Watershed Protection and Restoration Plan (TMDL Implementation Plan):

303d Impairments:

- Elk River Bacteria Impairment
- Elk River Turbidity Impairment
- Big Elk Lake Nutrient Impairment
- Mayhew Lake Nutrient Impairment

Wenck File #2378-01

Prepared for:

ELK RIVER WATERSHED ASSOCIATION

September 2011
Revised April 2012

Prepared by:

WENCK ASSOCIATES, INC.
1800 Pioneer Creek Center
P.O. Box 249
Maple Plain, Minnesota 55359-0249
(763) 479-4200

Table of Contents

Tables

Figures

1.0 Introduction

The Elk River Watershed Association (ERWSA) Watershed Protection and Restoration Plan (Implementation Plan) addresses bacteria and turbidity impairments in the Elk River and lake nutrient impairments for Big Elk Lake and Mayhew Lake. The Elk River Watershed is located in the Upper Mississippi St. Cloud HUC 07010203.

The ERWSA completed TMDL analyses in cooperation with the Minnesota Pollution Control Agency (MPCA) to quantify load reductions required to meet state water quality standards for the impairments listed in Table 1.1:

Table 1.1. Impairments addressed in this report

Water Body	Impairment
Mayhew Lake (05-0007-00)	Excess nutrient concentration impairing aquatic recreation
Big Elk Lake (71-0141-00)	Excess nutrient concentration impairing aquatic recreation
Elk River: Big Elk Lake to St. Francis River (07010203-579)	Excess turbidity and bacterial concentrations impairing aquatic life and aquatic recreation

Figures 1.1 and 1.2 show the location of the impaired waters and their tributary watersheds. The work to set the TMDLs was performed in accordance with Section 303(d) of the Clean Water Act.

The final step in the TMDL process is the development of a Watershed Restoration and Protection Plan (Implementation Plan). The Implementation Plan identifies the activities that will be undertaken to reduce nutrient, bacteria and turbidity sources to the impaired waters. This Implementation Plan provides a brief overview of the TMDL findings, describes the implementation strategies and principles guiding this Implementation Plan, discusses sequencing, schedule, lead agencies and organizations, partners, and other implementation general strategies.

The Implementation Plan is aggressive because the load reduction goals to meet state standards are significant. However, the strategies themselves are well defined and focused to high priority areas to achieve a higher benefit for the dollars spent. This approach is necessary due to the size of the watershed and the magnitude of the goals.

BMPs are targeted to areas that are directly riparian to receiving waters, and prioritized based on their location within the watershed relative to the impairment.

Figure 1.1. Location of impaired waters

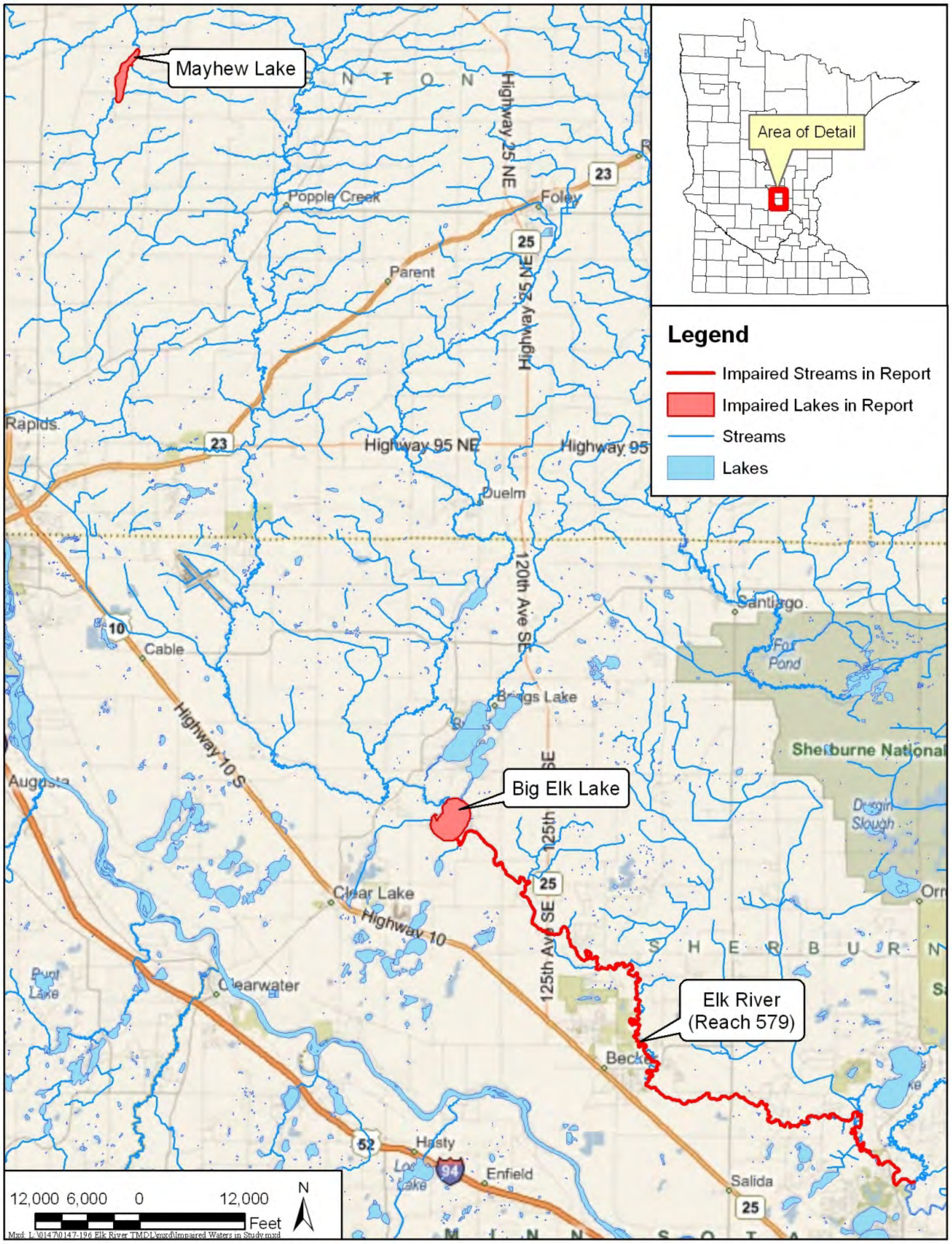
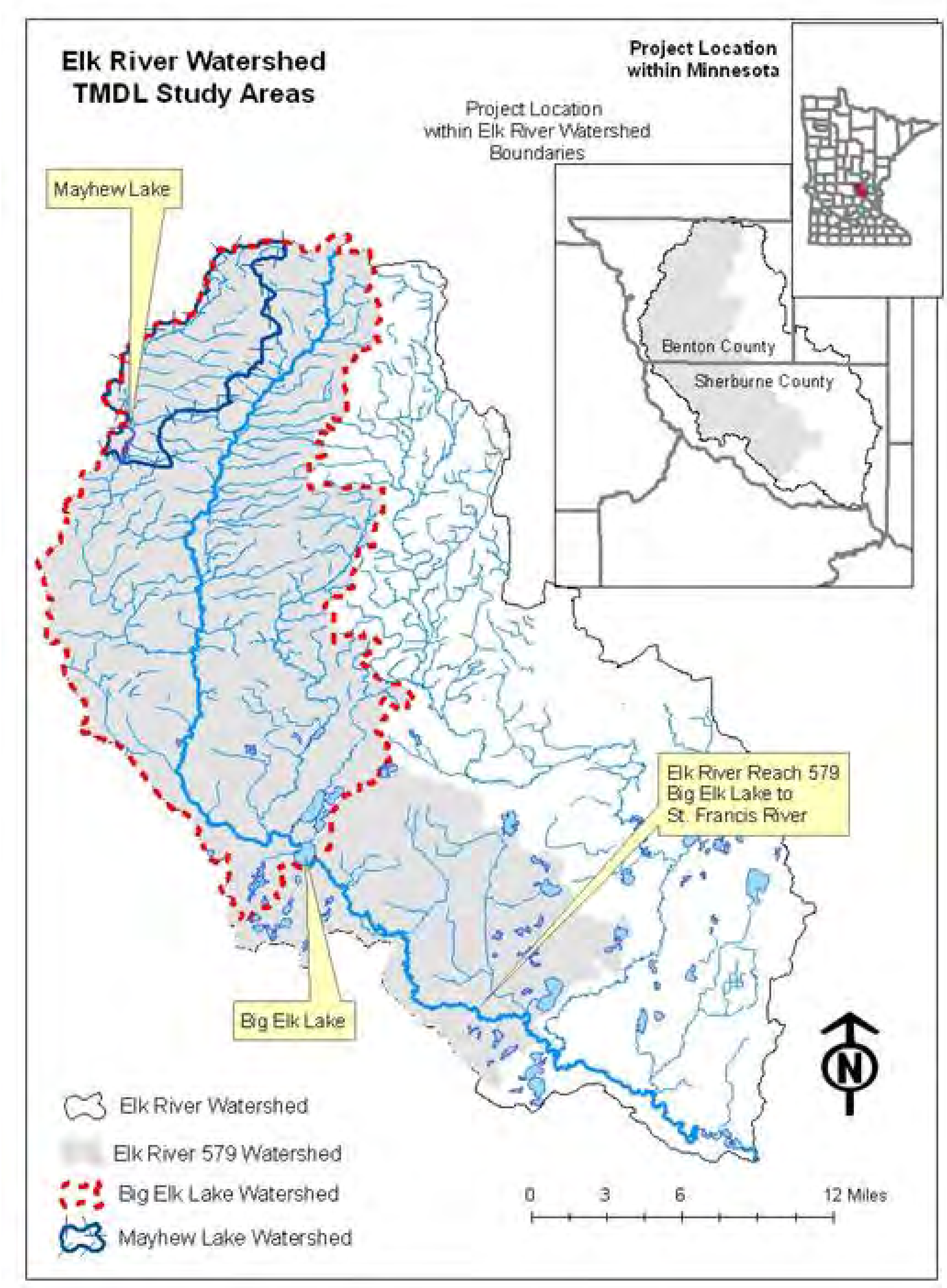


Figure 1.2 Impaired waters and tributary watersheds



2.0 TMDL Summary

A key element of a TMDL is the development of an analytical link between loading sources and receiving water quality. To establish the link between pollutant loading and the quality of water in the Mayhew Lake, Elk River, and Big Elk Lake existing water quality and hydrologic data were used along with data collected specifically for this project. These data provided an understanding of current conditions, potential sources and trends. Other data examined include fish and aquatic macrophyte survey data compiled by the Minnesota Department of Natural Resources (DNR). A summary of the TMDL is presented in this section.

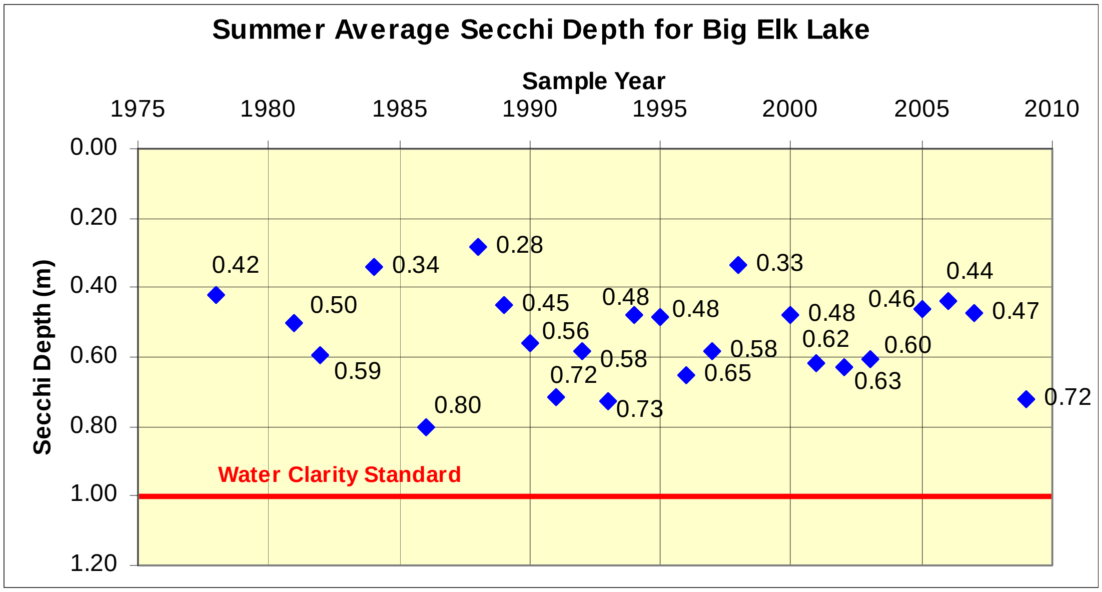
2.1 CURRENT WATER QUALITY

Current water quality for each of the impaired waters is summarized with respect to the impaired parameter in the following sections.

2.1.1 Big Elk Lake

Water quality data for Big Elk Lake was retrieved from the MPCA EDA website. Water clarity data (i.e. Secchi depth measurements) are available from 1978 through 2007. Total phosphorus and chlorophyll-a data are available from 1981 through 2007. Water clarity, total phosphorus, and chlorophyll-a data as well as other water quality data were collected in 2009 as part of Phase II of the TMDL. Secchi depth measurements for Big Elk Lake have varied from a low of 0.28 meters in 1988 to a high of 0.80 meters in 1986 (Figure 2.1). From 2000 to 2007, summer average Secchi depth was relatively stable ranging from 0.44 to 0.63 meters. The 2009 summer average Secchi depth was 0.72 meters. All measured years for water clarity fall below the State standard of 1.0 meters for shallow lakes in the North Central Hardwood Forest ecoregion. The Secchi data reveals no significant improving or declining trend.

Figure 2.1 Summer Average Secchi Depth Readings for Big Elk Lake.

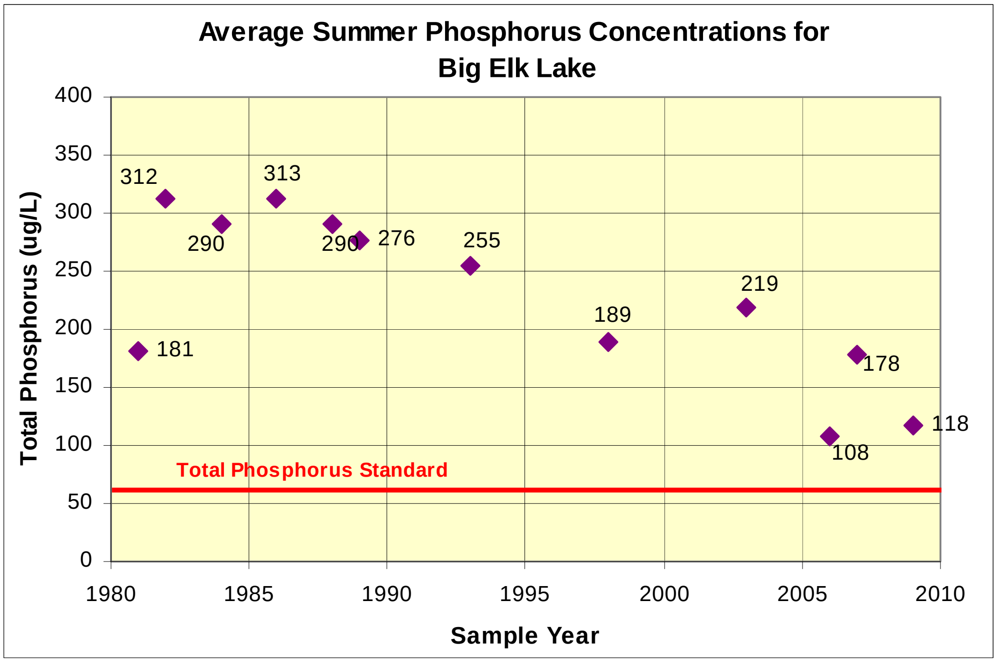


T:\2378_ERWSA\Big Elk Lake\Copy of EDA_71_0141_Elk Lake.xls\Graphs

Average summer growing season total phosphorus concentrations have ranged from 108 µg/L in 2006 to 313 µg/L in 1986 (Figure 2.2). Total phosphorus concentrations in Big Elk Lake ranged from 181 to 313 µg/L from 1980 to 2000. Phosphorus data shows a strong declining trend in recent years, the four sample years since 2000 showed average total phosphorus concentrations ranging from 108 to 219 µg/L with the 2006, 2007, and 2009 sample years presenting the lowest averages on record. However, despite the lower total phosphorus concentrations observed in recent years, concentrations have exceeded the State standard of 60 µg/L for shallow lakes of the North Central Hardwood Forests ecoregion in all monitoring years.

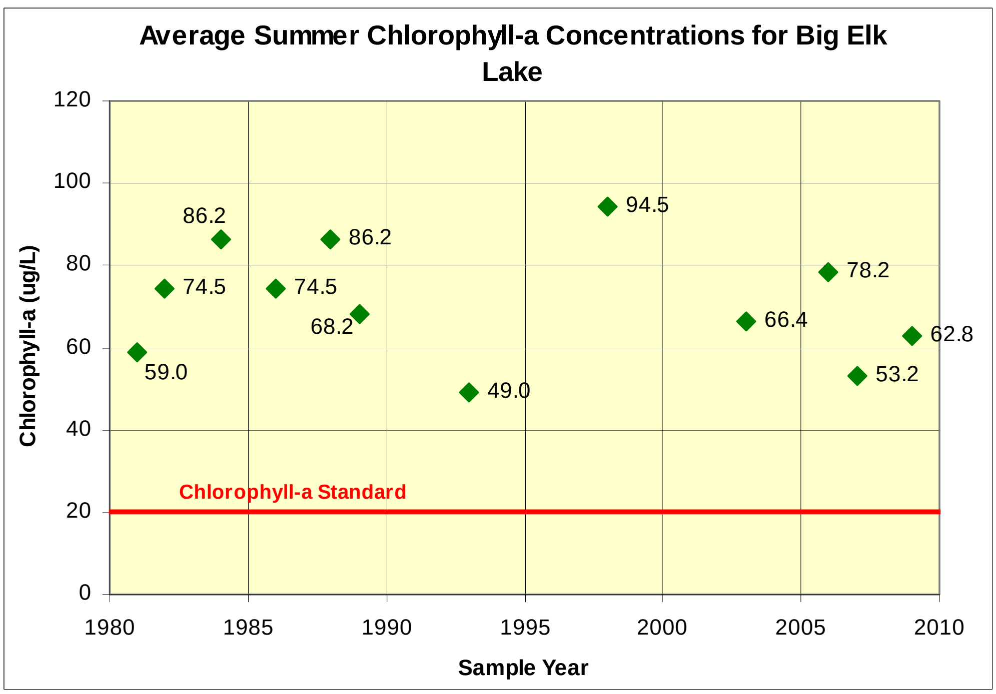
Average summer growing season chlorophyll-a concentrations have ranged from a low of 49 µg/L in 1993 to 94.5 µg/L in 1998 (Figure 2.3). The 2009 average concentration was 62.8 µg/L. There has been a moderate amount of observed variation in summer growing season average chlorophyll-a concentrations in Big Elk Lake. Chlorophyll-a concentrations have increased or decreased by more than 50 percent between monitoring years, with no clear trends across monitoring years. Average summer growing season chlorophyll-a concentrations in Big Elk Lake have exceeded the State standard of 20 µg/L for shallow lakes of the North Central Hardwood Forests ecoregion during all monitoring years.

Figure 2.2 Summer average total phosphorus concentrations for Big Elk Lake.



T:\2378_ERWSA\Big Elk Lake\All WQ Data.xls\All Years TP

Figure 2.3 Summer average chlorophyll-a concentrations for Big Elk Lake



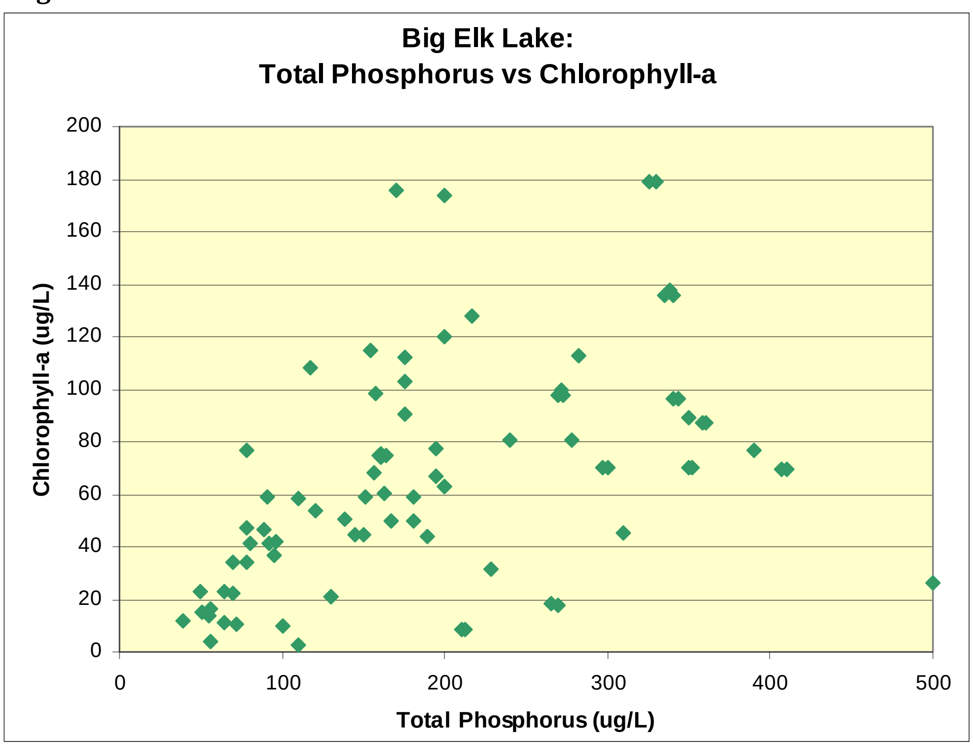
T:\2378_ERWSA\Big Elk Lake\Copy of EDA_71_0141_Elk Lake.xls\Graphs

Discrete chlorophyll-a concentrations were compared to discrete total phosphorus concentrations in Big Elk Lake (Figure 2.4). In general, high chlorophyll-a concentrations are associated with high total phosphorus concentrations. Variability in the relationship between TP and chlorophyll-a in Big Elk Lake is likely due to a combination of factors:

1. First, the residence time of Big Elk Lake is short relative to generation times for algae. Figure 5.2 in the Phase I Report shows the relationship between Elk River inflows to Big Elk Lake and residence time in Big Elk Lake as it relates to the flow duration curve for that location. About 40% of the time, the lake has a residence time less than 7 days. About 80 % of the time, the residence time for Big Elk Lake is less than 14 days. The high flow-through rate of this lake indicates that the lake hydrodynamics are influencing growing conditions for chlorophyll-*a*. That is to say that TP is not the limiting factor for chlorophyll-*a* in this lake and that chlorophyll-*a* concentrations are the result of a multiplicity of factors.
2. It is common to have high variability in chlorophyll-a at the high TP concentrations observed in Big Elk Lake, as TP is far in excess of algal needs.

Despite the variability of the TP- chlorophyll-a relationship at high levels of TP and low residence times, it is generally understood that the best way to control chlorophyll-a concentrations (algal blooms and the accompanying algal turbidity observed in Elk River) in lakes is to reduce TP loads to lakes (Heiskary and Walker, 1988, Heiskary and Wilson, 2005 and 2008).

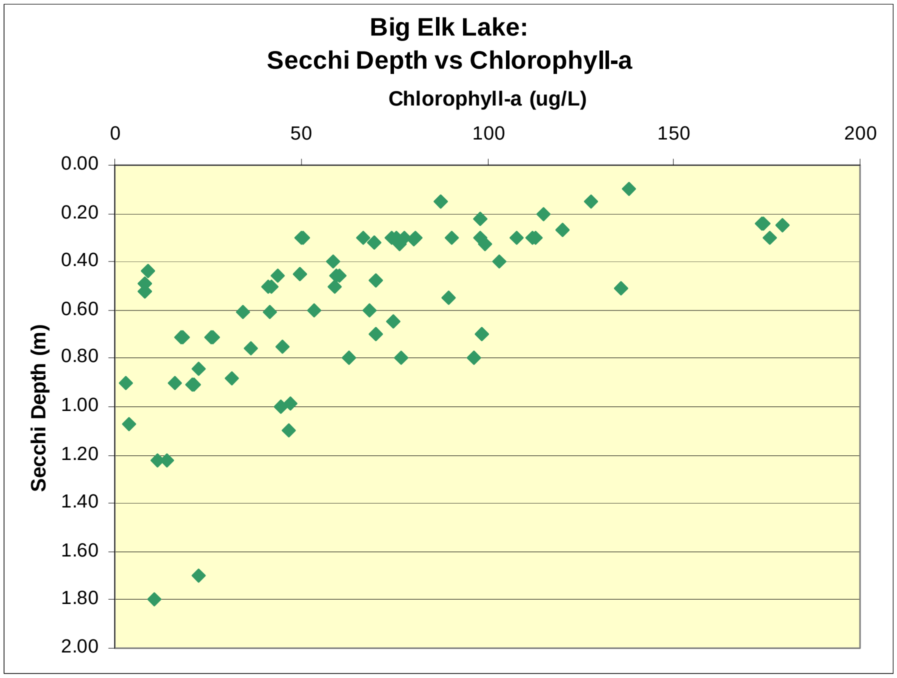
Figure 2.4 Discrete chlorophyll-*a* concentrations versus discrete total phosphorus concentrations for Big Elk Lake.



2378_ERWSA\Big Elk Lake\Copy of EDA_71_0141_Elk Lake.xls\Chla vs Flow

Discrete chlorophyll-a concentrations were also compared to discrete Secchi depth readings in Big Elk Lake (Figure 2.5). This comparison reveals that algal turbidity is likely the main driving factor affecting water clarity in Big Elk Lake, though turbidity from other sources like wind re-suspension and rough fish is also common in shallow lake systems like this one.

Figure 2.5. Discrete chlorophyll-a concentrations versus discrete Secchi depth readings for Big Elk Lake.

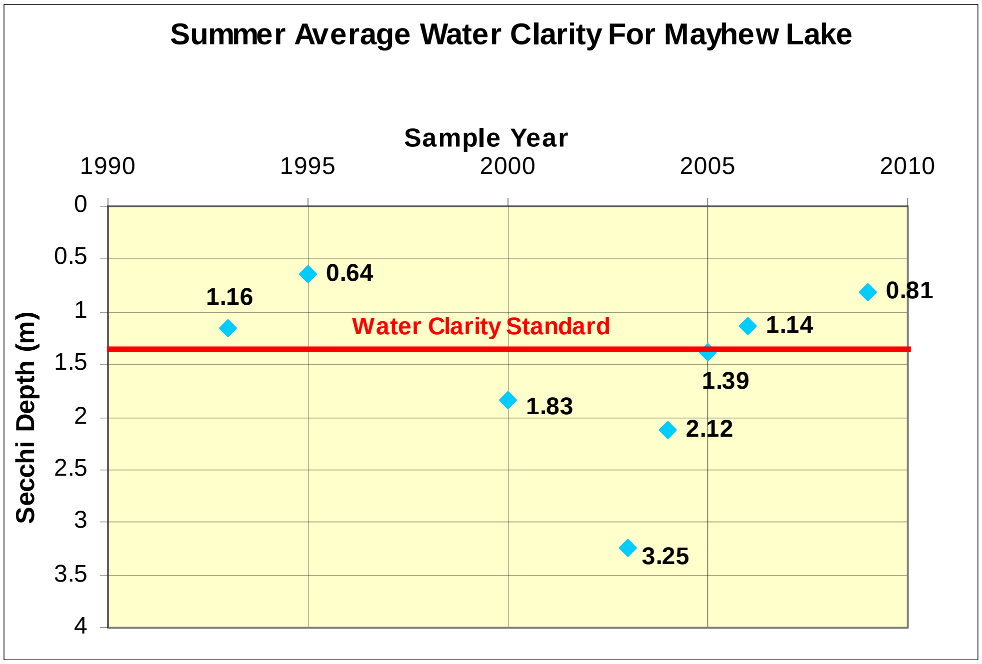


T:\2378_ERWSA\Big Elk Lake\Copy of EDA_71_0141_Elk Lake.xls\Chla vs Flow

2.1.2 Mayhew Lake

Historical water quality data for Mayhew Lake was retrieved from the MPCA Environmental Data Access (EDA) website. Water clarity data (i.e., Secchi depth measurements) are available from 1993 through 2006. Total phosphorus and chlorophyll-a data are available from 1995 through 2006. Water clarity, phosphorus, and chlorophyll-a data were also collected in 2009 as part of Phase II of the TMDL. Mean Secchi depth measurements for Mayhew Lake have varied from a low of 0.64 meters in 1995 to a high of 3.25 meters in 2003 (Figure 2.6). The 2009 summer average was 0.81 meters. The most recent years of water clarity measurements, 2003 through 2009, show a decline in lake water clarity; however, some of the data seemed to have been entered with incorrect units (three of the measurements exceeded the maximum lake depth, and many more exceeded the lake depth at the measurement location indicating that meters were mistaken for feet). For the purpose of Figure 2.7, values that appeared to have been mis-entered were corrected by using the correct units (feet). In any case, given the issue with these data, the Secchi depth data is not given equal weight with TP or chlorophyll-a in terms of evaluation of lake water quality or trends. 2003 is the only year in which the average summer Secchi depth met the new State standard of readings greater than 1.4 meters for deep lakes in the North Central Hardwood Forest ecoregion.

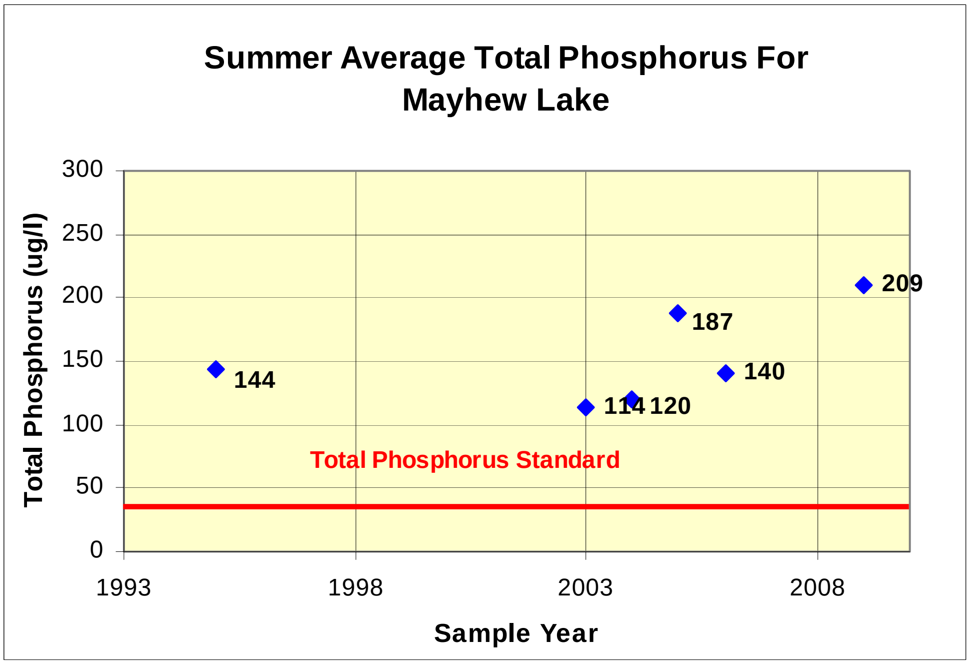
Figure 2.6. Summer average Secchi depth readings in Mayhew Lake.



T:\2378_ERWSA\Mayhew\Copy of Mayhew WQ_All_Data.xls\Graphs

Average summer growing season total phosphorus has ranged from 110 µg/L to 223 µg/L (Figure 2.7). The reported decline in lake water clarity values observed from 2003 through 2009 appears to correlate with observed total phosphorus concentrations in Mayhew Lake. Total phosphorus concentrations in Mayhew Lake have exceeded the State standard of 40 µg/L for lakes of the North Central Hardwood Forests ecoregion in all monitoring years with 2009 presenting the highest average on record.

Figure 2.7. Summer average total phosphorus concentrations in Mayhew Lake.



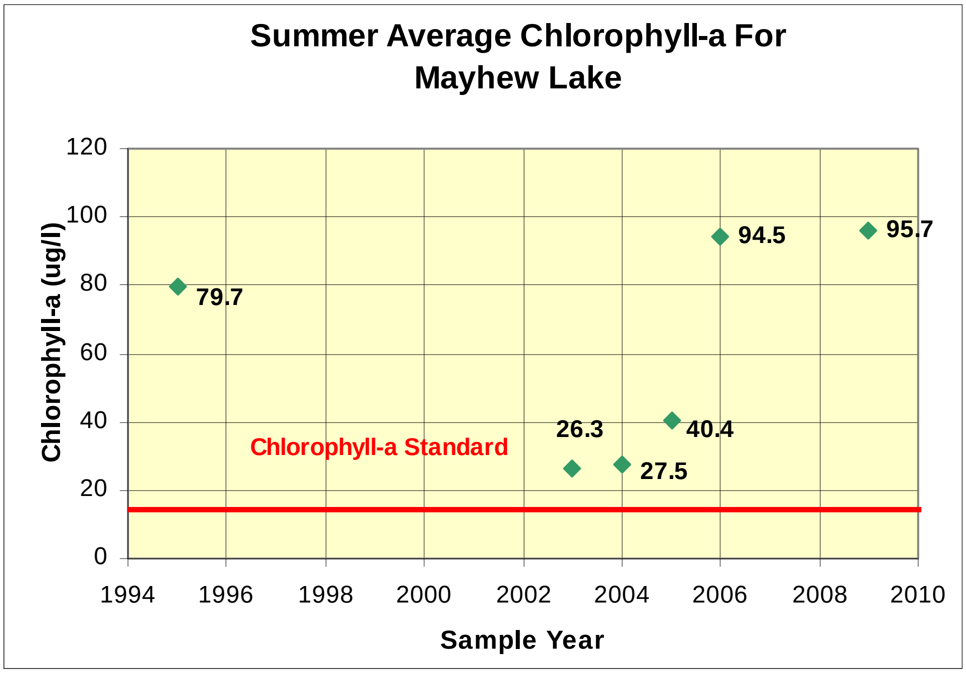
T:\2378_ERWSA\Mayhew\All WQ Data.xls\Summer TP_CHla

The highest observed average chlorophyll-a concentration was 95.7 µg/L in 2009 (Figure 2.8). Concentrations have exceeded the State standard of 14 µg/L for lakes of the North Central Hardwood Forests ecoregion in all monitoring years and recent years, 2006 and 2009, present the highest concentrations on record for Mayhew Lake.

Each of the Trophic Status Indicators (TSI's, Secchi, phosphorus and chlorophyll-a) show a trend of declining water quality between 2003 and 2009. The 2003 to 2009 trend correlates with increased precipitation between 2003 and 2009. Increased precipitation in a lake with long residence times can correspond to higher watershed loads of phosphorus, which would explain the observed decline in water quality. The trend is not necessarily reflective of changing watershed conditions, but continued evaluation is recommended. Annual precipitation in Benton County for measured years shown in the graphs is as follows:

2003: 26.56 inches
2004: 27.28 inches
2005: 30.59 inches
2006: 30.39 inches
2009: 33.80 inches

Figure 2.8. Summer average chlorophyll-a concentrations in Mayhew Lake.



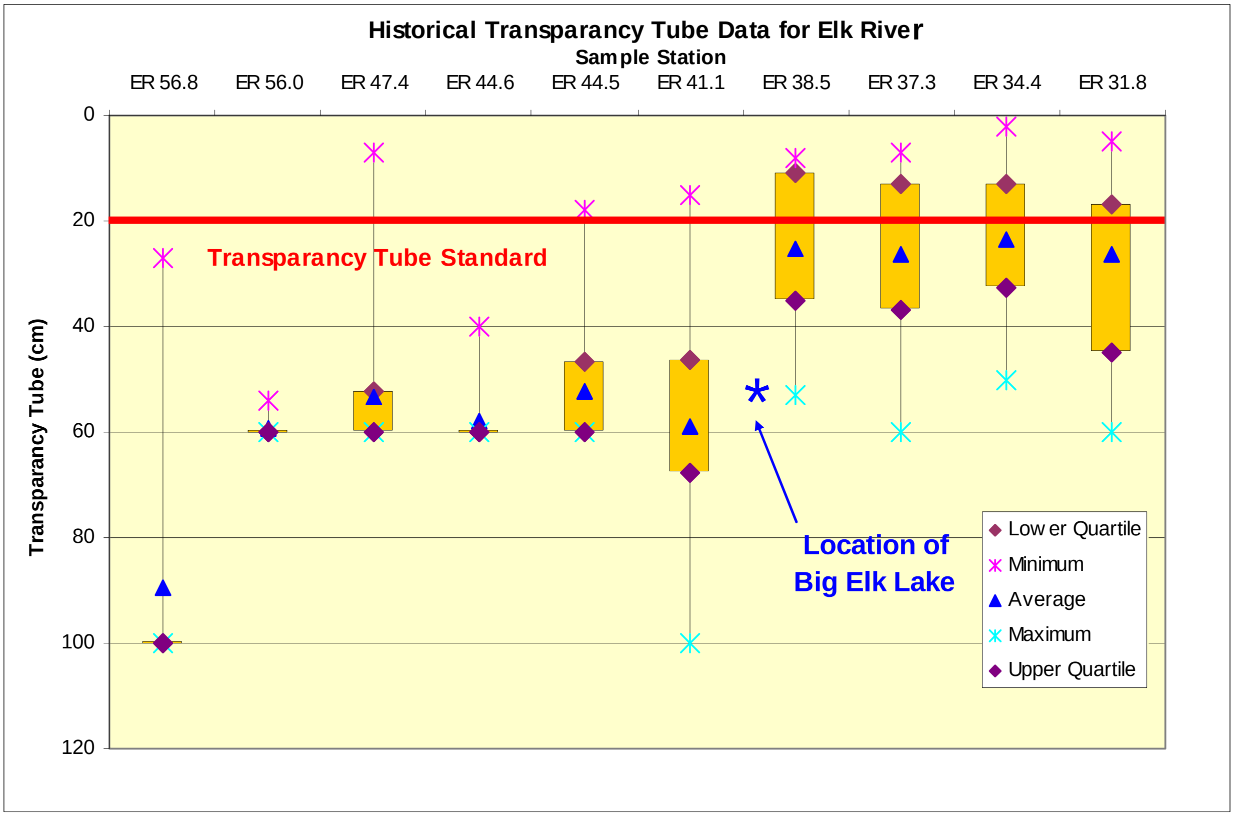
T:\2378_ERWSA\Mayhew\ All WQ Data.xls\Summer TP_CHla

2.1.3 Elk River Turbidity and Bacteria

The Elk River is impaired for turbidity between Big Elk Lake and the St. Francis River. Monitoring conducted for this TMDL showed that turbidity concentrations in the Elk River sometimes fall exceed the state standard for turbidity.

Historical transparency data is available for ten stations along the Elk River, six stations upstream of Big Elk Lake and four stations within the listed reach downstream of Big Elk Lake. Longitudinal transparency data for the Elk River is presented by river mile from upstream to downstream (Figure 2.9). Stations ER 56.8 through Station ER 41.1 are upstream of Elk Lake and outside of the reach listed for turbidity impairment. The median transparency value for these samples is 60 or greater. Station ER 47.4, ER 44.5 and ER 41.1 do have three or more values below 20 cm. However, the number of samples below 20 cm is not greater than 10% of the total sample measurements and therefore the reach is not considered impaired for turbidity. Sampling stations within the listed reach are Stations ER 38.5, ER 37.3, ER 34.3 and ER 31.8.

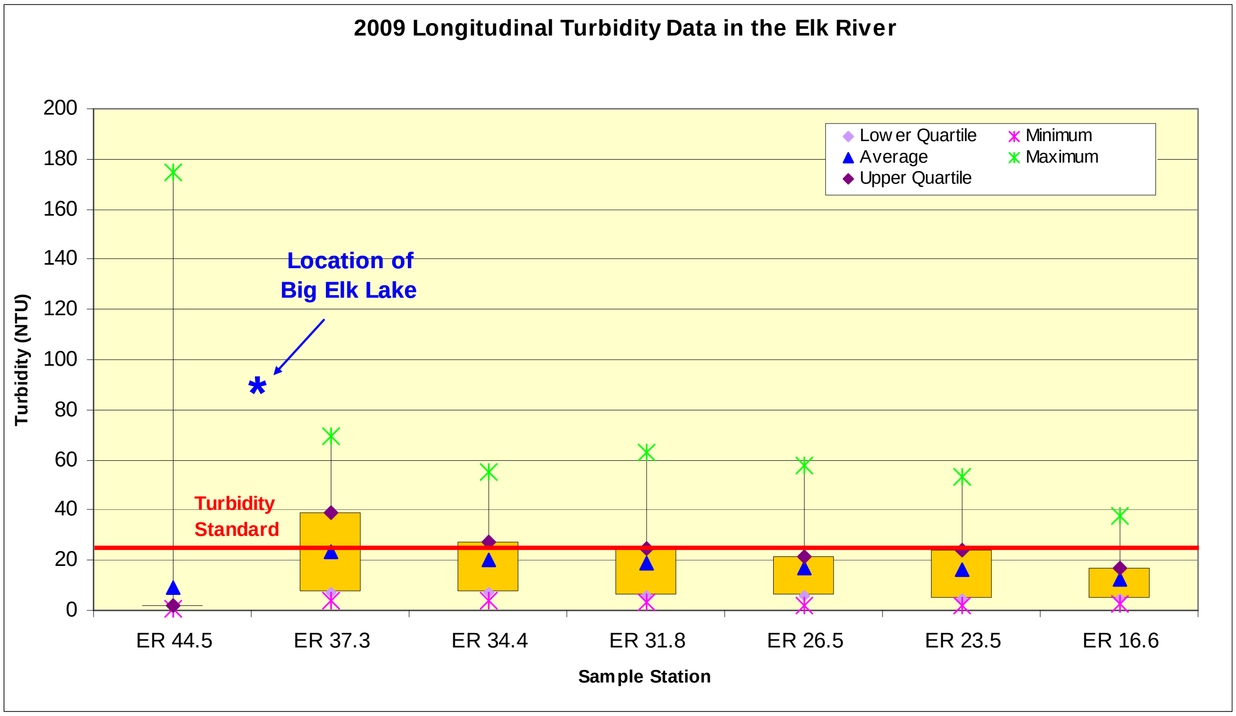
Figure 2.9. Historical longitudinal transparency tube readings in the Elk River.



T:\2378_ERWSA\Elk River\[Copy of Mainstem Elk River WQ Data.xls]Turbidity Charts

Turbidity data was collected in 2009 as part of Phase II. Data was collected at one station upstream of Big Elk Lake and at 6 stations within the listed reach of the Elk River. Box plots displaying the geometric mean turbidity values, as well as the range of observed values for each sample station are presented in Figure 2.10. State standards are displayed on the chart.

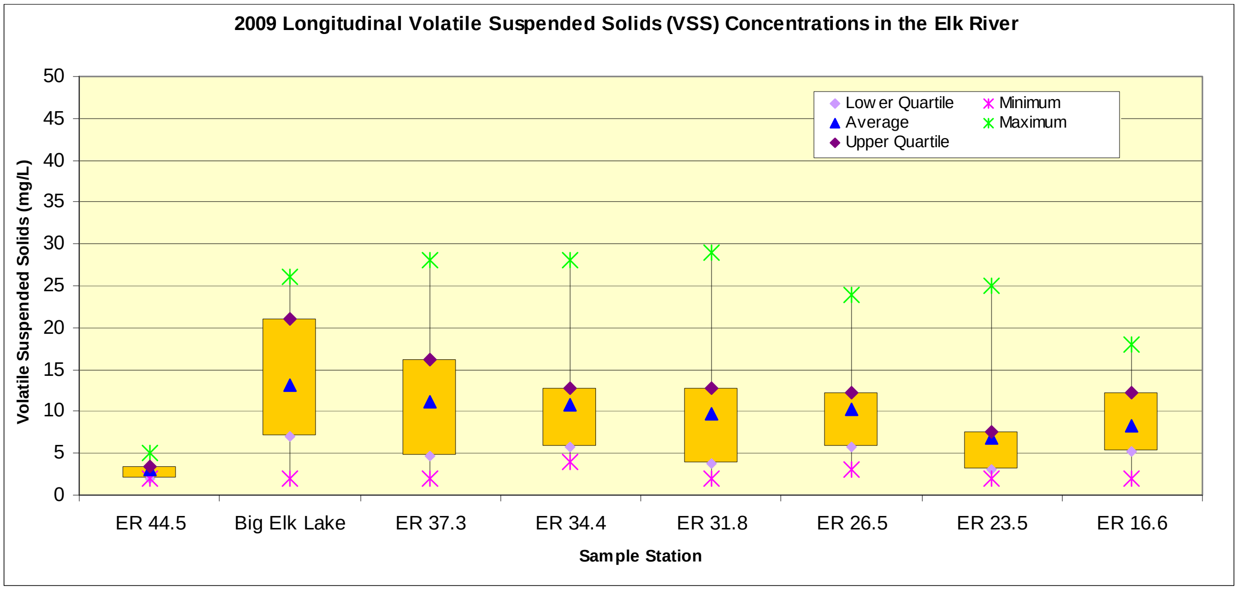
Figure 2.10. 2009 longitudinal turbidity readings in the Elk River.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Turbidity Chart

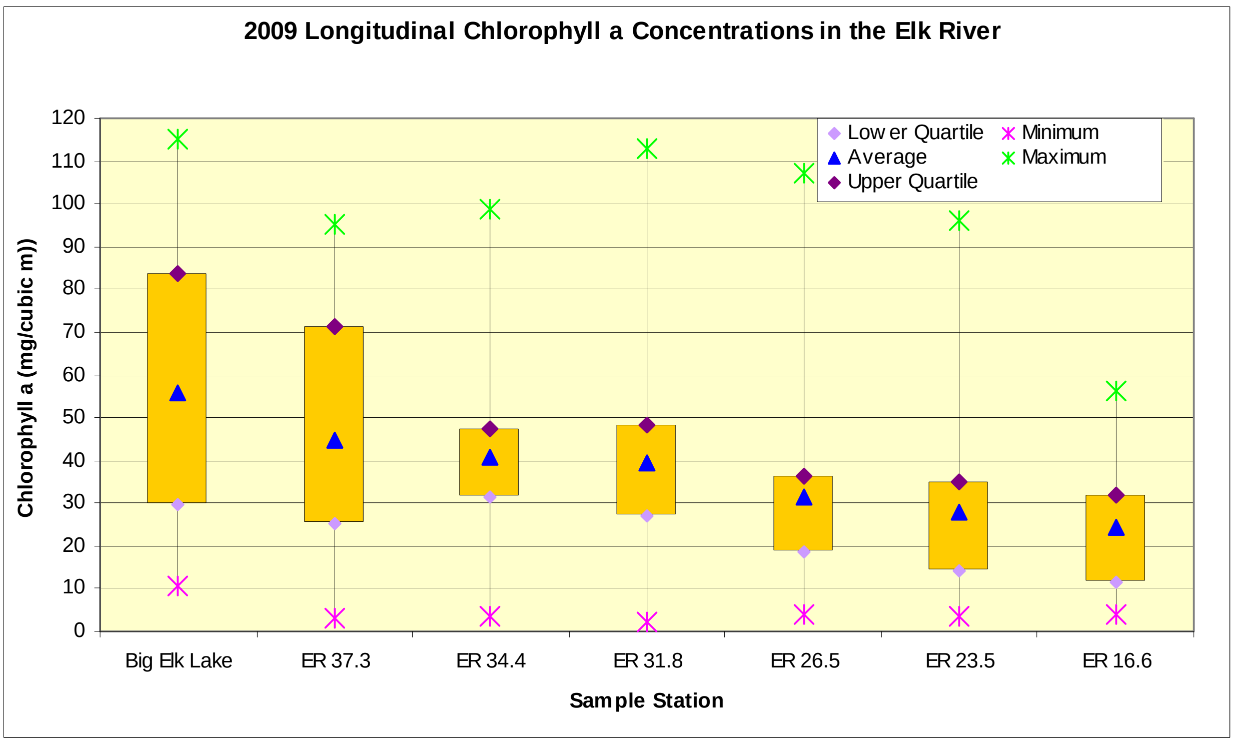
Displaying the turbidity data longitudinally helps to illustrate the influence Big Elk Lake has on the water clarity within the Elk River. Big Elk Lake is a hyper-eutrophic system with total phosphorus and chlorophyll-*a* concentrations well above the state water quality standards. Water clarity, measured by Secchi depth, is typically 0.5 meters or less within Big Elk Lake. Flows from the Elk River entering Big Elk Lake are typically clear and low in turbidity (see Figure 2.9). Watershed sediment and in-stream sources of turbidity upstream of the lake are not likely contributing significantly to the turbidity downstream of the lake. Instead, watershed nutrient sources to the lake from the upper watershed coupled with the lake dynamics are the driving factor in the turbidity impairment in the Elk River downstream of Big Elk Lake. The high nutrient and chlorophyll-*a* concentrations in the lake lead to high algal turbidity within the lake, which is discharged to Elk River. Data and observations also indicate that algae populations are sustained the upper portion of listed reach of the Elk River. Figures 2.11 and 2.12 present longitudinal box plots of volatile suspended solids (VSS) and chlorophyll-*a* concentrations in the Elk River, indicating these are the primary contributor to the turbidity impairment.

Figure 2.11. Longitudinal VSS concentrations in the Elk River.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]VSS Chart

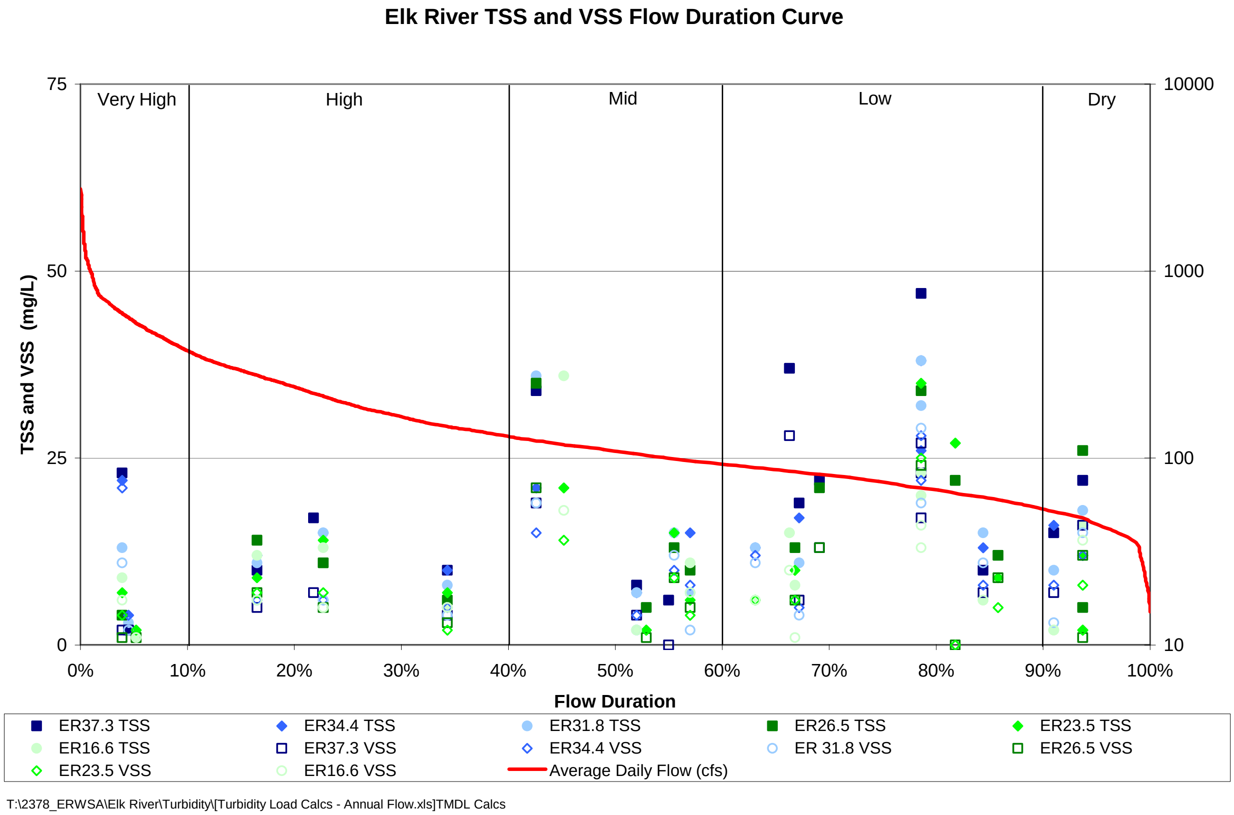
Figure 2.12. Longitudinal chlorophyll-a concentrations in the Elk River.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Chlorophyl Chart

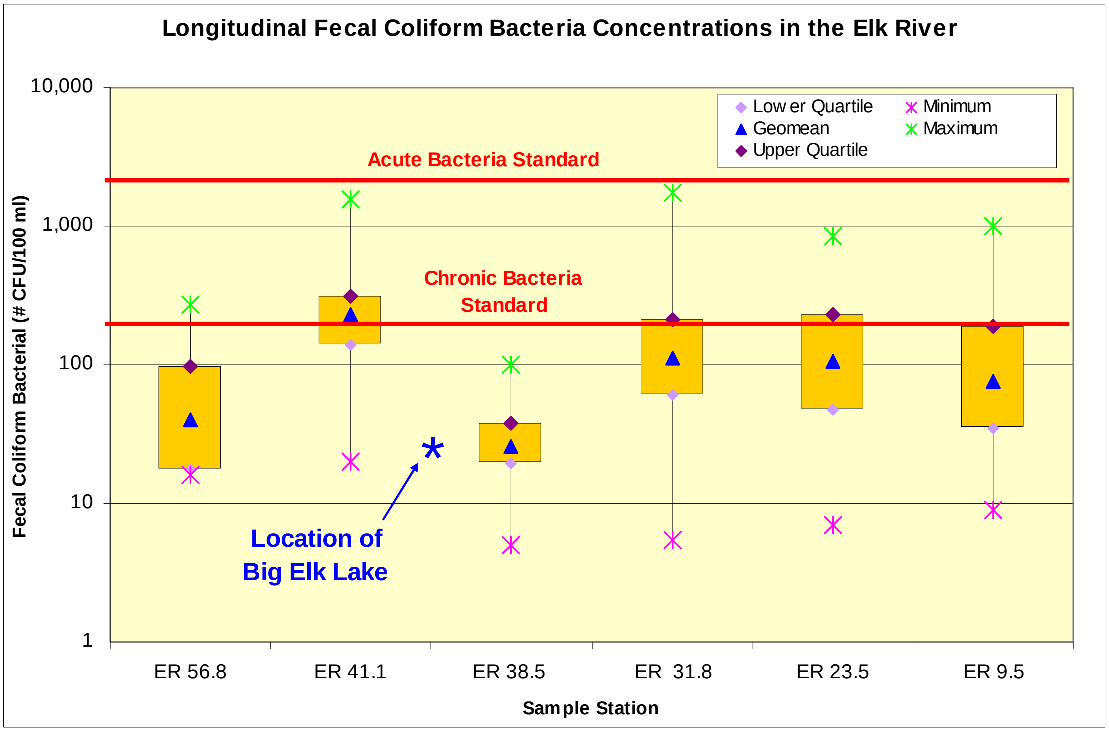
Figure 2.13 shows TSS and VSS along the flow duration curve for the listed reach. The highest turbidity readings generally occur in lower flows.

Figure 2.13. Flow Duration Curve with TSS and VSS Concentrations.



The same reach is also impaired for bacteria. Historical water quality data for the Elk River was analyzed for fecal coliform bacteria concentrations for sampling years 1974-1976 and 2002-2007. Bacteria concentrations as fecal coliform were measured at six stations along the main stem of the Elk River, two stations upstream of Big Elk Lake, three stations downstream of Big Elk Lake within the listed reach and one station downstream of the St. Francis River outside of the listed reach. Box plots displaying the geometric mean fecal coliform bacteria concentrations, as well as the range of observed values from each station are presented in Figure 2.14. The chronic (200 CFU/100ml) and acute (2,000 CFU/100ml) standards for fecal coliform are displayed on this graph.

Figure 2.14. Box plots of historical longitudinal fecal coliform bacteria concentrations in the Elk River.



T:\0147\196 Elk River TMDL\Elk River Water Quality Data\Mainstem Elk WQ Data.xls\Fecal Coliform Charts

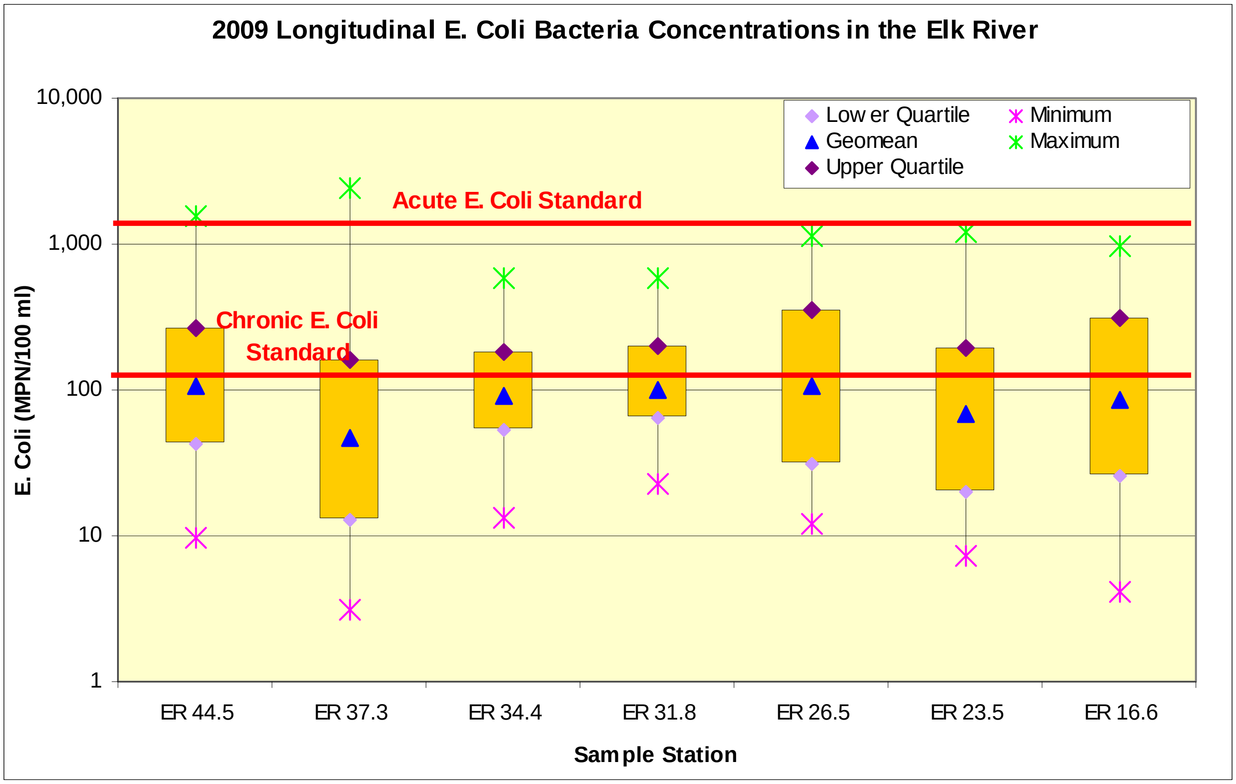
A summary of the discrete fecal coliform samples by month for the three sample stations within the listed reach of the Elk River are presented in Table 2.1. Although there were no exceedances of the acute standard, there were 15 samples exceeding the chronic standard. Eleven of the fifteen exceedances of the State chronic standard occur in August and September. Approximately 20 percent of all collected samples exceed the State chronic standard.

Table 2.1. Summary of fecal coliform bacteria samples for monitoring stations within the listed reach of the Elk River

Month	Total Samples	# > 200 CFU/100 ml	# >2,000 CFU/100ml	Monthly Geomean
May	8	0	0	23
June	15	3	0	59
July	12	1	0	83
August	18	7	0	165
September	11	4	0	148

Water quality data was collected in 2009 as part of Phase II of the TMDL and bacterial data was analyzed for *E. coli*, consistent with the new State standard. Bacteria concentrations as *E. coli* were measured at seven stations along the main stem of the Elk River; one station upstream of Big Elk Lake and six stations downstream of Big Elk Lake within the listed reach. Box plots displaying the geometric mean *E. coli* bacteria concentrations, as well as the range of observed values from each station are presented in Figure 2.15. The chronic (126 CFU/100ml) and acute (1,260 CFU/100ml) standards for *E. coli* are displayed on this graph.

Figure 2.15. Box plots of 2009 longitudinal *E. coli* bacteria concentrations in the Elk River (mainstem).



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]E Coli Chart

A summary of the discrete *E. coli* samples by month for the six sample stations within the listed reach of the Elk River are presented in Table 2.2. There were thirty-nine exceedances of the State chronic standard which is approximately 40 percent of all samples collected. One sample at river mile 37.3 in the month of August exceeded the State acute standard.

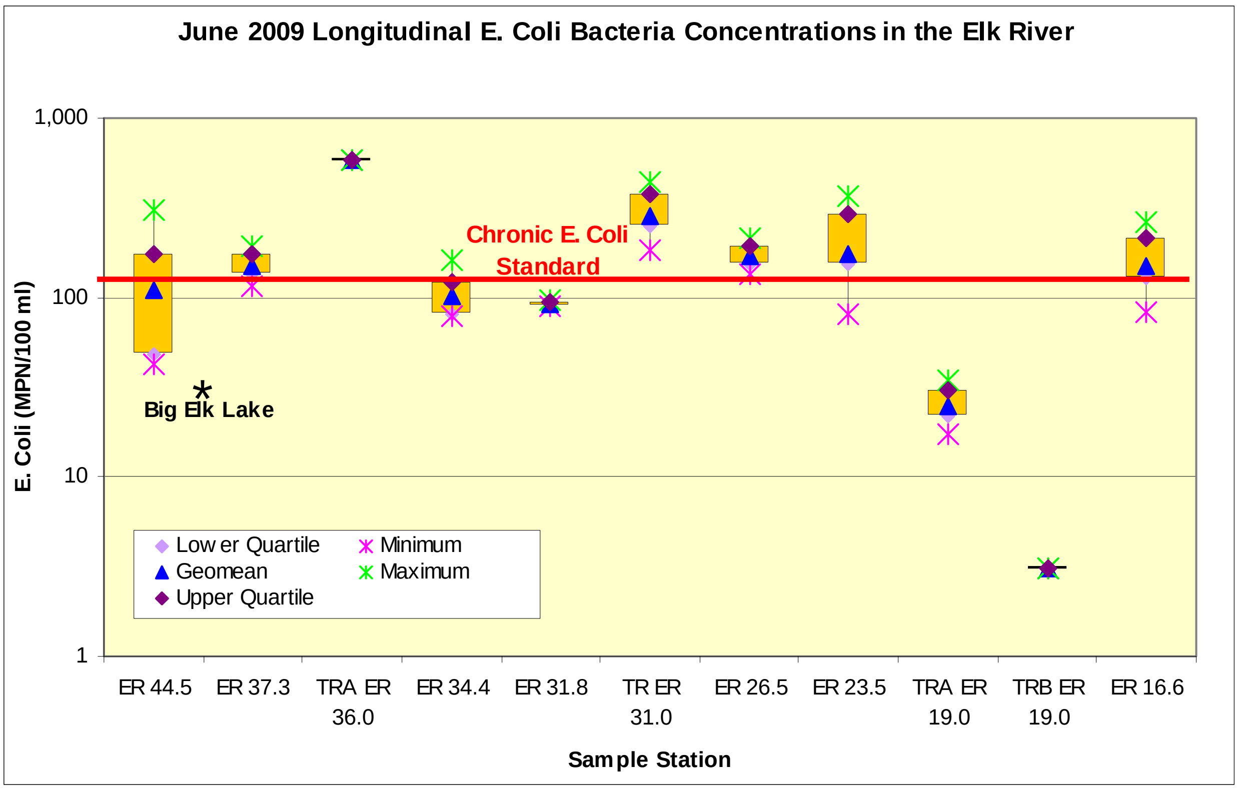
Table 2.2. Summary of *E. coli* bacteria samples for monitoring stations within the listed reach of the Elk River.

Sample Month	Total Samples (n)	#>126 CFU/100 ml	#>1260 CFU/100ml	Monthly Geomean
April	19	2	0	19
May	12	0	0	36
June	13	6	0	**132**
July	12	6	0	**127**
August	12	10	1	**458**
September	18	15	0	**198**
October	13	0	0	29

The monthly geometric mean *E. coli* concentrations exceed the State standard of 126 cfu/100 ml in the months of June – September. The higher concentrations of *E. coli* in August and September correlate with the high concentrations of Fecal Coliform present in the historical data for the same months.

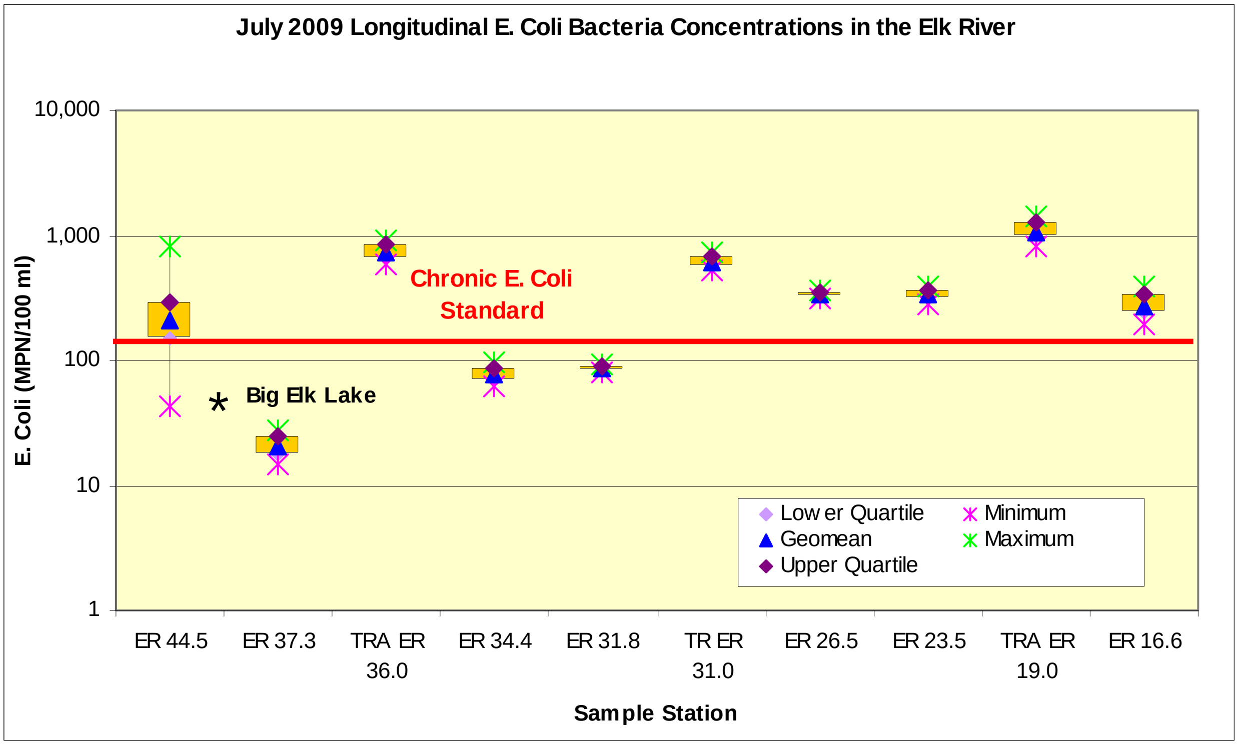
Figures 2.16 – 2.19 present longitudinal bacteria concentrations for the Elk River, including data upstream of Big Elk lake as well as tributaries, for the months where exceedances occurred (June-August). This data indicates that the bacteria impairment cannot be attributed to a specific use or subwatershed and the impairment is most likely a land use issue throughout the entire watershed, most specifically land use in the riparian areas.

Figure 2.16. June 2009 Longitudinal *E. coli* concentrations in the Elk River.



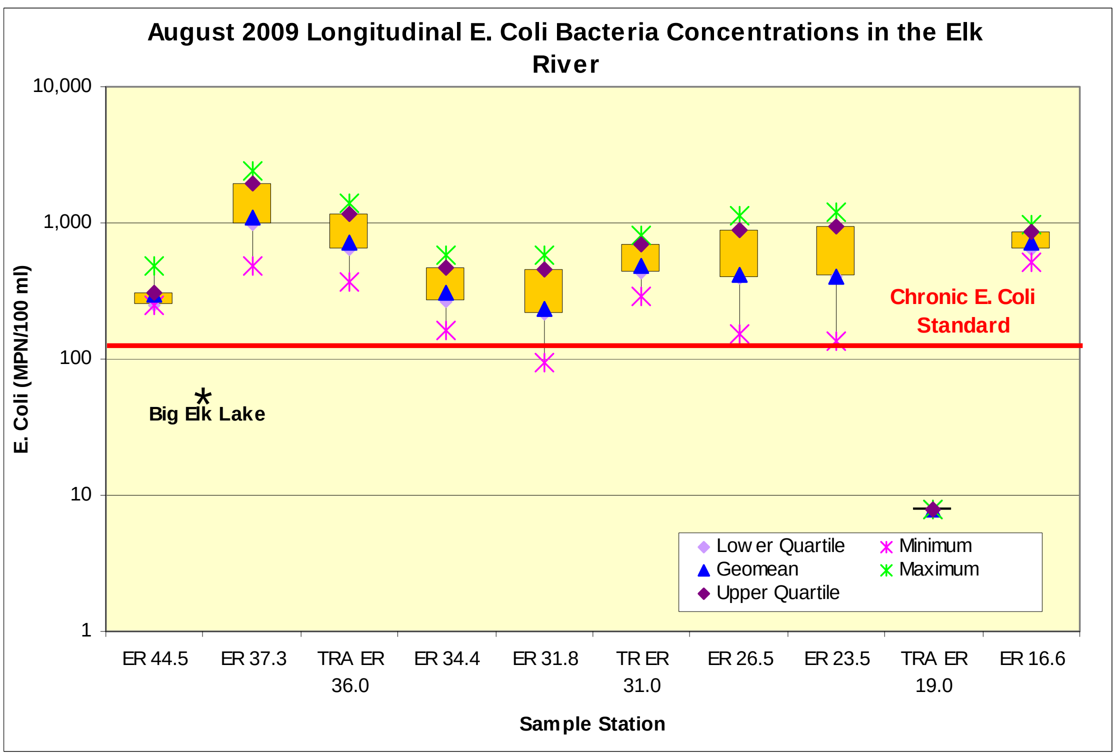
T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Long. E. coli by exceed. months

Figure 2.17: July 2009 longitudinal *E. coli* concentrations in the Elk River.



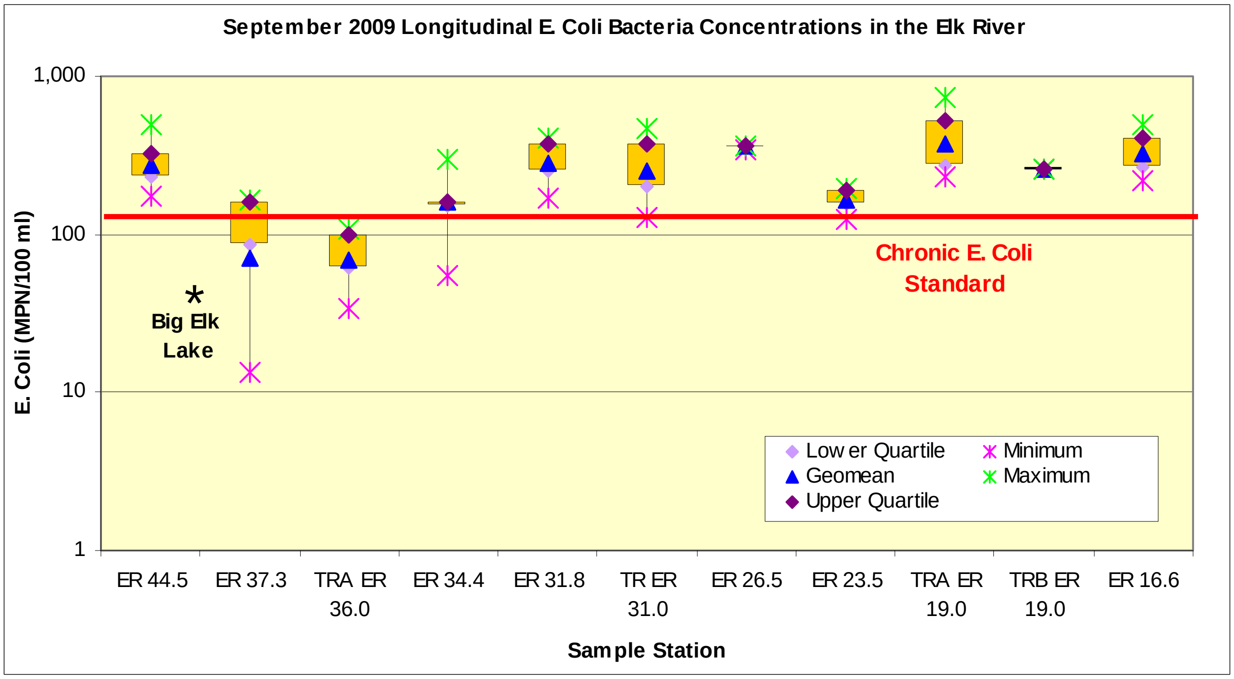
T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Long. E. coli by exceed. months

Figure 2.18. August 2009 longitudinal *E. coli* concentrations in the Elk River.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Long. E. coli by exceed. months

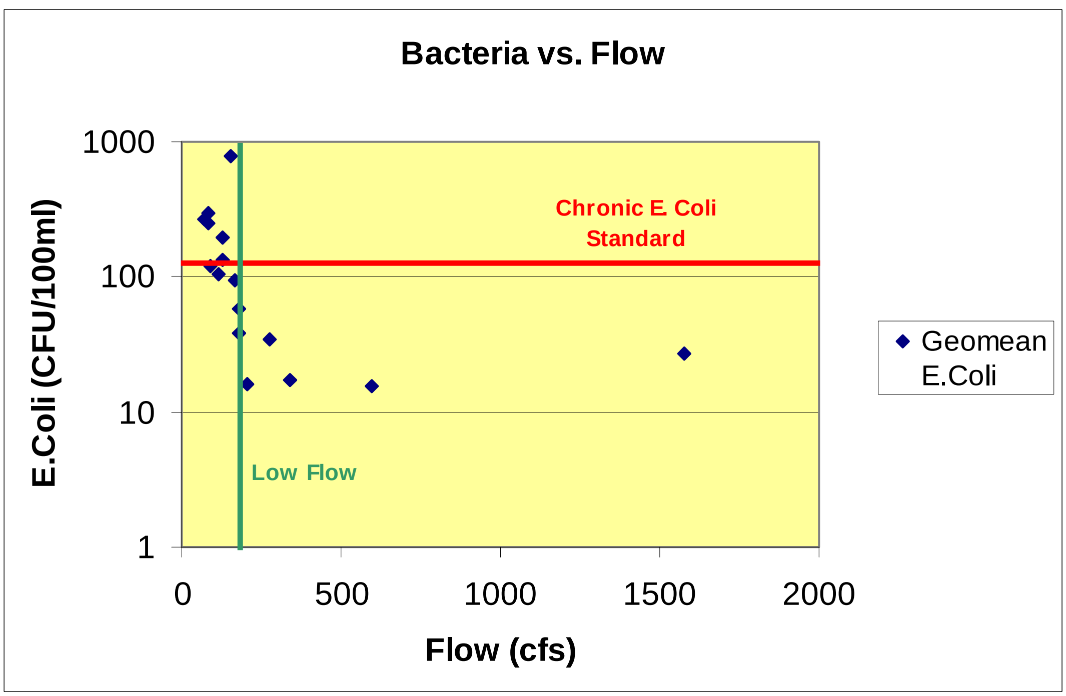
Figure 2.19. September 2009 longitudinal *E. coli* concentrations in the Elk River.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Long. E. coli by exceed. months

Figure 2.20 presents a correlation between bacteria concentrations and flow conditions. This data indicates that the bacteria impairment is prevalent in lower flow conditions.

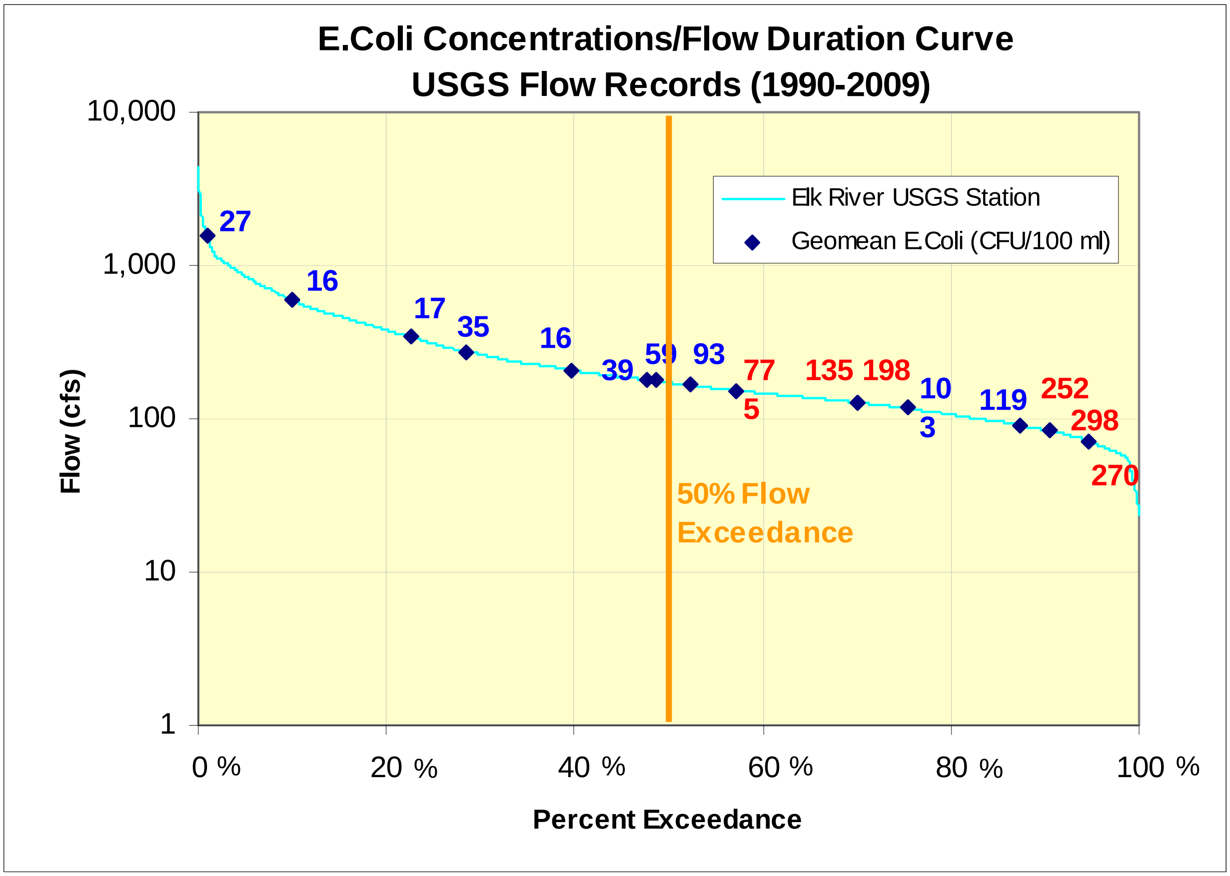
Figure 2.20: Bacteria concentrations vs. flow for Elk River impaired reach.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Bacteria vs. Flow

Figure 2.21 presents geomean bacteria concentrations along the flow duration curve for the listed reach. *E. coli* concentrations exceeding the State standard occur in the upper mid-range, dry, or low flow conditions. No impairment is indicated for higher flow regimes.

Figure 2.21. Flow duration curve with bacteria concentrations.



T:\2378_ERWSA\Elk River\Bacteria\[Bacteria Load Calcs - Annual Flow.xls]20 year flow duration (daily)

2.2 MEETING STATE STANDARDS

2.2.1 Lake Nutrients

Minnesota's standards for nutrients limit the quantity of nutrients which may enter waters. Minnesota's standards at the time of listing (Minnesota Rules 7050.0150(3)) stated that in all Class 2 waters of the State (i.e., "…waters…which do or may support fish, other aquatic life, bathing, boating, or other recreational purposes…") "…there shall be no material increase in undesirable slime growths or aquatic plants including algae…" In accordance with Minnesota Rules 7050.0150(5), to evaluate whether a water body is in an impaired condition the MPCA developed "numeric translators" for the narrative standard for purposes of determining which lakes should be included in the section 303(d) list as being impaired for nutrients. The numeric translators established numeric thresholds for phosphorus, chlorophyll-a, and clarity as measured by Secchi depth. Table 2.3 lists the thresholds for listing lakes on the 303(d) list of impaired waters in Minnesota that were in place when these lakes were listed.

Table 2.3. Trophic status thresholds for determination of use support for lakes

305(b) Designation	Full Support			Partial support to Potential Non-Support			
303(d) Designation	Not Listed			Review	Listed		
Ecoregion	TP Range (ppb)	Chl-a (ppb)	Secchi (m)	TP Range (ppb)	TP (ppb)	Chl-a (ppb)	Secchi (m)
Northern Lakes and Forests	<30	<10	>1.6	30-35	>35	>12	<1.4
(Carlson's TSI)	(<53)	(<53)	(<53)	(53-56)	(>56)	(>56)	(>56)
North Central Hardwood Forests	<40	<14	>1.4	40-45	>45	>18	<1.1
(Carlson's TSI)	(<57)	(<57)	(<57)	(57-59)	(>59)	(>59)	(>59)
Western Cornbelt Plains and Northern Glaciated Plains	<70	<24	>1.0	70-90	>90	>32	<0.7
(Carlson's TSI)	(<66)	(<61)	(<61)	(66-69)	(>69)	(>65)	(>65)

TSI= Carlson trophic state index; Chl-a= chlorophyll-a; ppb= parts per billion or µg/L; m=meters

The numeric target used to list these lakes was the numeric translator threshold phosphorus standard for Class 2B waters in the North Central Hardwood Forest ecoregion (40 µg/L) prior to adoption of new standards in 2008 (Table 2.3). Under the new standards, Big Elk Lake is considered a shallow lake with a numeric target of 60 µg/L. Mayhew Lake is considered a deep lakes with a numeric target of 40 µg/L. Therefore, this TMDL presents load and wasteload allocations and estimated load reductions assuming an endpoint of 40 µg/L for Mayhew Lake and an endpoint of 60 µg/L for Big Elk Lake.

The numeric standards for chlorophyll-a and Secchi depth are 14 μg/L and 1.4 meters, respectively for deep lakes. The numeric standards for chlorophyll-a and Secchi depth are 20 μg/L and 1.0 meters, respectively for shallow lakes (Table 2.4).

Table 2.4 Numeric targets for Lakes in the North Central Hardwood Forest Ecoregion

Parameters	North Central Hardwood Forest	
	Shallow [1]	Deep
Phosphorus Concentration (μg/L)	60	40
Chlorophyll-a Concentration (μg/L)	20	14
Secchi disk transparency (m)	>1	>1.4

[1] Shallow lakes are defined as lakes with a maximum depth of 15 feet or a less, or with 80% or more of the lake area shallow enough to support emergent and submerged rooted aquatic plants (littoral zone).

2.2.2 Turbidity

The numeric criteria for turbidity, based on stream use classification, are provided in Table 2.5 (Minnesota Rules Chapter 7050.0220). The impaired reach covered in this TMDL is classified as a Class 2B water and has a turbidity standard of 25 NTU.

Table 2.5. Minnesota turbidity standards by stream classification.

Class	Description	Turbidity (NTUs)
1B	Drinking water	10
2A	Cold water fishery, all recreation	10
2B	Cool and warm water fishery, all recreation	25
2C	Indigenous fish, most recreation	25

Turbidity, a measure of impaired water clarity, is caused by the suspension of sediment, organic matter or algae in the water. High turbidity limits the beneficial uses of streams such as aquatic life and recreation. In source water areas, high turbidity can increase the cost of treatment for drinking water. Turbidity exceedances in reach 579 are caused by extreme algae blooms in Big Elk Lake, located at the upstream end of the impaired reach.

The standard and goal for turbidity in Class 2B waters is 25 nephelometric turbidity units (NTU). Transparency and TSS values reliably predict turbidity and can serve as surrogates at sites where there are an inadequate number of turbidity observations. For waters to be considered impaired, there must be at least 3 observations, and 10% of the observations must violate the standard. The surrogate values of transparency and TSS that correspond to the 25 NTU turbidity standard are as follows:

- transparency tube <20 centimeters
- TSS >100 mg/L

Endpoint turbidity measurements must meet the turbidity standard for Class 2B waters, 25 NTUs.

2.2.3 Bacteria

This Elk River reach is classified as a Class 2B, 3C, 4a, 4B, 5 and 6 water and is protected for aquatic life (warm and cool water fisheries and associated biota) and recreation (all water recreation activities including bathing). The Minnesota standard for class 2B waters is as follows:

Minn. R. ch. 7050.0222 subp. 4, *E. coli* water quality standard for class 2B and 2C waters states that *E. coli* shall not exceed 126 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 1,260 organisms per 100 milliliters. The standard applies between April 1 and October 31.

Endpoint *E. coli* concentrations were determined to be the State water quality standard of a monthly geometric mean of less than 126 cfu/ 100 ml and no value exceeding 1,260 cfu/ 100 ml for the period of April 1 through October 31. However, the focus of this TMDL is on the "chronic" standard of 126 cfu/ 100 ml. It is believed that achieving the necessary reductions to meet the chronic standard will also reduce the exceedances of the acute standard (MPCA 2002).

This standard, current as of 2008, represents a change from the historic use of fecal coliform as a regulated pathogen indicator. Because the change is recent, the in-stream water quality data available for this TMDL study was fecal coliform, not *E. coli.* The fecal coliform data was used to link watershed sources of bacteria to in-stream bacteria concentrations and to determine effective load reduction strategies. The *E. coli* standard was determined to be as protective as the fecal coliform standard, and load reductions that are applicable to fecal coliform will result in similar load reductions to *E. coli* bacteria (MPCA 2007).

For reference, the historical fecal coliform standards were as follows: that Fecal Coliform shall not exceed 200 organisms per 100 milliliters as a geometric mean of not less than five samples in any calendar month, nor shall more than ten percent of all samples taken during any calendar month individually exceed 2,000 organisms per 100 milliliters. The standard applies between April 1 and October 31.

2.3 ALLOCATIONS

2.3.1 Nutrients

Nutrient loads for the lake TMDLs are set for phosphorus, since this is typically the limiting nutrient for nuisance aquatic plants. This TMDL is written to solve the TMDL equation for the numeric target of 40 µg/l of total phosphorus for Mayhew Lake and 60 µg/l of total phosphorus for Big Elk Lake.

There are no known WWTFs which discharge in the Mayhew Lake watershed. There are three WWTFs which discharge in the Big Elk Lake watershed, none of which has a total phosphorus effluent discharge limit. These discharges will require a Waste Load Allocation, which are included in this TMDL report.

There are several permitted MS4s within the Big Elk Lake watershed, Because the existing water quality data quantified total nutrient loads well, but did not partition loads specifically to sources, it is recommended these MS4s be assigned a categorical wasteload allocation calculated from the permitted MS4 area and the total watershed area and expressed as a percentage (0% for Mayhew Lake and 28.9% for Big Elk Lake). The resulting WLA was increased by 2% to account for future growth. An additional 0.2% of the overall TMDL was added to the WLA to account for construction and industrial stormwater.

The WLA must be divided among existing permitted sources under state law. Discharge from septic systems is not allowed by law and therefore the load allocation for septic systems will be zero. Relative proportions allocated to each source are based on reductions that can be achieved through Best Management Practices.

The loading capacity is the total maximum daily load of phosphorus to the impaired water. The daily load and waste load allocations for the average annual hydrologic conditions in each lake are shown in Table 2.6. The overall load reduction required is based on the lake response model. Required load reductions are shown and discussed in Section 8 of this report.

Table 2.6. Total phosphorus TMDL expressed as daily loads (from lake response models and source watershed data).

Lake	Total Phosphorus TMDL (lbs/day)	Waste Load Allocation (lbs/day)	Load Allocation (lbs/day)	MOS
Mayhew	4.67	0	4.67	Implicit
Big Elk	25.1	7.96	17.15	Implicit

Table 2.6a Big Elk Lake Waste Load Equation (all values in lbs/day)

WLA	=	WWTF WLA (Foley + Gilman)	+	MS4 WLA	+	Reserve Capacity	+	Construction Stormwater WLA
7.96	=	6.95	+	0.94	+	0.07	+	0.0007

Load allocations by source for each lake are provided in Table 2.7. No reduction in atmospheric or groundwater loading is targeted because this source is impossible to control on a local basis. The remaining load reductions were applied based on understanding of the lakes, efficacy of proposed implementation strategies, as well as the model results.

Table 2.7. Partitioned total phosphorus Load Allocations expressed as daily loads.

Lake	Load Allocation	Direct & Tributary Watershed Inflows	Septic Systems	Atmospheric + Groundwater	Internal
Mayhew	4.67	2.34	0.00	0.59	1.74
Big Elk	17.15	2.26	0.00	3.74	11.15

Annual total maximum loads are provided in Tables 2.8 and 2.9. The values above are calculated from these annual loads. The loading capacity is based on average model predicted results for years in which lake water quality data was available (within the last 10 years).

Table 2.8. Total phosphorus load allocations expressed as annual loads.

Lake	Total Phosphorus TMDL (lbs/year)	Waste Load Allocation (lbs/year)	Load Allocation (lbs/year)	MOS
Mayhew	1705	0	1705	Implicit
Big Elk	9163	2,905	6,258	Implicit

Table 2.9. Partitioned total phosphorus load allocations expressed as annual loads (lbs/ yr).

Lake	Load Allocation (lbs/year)	Direct & Tributary Watershed Inflows (lbs/year)	Septic Systems (lbs/year)	Atmospheric + Groundwater (lbs/year)	Internal (lbs/year)
Mayhew	1,705	854	0	216	635
Big Elk	6,258	824	0	1365	4069

2.3.2 Turbidity

The numeric TMDL for the turbidity impairment in the Elk River reach 579 is the nutrient TMDL for Big Elk Lake, plus a TSS allocation for sources of turbidity downstream of Big Elk Lake.

As discussed previously in this report, setting the nutrient TMDL in Big Elk Lake is an appropriate surrogate for a numeric turbidity TMDL. By achieving the nutrient goal in Big Elk Lake as allocated in the above section, water quality within the listed reach will improve and meet the State standard of 25 NTUs for turbidity. In addition to the load reduction for Big Elk Lake, sources of turbidity to the Elk River downstream of Big Elk Lake were assigned TMDLs using a TSS surrogate. However, no load reductions in TSS from downstream sources were necessary in this TMDL.

Table 2.10 shows the non-algal turbidity TMDL.

Table 2.10. Partitioned non-algal turbidity TMDL (daily loads).

Daily (Tons per day)										
246876	Critical Condition	Total Wasteload Allocation (Tons)	WWTF Allocation (tons)	MS4 Allocation (Tons)	Industrial Stormwater Allocation (Tons)	Construction Stormwater Allocation (Tons)	Load Allocation (tons)	Margin of Safety (tons)	TMDL (tons)
Elk River 579	High Flow	0.56	0.27	0.13	0.08	0.08	6.84	0.82	8.23
	Wet	0.37	0.27	0.05	0.03	0.03	2.31	0.30	2.98
	Mid-Range	0.33	0.27	0.03	0.02	0.02	1.17	0.17	1.66
	Dry	0.31	0.27	0.02	0.01	0.01	0.71	0.11	1.13
	Low Flow	0.29	0.27	0.01	0.01	0.01	0.31	0.07	0.67

All calculations are based on a TSS-VSS average of 5.65 mg/L (Results of 2009 monitoring data)

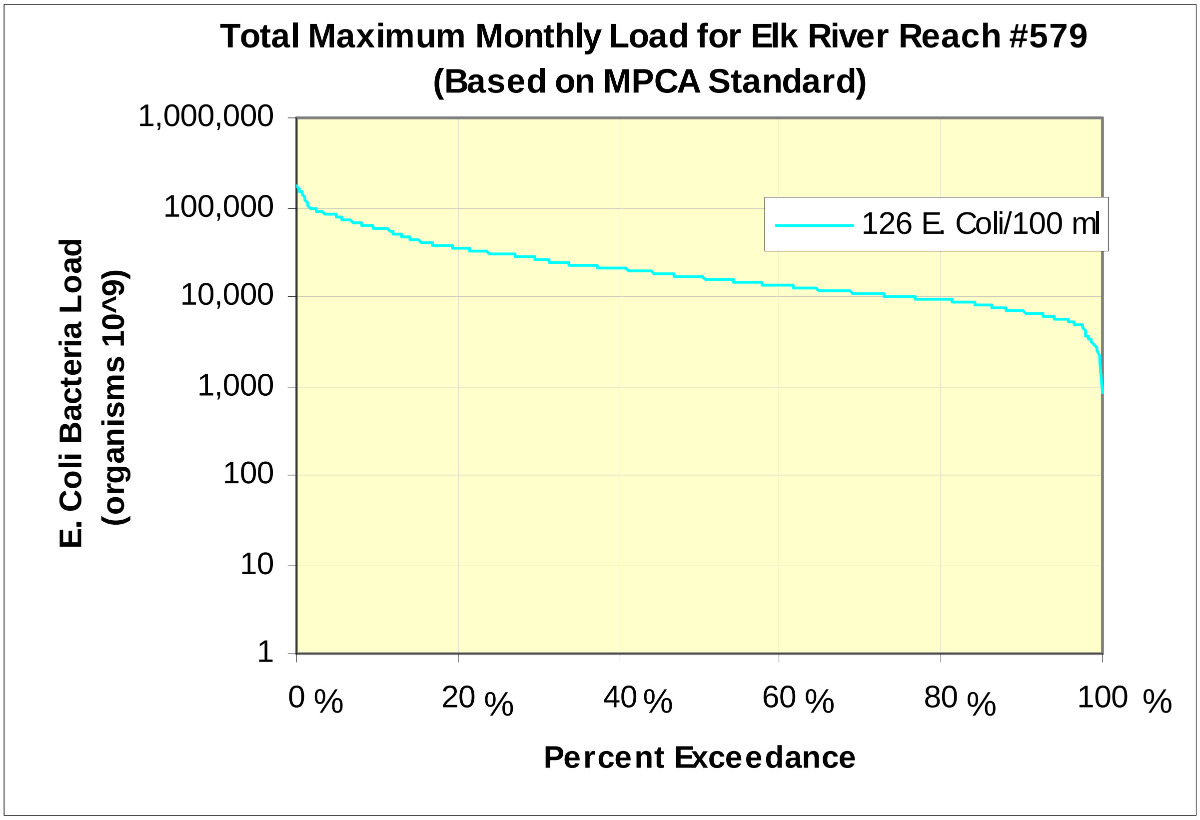
T:\2378_ERWSA\Elk River\Turbidity\[Turbidity Load Calcs - Annual Flow.xls]TMDL Calcs

WWTF allocation is for Becker alone.

2.3.3 Bacteria

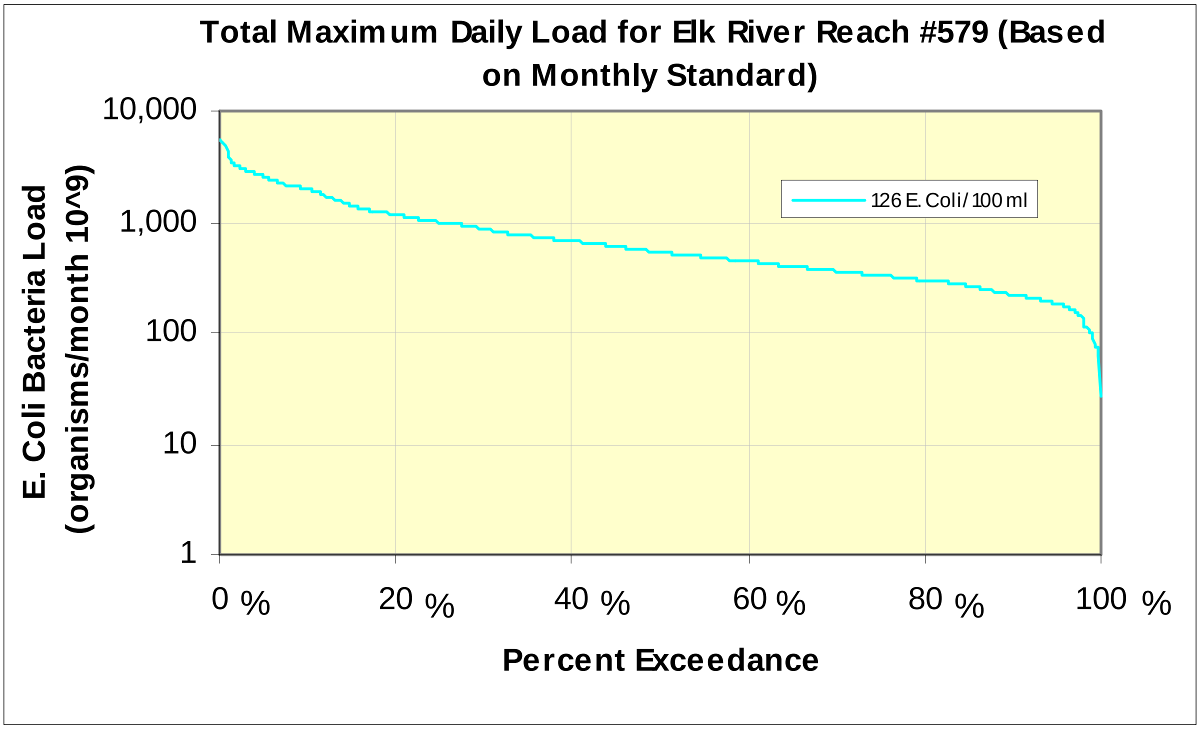
Because stream *E. coli* concentrations are dependent upon the daily flow which is dynamic, it is appropriate to express the TMDL and load reduction by an allowable load across all flow conditions as is demonstrated in Figure 2.22 for monthly loads and 2.23 for daily loads. To determine acceptable loads under the critical flow regimes, chronic standard concentrations were multiplied by the flow at each interval. Monthly mean flow data was used to calculate the load duration curve. The daily loads were derived from the calculated monthly loads.

Figure 2.22. Total Maximum Daily Load for the listed segment of the Elk River. Concentrations represent total monthly load based on 126 *E. coli*/100 mL standard.



T:\2378_ERWSA\Elk River\Bacteria\[Bacteria Load Calcs - Annual Flow.xls]Load Duration (Method 2)

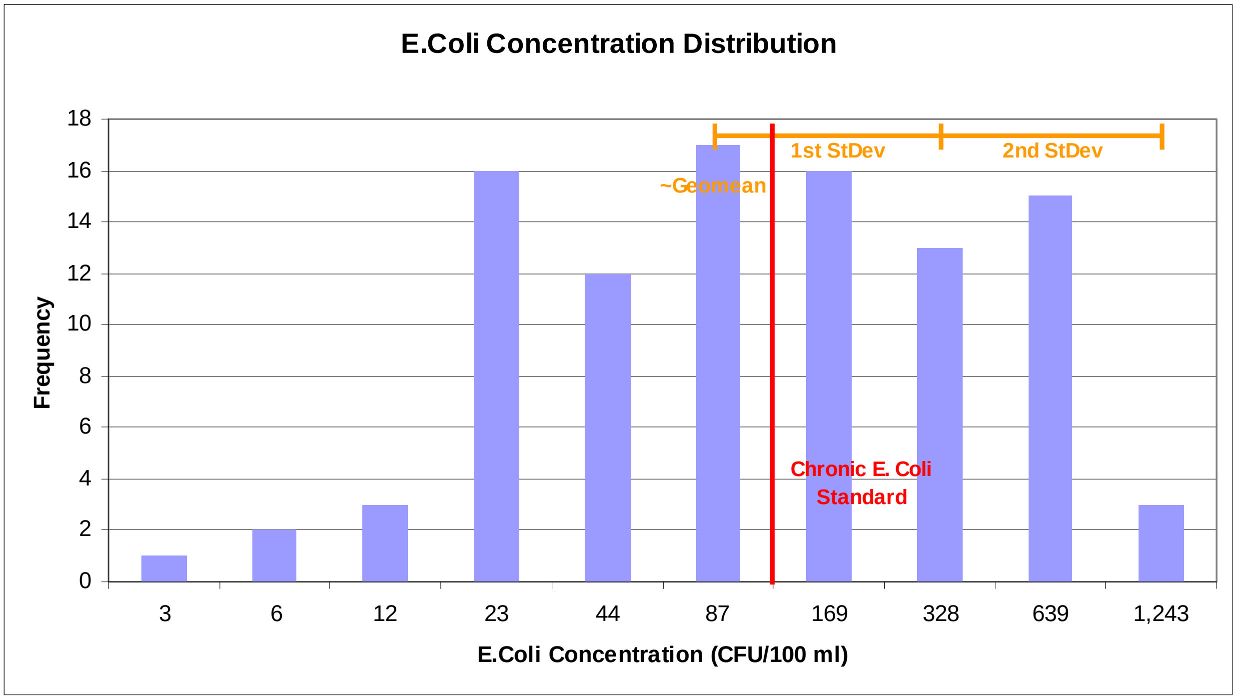
Figure 2.23. The Total Maximum Daily Load for the listed segment of the Elk River. Concentrations represent Total Daily Load derived from monthly load (Standard of 126 *E. coli*/100 ml.)



T:\2378_ERWSA\Elk River\Bacteria\[Bacteria Load Calcs - Annual Flow.xls]Load Duration (Method 2)

To develop the TMDL equation, the seasonal mean discharge was calculated for each of five flow conditions. These data were then multiplied by the standard of 126 *E. coli*/100 ml to establish the TMDL (Table 2.11). The Margin of Safety (MOS) was established using all existing watershed data to quantify uncertainty in the data. Figure 2.24 displays the distribution of the available data. The MOS was calculated from the difference between the geometric mean and the value two standard deviations above the geometric mean. The use of two standard deviations was applicable due to the data distribution and range of concentrations. The calculated MOS, expressed as a percentage of the state chronic standard (16%) and applied to the TMDL equation, is extremely conservative in this case.

Figure 2.24. Distribution of 2009 *E. coli* concentrations.



T:\2378_ERWSA\Elk River\[2009 WQ data.xls]Hist1

The wasteload allocation (WLA) was calculated using known discharges from the point sources within the watershed. The WLA is 213.21 x 10^9 for the wet condition. The load allocation (LA) assigned for the wet flow is the load remaining after the MOS and WLA are subtracted from the TMDL using the following calculation:

TMDL – MOS - WLA = LA

or

1072.70 x 10^9 *E. coli* – 171.63 x 10^9 *E. coli* – 213.21 x 10^9 *E. coli* = 687.86 x 10^9 *E. coli*

Under this scenario the load allocation is 64 percent of the TMDL at 126 *E. coli*/100 ml and the MOS and WLA make up the remaining load. The TMDL loads for both daily loads and monthly loads based on the 126 *E. coli* /100 ml daily standard are provided in Tables 2.11 and 2.12, respectively. Note that the WLA for bacteria, though expressed as *E. coli* for the TMDL will be expressed in MPCA permits as fecal coliform where 126 cfu/ mL *E. coli* = 200 cfu/mL fecal coliform. This is the current practice of the MPCA.

Table 2.11. The TMDL expressed as daily loading capacity of *E. coli* in the Elk River Reach # 579.

Daily						
Reach	**Critical Condition**	**WWTF Wasteload Allocation (10^9 org) (Becker WWTF)**	**MS4 Wasteload Allocation (10^9 org)**	**Load Allocation (10^9 org)**	**Margin of Safety (10^9 org)**	**TMDL (10^9 org)**
Elk River 579	High Flow	10.3	539.43	1817.25	450.65	2816.55
	Wet	10.3.	203.99	686.78	171.63	1072.70
	Mid-Range	10.3	101.84	342.87	86.67	541.67
	Dry	10.3	61.01	205.41	52.71	329.43
	Low Flow	10.3	29.95	100.85	26.88	167.98

Table 2.12. The TMDL expressed as monthly loading capacity of *E. coli* in the Elk River Reach # 579.

Monthly						
Reach	**Critical Condition**	**WWTF Wasteload Allocation (10^9 org)**	**MS4 Wasteload Allocation (10^9 org)**	**Load Allocation (10^9 org)**	**Margin of Safety (10^9 org)**	**TMDL (10^9 org)**
Elk River 579	High Flow	313.33	16409.56	55247.89	13708.72	85679.49
	Wet	313.33	6205.28	20892.00	5221.07	32631.67
	Mid-Range	313.33	3097.89	10430.03	2636.43	16477.67
	Dry	313.33	1855.93	6248.57	1603.39	10021.22
	Low Flow	313.33	911.20	3067.84	817.59	5109.96

While estimates of *E. coli* contributions are derived from literature values and knowledge of the land practices, actual fecal coliform or *E. coli* data is based on field monitoring. Load and wasteload allocations were based on thorough watershed wide monitoring of *E. coli* from April 1 through October 31. This robust data set provided for a thorough seasonal evaluation of loads and consequently the magnitude of the exceedances and reductions needed to meet the standard.

2.4 REQUIRED LOAD REDUCTIONS

2.4.1 Lake Nutrients

Mayhew Lake is impaired for aquatic recreation and requires the reduction of both internal and external loading of nutrients to meet TMDL requirements. The following table shows the existing average-year phosphorus loads and required phosphorus load reductions by source:

Table 2.13. Mayhew average year phosphorus and load reductions.

Category	Description	Drainage Area (ac)	Pounds of Phosphorus/ Yr Existing	Goal	Reduction	Load Reduction %
Watershed Loads	Mayhew Direct	809	824	115	709	86%
	Mayhew 1	16,768	4,104	575	3,529	86%
	Mayhew 2	361	308	43	265	86%
	Mayhew 3	442	865	121	744	86%
SSTS			5	0	5	100%
Atmospheric			30	30	0	0%
Groundwater			186	186	0	0%
Internal Load			1,587	635	952	60%
Total			**7,910**	**1,706**	**6,204**	**78%**

T:\2378_ERWSA\Lake Response Models\[LRM Mayhew_mmb Calib 1.xls]Summary

The dominant land use in the Mayhew Lake subwatershed is corn and soy bean rotation agriculture (40%), followed by pasture/ hay (25%). Data collected in this watershed indicates that spring phosphorus loads from the watershed are the dominant source of watershed loads. As such BMPs will target this source.

The Big Elk Nutrient impairment and resulting turbidity impairment in the Elk River are driven by mid to late summer phosphorus loads from the watershed. Load reductions must be achieved by reducing watershed loads from the direct tributary watersheds and by achieving state standards in upstream water bodies such as the Briggs-Julia Chain of Lakes as well as Mayhew Lake. Internal load management is not feasible in Big Elk Lake due to the short residence time. Table 2.14 summarizes load reductions required by source.

Table 2.14. Big Elk Lake average year phosphorus and load reductions.

Category	Pounds of Phosphorus / year Existing	Goal	Reduction	% Reduction
Watershed Load	15,533	3,728	11,806	76%
SSTS	529	0	529	100%
Atmospheric & Groundwater	1,365	1,365	0	0%
Internal Load	4,069	4,069	0	0%
Total	**21,497**	**9,163**	**12,334**	**57%**

2.4.2 Turbidity

Achieving the lake nutrient load reduction in Big Elk Lake will provide the necessary load reduction to meet the state turbidity standard in the Elk River downstream of Big Elk Lake.

2.4.3 Bacteria

A load reduction of 72.5% is required in terms of *E. coli* within the listed reach to meet the State standards. Based on *E. coli* bacteria available in the watershed, the primary implementation strategies will focus on riparian pasture management and agricultural BMPs.

2.4.4 Implementation Focus

The focus of the Implementation Plan is targeted towards specific BMPs that data indicate will have the highest likelihood of achieving load reductions. These BMPs are targeted towards specific areas of the watershed where the BMPs are likely to have the greatest impact to receiving waters. Load reductions will be required from urban, agricultural, and lake shore land uses as well as internal nutrient loading for lakes.

The major guiding principles are to

1. Target BMPs to address the source specifically. For example, Mayhew Lake is sensitive to spring loads from an agricultural watershed, as such BMPs will target reductions in spring loads.
2. Saturate the target implementation areas with BMP implementation to achieve maximum benefits. The size of the watershed coupled with the aggressive load reductions require an innovative approach. Implementing strategies over a large area with low density of implementation will not likely achieve major load reductions. Instead target specific areas for saturation with BMP implementation and work out from there. Begin with areas riparian to the receiving water or its primary load and move out from there.

Specific focuses for each of the impairments are discussed below. Strategies are recommended based on their relative cost and effectiveness. Section 3.0 provides a more detailed discussion of implementation strategies.

Mayhew Lake Nutrient TMDL

The nutrient impairment in Mayhew Lake is driven by spring phosphorus loads from the large agricultural drainage area. As such, implementation will focus on watershed based BMPs that target reductions in spring runoff. Further, it will be necessary to manage internal load in Mayhew Lake. Whole lake or partial lake alum treatment is an effective way to achieve load reductions from internal sources for this lake.

Big Elk Lake Nutrient TMDL & Elk River Turbidity TMDL

The nutrient impairment in Big Elk Lake is dominated by summer loads from the large agricultural drainage area to the lake. As such, the strategies to address the Big Elk TMDL will include a mix of land use based BMPs and capital projects to reduce phosphorus. Because the summer condition is the dominant factor in both impairments, BMPs will target summer loads. The main discharge to Big Elk Lake is the Elk River, so areas riparian to Big Elk Lake and the main stem of the Elk River will be targeted first, moving outward in the watershed along tributary streams until the TMDL is achieved, or new information suggests a different strategy. Due to short residence times and the lakes connectivity with the Elk River, traditional methods of dealing with internal load will be minimally effective.

Achieving the nutrient TMDL in Big Elk Lake will ensure that the turbidity TMDL for the Elk River downstream of the lake is also achieved.

Elk River Bacteria TMDL

Implementation to achieve the bacteria TMDL in the Elk River will focus on efforts in the riparian zone. This is because risk of transport of bacteria from watershed sources to the receiving water generally declines with distance from the receiving water. Specifically, the implementation plan will include measures to address issues with riparian grazing, agriculture, livestock, and septic systems.

3.0 Implementation Plan

3.1 TMDL AND IMPLEMENTATION PLAN PROCESS

The activities and BMPs identified in this Implementation Plan are the result of:

- A detailed TMDL study which included analysis of existing data as well as data collected during the study to address gaps, water quality modeling, and source quantification.
- A review of potential implementation options based on technical evaluation of the impaired waters and their tributary watersheds and input gathered through early stakeholder meetings as well as through input from the ERWSA and County Staff, Technical Advisory Committee (TAC) and Stakeholders and refined through the course of setting the TMDLs.
- Numerous TAC meetings and work sessions along with continuous, ongoing communications with the TAC members that included staff from the ERWS and NRCS and SWCD staff, MPCA, DNR, USFWS, US Department of Agriculture and others.
- Several stakeholder meetings led by the ERWSA which included representatives from lake associations, cities, townships, counties, and citizens. Representatives from all impaired waters were invited and did attend. The MPCA project manager for this TMDL was present at all stakeholder meetings.

The Section 3 Appendix contains a listing of stakeholders that were invited to and participated in these various meetings. It also contains a summary of outcomes from the final stakeholder meetings. The summaries from final stakeholder meetings should be taken into consideration when planning for implementation activities.

Specific load reduction scenarios and implementation principles presented in this report were developed through taking into account all the input gathered through the stakeholder and TAC processes. The ERWSA, Sherburne and Benton Counties, SWCD and NRCS staff played a significant role in selecting the final BMPs for implementation.

3.2 IMPLEMENTATION PLAN PRINCIPLES

Through the discussion of policies and practices, current activities, and ongoing research, the stakeholders have come to understand the required steps towards implementation of the load reduction plan. Additionally, as our understanding of watershed load reductions improve through monitoring and tracking implementation, and as land changes hands, new opportunities for load reductions will arise. These opportunities must be evaluated and implemented if they provide a reasonable benefit in terms of cost per pound of load reduction. It is recommended that the ERWSA maintain a spreadsheet and standard method to track cost/ benefit of projects for implementation so that potential projects can be compared to other proposed projects and existing projects for funding prioritization. The general principles that will guide implementation are listed below:

1. <u>Target specifically identified BMPs or types of BMPs to specific areas based on the nature and sources of the impairment</u>

Data evaluation and modeling conducted for the TMDL pointed towards the dominance of difference sources in different impairments. For example, the spring time loads that dominate the Mayhew Lake nutrient impairment, whereas summer loads dominate the Big Elk Lake nutrient impairment / Elk River turbidity impairment. As such, the BMPs identified for Mayhew Lake target springtime loads (i.e. winter manure management, etc). BMPs identified for Big Elk Lake should address summer loads (i.e. buffer strips, capital projects).

2. <u>Achieve maximum implementation density</u>

Given the size of the watershed, widespread, low density implementation of any BMP will likely be minimally effective at realizing load reductions downstream. It will be necessary to saturate a target area with BMPs to achieve load reductions in the receiving waters. To that end, the areas riparian to the receiving water, or to the main loading source for the receiving areas will be targeted first for BMP implementation. For example, the Elk River is the main source of nutrients to Big Elk Lake. As such, the lake shore and areas riparian to the main stem will be targeted first for implementation. Once saturation has been achieved, implementation can work out from there. Of course this should not prohibit major opportunities for load reduction in the upper watershed if they arise during the course of implementation. Such decisions will have to be made on a case by case basis.

3. <u>A Sustained, Coordinated Effort</u>

Achieving and maintaining load reductions to meet the water quality goals will require a sustained effort. Education will need to be on-going from generation to generation, and BMPs will require maintenance and monitoring to maintain their efficacy. Further, implementation will require dedicated staff to administer the program.

4. <u>Ecological Integrity</u>

The ERWSA recognizes the importance of healthy biological communities in shallow lakes, shallow near shore areas of deep lakes, lake shore, streams, and riparian areas. To that end, the ERWSA will work cooperatively with stakeholders when possible to restore these biological communities of impaired lakes and these areas in full use lakes where such restorations will have a positive benefit for downstream impairments. Biological integrity as defined by stakeholder input includes healthy fish, plant, and zooplankton communities as well as healthy lake and riverine biological communities in shallow areas of ERWSA lakes and streams.

5. <u>Foster Stewardship and Partnerships</u>

City, county and township staff and officials will be provided opportunities for education and training to better understand how their areas of responsibility relate to the protection and improvement of water quality in the ERWSA. The ERWSA should seek to foster stewardship through education and encourage partnerships in achieving and maintaining water quality.

6. <u>Communicate with the Public</u>

Public education should take a variety of forms, and should include both general and specialized information, targeted but not limited to:

- Urban, residential, and rural residents
- Elected and appointed officials from Cities, Counties and Townships
- Active Family Farmers
- Lakeshore residents and Lake Associations
- Lake users
- Property owners and managers
- Agricultural associations and trade groups
- Staff from Cities, Counties and Townships

7. Innovation in Watershed Management

The water quality goals in the TMDL are aggressive, and load reductions substantial. It is not clear at this point if they can be achieved with existing technology. To that end, the ERWSA should commit to innovation in terms of capital projects, BMPs, and stakeholder involvement. This approach recognizes that the largest potential for progress towards water quality goals might be evolving technologies and as such, not identified specifically in this plan. This plan addresses a framework and timeline for evaluating new technologies and ranking them for implementation.

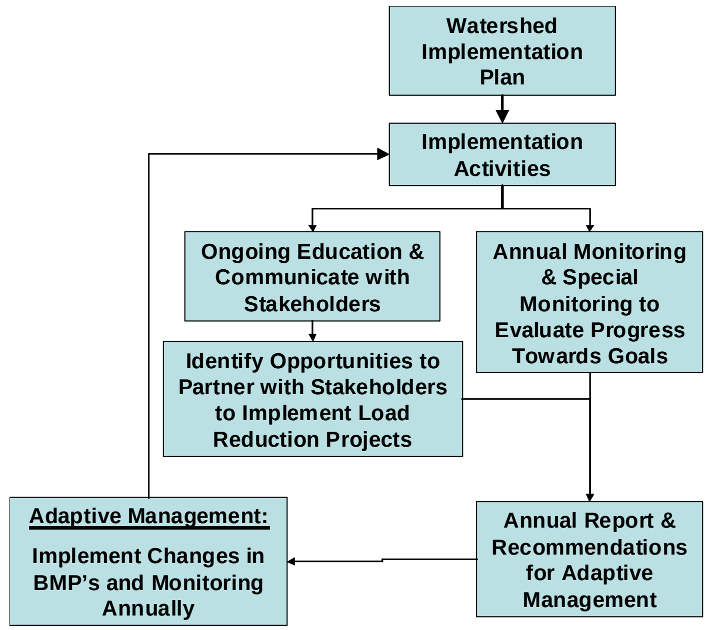
8. Leverage Existing Programs to the Maximum Practical Extent

The ERWSA already implements several programs to improve water quality, for example lake shore restorations, agricultural buffers, rain gardens, etc. The ERWSA also partners with federal, state and local governments, lake associations, and groups like the DNR to implement programs and projects for water resource improvements. This ongoing ERWSA approach leverages existing state and local available funding and expertise to maximize water quality benefits. To achieve the significant load reductions required to meet state standards at a reasonable cost, the ERWSA will continue and expand this approach. One specific area of expansion is to include agricultural groups.

3.3 IMPLEMENTATION PLAN

The ERWSA should work with stakeholders to identify opportunities for partnership in implementation plan activities. The ERWSA should take responsibility for ongoing coordination of projects, education and outreach, monitoring activities, and evaluation for adaptive management. This framework is illustrated in Figure 3.1 below.

Figure 3.1 Implementation Framework



3.3.1 Implementation Strategies

The early (0 to 5 year) emphasis of implementation for the upper watershed will be on implementing the priority BMPs in the Tier 1 areas. Specifically it is recommended to begin on the main stem of the Elk River and around Big Elk Lake, and the Briggs-Julia- Rush Chain of Lakes. As the Tier 1 zones are saturated with BMPs, implementation can move to Tier 2 and so on until goals are achieved (Tier 1 and Tier 2 priority areas are shown in appendix).

The following sections discuss the general BMP strategies that were identified in the TMDL process to reduce phosphorus, bacteria, restore ecological integrity, and meet state water quality goals for these lakes; the general sequence of implementation activities; and the stakeholders who would take the lead in implementing each activity. BMP strategies are listed below and described in more detail in Sections 4 of this Plan.

<u>Implementation Strategies for Mayhew Lake</u>

- Limit manure application prior to spring melt in Tier 1 areas
- Implement cover crops if possible (local expertise indicates this is not likely to work)
- Manage riparian grazing

<u>Implementation Strategies for Big Elk Lake and Elk River Turbidity</u>

- Manage livestock in riparian areas

- Manage lake-shore loads
- Install riparian buffers
- Develop a plan to manage septic loads
- Implement plans to achieve Mayhew and Briggs Chain of Lakes water quality standards

Implementation Strategies for Elk River Bacteria TMDL

- Manage livestock in riparian areas
- Develop a plan to manage septic loads

The three figures in Appendix 3 Section 1 shows the priority implementation zones.

3.3.2 Sequencing

Some of the above activities may be undertaken immediately, while others would be implemented as opportunities arise. In general implementation will proceed according to the following sequence of activities and as funding is available:

First Five Years

- Implement identified BMPs in Tier 1 areas, saturate the Tier 1 areas with appropriate BMPs prior to moving on to Tier 2 areas.
- Implement a continuing annual monitoring / reporting program in the ERWSA to collect baseline data and track progress towards goals
- Complete the TMDLs for the 8-Digit HUC (Mississippi-St. Cloud)
- Evaluate monitoring and implementation results annually for adaptive management opportunities and evaluate opportunities for BMPs annually. Specifically, report progress towards goals in terms of number of BMPs implemented and load reductions as well as current water quality compared to standards and a recalculation of load reduction required to meet goals.
- Amend the Implementation Plan as necessary based on findings of 8-Digit HUC TMDL, and monitoring and implementation results. Track cost per pound of load reduction for proposed and implemented projects to prioritize funding. Develop spreadsheet for tracking benefits and costs of projects.

Second Five Years and Subsequent Permit Cycles

- Implement targeted BMPs in Tier 2 areas
- Continue the ERWSAs annual monitoring/ reporting program.
- Evaluate monitoring and implementation results annually for adaptive management opportunities and evaluate opportunities for BMPs annually. Specifically report progress towards goals in terms of number of BMPs implemented and load reductions as well as current water quality compared to standards and a recalculation of load reduction required to meet goals.
- Amend the Implementation Plan by reference to Annual Water Quality Monitoring Report as necessary based on progress.

3.3.3 Stakeholder Roles and Responsibilities

The primary stakeholder in this Plan is the ERWSA. Other stakeholders include the Sherburne and Benton Counties, SWCDs, NRCS and USDA, the DNR and the MPCA, US Fish and Wildlife Service, Lake Associations and private groups. In addition, property owners in the watershed have a role to play in implementing BMPs on their private properties. The ERWSA stakeholder program should provide both residential and non-residential property owners and managers with information on BMPs that would have the most impact on improving water quality. The specific roles and responsibilities for the stakeholders are listed below.

ERWSA JPB

The ERWSA will be lead organization in the 8-digit HUC working with other LGU's to prioritize funding allocation for the MPCA's new approach to meeting TMDL goals. In 1994 the Elk River Watershed Association Joint Powers Board was formed as a result of Local Water Planning efforts in Sherburne and Benton Counties. Concerned citizens identified the water quality of the Elk River and lakes in the Elk River Watershed as priorities for improvement. Thus, the two Counties determined that a watershed approach would be the most effective way to improve water quality. A Joint Powers Board was formed by Sherburne and Benton SWCDs and Counties for the purpose of coordinating efforts within the Elk River Watershed. The ERWSA recently retained a full time Watershed Coordinator to oversee conducting of TMDL studies and implementation. This Coordinator splits time between the Sherburne and Benton County SWCD offices and can bring to bear existing resources, as well as identify and bring to bear new resources and relationships necessary to implement the TMDLs described in this report.

The entities which partner to form the ERWSA JPB should continue to work together to implement the activities associated with this plan as determined to be applicable and as not to duplicate efforts. Such entities are identified below.

Sherburne County (Planning & Zoning Administration)
Benton County (Department of Development)
Sherburne SWCD
Benton SWCD

Private Landowners

Because watershed load reductions are significant, and most of the land is privately owned, the ERWSA will have to cultivate relationships with private landowners to motivate implementation of best management practices, and potentially capital projects towards achieving water quality goals. Education and outreach will be the primary driver behind partnership on this level. Additionally, landowners are currently involved with volunteer lake and stream monitoring though the MPCA's Citizen Volunteer Monitoring programs. The ERWSA should continue to take advantage of the data gathered by volunteers to asses BMP effectiveness and baseline conditions.

Lake Associations and Riparian Land-Owners

Given the size of the watershed tributary to the impaired waters, it is necessary to focus on high-priority areas for implementation. These areas are the riparian and lake shore land owners. The primary lake association that will be involved in implementation of these TMDLs is the Briggs Lake Chain Association which is comprised of residents living on Briggs Lake, Lake Julia and Rush Lake and Big Elk Lake (the Briggs Chain). The entire Briggs Lake Chain is currently impaired for nutrients and these lakes discharge into Big Elk Lake. Meeting water quality goals in the Briggs Lake Chain is critical to meeting downstream water quality goals for Big Elk Lake and the Elk River. The ERWSA may wish to foster development of other associations of riparian land owners.

Minnesota Corn and Soy Growers Associations, Farm Co-ops, crop consultants, and other agricultural groups

Land use in the watersheds tributary to the impaired waters is dominantly agricultural. By the sheer dominance in land use, much of the watershed load is derived from agricultural lands. Reducing those loads will require changes in existing farm practices. Agricultural groups bring expertise in farming practices, influence over farmers and an in-place communication and education system to reach owners and operators of agricultural lands. As such, they should be full partners in implementing watershed TMDLs.

MPCA

This TMDL project will be addressed in the state of Minnesota's new approach in surface water assessment, monitoring and implementation planning. This new MPCA approach addresses surface water resource restoration and protection strategies on a major (8 digit Hydrologic Unit Code- HUC) watershed level in a 10 year cycle. This process, called the "One Waters Approach" began for the Mississippi River St. Cloud Watershed (which includes the surface waters within the Elk River Watershed) in the fall of 2010. This approach will rely on local input and prioritization and state level funding to address all the impaired surface water resources within this watershed and prescribe protection measures for unimpaired surface water resources. Details of the approach can be found at the MPCA's web site: http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/basins-and-watersheds/watershed-approach.html.

The MPCA administers the NPDES program that will control loads from construction and industrial stormwater. Construction stormwater activities are considered in compliance with provisions of the TMDL if they obtain a Construction General Permit under the NPDES program and properly select, install, and maintain all BMPs required under the permit, including any applicable additional BMPs required in Appendix A of the Construction General Permit for discharges to impaired waters, or meet local construction stormwater requirements if they are more restrictive than requirements of the State General Permit. Industrial stormwater activities are also considered in compliance with provisions of the TMDL if they obtain an Industrial Stormwater General Permit or General Sand and Gravel general permit (MNG49) under the NPDES program and properly select, install, and maintain all BMPs required under the permit, or meet local industrial stormwater requirements if they are more restrictive than requirements of the State General Permit.

MS4s that have been designated by the MPCA for permit coverage under Minn. R.ch. 7090 are required to obtain a NPDES/SDS stormwater permit. The stormwater Program for MS4s is designed to reduce the amount of sediment and pollution that enters surface and ground water from storm sewer systems to the maximum extent practicable.

NRCS and USDA

Benton and Sherburne SWCDs have, and will continue to partner with the Natural Resources Conservation Service (NRCS) and the United States Department of Agriculture (USDA).

The NRCS and USDA administers federal programs such as Environmental Quality Incentive Program (EQIP), Conservation Stewardship Program (CSP), Conservation Reserve Program (CRP), and easement programs such as Grassland Reserve Program (GRP), Wetland Reserve Program (WRP), and Farm and Ranchland Protection program (FRPP). Using the information cultivated through the TMDL process, these dollars can be leveraged towards achieving water quality goals.

US Fish and Wildlife Service

The USFWS, a land owner in the watershed, participated in the TAC meetings and provided input throughout the TMDL process. As a land-owner, they are a potential partner for capital projects where land may be utilized, or other USFWS resources may be leveraged meeting water quality goals overlaps with improving targeted habitats. Potential capital improvements have not yet been identified, nor have their land holdings been reviewed. This can be done cooperatively through the implementation process.

Minnesota DNR Fisheries and DNR Waters

The Minnesota DNR is a full partner with the ERWSA and has participated in the TAC meetings providing input and data collection assistance throughout the TMDL process. The ERWSA looks to the DNR to continue to provide assistance with monitoring associated with the impaired lakes and streams in the watershed, and assistance guiding the ERWSA and its partners in seeking grants.

Other Local and State Partners

Other local and state partners/ stakeholders are listed in the table in Appendix for Section 3 of this report. Implementation will rely on cooperation from these stakeholders, and perhaps partnerships in funding and on grant applications to implement watershed projects towards load reduction goals. These and other departments and agencies will be called upon to perform water management duties that fall within their area of responsibility. These responsibilities may change as the need arises.

Table 3.1 shows which stakeholders will take the lead in implementing the various activities identified in this Plan.

Table 3.1 Implementation activity by stakeholder.

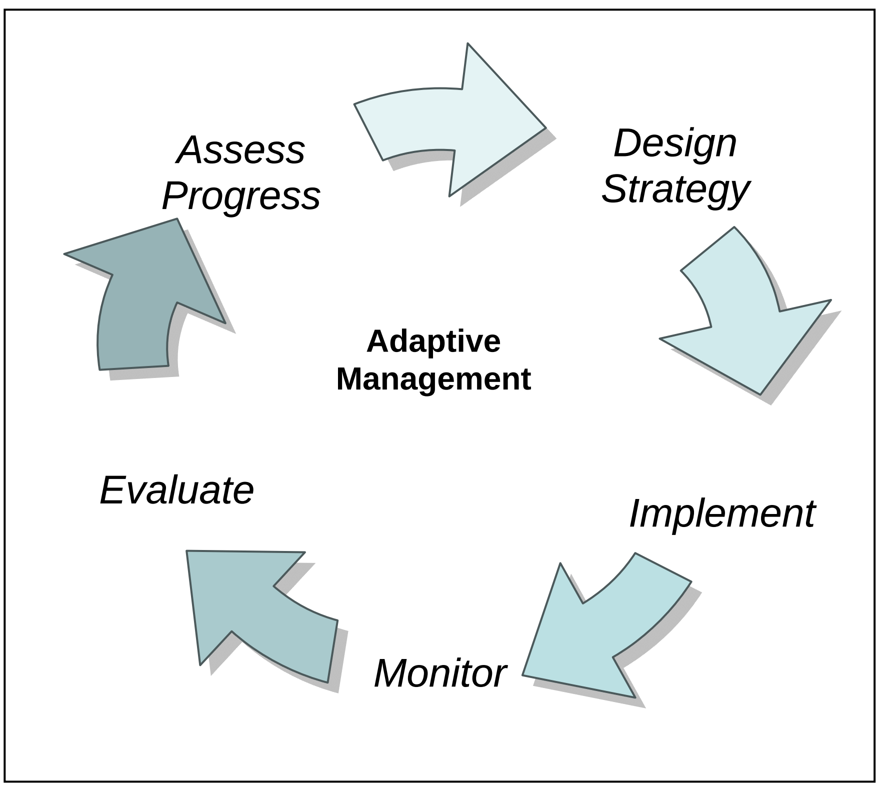
	Stakeholder	Residential/ Urban/ Lakeshore	Agricultural	Education & Administrative	Monitoring/ Reporting
ERWSA	**Sherburne and Benton SWCDs**	• Identify potential shoreline and riparian restoration projects • Consider partial funding, or low interest financing for septic system inspections and/or upgrades • Provide education for riparian residents on land use and water quality • Review need for ordinances with Counties when needed	• Identify potential shoreline and riparian restoration projects • Partner with Counties and other stakeholders to direct dollars to provide the greatest benefit for water quality • Identify additional data needs (i.e. large animal inventory)	• Prepare grant applications • Provide focused education and outreach • Solicit and fund demonstration projects • Coordinate efforts of other agencies	• Continue annual and special water quality monitoring as recommended herein • Prepare annual report on monitoring, BMP activities, recommendations for adaptive management and progress towards goals • Continue to identify and fill data gaps
	Sherburne & Benton Counties	• Consider partial funding, or low interest financing for septic system inspections and/or upgrades • Provide education for riparian residents on land use and water quality • Review need for ordinances	• Partner with SWCD, NRCS and other stakeholders to direct dollars to provide the greatest benefit for water quality	• Provide focused education and outreach • Prepare grant applications (ex. CWL SSTS Low Interest Loans)	• Reporting as regularly required by duties completed by each County.
	Local Government, Cities, Townships, Etc.	• Partner with the ERWSA to implement watershed BMPs • Provide input in stakeholder process	• Communicate with ERWSA to identify areas were assistance is needed.		
	Federal: NRCS, USDA		• Work closely with ERWSA and County SWCDs to direct grant dollars towards high priority areas	• Maintain existing contact with landowners	• Report on practices implemented
	MPCA/ DNR/ BWSR	• Provide funding to implement TMDL BMPs as available (BWSR)	• Provide funding to implement TMDL BMPs as available (BWSR) • Review feasibility studies		
	Property Owners/Agricultural Assns , Farm Coops & Lake Associations	• Implement BMPs to reduce loads as opportunities arise including riparian management, septic upgrades • Provide input in stakeholder process	• Implement BMPs to reduce loads as opportunities arise including riparian management, feedlot upgrades, septic upgrades Provide input in stakeholder process	• Lake associations and farm groups/ coops to provide education to members • Brochures and outreach	• Assistance with lake level gauge reading, Secchi depth & T-Tube readings, precipitation monitoring and others where applicable

3.4 ADAPTIVE MANAGEMENT

The load allocations in the TMDL represent aggressive goals for nutrients, their resulting algal turbidity, and bacteria load reduction. Consequently, implementation will be conducted using adaptive management principles. Adaptive management is an iterative approach of implementation, evaluation, and course correction (see Figure 3.2). It is appropriate here because it is difficult to predict the load reductions from various BMPs applied in different places throughout the watershed. Future conditions and technological advances may alter the specific course of actions detailed in this Plan. Continued lake and stream water quality monitoring and course corrections responding to monitoring results offer the best opportunity for meeting the water quality goals established in this Watershed Protection and Restoration Plan.

Adaptive management will be tracked by leveraging the ERWSA's existing programs and staff. Staff time will be necessary monitor and track progress towards goals and to quantify progress of specific BMPs and recommend course corrections. An annual report to document water quality monitoring results, BMPs implemented is recommended. The report should at a minimum quantify load reductions and relate them to water quality improvements if possible and make recommendations for adjustments to the program. Potential implementation strategies should be evaluated and ranked based on the criteria developed in this report. A spreadsheet should be maintained to rank choices for funding.

Figure 3.2 Adaptive Management



4.0 Elk River Watershed Association Activities

The ERWSA has agreed to take the lead on general coordination, implementation, stakeholder involvement, and ongoing monitoring. Activities will be implemented as funding is available with priority given to projects and programs listed herein. The ERWSA will also report on implementation progress, new opportunities for implementation and update the plan as necessary to implement adaptive management. This information will be incorporated into an Annual Water Quality Report. The following activities will be conducted by the ERWSA as funding is available.

4.1 GENERAL COORDINATION

4.1.1 Coordination

The ERWSA will serve in the role of coordinator in the implementation of this TMDL. General activities now undertaken by the ERWSA should be continued or expanded as the ERWSA moves from management planning to implementation coordination:

- Provide advice and assistance to lake associations, farm groups such as co-ops and Minnesota Corn and Soy Growers, cities, townships, counties, and NRCS on storm water management, agricultural and residential BMPs, development requirements, etc.
- Research and disseminate information on changing BMP technology and practices;
- Collect and report annual water quality and implementation activity data;
- Evaluate annually the progress towards goals and make recommendations as necessary to correct course
- Recommend activities such as vegetation or fishery management, partnering with the DNR, Ducks Unlimited, etc;
- Assist in coordinating public hearings on proposed projects; and
- Share the cost of qualifying improvement projects as funds are available.

4.1.2 Annual Report on Monitoring and Activities

An annual report on phosphorus, algal turbidity and bacteria load reduction activities is recommended under the adaptive management approach established in the TMDL. Each year the ERWSA should compile a listing of the activities undertaken in the previous year, quantify load reductions, review existing BMP strategies and make recommendations for new projects or practices. The annual monitoring report will summarize the BMP activities as well as annual water quality and hydrologic monitoring in order to track progress towards goals.

Table 4.1. Sample BMP documentation table.

BMP	Location	Size	Drainage Area (ac)	Cap Cost	Maintenance Cost	Pollutant Removal	Target TMDL
Rain garden	1234 Johnson Lane, Map ID 1	1,500 sq. ft	0.5 acre	$500	Landowner	.02lbs TP/ yr	Big Elk Lake Nutrient/ Elk River Turbidity
Crop Nutrient Management	Township Range Section, Map ID 2	24 acres	NA	$1,200	$300/ acre/ year	.01 lbs/ TP/ acre/ year	Big Elk Lake Nutrient/ Elk River Turbidity

Table 4.2. Sample implementation progress table.

BMP	Target Implementation	Historical Progress	2010 Progress	Total Progress
Nutrient Management,	400 acres Priority zone 1	200 acres	140 acres	340 acres
Riparian Buffers	100 acres, Priority Zones 1 & 2	20 acres	5 acres	25 acres

4.1.3 Rules and Standards

The TMDLs call for little or no allowable increases in nutrient, algal turbidity and bacteria loads in the watershed. ERWSA may wish to coordinate with the corresponding agencies in evaluating the need for rules and standards with respect to new development and redevelopment as needed.

4.2 EDUCATION

4.2.1 Public Education and Outreach

As part of the TMDL process, the ERWSA TMDL Coordinator has been meeting with stakeholders and the public to discuss the TMDLs and water quality improvement within the ERWSA. Given the ERWSA's significant load reduction requirements, cooperation and buy in is necessary over a long period of time to ensure implementation.

4.2.2 Encourage Public Official and Staff Education

There is a need for township, city, county and state officials and staff to understand the TMDL process and the proposed implementation activities so that they can effectively make regulatory, budget and programming decisions and conduct daily business. Resources such as self-study lake management background information from Water on the Web ("Understanding Lake Ecology"), Project NEMO (Nonpoint Education for Municipal Officials), UW Extension ("Understanding Lake Data") and other sources would provide basic information about lake ecology to help staff and officials make informed decisions about lake management. The ERWSA will facilitate this.

4.2.3 Presentations at Meetings

Awareness of lake, stream, and watershed management can be raised through periodic presentations at meetings of lake associations, homeownership associations, block clubs, garden clubs, service organizations or other groups as well as displays at events such as remodeling fairs and yard and garden events. "Discussion kits" including more detailed information about topics and questions and points for topic discussion could be made available to interested parties.

4.2.4 Demonstration Projects

Property owners may be reluctant to adopt good lake, stream and watershed management practices without examples they can evaluate and emulate. Many demonstration projects have been completed in the watershed. The ERWSA should continue to encourage demonstration projects so property owners can see how a project or practice is implemented and how it looks. Examples might include planting native plants; planting a rain garden; restoring a shoreline and agricultural BMPs. The estimated cost of this activity is highly variable. The ERWSA should evaluate appropriate activities and develop guidelines for funding demonstration projects from this budget.

4.3 MONITORING

4.3.1 Water Quality Monitoring

The ERWSA should institute an ongoing annual monitoring program to track long term water quality trends and progress towards goals. The program should also track the implementation of BMPs to evaluate the effectiveness of activities implemented to reduce nutrient and bacteria loading in the watershed. The current water quality monitoring program varies annually based on available funds. Some of the monitoring needs identified here are periodically completed by JPB members such as Sherburne County and/or citizen volunteers. Efforts should be made not to duplicate efforts. A minimum annual monitoring program should include the following:

- Annual/ or every other year growing season characterization of Tropic Status Indicators in the Mayhew Lake, Big Elk Lake, and the Briggs-Julia Chain of Lakes. Samples can be monthly, collected June to September.
- Volunteer T-Tube readings in the impaired reach of the Elk River
- Sampling the impaired reach of the Elk River for bacteria (*E. coli*) monthly between April 1 and October 31. Consider 2 to 3 locations.
- An annual report that summarizes:
    - water quality, hydrologic and hydraulic information
    - BMPs implemented to date, and in the specific year
    - evaluates the efficacy of the implementation efforts in the context of the water quality results and social/ political climate.
    - makes recommendations for the following year(s)

The TMDL study showed that the flow record maintained for the Elk River downstream is a good surrogate for gauging watershed runoff annually, so flow measurements are not essential.

In addition to the ERWSA's annual monitoring plan, supplemental annual monitoring and special monitoring projects may be added to better track progress towards goals and to provide additional information and tools for adaptive management and track progress of individual practices and projects.

4.3.2 Additional Monitoring

A baseline aquatic vegetation survey should be completed and then updated every 4-5 years as part of the more detailed water quality assessment described above. Zooplankton sampling has not been conducted recently and should be periodically completed to assess overall biologic conditions. The ERWSA should work together with the DNR to determine the optimum strategy for monitoring the fish community. The ERWSA might wish to explore funding opportunities to research or pilot monitoring of BMP effectiveness.

4.4 PRIORITY LOAD MANAGEMENT STRATEGIES

4.4.1 Mayhew Lake Nutrient Impairment

Mayhew Lake is impaired for aquatic recreation and requires the reduction of both internal and external loading of nutrients to meet TMDL requirements. The following table shows the existing average-year phosphorus loads and required phosphorus load reductions by source:

Table 4.3. Mayhew average year phosphorus and load reductions.

Category	Description	Drainage Area (ac)	Pounds of Phosphorus/ Yr			Load Reduction %
			Existing	Goal	Reduction	
Watershed Loads	Mayhew Direct	809	824	115	709	86%
	Mayhew 1	16,768	4,104	575	3,529	86%
	Mayhew 2	361	308	43	265	86%
	Mayhew 3	442	865	121	744	86%
SSTS			5	0	5	100%
Atmospheric			30	30	0	0%
Groundwater			186	186	0	0%
Internal Load			1,587	635	952	60%
Total			**7,910**	**1,706**	**6,204**	**78%**

T:\2378_ERWSA\Lake Response Models\[LRM Mayhew_mmb Calib 1.xls]Summary

The dominant land use in the Mayhew Lake subwatershed is corn and soy bean rotation agriculture (40%), followed by pasture/ hay (25%). SWCD staff also report the presence of livestock in the area, primarily poultry, but some beef and or dairy operations exist. Data collected in this watershed indicates that spring phosphorus loads from the watershed are the dominant source of watershed loads. As such BMPs will target this source.

4.4.1.1 Internal Phosphorus Cycling

The most cost effective tools to control internal loading within a short time frame is sediment phosphorus inactivation, where phosphorus is permanently bound in the sediment using chemical addition. One of the most common chemicals used for phosphorus inactivation is aluminum sulfate or alum. The aluminum-phosphorus bond is very stable under typical environmental conditions and provides a long term sink for phosphorus in the lake. The process of applying alum to a lake typically includes injection of liquid alum just below the surface of the lake. The alum quickly forms a floc and settles to the bottom of the lake, forming a sediment seal while stripping phosphorus from the water column on the way down to the sediments. The undisturbed floc provides a sediment barrier that binds any phosphorus released from the sediment, essentially eliminating internal phosphorus loading from that portion of the lake. Studies have shown that alum dosing will typically reduce sediment phosphorous release by 80 – 90 percent for several years.

Carp management can also be implemented in Mayhew Lake to reduce the internal loading of phosphorous. Migration barriers can prevent carp from migrating into and out of the lake for effective management. Rotenone or harvesting may be used to reduce the carp population.

Vegetation in the lake is currently minimal due to low clarity; however the nutrient rich substrate could provide an ideal habitat for curly leaf pond weed if clarity improves. As clarity improves in Mayhew Lake due to reduced watershed and internal loads, plant populations should be monitored. If curly leaf pond weed becomes a dominant plant community, it could exacerbate internal loading issues and chemical control should be considered.

4.4.1.2 External (Watershed)

Because the Mayhew watershed is dominated by agricultural land uses, agricultural priority management strategies will be critical towards achieving goals. The lake is sensitive to spring time watershed nutrient loads. Priority management strategies will need to target those that can reduce spring time loads. Including but not limited to:

- Manure management practices such as application after the spring melt to reduce the amount of runoff loading, incorporation of manure and setbacks from waters.
- Management of runoff from feedlots.
- Managing livestock, especially in riparian areas and priority areas, to reduce runoff from these sources.

Necessary repairs to leaking SSTSs are recommended to reduce nutrient loading into Mayhew Lake. State law prohibits discharge from septic systems so a 100% reduction of the nutrient load contribution is required.

Riparian buffers and filter strips can improve water quality by reducing nutrient runoff and soil erosion along the riparian zones. Uniformly graded areas of deep rooted, dense vegetation reduce erosion as well as the nutrient loads to lakes from runoff by slowing runoff velocities and trapping sediment and other pollutants and providing some infiltration. They are used to treat sheet flow off agricultural lands as well as flow entering lakes and streams and prevent shoreland erosion. Filter strips should be designed utilizing species that will function in the spring such as switch grass which remains stiff when dormant. A typical lake or stream buffer zone ranges from 15 to 100 feet with corresponding removal efficiencies for phosphorus for appropriately designed and maintained buffers of 50 to 70% (Met Council 2000).

4.4.1.3 Mayhew Lake Implementation Schedule and Costs

Table 4.4 summarizes the specific elements of the recommended implementation activities, a proposed schedule, and associated costs for Mayhew Lake. Milestones completing the tasks in the allotted time and achieving participation level from the target percentage of the land owners identified in the priority management zones.

Table 4.4. Recommended Mayhew Lake nutrient impairment implementation summary.

Mayhew Lake- Nutrient Impairment							
Priority Level	BMP	Annual Cost	Schedule	Duration (yrs)	Extended Cost	Outcome	Note
1	GIS/ Air Photo (BING) Survey Tier 1 & 2 Implementation Areas to identify opportunities for feedlot and riparian grazing management	$5,500	Year 1	1	$5,500	GIS-based prioritized database of tier 1 and 2 implementation areas	4 weeks of County staff, SWCD staff or intern time, plus 2 large computer screens, GIS and internet connection with available GIS information (Computer equipment not included). It is advisable to wait until LiDar is available. Additional time to develop criteria and evaluate function of database.
1	Outreach & grant opportunities plus inspections	$13,000	Year 1	1	$13,000	Staff to develop a plan for 20% of parcels (27 parcels)	~7 weeks of County staff, SWCD staff or intern time
1	Alum treatment of Mayhew	$20-$50k	Year 5	30	$20-$50k plus design & permitting	Target internal load reduction of 900 lbs (load reduction is only 60% of internal, this targets entire internal load	
1	Education and Outreach: Implement watershed-wide advocacy of cover crops and stopping winter spreading	$6,320	Year 0-5	5	$31,600	Literature distribution twice per year timed to target practices, plus outreach to 10% of tier 1 and 2 implementation areas	~ 3 weeks of County staff, SWCD staff or intern time plus expenses
2	Cost for per acre for grants/ loans, etc.	$72,632	Year 0-10	10	$726,319	Implement protection strategies on 5% of land in Tier 1 and 2 Implementation Areas, $250/ acre	Can the nutrient management plans be implemented effectively on site without cost share?
2	Staff time for inspections (Nutrient Management)	$3,500	Year 0-10	10	$35,000	Staff inspections (also yields farmer outreach)	2 weeks of staff time per year
				Total	$811,419		

Note: Staff time is an estimate of the level of effort by for County Staff or SWCD staff to perform the recommended task. Staff required for these tasks can be trained interns, or existing staff. It is presented for the information of planners to make staffing decisions.

4.4.2 Big Elk Lake Nutrient Impairment/ Elk River Turbidity

The Big Elk Nutrient impairment and resulting turbidity impairment in the Elk River are driven by mid to late summer phosphorus loads from the watershed. Load reductions must be achieved by reducing watershed loads from the direct tributary watersheds and by achieving state standards in upstream water bodies such as the Briggs-Julia Chain of Lakes as well as Mayhew Lake. Internal load management is not feasible in Big Elk Lake due to the short residence time. Table 4.5 summarizes load reductions required by source.

Table 4.5. Big Elk Lake average year phosphorus and load reductions.

Category	Pounds of Phosphorus / year			% Reduction
	Existing	Goal	Reduction	
Watershed Load	15,533	3,728	11,806	76%
SSTS	529	0	529	100%
Atmospheric & Groundwater	1,365	1,365	0	0%
Internal Load	4,069	4,069	0	0%
Total	**21,497**	**9,163**	**12,334**	**57%**

4.4.2.1 BMPs in the Big Elk Lake Subwatershed

Because the lake is sensitive to mid to late summer watershed loads agricultural BMPs should be directed towards reducing these loads from high priority areas. Priority areas were identified as those riparian to surface waters directly tributary to Big Elk Lake not upstream of another major impoundment.

Priority BMPs will include management of crop farming and livestock in riparian areas (priority areas). It is recommended that grant dollars directed through the ERWSA and federal programs administered by the NRCS be targeted to priority BMPs in priority areas.

Lakeshore buffers can improve water quality by reducing nutrient runoff and soil erosion along the riparian zones. Uniformly graded areas of deep rooted, dense vegetation reduce erosion as well as the nutrient loads to lakes from runoff by slowing runoff velocities and trapping sediment and other pollutants and providing some infiltration. They are used to treat sheet flow off agricultural lands as well as flow entering lakes and streams and prevent shoreland erosion. A typical lake or stream buffer zone ranges from 15 to 100 feet with corresponding removal efficiencies for phosphorus for appropriately designed and maintained buffers of 50 to 70% (Met Council 2000).

Necessary repairs to leaking SSTSs are recommended to reduce nutrient loading into Big Elk Lake. State law prohibits discharge from septic systems so a 100% reduction of the nutrient load contribution is required. Benton County administers the sewage and wastewater treatment systems based on state “chapter 7080” rules. Sherburne County Board of Commissioner’s adopted newly revised septic system regulations on April 5th, 2011. These ordinances are more restrictive than those required by the State.

4.4.2.2 Briggs-Julia Chain of Lakes Improvement

As stated above, the Briggs-Julia Chain of Lakes must meet state standards in order for Big Elk Lake to meet standards. Target load reductions required to meet in-lake standards for the Briggs-Julia Chain of Lakes will be determined through the MPCA’s One-Waters approach currently underway for this 8-digit HUC. Specific implementation strategies to meet the required load reductions and high-priority areas will be identified during this process.

4.4.2.3 Other Watershed BMPs

Where needed, LGUs should consider updating ordinances for development and re-development permits to require best management practices to the maximum extent practical and guided by performance design standards. Such ordinances can be written to require implementation of best management practices to the maximum practical extent and guided by performance design standards. These design standards should be targeted toward meeting the load reduction goals of these TMDLs. The State of Minnesota is currently working on standards for minimal impact design, recognizing the need for higher clean water performance goals. The potential load reduction from implementing such an ordinance is dependent on the amount of development and re-development that occurs in the watershed and the level of controls required.

4.4.2.4 Big Elk Lake/ Elk River Turbidity Implementation Schedule and Costs

Table 4.6 shows the specific implementation measures and associated costs and schedule for the implementation plan for Big Elk Lake and the Elk River.

Table 4.6. Recommended Big Elk Lake nutrient impairment/Elk River turbidity impairment implementation schedule and estimated costs.

Priority Level	Priority BMP	Annual Cost	Schedule	Duration (yrs)	Extended Cost	Outcome	Note
Big Elk Lake Nutrient Impairment/ Elk River Turbidity Impairment							
1	Upper Watershed Tier 1 and 2 Implementation Areas Inspection SSTS inspections	$25,000	Years 0-2	1.4	$35,000	at a rate of 300 Inspections/ yr of Tier 1 and 2 Implementation Areas (413 parcels), at 25% failure rates yields 103 replacements	Inspections conducted May to November.
1	Tier 1 and 2- Implementation Areas SSTS Inspections (Big Elk Lake tributary watershed)	$25,000	Years 0-2	1.7	$42,500	at a rate of 300 Inspections/ yr of Tier 1 and 2 Implementation Areas (504 parcels), at 25% failure rates yields 126 replacements	Inspections conducted May to November.
1	Tier 1 and 2 Implementation Areas SSTS Inspections, (Briggs-Julia chain tributary watershed)	$25,000	Years 0-2	1.5	$37,500	at a rate of 300 Inspections/ yr of Tier 1 and 2 Implementation Areas (453 tier 1 and 2 parcels), at 25% failure rates yields 113 replacements	Inspections conducted May to November.
1	GIS/ Air Photo (BING) Survey Tier 1 & 2 Implementation Areas to identify opportunities for feedlot and riparian grazing management	$37,170	Years 0-1	1	$37,170	GIS-based prioritized database of tier 1 and tier 2 implementation areas	12 weeks of County staff, SWCD staff or intern time, plus 2 large computer screens, GIS and internet connection with available GIS information (Computer equipment not included). It is advisable to wait until LiDar is available. Additional time to develop criteria and evaluate function of database. QA/QC.
1	Outreach & grant opportunities plus inspections	$37,350	Years 0-1	1	$37,350	Staff to develop a plan for 20% of parcels (83 parcels)	~ 21 weeks of County staff, SWCD staff or intern time
1	Education and Outreach: Implement watershed-wide advocacy of cover crops and stopping winter spreading	$7,478	Years 0-5	5	$37,390	Literature distribution twice per year timed to target practices, plus outreach to 10% of tier 1 and 2 parcels	~ 3 weeks of County staff, SWCD staff or intern time plus expenses
2	Cost for per acre for grants/ loans, etc.	$169,680	Years 0-10	10	$1,696,801	Implement protection strategies on 5% of land in tier 1 and 2 parcels, $250/ acre	Can the nutrient management plans be implemented effectively on site without cost share?
2	Staff time for inspections (Nutrient Management)	$3,735	Years 0-10	10	$37,350	Staff inspections (also yields farmer outreach)	2 weeks of staff time per year
Updated: April 27, 2011				**Total**	**$1,961,061**		

* Septic inspections include Briggs-Julia Chain homes.

4.4.3 Elk River Bacteria Impairment

To achieve the state standard for bacteria in the Elk River, it is recommended to manage grazing in the riparian area and to focus on replacing failing septic systems in the priority management zones. Priority management zones are those located adjacent to the main stem, and direct tributaries to the Elk River downstream of Big Elk Lake.

4.4.4 Riparian pasture and manure management

Riparian livestock were determined to be the primary cause of the bacteria impairment in this reach. As such a riparian pasture management plan will be implemented to control livestock in riparian areas, manage grazing, and provide water sources outside riparian area. Manure management, particularity near riparian areas should also be examined and appropriate measures taken to ensure activities do not result in bacteria runoff.

4.4.5 SSTS Inspection/ Replacement/ Loans

Necessary repairs to leaking SSTSs are recommended to reduce nutrient loading into Big Elk Lake and the 579 reach of Elk River. State law prohibits discharge from septic systems so a 100% reduction of the nutrient load contribution is required. Sherburne County Board of Commissioner's adopted newly revised septic system regulations on April 5th, 2011. These ordinances are more restrictive than those required by the State.

4.4.5.1 Bacteria TMDL Implementation Schedule and Costs

Table 4.7 shows the schedule, milestones and associated costs for the specific implementation activities necessary to achieve the bacterial load reductions.

Table 4.7. Recommended Elk River bacteria impairment implementation schedule and estimated costs.

Elk River- Bacteria Impairment							
Priority Level	Priority BMP	Annual Cost	Schedule	Duration (yrs)	Extended Cost	Outcome	Note
1	Inspection On–site SSTS inspections	$50,000	Years 0-2	2	$100,000	300 Inspections/ yr of tier 1 and 2 implementation areas (366 parcels), at 25% failure rates yields 75 replacements per year	May to November inspections.
1	GIS/ Air Photo (BING) Survey tier 1 & 2 implementation areas to identify opportunities for feedlot and riparian grazing management	$15,000	Years 0-1	1	$15,000	GIS-based prioritized database of tier 1 and 2 implementation areas	10-12 weeks of County staff or intern time, plus 2 large computer screens, GIS and internet connection with available GIS / parcel information (Computer equipment not included). It is advisable to wait until LiDar is available. Additional time to develop criteria and evaluate function of database. QA/QC.
1	Outreach & grant opportunities plus inspections	$35,000	Years 0-1	1	$35,000	Staff to develop a plan for 20% of parcels (75 parcels)	20 weeks of County staff, SWCD Staff or intern time
2	Cost per acre for grants/ loans, etc.	$56,000	Years 0-10	10	$560,000	Implement protection strategies on 5% of land in tier 1 and 2 Areas, $250/ acre	
2	Staff time for inspections (Nutrient Management)	$3,500	Years 0-10	10	$35,000	Staff inspections (also yields farmer outreach)	2 weeks of staff time per year
	Total				**$745,000**		

5.0 Stakeholder Activities

The ERWSA will lead and coordinate implementation of the ERWSA watershed wide TMDLs. The primary expectation of stakeholders will be to act as project cooperators. Specifically, the ERWSA expects stakeholders to communicate actively with the ERWSA information about current events, citizen concerns, potential problems, and opportunities to partner for improved water quality. This communication provides the ERWSA with important information about opportunities to improve water quality within the ERWSA. A list of expected activities by stakeholder is provided below.

Because the ERWSA was founded as a Joint Powers Board by Sherburne and Benton Counties and SWCDs the administration of these implementation activities will also require the ongoing commitment by these entities to work together, and to support the TMDL effort, including maintaining the position of the TMDL Coordinator to administer the efforts. Further, it is recommended that SWCD staff continue to offer their expertise and assistance in the TMDL implementation efforts as needed.

Some possible general and specific activities of other stakeholders are listed below:

Sherburne and Benton Counties:
In addition to playing an active role in the ERWSA JPB, Benton and Sherburne Counties provide services related to the use and development of land as guided by each County's goals and objectives within their Comprehensive Land Use Plan. The zoning departments are responsible for the administration of Local, State, and Federal laws and rules such as the Development Code, Wetland Conservation Act, Shoreland Regulations and Flood Plain Management. The ERWSA may coordinate with both County's boards of commissioners and their corresponding zoning departments on issues such as SSTS and ordinance enforcement efforts as well as education where applicable in addition to other tasks identified throughout the implementation process.

Sherburne and Benton SWCDs
In addition to coordinating programs implemented by the ERWA the SWCDs are dedicated to working directly with landowners and agencies in order to promote the wise and sustainable use of the land and water related resources and to educate and inform the public about those uses. The SWCDs may assist in meeting TMDL goals by applying their technical expertise in the design and selling of BMPs within in priority management areas, providing education as applicable and other tasks as identified thorough the implementation process. Finally, both SWCDs are responsible for the administration of the corresponding Water Plan as well as coordination of implementation efforts.

Natural Resource Conservation Service (NRCS): The local NRCS staff members bring enormous expertise and existing relationships with local farmers. To that end, ERWSA hopes that the educational and nutrient and bacteria load reduction opportunities available through their administration of current federal financial programs such as Environmental Quality Incentive Program (EQUIP), Conservation Stewardship Program (CSP), Conservation Reserve Program

(CRP), and easement programs such as Grassland Reserve Program (GRP), Wetland Reserve Program (WRP), and Farm and Ranchland Protection Program (FRPP). Assistance is recommended to prioritize BMPs in high priority areas to achieve water quality goals. Further it is hoped that they provide the ERWSA TMDL coordinator with ongoing support, reporting and feed back in implementation activities.

Board of Water and Soil Resources (BWSR): Review grant applications, provide comments and feedback and funding for TMDL implementation. A 25-50% funding match will be required to implement the full range of TMDLs.

Minnesota DNR: Review grant applications, provide comments, feedback and necessary permits for TMDL implementation projects. Work may include attending ERWSA meetings, and providing technical support and possibly funding support for implementation projects. Specific assistance in surveying and managing aquatic habitat is expected.

Minnesota Pollution Control Agency: The MPCA's role in TMDL implementation may entail reviewing grant applications and providing some funding for eligible implementation projects. Some implementation projects, specifically capital projects, may require permit reviews. It is hoped that the project manager will remain in contact with and continue to support the ERWSA in its TMDL efforts.

Cities and Townships:
Cities and townships will be expected to partner with the ERWSA to implement the projects in each cities stormwater management plan. Elected city and township officials as well as staff can play an important role in water quality improvement through ongoing communication with the ERWSA. This communication provides the ERWSA with information about current events in the city/township, as well as citizen concerns, potential problems, and opportunities to partner for improved water quality.

Lake Associations: Lake Associations such as Briggs Lake Chain\ Association are expected to disseminate information to their members about septic system upgrades, and Shoreland best management practices for lake water quality.

Private Landowners: It will be necessary for private land owners to educate themselves, and participate in implementation projects as they are willing and able. Specifically a willingness to upgrade failing septic systems, install rain gardens, and maintain a healthy riparian zone.

***Minnesota Corn and Soy Growers Associations, Farm Co-ops, crop consultants, and other agricultural groups*:** It will be necessary for agricultural groups such as Corn and Soy growers to bring their expertise in farming practices, influence over farmers and an in-place communication and education system to reach owners and operators of agricultural lands with information on how to protect water quality.

US Fish and Wildlife Service As a land-owner, they are a potential partner for capital projects where land may be utilized, or other USFWS resources may be leveraged meeting water quality goals overlaps with improving targeted habitats.

6.0 References

Heiskary, S.A. and C.B. Wilson. 2005. Minnesota lake water quality assessment report: Developing nutrient criteria. Minnesota Pollution Control Agency. St. Paul, Minnesota.

Heiskary, S.A. and C.B. Wilson. 2008. Minnesota's approach to lake nutrient criteria development. Lake Reserv. Manage. 24:282-297.

Heiskary, S.A. and W.W. Walter, Jr. 1988. Developing Phosphorus Criteria for Minnesota Lakes. Lake and Reservoir Manage., 1988 4(1): 1-9.

Section 3 Appendix

Priority Implementation Zones

Stakeholders, TAC and Public Meeting Summaries

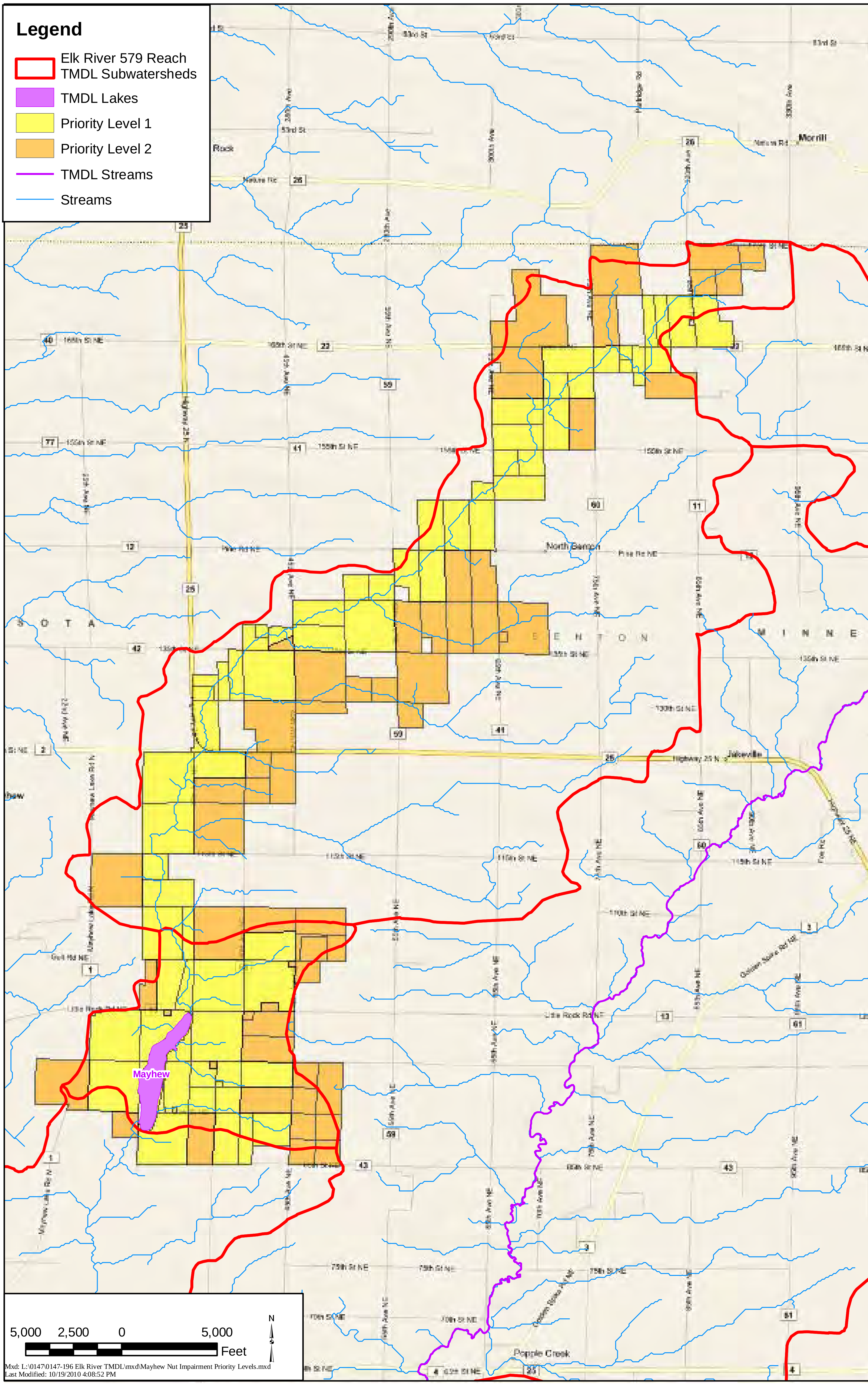
Stakeholders list/TAC participation

Stakeholder	Public Meeting Participation	TAC Meeting Participation
MPCA	x	x
US Fish and Wildlife Service (USFWS)	x	x
ERWSA	x	x
City of Becker	x	
Sherburne County SWCD	x	x
Benton County SWCD	x	x
Minnesota DNR (Fisheries & waters)	x	x
Palmer Township	x	
Minden Township	x	
Briggs Lake Chain Association	x	
Benton County Board of Commissioners	x	
Sherburne County Board of Commissioners	x	
Benton SWCD Board of Commissioners	x	
Sherburne SWCD Board of Commissioners	x	
MN Agricultural Water Resources Coalition	x	
Sauk Rapids Township	x	
Haven Township	x	
University of MN Extension	x	
Sherburne/Benton Water Plan Subcommittee Group	x	
MN Potato Growers	x	
MN Rural Water Association	x	
Big Lake Township	x	
MN Irrigators Association	x	
MN Board of Water and Soil Resources	x	

Section 3 Appendix

Priority Implementation Zones

Stakeholders, TAC and Public Meeting Summaries



ELK RIVER WATERSHED ASSOCIATION

Mayhew Lake Nutrient Impairment:
Implementation Priority Areas

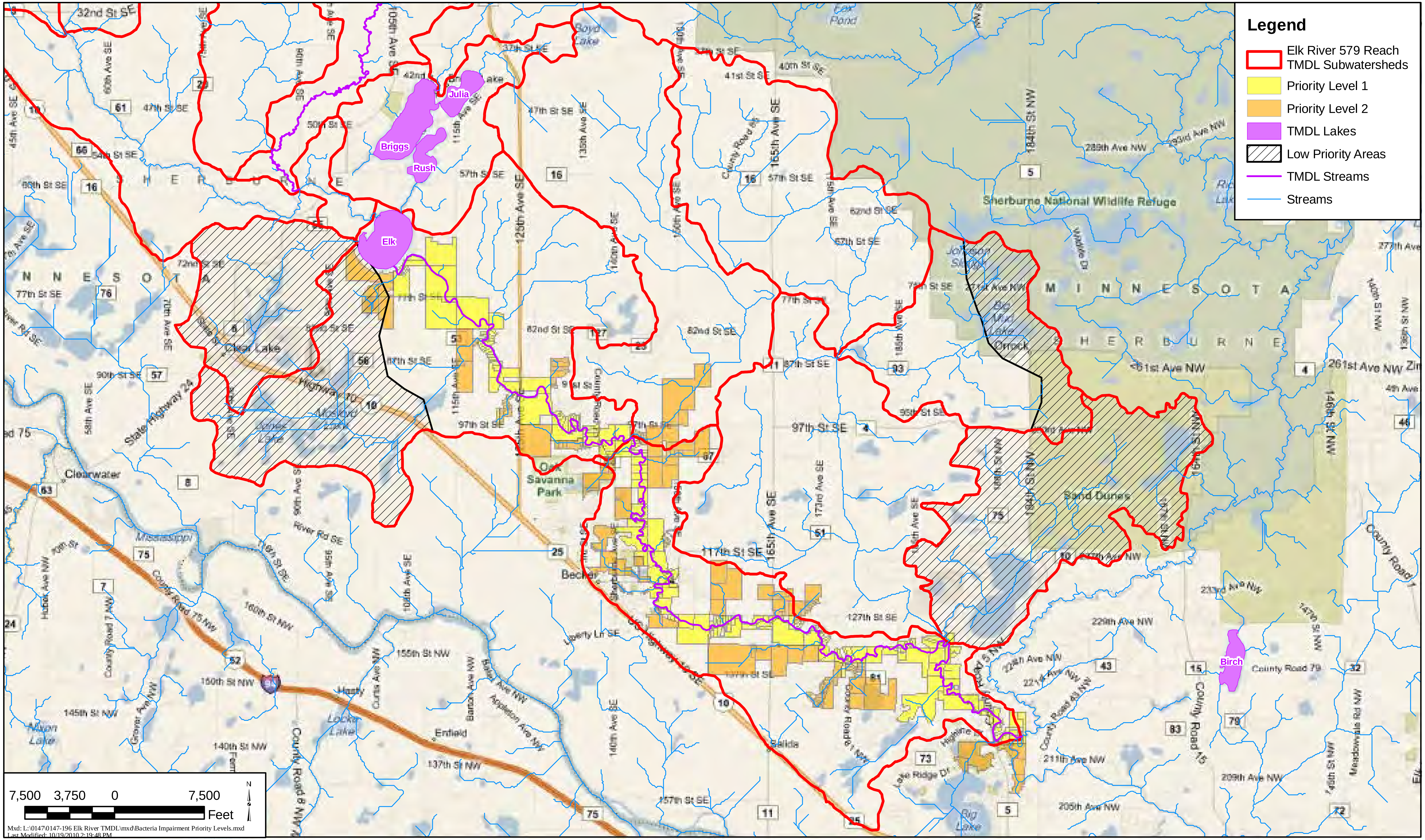
COPYRIGHT

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

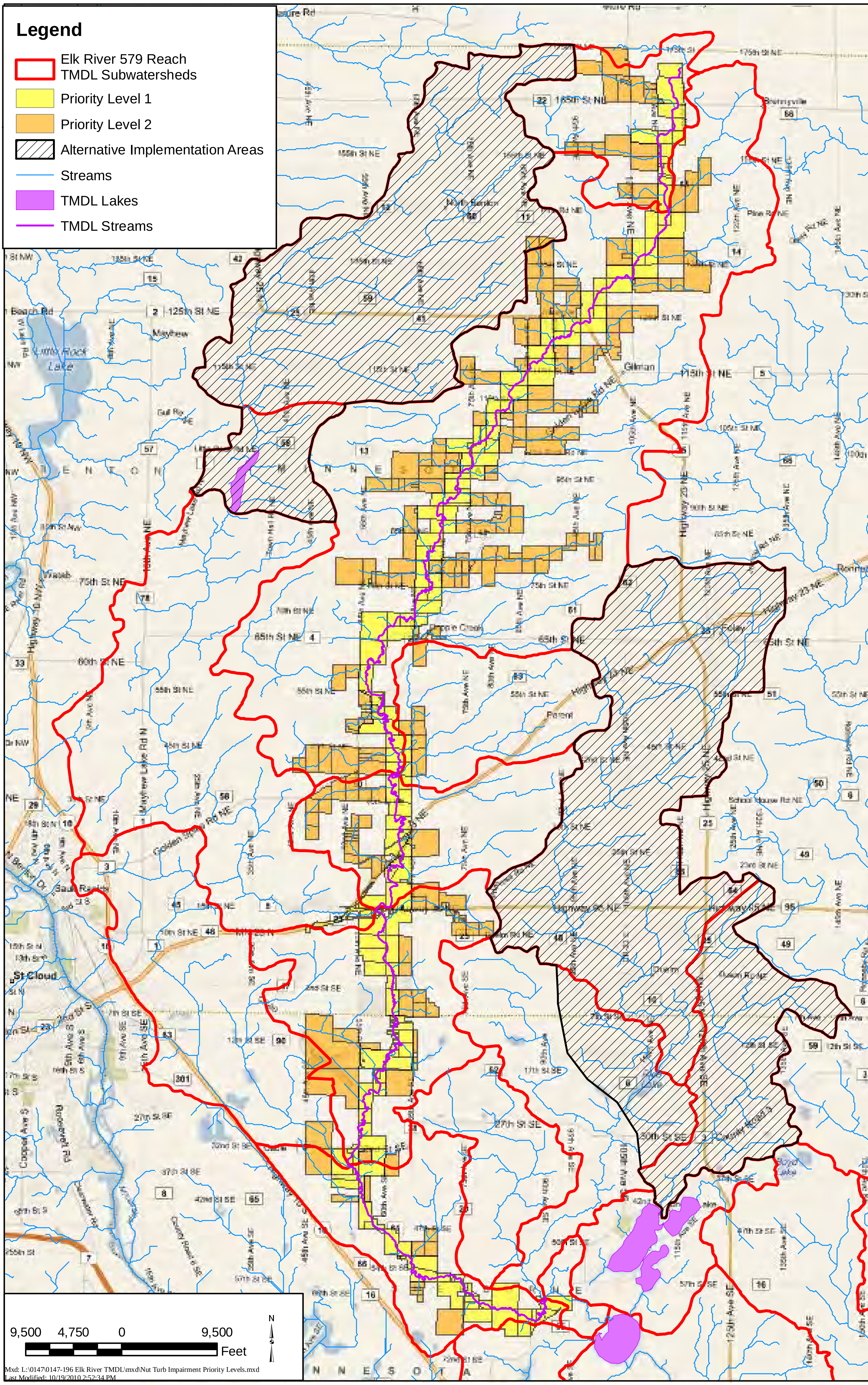
OCT 2010

Figure 1



ELK RIVER WATERSHED ASSOCIATION	Wenck Associates, Inc. Environmental Engineers 1800 Pioneer Creek Center Maple Plain, MN 55359-0429	OCT 2010
Bacteria Impairment Priority Levels		Figure 2

Mxd: L:\0147\0147-196 Elk River TMDL\mxd\Bacteria Impairment Priority Levels.mxd
Last Modified: 10/19/2010 2:19:48 PM



Mxd: L:\0147\0147-196 Elk River TMDL\mxd\Nut Turb Impairment Priority Levels.mxd
Last Modified: 10/19/2010 2:52:34 PM

ELK RIVER WATERSHED ASSOCIATION

Elk River Nutrient and Turbidity Impairment: Implementation Priority Areas

Wenck

Wenck Associates, Inc. 1800 Pioneer Creek Center
Environmental Engineers Maple Plain, MN 55359-0429

OCT 2010

Figure 3

Stakeholders, TAC and Public Meeting Summaries

Stakeholder	Public Meeting Participation	TAC Meeting Participation
MPCA	x	x
US Fish and Wildlife Service (USFWS)	x	x
City of Becker	x	
Sherburne County SWCD	x	x
Benton County SWCD	x	x
Minnesota DNR (Fisheries & waters)	x	x
Palmer Township	x	
Minden Township	x	
Briggs Lake Chain Association	x	
Benton County Board of Commissioners	x	
Sherburne County Board of Commissioners	x	
Benton SWCD Board of Commissioners	x	
Sherburne SWCD Board of Commissioners	x	
MN Agricultural Water Resources Coalition	x	
Sauk Rapids Township	x	
Haven Township	x	
University of MN Extension	x	
Sherburne/Benton Water Plan Subcommittee Group	x	
MN Potato Growers	x	
MN Rural Water Association	x	
Big Lake Township	x	

ERWSA TMDL: Phase III Public Meeting Summary **DATE: 12/1 & 12/3/10**

Attendance:

Dec. 1st , Palmer Town Hall, Clear Lake (Sherburne County)
6:00 PM: 25 landowners

Dec. 3rd , Annunciation Church, Mayhew TWP (Benton County)
1:00 PM: 14 landowners

On December 1st and 3rd the final set of public meetings were held to inform watershed residents of the TMDL results and proposed best management practice priorities in Sherburne and Benton Counties respectively. During each meeting a short summary presentation was followed by small group discussions on Best Management Practice (BMP) strategy topics.

Presentation Summary

The presentation covered a background on the projects and also detailed the primary pollutant sources and key best management practices by impairment. For Mayhew Lake the primary nutrient loading period was identified as spring runoff. Practices focused on would include those which keep nutrients on the land in the spring focusing on the primary land use within that area (agricultural). Priority management strategies will need to target those that can reduce spring time loads. Recommended practices include:

- Manure should be applied after the spring melt to reduce the amount of runoff loading.
- Cover crops should be used to stabilize agricultural land and prevent spring erosion.
- Riparian grazing should be managed to protect shoreline areas as part of a buffer management plan.

The Big Elk Nutrient impairment and resulting turbidity impairment in the Elk River are driven by late summer phosphorus loads from the watershed. Load reductions must be achieved by reducing watershed loads from the direct tributary watersheds and by achieving state standards in upstream water bodies such as the Briggs-Julia Chain of Lakes as well as Mayhew Lake. Priority BMPs will include management of livestock in riparian areas, buffer strips and lakeshore management (septic systems, lawn runoff management, rain gardens, etc). Federal grant dollars directed through the SWCDs will be targeted to priority BMPs in priority areas.

Finally, for the Elk River (bacteria) impairment the primary focus time is late summer through fall under low flow conditions. To achieve the state standard for bacteria in the Elk River, it will be necessary to manage grazing in riparian areas and to focus on replacing failing septic systems in the priority management zones. Priority management zones are those located adjacent to the main stem, and direct tributaries to the Elk River.

Participants learned that the TMDL is scheduled for completion by March 2011 upon approval by the Minnesota Pollution Control Agency (MPCA) and the Environmental Protection Agency (EPA). The corresponding implementation plan will also need to be approved by the MPCA (est. winter 2010-11).

Small Group Discussion Summary

Following the presentation participants moved to one of three discussion topics including agricultural, residential and education based BMPs where they discussed the potential barriers to adopting the related BMPs and methods to overcome those barriers. The information will be used to assist in developing successful restoration plans and grant applications. Below I have summarized the key points from each discussion group. A full listing of conversation points can be viewed online at www.sherburneswcd.org or www.soilandwater.org .

Summary of Residential/ Urban Discussions

1. **Education** is a major factor in whether or not a certain practice would be adopted. This should be done through a combination of methods including but not limited to newsletters, videos (on DVDs and the internet), demonstration sites, newspaper articles, and various other methods. We will need to use creative thinking!
2. **Ordinances**; there is a need for stricter Shoreland ordinances and a need for policy changes for septic system codes.
3. **Increased funding** assistance. Landowners should be compensated for losses or provided assistance for changing procedures.

Summary of Agricultural Discussions

1. **Education** is a major factor in whether or not a certain practice would be adopted. This should be done through a variety of methods including: farmer-to-farmer (small group meetings), demonstration plots, tours, newsletters, workshops. We will also need to be creative and develop new strategies of education.
2. **Ordinances**/changes in **government policy**; i.e. require wider easements along waterways/ditches or policy changes for septic system codes.
3. **Increased funding** assistance. Landowners should be compensated for loses or provided assistance for changing procedures.

Summary of Education Discussions

1. Methods need to be **grouped or paired** to have the greatest impact. Alone they're not nearly as effective.
2. Since a number of these methods are generational and/or require constant updating, we should be sure to bring in the experienced **staff** to help create, produce and deliver the methods.
3. Since cost is a factor, work to establish consistent, long term **funding** to keep the outreach methods consistent.

The tables below include a compilation of all points brought up through the small group discussions at both Sherburne and Benton County meetings. Each table is followed by a summary of the three top issues .

Residential/Urban Best Management Practice Discussion Points

Outreach Method	Barrier / Obstacles	Ideas to Overcome them
a. General (overall, the conversation for this topic covered all strategies together)	1. Notes for barriers are listed in each BMP category below.	1. Increase creative thinking/ try to create personal community values. 2. Ensure that the practice is giving the "biggest bang for your buck" as to make the best use of the financial resources. 3. Education; get the word out on successful practices though projects such as demonstration sites. 4. Update ordinances and back them up with better enforcement. 5. Time; there is a certain time commitment needed to make the change. People are busy. 6. Lack of education; landowners need to be convinced to make the change. 7. Old habits are hard to break. 8. It is hard to approach a landowner and inform them of what they could/should be doing. 9. It is easy to lay blame and not accept responsibility for your own actions. 10. Cost; unknown to landowners what the cost is vs. the benefit.

b. Lakeshore Revegetation	11. Landowners do not want "weeds" on their lakeshore. 12. Time; there is a certain time commitment needed to make the change. People are busy. 13. Lack of education; landowners need to be convinced to make the change. 14. Old habits are hard to break. 15. It is hard to approach a landowner and inform them of what they could/should be doing. 16. It is easy to lay blame and not accept responsibility for your own actions. 17. Cost; unknown to landowners what the cost is vs. the benefit. 18. Lack of laws and enforcement of laws. 19. Space; limited size of lakeshore lots make it difficult to build buffers to regulation.	20. Landowners do not want "weeds" on their lakeshore.
c. Rain Gardens, infiltration ponds, vegetated swales	1. Cost; these practices are costly 2. Misconception: i.e. more mosquitoes, too much space needed… 3. These practices do not work everywhere; areas with heavy soils may not be appropriate. 4. Lack of education of City Officials. 5. May be no room for such practices due to underground utilities. 6. Lack of zoning regulations.	Listed with general above.
d. Pet Waste Management	7. Not a priority for people. 8. There is a lack of responsibility. 9. Lack of education.	Listed with general above.
e. Stormwater retrofits (cities)	1. Cost; can be extremely expensive. 2. Space available may be limited.	21. Implement rules which mandate one lot be dedicated for this use in new developments.
f. Septic System Compliance	3. Cost. 4. Standards change too often, the program is evolving; this could make a system which has been recently updated out of compliance if inspected.	1. New Standards

	5. Homeowners do not know that there are low interest loans they may qualify for.	

Summary of Residential/ Urban Discussions

1. **Education** is a major factor in whether or not a certain practice would be adopted. This should be done through a combination of methods including but not limited to newsletters, videos (on DVDs and the internet), demonstration sites, newspaper articles, and various other methods. Will need to use creative thinking!
2. **Ordinances**, there is a need for stricter Shoreland ordinances and a need for policy changes for septic system codes.
3. **Increased funding** assistance. Landowners should to be compensated for loses or provided assistance for changing procedures.

Agricultural Best Management Practice Discussion Points

Outreach Method	Barrier / Obstacles	Ideas to Overcome them
g. General (overall, the conversation for this topic covered all strategies together)	1. Landowner is used to doing things one way (I have always done it that way). 2. The Size of the operation and equipment available may limit what can be done. 3. Timing; sometimes there is just not enough time to get projects going- i.e. fields need to get planted and that is the top priority. 4. Cost; the practice may be costly up-front even with cost-share or incentives. 5. A fear that the practice has failed and will again. 6. Lack of education; not all agricultural landowners know what programs are available or what the alternatives are to the current practice.	7. Education; use of demonstration plots, tours, newsletters and workshops. 8. Education on new technology. 9. Changes in government policy such as new codes for septic systems. 10. Need to show the value in new ideas or practices- “sell” the idea. A good way to do this is farmer-to-farmer education. This could be done through small groups (5-6) at someone’s house. Those who have been through certain programs can help others through the same process (paperwork, who to contact …). Have those farmers present at meetings to talk about what they have done and how it worked and how the program has paid for itself over the long run. 11. Farmer-to-farmer education. 12. Increase the number of meetings and mailings to get the word out. Not just one meeting (date and time) will work for all landowners; need to see the information more than once.
a. Nutrient Management (fertilize based on soil tests	13. Cost for soil testing 14. No regulation over it	Listed with general above.

and realistic yield goals)	15. Education – farmers don't know what they have 16. Some people just don't care, there to make a buck	
b. Riparian Buffers/Filter Strips	17. Take land out of production 18. Cost to do it 19. Taxes on non productive land	20. Provide payments to grow a particular crop in sensitive area.
c. Cover Crops: holding nutrients/sediment on the land	21. Cost 22. Extra work 23. Desire	Listed with general above.
d. Soil Conservation Practices: conservation tillage, grassed waterways	24. Location 25. Giving up land 26. Money 27. Time	Listed with general above.
e. Manure Management: no winter spreading	28. Storage 29. Timing ; short window to empty a pit in spring and fall 30. Money 31. Odors 32. May have a high volume of manure- don't know what else to do with it.	Listed with general above.
f. Riparian Buffers/Filter Strips (livestock related)	33. Finding replacement water sources 34. Money 35. Lost production	Listed with general above.
g. Grazing/Pasture Management: rotational grazing, use exclusions	36. More labor 37. Cost 38. Cost/benefit 39. Won't see results in first year 40. A lot of upfront cost	Listed with general above.

h. Septic System Compliance	41. Staff 42. Only house that are sold or remodeled have to be checked 43. Cost 44. How to get loans 45. Education 46. Eligible for loans 47. Who to talk to about loans	Listed with general above.

Summary of Agricultural Discussions

4. **Education** is a major factor in whether or not a certain practice would be adopted. This should be done through a variety of methods including: farmer-to-farmer (small group meetings), demonstration plots, tours, newsletters, workshops. We will also need to be creative and develop new strategies of education.
5. **Ordinances**/changes in **government policy**; i.e. require wider easements along waterways/ditches or policy changes for septic system codes.
6. **Increased funding** assistance. Landowners should to be compensated for loses or provided assistance for changing procedures.

Educational Best Management Practice Discussion Points

Outreach Method	Barrier / Obstacles	Ideas to Overcome them
i. Newspaper articles	1. Newspapers not putting in water articles unless related to a crisis or pressing need 2. Reporters not educated on the issues 3. Area in a dead zone – between two major newspapers 4. Need to rely on the small papers that people may not read as much 5. Hard to cover multi-county issues and the watershed issues are multi-county 6. Articles not in-depth and then where do people go to follow up and get more information 7. Hard to get paper to buy in to a series of articles 8. Not read- people don't always read the small	22. Find a human interest angle to sell to the papers 23. Build relationships with reporters, keeping them up-to-date on the issues and feeding them information in a usable format. Find out their needs and help to meet them. 24. Find out the newspapers distribution demographics if possible and target the articles towards the readers 25. Once again build a relationship with the local papers or even get a column in them so people look for the water information consistently 26. Start including watershed information in the articles to educate people on their residency in not

	papers 9. Hard to cover multi-county issues and the watershed issues are multicounty	only their towns and counties but their watersheds too 27. Work with papers to offer in-depth stories that they could highlight – do the work so they don't have to – or at least line up the contacts 28. Write a series and present it to them as a packet or ask for their needs and create articles to fill those needs 29. Submit weekly articles- not only to papers
j. Websites	1. So many websites it can get lost in the numbers 2. Select group that gets their information that way 3. Generational 4. Someone needs to be in charge of the site constantly and consistently (people power) 5. Hard to navigate 6. People don't go to a website unless they have a reason to go to it- results in limited use	10. Market the website well, so people don't have to search for it. Make the URL easy to remember and make sure the site is linked to many related organizations and efforts. 11. Do some surveys to discover who does get their information from web sites in your area and what type of information are they getting online so you can refine your site accordingly. Include the website URL on all your written pieces, electronic pieces and tours, etc. 12. Contact local colleges, maybe high schools, to find if they have classes on designing sites. Ask to work with students to get their input for a more appealing site for youth. 13. Need staff assigned to be the site "master". Make it part of their workplan. If needed, work with partners to have several people involved in the upkeep. Having a person committed to the site is key for keeping the site fresh, relevant and up-to-date.
k. Emails	1. Not everyone connected to email 2. Need to have addresses to email to 3. Need to be short and sweet	48. Recognize that even though not everyone is connected with email, they know someone who is. So whenever you send out an email, ask the recipient to send it on AND tell their friends who are not connected about the information – print it out or simply tell them. 49. Create an email list and keep it up-to-date. Assign

		someone to be in charge of this. Create it in a system that can be shared. A good list can work wonders, especially when you use them as a point of contact, asking them to send it on to their contacts. 50. Be sure to have hotlinks to more information, sites, and supporting materials in the email body to make it easy for people to click and get more info.
l. Twitter/Facebook	4. Generational 5. No knowledge how to make these work 6. Need to keep it interactive consistently to get people engaged 7. Feel this is the wrong audience for the short term	51. Gather partners together to discuss what the Facebook / Twitter / and/or Text messages need to do. What's the goal? Build watershed identity? Act as a call to action? Once discussed and decided, then engage and/or employ a young intern or staff member to set the systems up. 52. Have the creator of the systems (intern or staff) teach the rest of the people involved how to keep things going. 53. Assign a person (staff preferably for consistency) to keep on top of these tools. Need constant opportunities to engage people.
m. Demonstration sites	1. Few of them 2. Most have limited visibility; on private land. 3. Limited on times of accessibility 4. Need someone to explain the site 5. Difficult to get people to visit	2. Work to establish sites around the watershed, so one site is geographically close to all residents. 3. Require private landowners that receive assistance to do the practice to be demonstration sites a certain numbers of times a year. Build it into the process. 4. Market the sites through your partners, on websites, in meetings, etc. Make an effort to market them. Also videotape the demonstrations and post them on YouTube for easy access. Once again, market like crazy. Get Dept of Ag, DNR, PCA and others to market these too. 5. Work to provide varied times throughout the years for people to view them. 6. Work with the owners and partners to find volunteers willing to lead the demonstration.

n. Tours	1. Timing; most are held during the day when people are working 2. Cost of transportation 3. Staff time to lead the tour 4. Length of time it takes to do a tour 5. Feel that these are only good for "key" people	1. Try to offer the tours a few times at varied times of day and days of week. 2. Find a group or business to sponsor the tour. Free advertising for them in exchange of the transportation fees. Work with local and state partners to provide their vans from their vehicle pools to drive and pick up cost of transportation. 3. Get volunteer groups to take responsibility for various tours. Need to educate them on good presentation skills, safety, etc. before letting them lead. Or make the tours part of a staff person's responsibilities – build it into their workplan. 4. Offer shorter routes. Offer videos of the tours online. 5. Offer them a few time at varied time of day and days of week.
o. Workshops	1. Timing – during the day when people are working, or at night when tired or on weekends when people cherish their free time 2. Not all people learn best in this manner 3. Cost to hold them (location, staff, materials, etc.) 4. Low attendance, the wrong people attend. The same group of people tend to attend time after time. 5. Not all people learn best in this manner	1. Offer workshops at different times of day and on varied days if possible. Also, begin to webcast workshops or speakers to people can connect online. Archive the workshop so anyone can view it anytime. Webcasting is catching on, so begin to learn how to do it. 2. Be aware that people learn differently so present this information is different formats, like discussion groups, webcasts, online PPTs, etc. 3. Make workshops or skill building events part of the annual budget to be consistent in offering them. Work with partners to divide up the costs. Get sponsors for the workshops. Ask state agencies and non-profits working on the issues if they would offer free trainings and you set up site and marketing.
p. Mainstream media	1. Cost to get something on the air 2. Takes time to write the pieces and market them 3. What radio station? Which ones to hit? 4. Sound bytes needed or else it's ignored	1. Work with public radio and TV to get public service announcements online. Build from there. Solicit sponsors for the pieces. 2. Beat the bushes for volunteers to write the pieces

	5. Takes time to write the pieces and market them 6. So many stations- which would you hit? 7. Gets ignored	or assign a staff member to do them. Take pieces already produced by other groups, get permission to use and submit them. It's good for people to hear consistent messages. 3. Who do you want to target? Decide that first and then figure out which radio stations to work with. Adapt your messages accordingly. 4. Work to make your messages catchy and brief – but always have "for more information go to" be part of the message.
q. Videos	1. Cost to produce them (script, people, equipment, edit, market, distribute) 2. People don't know where to access them 3. Takes time to watch them 4. People not sure what the next step is after the video 5. Limited visibility, hard to distribute	1. It doesn't take much to produce an "okay" video anymore. Involve the high school video club or class. Ask for volunteers from partnering groups to help produce them. Search out volunteer that have the skills and the interests. Market them through all the outreach methods. Show them on the tours, at workshops, in meetings, etc. 2. Put them on Youtube and encourage all your partners and others to link to them. Make it easy for them, send them the link and steps to link up. 3. Make the videos short and sweet or provide an executive summary video to entice them to learn more from the bigger video. Encourage groups to show them and give discussion questions they can use to create dialogue afterwards. 4. Be sure to plan out beforehand who the video is for, what the goal of the video is, how it's going to be distributed, etc. then offering the next step for people isn't difficult to figure out.
r. Fact sheets	1. People have information overload 2. Hard to catch people's eye 3. Need time to read through them 4. Cost to produce 5. Too much detail or wording is too technical 6. Many times they include dated material 7. Trouble getting the information to where it needs	1. One pagers, with good graphics to explain the info 2. Keep your look consistent for all your fact sheets which lets people know that these are yours. Use graphics, photos, art, etc. 3. Short and sweet text, with info how to follow up 4. Produce less numbers, use factsheets already produced, simply adapt them

	to go.	5. Have your volunteers review and edit the factsheets
s. Newsletters	1. People get too much mail and it can get lost in the shuffle 2. Cost to produce and distribute 3. Need people to write the articles, create the look, print them, mail them 4. Takes time to produce – not a quick method 5. Doesn't get to the right people 6. Hard to narrow down the purpose 7. Not everyone reads their mail; people get too much mail	1. Time when the newsletter arrive (time of month and year) 2. Ask members on the mailing who would prefer to get them as an e-newsletter - stress the cost savings and send them as e-newsletters through email. Post on web sites. 3. Organize a newsletter committee of staff and volunteers. Organize a set schedule. Search out print, graphic, writing savy folks to be involved – not just who's interested. Work with a local group to sponsor them. 4. See above. 5. Take the time to review the goals of the newsletters and then target who should get them. 6. Piggy back with other organizations/agencies to reduce cost (FSA, County)
t. Targeted mailings	1. Cost 2. Hard to know who to target 3. Needs to be time sensitive 4. To what purpose? Difficult to narrow down the purpose.	1. Use postcards to cut down on mailing cost. Partner with another group to send out information together. 2. Be specific of the goal of the mailing and send only to those who you feel need to know this information. Send the information to your targeted email list also. 3. Plan ahead! 4. Take the time to plan out when and why targeted mailings. Explore other, cheaper, possibly more effective methods.

<u>Summary of Education Discussions</u>

1. Methods need to be **grouped or paired** to have the greatest impact. Alone they're not nearly effective.
2. Since a number of these methods are generational and/or require constant updating, be sure to bring in the experienced **staff** to help create, produce and deliver the methods.

3. Since cost is a factor, work to establish consistent, long term **funding** to keep the outreach methods consistent.

Supplemental questions:

a. Are there any practices or programs not identified here that you would find beneficial to our cleanup plan?
   Door knocking, private parties (corn dealers, milk inspectors ,etc…how do we find and how do we convince them to spread the word), placemats at restaurants, signs for hose “doing good”, schools, large community events such as Foley fund days (but need to be staffed).

   Internal loading in Big Elk Lake: rough fish