section.

A TMDL is defined as:

$$\text{TMDL} = \text{LC} = \text{WLA} + \text{LA} + \text{Background} + \text{MOS}$$

As explained above, the LC was developed using data assessment curves and each stream's hydrograph and long-term gage information. The flow information (curve) is then translated into a load curve by multiplying the flow values (flow) by the WQS and a conversion factor (C). The acceptable "load" is then plotted graphically. Therefore, the LC for each of the segments is defined by flow position in the hydrograph which was defined by:

$$\text{LC} = \text{WQS} * \text{Flow} * \text{C}$$

In the case of *E. coli*, a "load" (flow x concentration x time) can be calculated, but is inappropriate for expressing this non-conservative parameter. Therefore, in these TMDLs the LC will not be calculated and will be expressed as the WQS (*E. coli* bacteria recreational season geometric mean $\leq 126/100$ ml). Because the water quality is expressed as a concentration, the LC will not equal the WLA + LA.

Because a daily load is required by the CWA, a daily load was calculated and included in the TMDLs. Example daily loads for each segment are included in Table 3.

Table 3. Example Daily Load Expression of *E. coli* Bacteria LC (#/100 ml) for the Elkhorn River Basin Segments with Segment Flow (cubic feet per second [cfs]) where 50 Percent of the Time Historic Flows have Met or Exceeded this Flow

Segment	Segment Flow (cfs)	<i>E. coli</i> Bacteria LC (#/100 ml)
EL1-10000	1290	3.97711E+12
EL1-10900	52	1.6E+11
EL1-20000	629	1.94E+12
EL1-20100	37	1.14E+11
EL3-20000	61	1.881E+11
EL4-10000	328	1.01E+12
EL4-20000	203	6.26E+11
EL4-30000	78	2.405E+11

Contribution of *E. coli* into the Elkhorn River Basin is from point and nonpoint sources which are both known to

exist along the segment and within the watershed.

The WLA for *E. coli* for point source discharges will be equivalent to the water quality criteria associated with the Primary Contact Recreation beneficial use, an *E. coli* bacteria recreation season geometric mean of $\leq 126/100$ ml.

The LA assigned to *E. coli* will be based upon the stream flow volume and will be defined as:

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

Where:

LA_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

126/100 ml = applicable/target water quality criteria for *E. coli* bacteria from Title 117

C = conversion factor

WLA Comment

Submittal lists individual WLAs for each identified point source [40 CFR § 130.2(h)]. If a WLA is not assigned it must be shown that the discharge does not cause or contribute to WQS excursions, the source is contained in a general permit addressed by the TMDL, or extenuating circumstances exist which prevent assignment of individual WLAs. Any such exceptions must be explained to a satisfactory degree. If a WLA of zero is assigned to any facility it must be stated as such [40 CFR § 130.2(i)]. If this is a phase II TMDL any differences in phase I and phase II WLAs will be documented in this section.

For *E. coli*, the WLA of NPDES-permitted facilities are set at an *E. coli* bacteria monthly geometric mean of 126/100 ml. These water quality criteria are applied to end-of-pipe concentrations and are applicable at all stream flows greater than the 7-day, 10-year low flow. The WLA will initially be applied to all facilities that discharge directly to segments designated for Primary Contact Recreation beneficial use. Future monitoring and evaluation will be used to determine if WLAs are needed for facilities that discharge to segment tributaries. Table 2 lists NPDES-permitted facilities in the Elkhorn River Basin and where they discharge. WLAs for facilities classified as non-discharging will be zero (0).

Table 4. Example Daily Load Expression of *E. coli* WLA (#/100 ml) for the Elkhorn River Basin Segments with Segment Flow (cfs) where 50 Percent of the Time Historic Flows have Met or Exceeded this Flow

Segment	Segment Flow (cfs)	<i>E. coli</i> WLA(#/100 ml)
EL1-10000	1290	5.216E+10
EL1-10900	52	8.51E+08
EL1-20000	629	1.7512E+10
EL1-20100	37	9.06E+08
EL3-20000	61	9.87E+08
EL4-10000	328	3.61E+10
EL4-20000	203	9.25E+08
EL4-30000	78	5.734E+09

EPA agrees these are appropriate WLAs.

LA Comment

Includes all nonpoint sources loads, natural background, and potential for future growth. If no nonpoint sources are identified the LA must be given as zero [40 CFR § 130.2(g)]. If this is a phase II TMDL any differences in phase I and phase II LAs will be documented in this section.

Nonpoint and natural sources for *E. coli* will not be separated due to the nature, distribution and delivery method. The LAs assigned to these TMDLs will be based upon the stream flow volume and will be defined as:

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

Where:

LA_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

126/100 ml = applicable/target water quality criteria for *E. coli* from Title 117

C = conversion factor

Table 4. Example Daily Load Expression of *E. coli* Bacteria LA (#/100 ml) for the Elkhorn River Basin Segments with Segment Flow (cfs) where 50 Percent of the Time Historic Flows have Met or Exceeded this Flow

Segment	Segment Flow (cfs)	<i>E. coli</i> Bacteria LA(#/100 ml)
EL1-10000	1290	3.52723E+12
EL1-10900	52	1.43E+11
EL1-20000	629	1.73E+12
EL1-20100	37	1.0176E+11
EL3-20000	61	1.68E+11
EL4-10000	328	8.74E+11
EL4-20000	203	5.62E+11
EL4-30000	78	2.11E+11

EPA agrees these are appropriate LAs.

Margin of Safety

Submittal describes explicit and/or implicit MOS for each pollutant [40 CFR § 130.7(c)(1)]. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided. If this is a phase II TMDL any differences in MOS will be documented in this section.

This TMDL contains an implicit and explicit MOS. To account for uncertainty in nonpoint source load reduction, an explicit targeted reduction for *E. coli* will focus on achieving 90 percent of the water quality target or $\leq 113/100$ ml.

Table 5. Targeted *E. coli* Bacteria Load Reduction, Expected Seasonal Geometric Mean, and Daily MOS for each Elkhorn River Basin Water Body Segment where 50 Percent of the Time Historic Flows have Met or Exceeded the Given Flow

Segment	Targeted Reduction	Expected Season Geometric Mean (#/100 ml)	Daily MOS at 50% Flows Exceeded
EL1-10000	83%	111	3.977E+11
EL1-10900	92%	104	1.6E+10
EL1-20000	85%	109	1.94E+11
EL1-20100	93%	105	1.141E+10
EL3-20000	95%	111	1.88E+10
EL4-10000	81%	109	1.01E+11
EL4-20000	89%	112	6.26E+10
EL4-30000	76%	112	2.4E+10

Implicit MOS assumptions include *E. coli* decay and/or die off were not assumed 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 water body. Also, these TMDLs assumed that point sources discharge *E. coli* as allowed by the WLA of 126/100 ml. In fact, WWTFs are often designed and operated to achieve 100 percent reduction

in indicator bacteria. Therefore, the actual point source contribution is likely less than estimated by the TMDLs.

EPA agrees this is an appropriate MOS.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s) [40 CFR § 130.7(c)(1)]. Critical conditions are factors such as flow or temperature which may lead to the excursion of WQS. If this is a phase II TMDL any differences in conditions will be documented in this section.

For *E. coli* the water quality criteria are only applicable during the recreational season of May 1 through September 30 as defined in Title 117 for Primary Contact Recreation beneficial uses. Therefore, the recreational season was considered the critical condition and water and stream volume data were limited to this time period.

These TMDLs also recognize that concentrations are dynamic and vary with stream flow and a wide range of environmental conditions. Seasonality of flows were accounted for in the development of data assessment curves in the assignment of LAs through:

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

Where:

LA_i = load allocations at the i^{th} flow

Q_i = stream flow at the i^{th} flow

126/100 ml = applicable/target water quality criteria for *E. coli* bacteria from Title 117

C = conversion factor

Seasonality and any critical conditions have been addressed in the submittal.

Public Participation

Submittal describes required public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s) [40 CFR § 130.7(c)(1)(ii)].

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

EPA agrees that NDEQ provided opportunity for meaningful public input regarding the draft TMDL.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used) [40 CFR § 130.7].

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

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

NPDES permits require self-monitoring of the effluent by the permittee in addition to the frequent monitoring based on discharge characteristics. The data is reported to NDEQ quarterly, semiannually, or annually and entered into the EPA's Integrated Compliance Information System (ICIS). The compliance monitoring and self-monitoring information will be used in assessing the success of the TMDLs.

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

Reasonable Assurance

Reasonable assurance only applies when less stringent WLAs are assigned based on the assumption of nonpoint source reductions in the LA will be met [40 CFR § 130.2(i)]. This section can also contain statements made by the state concerning the state's authority to control pollutant loads.

Reasonable assurance is not required as the WLA for all point sources are set at a level that will attain *E. coli* bacteria WQS.