UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

SEP 28 2010

REPLY TO THE ATTENTION OF:

WW-16J

Paul Eger, Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Dear Mr. Eger:

The U. S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Loads (TMDLs) for the Clearwater River Watershed Five Lakes, including supporting documentation and follow up information. All five lakes are located in the Clearwater River Watershed, in Stearns, Meeker, and Wright Counties. The TMDLs address the Aquatic Recreation Use impairments due to excess nutrients (total phosphorus).

The TMDLs meet the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, EPA hereby approves Minnesota's five TMDLs for phosphorus for Lake Caroline, Lake Augusta, Albion Lake, Henshaw Lake, and Swartout Lake. The statutory and regulatory requirements, and EPA's review of Minnesota's compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Minnesota's effort in submitting these TMDLs and look forward to future TMDL submissions by the State of Minnesota. If you have any questions, please contact Mr. Peter Swenson, Chief of the Watersheds and Wetlands Branch, at 312-886-0236.

Sincerely,

for Tinka G. Hyde
Director, Water Division

Enclosure

cc: Margaret Leach, MPCA
Dave Johnson, MPCA

wq-iw8-21g

TMDL: Clearwater River Five Lakes Nutrient TMDLs
Effective Date: 09/28/2010

Decision Document for Approval of Clearwater River Five Lakes Nutrient TMDL Report

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see section 2 below).

The TMDL submittal should include an identification of the point and non-point sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from non-point sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

(1) the spatial extent of the watershed in which the impaired waterbody is located;
(2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;

(4) present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and
(5) an explanation and analytical basis for expressing the TMDL through *surrogate measures*, if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll *a* and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:

Summary: The Minnesota Pollution Control Agency (MPCA) submitted TMDLs to EPA for the following waterbodies: Lake Caroline, Lake Augusta, Albion Lake, Henshaw Lake, and Swartout Lake. All lakes are listed on the Minnesota 303(d) list for excess nutrients (total phosphorus) impairing aquatic recreation. Development of the TMDLs for all lakes was prioritized to start in 2010 and to be completed by 2014. The "Five Lakes" TMDLs will not only address impairments in the Clearwater River watershed, but also reduce phosphorus loadings to Clearwater Lake and ultimately to the Mississippi River. MPCA believes the TMDLs will result in a 27% to 93% total load reduction of total phosphorus in the watershed. EPA is approving the phosphorus TMDLs for Lake Caroline, Lake Augusta, Albion Lake, Henshaw Lake, and Swartout Lake.

Location Description: The Five Lakes TMDL addresses five impaired lakes, all within the Clearwater River watershed (Figure E.1 of the TMDL Report). Listed from upstream to downstream locations, Lake Caroline and Lake Augusta, which are located on the Clearwater River, drain to the West Basin of Clearwater Lake; and Albion Lake, Henshaw Lake, and Swartout Lake drain to Cedar Lake which in turn drains to the East Basin of Clearwater Lake. Both chains of lakes are located on the border of Fairhaven and Southside Townships which borders Stearns and Wright counties. The TMDLs address aquatic recreation impairments due to total phosphorus. The TMDLs were developed by the Clearwater River Watershed District (CRWD) along with MPCA.

Lake Caroline is located upstream of Lake Augusta. The Clearwater River flows into the Lake Caroline at the southwest corner of the basin and is also the lake outlet, exiting at the southeast end of the lake. There are no other tributaries that flow directly into Lake Caroline. The Lake Caroline subwatershed consists of 60,131 acres of which 2,138 acres directly contribute to the subwatershed. The remaining upstream lake watershed includes 57,994 acres. The municipalities of Fairhaven and South Haven are located partially within the Lake Caroline subwatershed. Lake Caroline is a 125-acre basin and is located on the border of Stearns and Wright counties. The maximum water depth is 44.5 ft and the mean water depth is 15 ft. The littoral zone covers 47% of the lake at water depth areas of less than 15 ft. Lake Caroline is subject to MPCA's general eutrophication standards since its maximum water depth is greater than 15 ft and the littoral zone for water depth areas of less than 15 ft is less than 80%.

Lake Augusta is located downstream of Lake Caroline and upstream of Clearwater Lake. The Clearwater River flows into Lake Augusta at the northwest corner of the basin and is also the lake outlet, exiting at the east end of the basin. There is one unnamed tributary that flows into Lake Augusta at the point where the Clearwater River enters the basin. The Lake Augusta subwatershed consists of 62,935 acres of which 2,804 acres directly contribute to the watershed.

The remaining upstream lake watershed includes 60,132 acres. The municipalities of Fairhaven and South Haven are located partially within the Lake Augusta subwatershed. Lake Augusta is a 168-acre basin and is located on the border of Stearns and Wright counties. The maximum water depth is 82 ft and the mean water depth is 25 ft. The littoral zone covers 33% of the lake at water depth areas of less than 15 ft. Lake Augusta is subject to MPCA's general eutrophication standards since its maximum water depth is greater than 15 ft and the littoral zone for water depth areas of less than 15 ft is less than 80%.

Albion Lake is not located along the main stem of the Clearwater River, but instead is part of a chain of three lakes that drain to Cedar Lake in the southeast-most corner of the Clearwater River watershed. There are no defined inflow tributaries into Albion Lake. The outlet of Albion Lake is an unnamed perennial stream that exits on the north end of the lake and flows north towards Swartout Lake. The Albion Lake subwatershed covers 1,094 acres and is located within Albion Township in Wright County. There are no municipalities located within the Albion Lake subwatershed. Albion Lake is a 251-acre basin with a mean water depth of 6 ft and a maximum water depth of 9 ft. The littoral zone covers 100% of the lake. Albion Lake is subject to MPCA's eutrophication standards for shallow lakes since its maximum water depth is less than 15 ft and the littoral zone for water depth areas of less than 15 ft, which in this case is the entire lake, is greater than 80%.

Henshaw Lake is not located along the mainstem of the Clearwater River, but instead is part of a chain of three lakes that drain to Cedar Lake in the southeast-most corner of the Clearwater River watershed. There are no defined inflow or outlet tributaries for Henshaw Lake. A wetland complex at the northwest corner of the basin serves as the lake outlet as it flows north toward Swartout Lake. The Henshaw Lake subwatershed covers 903 acres and is located within Albion Township in Wright County. There are no municipalities located within the Henshaw Lake subwatershed. Henshaw Lake is a 270-acre basin with a mean water depth of 4 ft and a maximum water depth of 8 ft. The littoral zone covers 100% of the lake. Henshaw Lake is subject to MPCA's eutrophication standards for shallow lakes since its maximum water depth is less than 15 ft and the littoral zone for water depth areas of less than 15 ft, which in this case is the entire lake, is greater than 80%.

Swartout Lake is part of a chain of three lakes that drain to Cedar Lake in the southeast-most corner of the Clearwater River watershed. Swartout Lake is located downstream of Albion and Henshaw Lakes and upstream of Cedar Lake. One tributary flows from Albion Lake and enters the southwest corner of the basin and the second flows from a wetland complex that is part of the Swartout State Wildlife Management area and enters at the southeast corner of the basin. The outlet of Swartout Lake is a perennial stream that exits the northeast corner of the lake and flows north to Cedar Lake. The Swartout Lake subwatershed covers 4,768 acres including approximately 2,771 acres of direct sub-watershed and the upstream watersheds of Albion and Henshaw Lakes. The Swartout Lake subwatershed is located within Albion Township in Wright County. There are no municipalities located within the Swartout Lake subwatershed. Swartout Lake is a 296-acre basin with a mean water depth of 7 ft and a maximum water depth of 12 ft. The littoral zone covers 100% of the lake. Swartout Lake is subject to MPCA's eutrophication standards for shallow lakes since its maximum water depth is less than 15 ft and the littoral zone occurs at water depth of less than 15 ft, which in this case is the entire lake.

Section 3.0 of the TMDL report provides further detail on the lake and subwatershed characteristics.

Topography and Land Use: Table 1 shows the lake watershed land use for each lake.

Table 1. Watershed Land Use Summary

Land Use	Lake Caroline	Lake Augusta	Albion Lake	Henshaw Lake	Swartout Lake
Corn	23.6%	23.2%	22.0%	16.6%	26.1%
Soybeans	16.9%	16.9%	9.6%	26.2%	19.4%
Grains/Hay	2.8%	2.9%	3.6%	2.7%	3.5%
Grass/Pasture	16.0%	15.5%	3.6%	2.4%	2.9%
Woodland	18.0%	18.4%	14.2%	5.8%	10.0%
Barren	0.0%	0.0%	0.0%	0.0%	0.0%
Urban/Developed	10.8%	10.8%	9.3%	7.2%	9.1%
Water	3.3%	3.5%	23.3%	30.5%	17.4%
Wetlands	8.0%	8.2%	14.4%	8.4%	11.6%
Other	0.7%	0.7%	0.0%	0.2%	0.1%

The five lakes are part of two separate flowages or chains: 1) Lakes Caroline and Augusta, which are part of a chain of nine lakes along Clearwater River, drain to Clearwater Lake; and 2) Albion Lake, Henshaw Lake, and Swartout Lake, which are not a part of the Clearwater River chain of lakes, drain to Cedar Lake and ultimately to Clearwater Lake. Since these lakes are two separate chains of lakes in the Clearwater River watershed, the land use will be described separately for each set of lakes.

The land use types for Lake Caroline and Lake Augusta are displayed in Table 1. Since Lake Caroline and Lake Augusta are part of the chain of nine lakes along the Clearwater River to Clearwater Lake, the land use associated with the upstream lakes is a major factor in contributing to the land use totals for each lake's subwatershed. Agriculture (corn and soybean) is the major land use for both subwatersheds, with grass/pasture and woodlands as the next most extensive land uses. Urban land use is a minor land use (10.8%) for both subwatersheds.

The land use types for Albion, Henshaw, and Swartout Lakes are displayed in Table 1. The major land uses for all subwatersheds are corn, soybean, and open water. Less dominant land use categories contributing to Albion Lake, Henshaw Lake and Swartout Lake include wetlands, woodland, and urban.

Pollutant of concern: The pollutant of concern for all lakes is total phosphorus which affects aquatic recreation such as fishing and swimming. Levels of phosphorus are above water quality standards. To be listed as impaired in Minnesota, the monitoring data must show that the standards for both total phosphorus (causal factor) and either chlorophyll-A or Secchi depth (response factor) were violated. Section 3 of the TMDL report discusses the water quality data for each lake and its link to the water quality standards.

Sources: Section 4 of the TMDL report states that the nonpoint sources and point sources within the Clearwater River watershed are:

1) Pollutant point sources: None of the municipalities/townships operate under NPDES MS4 Phase II permits. No Concentrated Animal Feeding Operation (CAFO) permitted facilities exist within the Clearwater River watershed.

2) Pollutant nonpoint sources: Sources identified by MPCA in the TMDL report as contributing to the nutrient impairments include watershed runoff based on land use; upstream lakes, wetlands, and streams; individual failing septic systems; atmospheric deposition; and groundwater. MPCA also determined that there is significant phosphorus loading in each lake from internal phosphorus loading. Details on phosphorus loads from nonpoint sources are described in Sections 4.3 and 6.2 in the TMDL report.

Currently, wastewater treatment methods in the watershed include land application, sub-surface sewage treatment systems, and cluster and master wastewater treatment systems, none of which discharge to surface waters and therefore are not considered point sources under the Clean Water Act. These WWTPs are regulated under state permits. Additionally, the majority of spray irrigation fields used currently are not within the watersheds tributary to the impaired lakes, and the MPCA has rejected attempts by area WWTPs to discharge to area lakes (Section 4.2 of the TMDL).

Population and growth trends: MPCA states that portions of Stearns, Wright, and Meeker Counties including existing urban areas, along lake shores and along highway corridors, will have the highest projected growth rates in the watershed. There are no planned WWTP expansions within the Clearwater River watershed. Significant development is not anticipated, but many of the areas where growth is projected are tributary to the impaired waters in this TMDL.

Aside from the 1% that is allocated for NPDES construction permits, MPCA did not incorporate reserve capacity into the TMDL calculations due to the stringent loading capacity that was developed. Therefore future growth and potential expansions of WWTPs must not result in an increase of phosphorus loading.

Priority Ranking: Minnesota does not include separate priority rankings for its waters in the TMDL. MPCA prioritizes its waters during the development of the impaired waters list. The TMDLs for each of the five lakes were prioritized to start in 2010 and be completed by 2014.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this first element.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) – a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:

Designated Use of Waterbody: All of the lakes included in the TMDL report submittal are classified under Minnesota Rule 7050.0430 as Class 2B waters. Class 2 waters are protected for aquatic life and recreation. MN Rules Chapter 7050.0140 Water Use Classification for Waters of the State reads:

> Subp. 3. Class 2 waters, aquatic life and recreation. Aquatic life and recreation includes all waters of the state which do or may support fish, other aquatic life, bathing, boating, or other recreational purposes, and where quality control is or may be necessary to protect aquatic or terrestrial life or their habitats, or the public health, safety, or welfare.

Water Quality Standard: All lakes in the TMDL report are subject to Minnesota Eutrophication Standards for the North Central Hardwood Forests Ecoregion (Table 2.2 in the TMDL and Table 2 below). Numeric standards are given in MN's Rule 7050.0222. The narrative standards are found in Minneota's Rule 7050.0222 subpart 4a. Lake Caroline and Lake Augusta are subject to the general eutrophication standard. Albion Lake, Swartout Lake, and Henshaw Lake are subject to the eutrophication standard for shallow lakes.

Table 2. Minnestoa eutrophication Standards for Class 2B lakes, North Central Hardwood Forests Ecoregion.

Parameter	Eutrophication Standard, General	Eutrophication Standard, Shallow Lakes
TP (ug/L)	40	60
Chlorophyll-A (ug/L)	14	20
Secchi depth (m)	Not less than 1.4	Not less than 1.0

Targets: To achieve the designated use and the applicable eutrophication criteria, MPCA selected the applicable total phosphorus criterion (40 µg/L or 60 µg/L) as the primary target of the TMDLs (Section 2.2 of the TMDL).

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this second element.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a water body for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

TMDLs must take into account *critical conditions* for steam flow, loading, and water quality parameters as part of the analysis of loading capacity. (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and nonpoint source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:

Summary: The total loading capacities were determined for the five lakes to meet the phosphorus criterion for general (Lake Caroline and Lake Augusta) and shallow (Albion Lake, Henshaw Lake, Swartout Lake) lakes to meet recreational uses (Section 7.1.3 of the TMDL). Loading capacities are shown in Table 3; development of loading capacities, and allocations to point and nonpoint sources are discussed in further detail below.

Table 3. Total phosphorus TMDL (i.e. Loading Capacity) in lbs/day for the five lakes.

Lake Caroline	Lake Augusta	Albion Lake	Henshaw Lake	Swartout Lake
10.14	**11.36**	**0.98**	**0.73**	**2.22**

To estimate the loading capacity for the five lakes, first the current loading rates to lakes were estimated, next the in-lake responses to those loads were calculated using Canfield-Bachmann equations extracted from the BATHTUB model. Model results were compared to observed in-lake water quality data to confirm model accuracy. MPCA found that the residual between observed and modeled water quality values was within the reported standard deviations of annual averages for total phosphorus, therefore MPCA determined that BATHTUB could accurately represent in-lake response and thus was used to quantify TMDLs for these five lakes (Section 6.5 and Appendix B of the TMDL).

Data used for the TMDL study were from a large historical database containing runoff, precipitation, in-lake water quality, and watershed loads. Data were taken as part of CRWD's annual monitoring program. Available CRWD data drove model selection and were used to calibrate and compare to model results. The estimated partitioned loads from 2001-2007 were averaged to yield the current phosphorus loads for an average year, representative of watershed transport of phosphorus in a range of wet, dry, and average years (Appendix A and C of the TMDL).

Current loading from watershed sources: Atmospheric Load: Atmospheric loads of phosphorus to the lakes were determined with deposition rates (lb/ac/yr) from the literature (MPCA cites Barr 2004, 2007 in Section 6.2.1 of the TMDL). Deposition rates from wet, dry, and average years were multiplied by the lake area (acre) to determine atmospheric loads (lb/yr). MPCA found atmospheric deposition to be a small percentage of the total load.

Septic Systems: Phosphorus loads from septic systems were determined by first identifying the number of homes around a lake by reviewing county parcel information. MPCA assumed that each system would yield 4.2 lb TP/yr. Although there are part and full time residents around each lake, this number was based on year round occupancy by 4 residents. Then, assuming a 25% failure rate, the load from septic systems was calculated as:
Septic TP Load to Lake = (No. of septic systems on lake)*(4.2 lbs/TP/yr)*(25% failure rate).
MPCA did not include homes with holding tank systems as these are pumped, rather than drained to a field, and thus do not contribute TP load to a lake (Section 6.2.2 of the TMDL).

Groundwater: The Clearwater River Chain of Lakes lie in the Anoka Sand plain, which is subject to groundwater interaction. The Clearwater River discharges to Lake Caroline whose outflow then drains to Augusta (MPCA cites Helgesen et al., 1975 in Section 6.2.3 of the TMDL). Baseflow measurements in the Clearwater River support the assumption that Lakes Caroline and Augusta receive groundwater inflow. Therefore TP loads from groundwater to these lakes were determined by first calculating the rate of groundwater inflow, using hydraulic conductivity and hydraulic gradient values for the region (from literature), and Darcy's law. Then, total phosphorus loads from groundwater (lbs/yr) were determined from rates of groundwater inflow and median TP concentration in surficial glacial aquifers (56 µg/L; Section 6.2.3 of the TMDL). Groundwater contributions to Swartout, Albion, and Henshaw Lakes were not measured after a review of well logs suggested these lakes were perched or above the local aquifer, and therefore likely lose groundwater to the surrounding area, rather than receive groundwater inflow. Ordinary high water levels reported in the hydrological atlas for the Chain of Lakes also support this assumption (Section 6.2.3 of the TMDL).

Direct watershed runoff: The boundary of the direct watershed for each lake was determined as either an upstream lake, or monitoring station with measured data. MPCA assumed that these boundaries reduced uncertainty and allowed for nutrient removal upstream (i.e. loadings from upstream were less likely to be overestimated). Runoff from the direct watershed, as defined by the above boundaries, was then calculated for each lake using direct measurements of water quality and watershed runoff volume from either tributaries or surrounding areas with representative land-use for the watershed in question (Section 6.2.4 of the TMDL).

Upstream Lakes: Three of the five lakes receive loads from upstream lakes; Lakes Caroline, Augusta, and Swartout Lake. Lakes Caroline and Lake Augusta receive input from the following lakes (that are have been addressed in previous TMDLs): Clear Lake, Lake Betsy, Scott Lake, Lake Louisa, Lake Marie, and the Clearwater River. Swartout Lake receives discharge, and therefore upstream lake loads from Albion and Henshaw Lakes. Albion and Henshaw themselves do not receive inflow from any upstream lakes or rivers. In-lake water quality data were paired with data from the upstream lake or monitoring station to determine upstream loads. Paired data for each lake were available from 2 to 4 years, rather than all monitoring years, because of a rotating water quality monitoring schedule. Given the short residence time for these lakes, and the close correlation between water quality in an upstream and immediate downstream lake, MPCA assumed that paired data sets were the best available data for quantifying upstream loads. If paired data were not available, loads were determined from water quality data taken at the closest upstream station or lake (Figure 6.1 in Section 6.2.5 of the TMDL).

Internal Loading: Release of phosphorus from anoxic sediments (depleted of oxygen), and re-suspension from wind-mixing are common causes of internal loading in the five lakes discussed in this TMDL. Internal loading was calculated differently for general (Lake Caroline and Lake Augusta) and shallow lakes (Albion Lake, Swartout lake, and Henshaw Lake) because the rate of anoxia differs for deep stratified lakes, versus shallow, polymictic lakes. For the deeper lakes, Lake Caroline and Lake Augusta, the anoxic factor (the duration and extent a lake bottom is depleted of oxygen) was determined from dissolved oxygen profiles. The anoxic factor was used in conjunction with release rates of phosphorus from sediments taken from literature. Internal load for shallow lakes was determined from an anoxic factor calculated for shallow lakes and sediment phosphorus release rates from literature cited by MPCA (Section 6.2.6 of the TMDL).

MPCA calculated the total annual TP load to each lake as the sum of the individual sources described above. Data collected from 2001-2007 were used to calculate these values. MPCA supports that these years represent average conditions that affect TP loads. Both wet and dry years were included in the 2001-2007 range, and mean annual precipitation for this period agrees within 2.2 inches of the 20-year precipitation average for Annandale, a municipality within the watershed and approximately 3 miles of all five lakes (Figure E.1 of the TMDL). The results are summarized for each lake in Table 4.

Table 4. Current phosphorus loading (lb/yr) to the five lakes

	Total Annual Load to Lake	Direct Watershed	Upstream Lakes	Septic Systems	Atmospheric & Groundwater	Internal Loading
Lake Caroline	5,642	308	4,098	13	822	402
Lake Augusta	5,607	403	3,601	13	710	880
Albion Lake	3,865	342	-	14	60.3	3,449
Henshaw Lake	3,723	256	-	16	65.1	3,386
Swartout Lake	7,982	1,011	533	34	71	6,333

Loading Capacity: The loading capacity was developed to meet the phosphorus criterion of 40µg/l for Lake Caroline and Lake Augusta and the shallow lake phosphorus criterion of 60 ug/l

for Albion Lake, Henshaw Lake, and Swartout Lake. The loading capacities are shown in Table 5 below. Loading capacities were determined using Canfield-Bachmann equations from BATHTUB. The model equations were originally developed from data taken in over 704 lakes. The model estimates in-lake phosphorus concentration by calculating net phosphorus loss (phosphorus sedimentation) from annual phosphorus loads as functions of inflows to the lake, lake depth , and hydraulic flushing rate. To estimate loading capacity, the model is re-iterated, each time reducing current loads to the lake until the model result shows that in-lake total phosphorus would meet the applicable water quality standards (deep/shallow). The resulting loading capacities are shown in Table 5 (Section 7.0 and Appendix B of the TMDL).

Table 5. Total Phosphorus Loading Capacity (TMDL) in lbs/ day for the five lakes

	TMDL =	**WLA + LA + MOS**		
	Total Phosphorus TMDL (lbs/day)	**Wasteload allocation**	**Load Allocation**	**Margin of Safety**
Lake Caroline	**10.14**	**0.1**	**10.04**	**Implicit**
Lake Augusta	**11.36**	**0.11**	**11.25**	**Implicit**
Albion Lake	**0.98**	**0.01**	**0.97**	**Implicit**
Henshaw Lake	**0.73**	**0.01**	**0.72**	**Implicit**
Swartout Lake	**2.22**	**0.02**	**2.2**	**Implicit**

Linking targets to water quality standards: The total phosphorus loading capacities are then input to the Canfield-Bachmann (BATHTUB) model. This time, the model calculates in-lake concentrations of phosphorus, chl-a, and Secchi depth as if each lakes' phosphorus input were equal to the proposed loading capacity (TMDL, Table 5 in this document). The model results showed that, if a lake were to meet its TMDL, then phosphorus, chl-a, and secchi could achieve applicable water quality standards (Appendix B of the TMDL).

Critical conditions: MPCA identified the summer growing season as the critical condition for each of the five lakes in this TMDL. MPCA determined that total phosphorus and chl-a concentrations are highest, and clarity is lowest during the summer months for all five lakes. The nutrient standards were set by MPCA to meet the most critical period (summer), therefore, the TMDLs will be protective of water quality during all other seasons in all lakes (Section 7.3 of the TMDL report).

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this third element.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future non-point sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and non-point sources.

Comment: Section 7.1.3 of the TMDL states the load allocations for each existing nonpoint source identified for the five lakes subwatersheds. Load allocations are shown in lb/day in Table 6.

Table 6. Load Allocations for Total Phosphorus (lb/day)

	Total Load Allocation (lb/day)	Direct Watershed	Upstream Lakes	Septic Systems	Atmospheric & Groundwater	Internal Loading
Lake Caroline	10.04	0.59	6.41	0	2.23	0.82
Lake Augusta	11.25	0.76	6.65	0	1.93	1.91
Albion Lake	0.97	0.34	0	0	0.16	0.47
Henshaw Lake	0.72	0.08	0	0	0.18	0.46
Swartout Lake	2.2	0.82	0.33	0	0.19	0.86

The methods to determine current loadings from the sources in Table 6. were described in detail in Section 3 of this decision document. The entire loading capacity was divided among the existing nonpoint sources, with the exception of 1% of the total TMDL allocated to wasteload sources. Discharge from septic systems is not allowed by law and therefore received a load allocation of zero. No reduction from current loading rates of atmospheric and groundwater loads was given as these sources cannot be controlled. The proportion of load allocation given to the remaining sources (direct watershed, upstream lakes, and internal loading), was then determined based on MPCA's best professional judgment on what reductions could reasonably be achieved via implementation of BMPs, and local knowledge of the lakes.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this fourth element.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual

WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment: The only point source receiving a wasteload allocation in the five lakes subwatersheds is for potential future construction activity on sites greater than 1 acre (Table 8). These activities would be covered under NPDES general construction permits and were allocated 1% of the total TMDL for each lake (Section 7.2.2 of the TMDL). MPCA also identified WWTPs permitted as subsurface disposal systems that are regulated by MPCA. These WWTPs do not discharge to surface waters within the subwatershed of the five lakes, therefore receive a wasteload allocation of zero. WWTPs and their state permits are found in the TMDL summary table of the TMDL document.

Table 8. Wasteload allocations for total phosphorus (lbs/day).

	NPDES Construction	NPDES Construction Permit No.	WWTP
Lake Caroline	0.10	MNR100001	0
Lake Augusta	0.11	MNR100001	0
Albion Lake	0.01	MNR100001	0
Henshaw Lake	0.01	MNR100001	0
Swartout Lake	0.02	MNR100001	0

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this fifth element.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comment: MPCA used an implicit margin of safety for the five lake TMDLs to account for uncertainty of the lake system and model error. Canfield-Bachmann (BATHTUB) model results were compared to four to six years of observed water quality data for each lake. This comparison showed the model typically over-predicted in-lake total phosphorus concentrations. This over-prediction yields a conservative (larger) estimate of the load reduction required to meet water quality standards and thus should be protective of the general and shallow lake standards (Section 7.4 and Appendix B of the TMDL).

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this sixth element.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Comment: MPCA accounted for seasonal and annual variation in loadings when establishing these TMDLs. The water budget and subsequent loading capacities were calculated from data taken in 2001-2007. These years exhibited a range of wet, dry, and average precipitation years, therefore variations to loads were accounted for in the average calculated loads. The TMDL was also developed to be protective of water quality standards in the summer months, therefore the TMDL should still be protective of water quality in non-summer months when phosphorus and chl-a are likely lower, and clarity is higher (Section 7.3 of the TMDL).

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this seventh element.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and non-point sources, and the WLA is based on an assumption that non-point source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that non-point source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by non-point sources. However, EPA cannot disapprove a TMDL for non-point source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comment: MPCA states that implementation will be done on an iterative basis, so that adjustments can be made if necessary in order to attain water quality standards. Also, strong stakeholder interest and input to the implementation plan (Sections 8 and 9 of the TMDL) provide reasonable assurance that implementation will be pursued (Section 10 of the TMDL).

EPA finds that the TMDL document submitted by MPCA addresses this eighth element.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and non-point sources, and the WLA is based on an assumption that non-point source load reductions will occur. Such a TMDL should provide assurances that non-point source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment: The five lakes will continually to be monitored on a rotating basis as part of CRWDs water quality monitoring program. Water quality data will suggest if BMP implementation is improving water quality toward attainment of water quality standards. Supplemental monitoring is expected to occur during implementation of this TMDL. Recommendations to supplement current monitoring efforts were made in Section 11 of the TMDL. These suggestions include increasing number of sampling stations near Lake Augusta and Lake Caroline, increasing measures of dissolved oxygen and temperatures along a depth profile to better quantify anoxia, measure all Clearwater River Chain of lakes on a bi-weekly schedule, for 1 year to improve model calibration data.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this ninth element.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment: The mission of Clearwater River Watershed District is to preserve and protect water resources within its boundaries. The CRWD has developed an implementation framework for the five lakes that requires leveraging of existing regulatory frameworks, and maintaining relations with municipalities (counties, cities, towns, lake associations). The plan projects that a 50% cost-share support from the Board of Water and Soil Resources, MPCA or other sources will be required to complete implementation of the TMDL; the remaining 50% would come from individual (25%) and watershed (25%) budgets. Stakeholder input and professional judgment were used to compile the implementation plan and costs, which are presented in Table 9.2 of the TMDL report. Twenty-five structural and non-structural BMPs populate the implementation plan and target external and internal phosphorus loads identified in the TMDL. Example BMPs

include: septic upgrade grants, alum dosing, hypolimnetic withdrawl and stormwater management plans for various municipalities. The total estimated cost for implementation of the 25 BMPs is $8,300,000 (Section 9 of the TMDL).

EPA reviews, but does not approve, implementation plans. EPA finds that this criterion has been adequately addressed.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comment: A strong stakeholder group operates within the Clearwater River watershed. This group formed as the result of 11 meetings that took place from December 2002 to March 25, 2009 to discuss TMDL development of waters upstream of Lakes Caroline and Augusta. In 2003, these stakeholders and additional landowners became actively involved and informed about TMDL development activities for Albion, Henshaw, and Swartout Lakes. This involvement included an unknown number of stakeholder meetings and a public hearing.

The public comment period for the Clearwater River Five Lakes TMDL was public noticed in the Minnesota State Register, and posted on MPCA's website. The 30-day public comment period occurred from June 21, 2010 through July 21, 2010. The draft TMDL study was posted at: http://www.pca.state.mn.us/water/tmdl/tmdl-draft.html. During this time the MPCA received and responded to three comment letters from The Minnesota Corn Growers Assocation, Department of Agriculture, and Minnesota Department of Transportation. Public comments were submitted with the TMDL report and addressed appropriately by MPCA.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval*. Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA

review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment: On September 23, 2010, EPA received the Clearwater River Watershed District Five Lakes Nutrient TMDL, and a submittal letter dated September 14, 2010, signed by Paul Eger, Commissioner, addressed to Tinka Hyde, U.S. EPA, Region 5, Water Division. In the submittal letter, MPCA stated that the Upper Mississippi/Clearwater River Total Maximum Daily Load (Five Lakes) study for excess nutrients was being submitted to the U.S. Environmental Protection Agency (EPA) for final approval. The submittal letter included the names and locations of the waterbodies and the pollutants of concern.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of this twelfth element.

13. Conclusion

After a full and complete review, EPA finds that the total phosphorus TMDLs for Lake Caroline, Lake Augusta, Albion Lake, Henshaw Lake, and Swartout Lake in the Clearwater River watershed satisfy all of the elements of an approvable TMDL. This decision document addresses **5** TMDLs for **5** waterbodies as identified on Minnesota's 2008 303(d) list.

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.