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

MAY 22 2012

REPLY TO THE ATTENTION OF:
WW-16J

Rebecca J. Flood, Assistant Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, MN 55155-4194

Dear Ms. Flood:

The U.S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Loads (TMDLs) for Ann Lake and Lake Emma, including supporting documentation and follow-up information. The lakes are located northwest of Minneapolis, Minnesota in Wright County. The TMDLs address impairment of the aquatic recreation beneficial use due to elevated levels of 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 2 TMDLs for total phosphorus for Ann Lake and Lake Emma. 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 the 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: David Johnson, MPCA
Margaret Leach, MPCA

wq-iw8-34g

TMDL: Ann Lake and Lake Emma, Minnesota
Date: MAY 22 2012

DECISION DOCUMENT FOR ANN LAKE AND LAKE EMMA TMDLs, MN

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 nonpoint 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 nonpoint 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:

Ann Lake (DNR Lake # 86-0190) and Lake Emma (DNR Lake # 86-0188) are located northwest of Minneapolis, Minnesota in Wright County. Lake Emma is connected to Ann Lake via a small channel. Both lakes drain to the North Fork Crow River and are located within the North Fork Crow River watershed (NFCR), HUC (07010204), in the Upper Mississippi River basin. The Minnesota Pollution Control Agency (MPCA) placed Ann Lake on the State of Minnesota's 303(d) Impaired Waters List in 2002. Lake Emma is scheduled to be placed on the State of Minnesota 303(d) Impaired Waters List in 2012. Table 1 below identifies the waterbody segments covered by the TMDL as they appear on the Minnesota 303(d) list. The lakes are identified for not meeting the Class 2B designation of aquatic life and recreational use due to exceedances in total phosphorus (TP) concentrations. This decision document approves one TMDL for Ann Lake and one TMDL for Lake Emma.

Table 1. 303(d) List Summary for Ann Lake and Lake Emma

Waterbody Name	DNR Lake Number	Listing Year	Pollutant	Designated Use
Ann Lake	86-0190	2002	Total Phosphorus	Aquatic Life and Recreational Use
Lake Emma	86-0188	Scheduled to be listed in 2012	Total Phosphorus	Aquatic Life and Recreational Use

Location Description/Spatial Extent:

Lakes: The lakes are located within the NFCR watershed, HUC (07010204) and located northwest of Minneapolis, Minnesota in Wright County. The NFCR is part of the larger Minnesota River Basin which ultimately drains to the Mississippi River.

The physical details for the lakes are in Table 2 below. Based upon the physical data and lake morphology, Ann Lake and Lake Emma are classified by MPCA as shallow lakes (having a maximum depth less than 15 feet or more than 80% littoral) versus deep lakes (having a maximum depth of greater than 15 feet or less than 80% littoral). Although both lakes have a maximum depth greater than 15 feet, the lakes' littoral zones for areas where water depths are less than 15 ft are greater than 80%.

County Ditch #10 is located south of Grass Lake wetland and flows through Grass Lake wetland to Ann Lake. Ann Lake flows into Lake Emma. Black Dog Lake, which is located south of Lake Emma, ultimately flows into Lake Emma through Round Lake. Lake Emma is the final repository for all flows. Figure 2.2 of the TMDL report presents a map on a watershed scale showing the drainage pattern.

Table 2. Lake Characteristics[1]

Parameter	Ann Lake	Lake Emma
Surface Area (ac)	375	188
Average Depth (ft)	10	8
Maximum Depth (ft)	18.5	16
Volume (ac-ft)	3,750	1,421
Residence Time	0.36 (~4 months)	0.2 (~2.5 months)
Watershed (ac) [includes lake surface area]	20,657	23,017
Littoral Area (acres)	375	180
Littoral Area (%)	98	96
Watershed:Lake Area ratio	55	122

Population and Future Growth:
MPCA expects the Ann Lake and Lake Emma watersheds to remain as agricultural land use over the next several decades. This means runoff is expected to continue to come from agricultural sources, and thus significant future growth is not expected in the watershed. Nevertheless, the TMDLs account for future growth via reserve capacity by rounding the construction stormwater allocation to 1% and setting the industrial stormwater allocation to 0.5% in the TMDL.

Section 4.4 of the TMDL report provides more details on population growth and reserve capacity.

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.

Land Use:
As seen in Table 3 below, the primary land use for all lake watersheds covered by these TMDLs is cultivated land (corn and soybeans) at 54%. Grassland/Pasture land use ranks second for all lake watersheds at 23%. Thus, the watershed is largely agricultural, undeveloped, and largely unurbanized. This means that the major source of the runoff comes from agricultural sources and that there is little runoff contribution from urbanized/developed areas.

Section 2.3 of the TMDL provides further detailed information.

Table 3. Land Use Characteristics for Ann Lake and Emma Lake watersheds[2]

Land Use	Acres	Percent land use
Cultivated Land	12,440	54%
Grassland/Pasture	5,250	23%
Wetlands	1,368	6%
Developed	1,694	7%
Woodland	1,220	5%

[1] Table 2.1, page 2-1, of the TMDL report.
[2] Table 2.2, page 2-2, of the TMDL report.

Lakes/Open Water	1,044	5%
TOTAL	23.017	100%

Problem Identification/Pollutant of Concern:
The pollutant of concern for these lake TMDLs is total phosphorus (TP). Levels of phosphorus are above water quality targets, limiting all types of aquatic recreation, including fishing and swimming. Excess phosphorus stimulates excessive plant growth (algae and nuisance plants/weeds). This enhanced plant growth reduces dissolved oxygen in the water when dead plant material decomposes and can cause other organisms to die. The TMDLs also include water quality data and information for the nutrient indicators chlorophyll-a and Secchi depth. Chlorophyll-a is a primary pigment in aquatic algae. Chlorophyll-a (Chl-a) levels correlate well with algal production. Secchi depth (SD) is an indicator for water clarity and quality and is measured by lowering a probe into the water until it can no longer be seen from the surface (Section 2.3.1 of the TMDL).

Temperature and Dissolved Oxygen Data Results:
Based on dissolved oxygen (DO) data results for Lake Emma and Ann Lake, anoxia (DO $\leq$ 2 mg/L) is seen at the bottom 1-2 meters of the water column during the growing season (July to early September). Anoxia, i.e., low DO, results in stresses in the fish community and causes TP to move from sediment to the water column. The TP in the water column is then available for use by algae resulting in algal blooms.

DO and temperature data were taken at Lake Emma during the summer months of 2002, 2008, and 2009. The 2008 and 2009 DO results for Lake Emma show a dramatic decrease in DO levels starting in August at 0.5 m from the surface water irrespective of temperature. The 2008 and 2009 data show minimal temperature change with depth during the growing season and low DO levels at the bottom 1-2 m throughout the growing season. Due to Lake Emma's shallow water depth and a high surface area to depth ratio resulting in susceptibility to wind-driven mixing events, Lake Emma does not sustain a strong thermocline and does not sustain a large anoxic area at water depths near the surface water during the growing season. This means the anoxic zone occurs at the bottom 1-2 m at Lake Emma.

DO and temperature data were taken at Ann Lake during the summer months of 1995, 1996, 2003, 2008, and 2009. The 2002 data results for Ann Lake show low DO levels throughout water depth during the growing season. Due to Ann Lake's shallow water depth and a high surface area to depth ratio resulting in susceptibility to wind-driven mixing events, Ann Lake does not sustain a strong thermocline and does not sustain a large anoxic area during the growing season. This means that while there are low DO levels throughout water depth, the anoxic zone occurs at the bottom 1-2 m in Ann Lake.

For more information, see Section 2.3.2.1 and Appendix A of the TMDL report.

Total Phosphorus Data Results:
Total phosphorus (TP) sediment samples were taken at Ann Lake during the summer months for years 1995, 1996, and 2002-2009. The analytical method described in Appendix B was used to assess TP in the water column from the sediment. The summer average water column TP concentrations for Ann Lake ranged from 145-395 µg/L for sampling years with 4 or more samples during the growing season (i.e., 1995, 2004, 2006 and 2007 were not included in the data analyses). TP sediment samples were taken at Lake Emma during the summer months for years 2008 and 2009. The analytical method described in Appendix B was used to assess TP in the water column from the sediment. The summer average water column TP concentrations for Lake Emma were 117 µg/L in 2008 and 133 µg/L in 2009.

The summer TP concentrations for both lakes suggest that both consistently exceed MPCA's shallow lake eutrophication standard of 60 µg/L and indicate high inputs from the watershed or in-lake sources.

For more information, see Tables 2.3 and 2.4, Section 2.3.2.2, and Appendix B of the TMDL Report.

Chlorophyll-a Data Results:
Chlorophyll-a (Chl-a) samples were taken at Ann Lake during the summer months for years 1995, 1996, 2002 to 2009. The summer average Chl-a concentrations for Ann Lake ranged from 25-77 µg/L for all sampling years with 4 or more samples during the growing season. Chl-a samples were taken at Lake Emma during the summer months for years 2008 and 2009. The summer average Chl-a concentrations for Lake Emma were 58 µg/L for 2008 and 49 µg/L for 2009. The summer Chl-a concentrations for both lakes suggest that both consistently exceed MPCA's shallow lake eutrophication standard of 20 µg/L and that the high Chl-a concentrations in the lakes are indicative of high levels of algal growth and nuisance algal blooms.

For more information, see Tables 2.3 and 2.4, and Section 2.3.2.3 of the TMDL Report.

Secchi Depth Data Results:
Secchi depth measurements were taken at Ann Lake during the summer months for years 1992, 1993, 1995-2009. The Secchi depth measurements at Ann Lake for 2002 and 2008 during the summer months where 4 or more samples were taken did not meet MPCA's shallow lake eutrophication standard of > 1.0 meter (m). Secchi depth measurements were taken at Lake Emma for years 2008 and 2009. The Secchi depth measurement taken in 2008, 0.81 m, did not meet MPCA's shallow lake eutrophication standard of > 1.0 m.

For more information, see Tables 2.3 and 2.4, and Section 2.3.2.4 of the TMDL Report.

Fish Population Data Results:
The lakes are identified for not meeting the Class 2B designation of aquatic life and recreational use due to exceedances in total phosphorus (TP) concentrations. The fish population data collected by Minnesota Department of Natural Resources (DNR) for Ann Lake and Lake Emma supports the Class 2B designation of aquatic life and recreational use. The DNR performed fish surveys at Ann Lake during 1990, 1996, 2002, and 2006. DNR conducted fish surveys at Lake Emma during 1974, 1990, and 2006. Carp, forage species, top predators, rough fish, and pan fish have been collected at both lakes. Data from the fish surveys from both lakes show shifts towards an overall improvement in fish trophic balance.

Carp causes increased nutrients in waterbodies by uprooting aquatic macrophytes during feeding and spawning. The uprooting causes resuspension of bottom sediment and nutrients resulting in increased nuisance algal blooms. Results for both lakes in all years were inconclusive due to DNR fish survey methods. Data from all sampling years show that the carp population appears relatively low in both lakes and is likely have a small impact on lake water quality.

Aquatic Plants Data Results:
The lakes are identified for not meeting the Class 2B designation of aquatic life and recreational use due to exceedances in total phosphorus (TP) concentrations. The vegetation survey data collected by DNR for Ann Lake and Lake Emma supports the Class 2B designation of aquatic life and recreational use. High abundance and density in aquatic plants limit recreation activities and results in excess nutrients. Excess nutrients lead to non-native, invasive aquatic plants in a lake. This ultimately leads to a shift in

the fish community since high densities of one aquatic plant species favors one fish species over another.

Vegetation surveys at Ann Lake were taken by DNR during the mid-summer for years 1990, 1996, and 2006. Data showed that two most common native submerged plant species for Ann Lake were Canada waterweed and sago pondweed. However, data show that there was more curly-leaf pondweed than the Canada waterweed and sago pondweed in 1990 and 2006. Curly-leaf pondweed, an invasive species, had been observed in Ann Lake and Lake Emma for each DNR survey for all sampling years. Curly-leaf pondweed increases TP concentrations resulting in eutrophication.

Vegetation surveys at Lake Emma were taken by DNR during the mid-summer for years 1974, 1990, and 2006 and showed that sago pondweed and horned pondweed were the two most common native species. The data show that there was abundant vegetation of curly-pondweed and horned pondweed in 1990 and rare vegetation of sago pondweed and curly-leaf pondweed in 2006.

Based on the vegetation survey data, higher TP internal loading from curly-leaf pondweed would occur in Ann Lake than in Lake Emma.

DNR's observations of curly-leaf pondweed in both lakes in all surveys for all sampling years (except for 1974 for Lake Emma) supports the lakes being listed as impaired for not meeting the Class 2B designation of aquatic life and recreational use.

Section 2.6 of the TMDL report provides further information on aquatic vegetation data.

County Ditch #10 Data Results:
County Ditch #10 consists of the area-wide drainage pattern shown in Figure 2.2 in the TMDL report. The flow data for County Ditch #10 shows that the Ann and Emma Lake watersheds contribute high flows during spring runoff and early summer rain events. Flows decrease to low baseflow conditions starting in mid-July. The TP data shows that Grass Lake wetland is a TP source to County Ditch #10.

Section 2.4 of the TMDL report provides further information on TP and flow data for County Ditch #10.

Source identification:
The nonpoint sources for Ann Lake are:

- Inflow from Drainage Areas (agricultural/crop row land use)
- Atmosphere
- Internal Loading

The nonpoint sources for Lake Emma are:

- Inflow from Drainage Areas (agricultural/crop row land use)
- Inflow from Upstream Lakes
- Atmosphere
- Internal Loading

Nonpoint sources identified by MPCA in the TMDL report as contributing to the nutrient impairments are internal total phosphorus loading, atmospheric deposition and inflow from drainage areas for both lakes. In addition, Lake Emma receives inflow from upstream lakes. MPCA determined that inflow from drainage areas contribute 68% of the total phosphorus loading for Ann Lake and 8.6% for Lake Emma,

internal loading contributes 30% of the total phosphorus loading for Ann Lake and 17% for Lake Emma, atmospheric deposition contributes 1% of the total phosphorus loading to Ann Lake and Lake Emma, and inflow from upstream lakes contribute 74% of the total phosphorus loading for Lake Emma (Tables 4.1 and 4.2 in the TMDL report).

The point sources for Ann Lake and Lake Emma are:

- NPDES-regulated CAFOs
- Industrial and construction stormwater

There is one facility covered by an industrial stormwater permit in the watershed, and minimal runoff from construction activities. Thus, TP point source contributions are very low in the watershed. MPCA determined that industrial and construction stormwater contribute 1% of the TP loading for Ann Lake and 0.1% for Lake Emma. There are 33 CAFOs in the Ann and Lake Emma watersheds. Discharges from CAFOs are generally not permitted, so zero loading was assumed for both lakes (Tables 4.1 and 4.2 in the TMDL report).

Sections 3.0 and 4.3.1 of the TMDL report provides details on phosphorus loads from point and nonpoint sources to Ann Lake and Lake Emma.

EPA finds that the TMDL document submitted by MPCA satisfies all requirements of the 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: Ann Lake and Lake Emma are classified under Minnesota Rule 7050.0430 as Class 2B waters. 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:

Ann Lake and Lake Emma are subject to MN Eutrophication Standards, North Central Hardwood Forests Ecoregion. Numeric standards are given in MN's Rule 7050.0222, with narrative standards in MN's Rule 7050.0222 subpart 4a. According to the MPCA definition, a lake is considered shallow if its maximum depth is less than 15 ft or if the littoral zone for areas where water depth is less than 15 ft is greater than 80%. Based upon the physical data and lake morphology, Ann Lake and Lake Emma are classified by MPCA as shallow lakes rather than deep lakes. Although both lakes have a maximum depth greater than 15 feet, the lakes' littoral zones for areas where water depths are less than 15 ft are greater than 80%.

Table 4. MN Eutrophication Standards, North Central Hardwood Forests Ecoregion[3]

Parameter	Eutrophication Standard, Shallow Lakes
TP (ug/L)	TP < 60
Chlorophyll-a (ug/L)	Chl-a < 20
Secchi depth (m)	SD > 1.0

Targets: To achieve the designated use and the applicable eutrophication criteria, all three parameters must be met by the TMDLs (Section 1.3 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.

[3] Table 1.1, page 1-2, of the TMDL report.

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:

The TP loading capacity for Ann Lake is **0.05 lbs/day (WLA) + 4.0 lbs/day (LA) + 0.2 (MOS) = 4.25 lbs/day.**

The TP loading capacity for Lake Emma is **0.01 lbs/day (WLA) + 4.1 lbs/day (LA) + 0.2 (MOS) = 4.31 lbs/day.**

Four models were used to assess nutrient loading and to determine loading capacities for both lakes, including: the Generalized Watershed Loading Function (GWLF) model; the Nürnberg equation (2004); use of wet and dry deposition rates from MPCA's Detailed Assessment of Phosphorus Sources to MN Watersheds; and use of BATHTUB for the analyses.

The GWLF model was used to calculate TP loading from inflow drainage areas and upstream lakes. The Nürnberg equation (2004) was used to calculate TP loading from internal loading. The use of wet and dry deposition rates from MPCA's Detailed Assessment of Phosphorus Sources to MN Watersheds was used to calculate TP loadings from atmosphere. All model outputs were used as model inputs to the BATHTUB model. The BATHTUB model was used to calculate in-lake water quality resulting from the phosphorus loads.

Watershed loading: The GWLF model was used to estimate water and nutrient loads on a watershed scale. The GWLF model is a GIS-based continuous simulation model. Monitoring data for all years, where available, was used to calculate water balance and to simulate runoff, sediment, and nutrient loading. The model was used to predict runoff and nutrient loads for unmonitored areas and for years where no monitoring data was available. The model was also used to identify major source areas.

The model was calibrated to two years of monitoring data, 2008-2009. The model was calibrated to observed monthly water yields to attain flow data. Results showed an over-prediction of storm peaks and under-prediction of observed summer baseflow. To match the observed monthly water yields with model results, model runoff curve numbers were lowered by 20% from their original value.

After calibrating the model for flow, the model was calibrated for TP loading. Initial results showed that modeled TP loads were higher than observed TP values due to higher proportion of particulate (sediment) TP as compared to soluble TP (i.e., soluble TP comes from manure, commercial fertilizer, etc.) in modeled values. Based on 2009 monitoring data, soluble phosphorus accounted for 75% or more of the total phosphorus fraction. Although total suspended solids were not analyzed for in 2008 and 2009, MPCA assumed that sediment loading to Ann Lake was low in 2008 and 2009. As a result, the modeled particulate TP needed to be lowered and the soluble TP had to be increased in order to match with the observed TP loading. Section 3.2.1.1 of the TMDL report provides further information.

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 3.2.3 of the TMDL report). Deposition rates from wet, dry, and average years were multiplied by the lake area (acres) to determine atmospheric loads (lb/yr). MPCA found atmospheric deposition to be a small percentage of the total load. MPCA calculated the atmospheric deposition rate to be 0.239 lbs/ac-yr. The atmospheric load for Ann Lake was 83.3 lbs/year and 41.8 lbs/yr for Lake Emma (Appendix C and Tables 4.1 and 4.2 of the TMDL report).

Internal loading: Total phosphorus is released from sediments under anoxic conditions. Internal loading was estimated by using the anoxic factor and sediment release rate. The anoxic factor estimates the amount of time where anoxic conditions exist over the sediments. This indicates the amount of time (days) that TP would be released from sediments. DO data is used to determine the anoxic factor. The DO data for Ann Lake and Lake Emma indicated that low DO concentrations were present within 1-2 meters of the lake bottom. The anoxic factor combined with the sediment release rate resulted in the internal TP loading. Table 3.6 of the TMDL report presents the sediment release rates, anoxic factors, and TP internal loading for Ann Lake and Lake Emma. Since the 2002 data was incomplete for Ann Lake, MPCA used the anoxic factor for shallow lakes of 62 based on Nürnberg 2004 as part of the calculation of the average. Although Ann Lakes's average anoxic factor result was 31 (see Table 3.6 of the TMDL report), MPCA decided to use 36 as the anoxic factor for Ann Lake based on model results. TP released from sediments occurs at anoxic and oxic areas in lakes. The internal load for Ann Lake was 1938 lbs/yr (oxic) + 543 lbs/yr (anoxic) = 2481 TP lbs/yr. The internal load for Lake Emma was 266 lbs/yr (oxic) + 351 lbs/yr (average anoxic factor) = 617 TP lbs/yr.

Loading Capacity: Loading capacities were determined using Canfield-Bachmann equations from BATHTUB. The model equations were originally developed from data taken from 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 rerun, 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. MPCA did not use BATHTUB's default value of the ratio of the inverse of Secchi depth to Chl-a, 0.025 m^2/mg; instead, MPCA used 0.015 m^2/mg as this value is representative of Minnesota lakes. Four years were modeled for Ann Lake and all years were predicted within 15% of the monitored values. Two years were modeled for Lake Emma and both years were within 15% of monitored values. No calibration factors were applied for the lake response models. The resulting loading capacities are shown in Tables 5 and 6 (Section 3 of the TMDL report).

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 and Chl-a, and Secchi depth as if each lakes' phosphorus input were equal to the proposed loading capacity. The model results showed that if the phosphorus TMDL was met for each lake, the phosphorus, Chl-a, and Secchi depth water quality criteria would be achieved (Appendix C of the TMDL report).

Table 5. Total Phosphorus TMDL for Ann Lake[4]

Load Allocation (lbs/day)		Wasteload Allocation (lbs/day)		Margin of Safety (MOS) (lbs/day)	TMDL (lbs/day)
County Ditch 10/Direct	3.2	Industrial and Construction Stormwater	0.05	**0.2**	**4.25**
Atmospheric	0.2	CAFO	0		
Internal Load	0.6				
Total	**4.0**	Total	**0.05**		

The current TP loading is 8,326 lbs/yr (22.5 lbs/day) and a TP reduction of 82% is needed to meet the TP water quality standard of 60 µg/L for Ann Lake.

Table 6. Total Phosphorus TMDL for Lake Emma[5]

Load Allocation (lbs/day)		Wasteload Allocation (lbs/day)		Margin of Safety (MOS) (lbs/day)	TMDL (lbs/day)
Direct Watershed	0.8	Industrial and Construction Stormwater	0.01	**0.2**	**4.31**
Atmospheric	0.1				
Upstream Lake (Ann)	2.7	CAFO	0		
Internal Load	0.5				
Total	**4.1**	Total	**0.01**		

The current TP loading is 3,732 lbs/yr (10.2 lbs/day) and a TP reduction of 60% is needed to meet the TP water quality standard of 60 µg/L for Lake Emma.

EPA supports the data analysis and modeling approach utilized by MPCA in their calculation of wasteload allocations, load allocations and margin of safety for the Ann Lake and Lake Emma TMDLs. Additionally, EPA concurs with the loading capacities calculated by the MPCA in the Ann Lake and Lake Emma TMDLs.

Critical conditions:
Section 4.3 of the TMDL report and data presented in the TMDL report states that the critical conditions in Ann Lake and Lake Emma occur in the summer when TP concentrations peak and clarity is at its worst, often in late July and August. Since the phosphorus standard is based on June through September water quality averages, the standard addresses the lake condition during critical conditions. The load

[4] Table 4.1, page 4-4, of the TMDL report.
[5] Table 4.2, page 4-5, of the TMDL report.

reduction is designed so Ann Lake and Lake Emma Lake will meet the water quality standard over the course of the growing season (June through September).

Further detail on Load Capacity can be found in Section 4.1.1 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 4.1.2 of the TMDL report states that the LA is comprised of direct watershed inputs, atmospheric loading, and internal loading for both lakes. In addition, Lake Emma also has TP loading from Ann Lake, an upstream lake source. Table 7 presents the load allocation for Ann Lake and Lake Emma. EPA concurs with the State's approach in determining the LA for which the Ann Lake and Lake Emma TMDLs have been established.

EPA finds the MPCA's approach for calculating the LA to be reasonable.

Table 7. Total Phosphorus Load Allocation

Lake and Standard	Load Allocation (lbs/day)	Source (lbs/day)	
Ann Lake (60 µg/L)	**4.0**	County Ditch 10/Direct	3.2
		Atmospheric	0.2
		Internal Load	0.6
Lake Emma (60 µg/L)	**4.1**	Direct Watershed	0.8
		Atmospheric	0.1
		Upstream Lake (Ann)	2.7
		Internal Load	0.5

Section 3.3 in the TMDL report provides further detail on load allocation calculation by source.

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 point sources identified by MPCA are the industrial and construction stormwater runoff loads regulated under NPDES, and NPDES-regulated CAFOs as discussed in Section 4.1.3 of the TMDL. There are 33 CAFOs in the Ann and Lake Emma watersheds. Discharges from CAFOs are generally not permitted by rule so zero loading was assumed for both lakes. There are no MS4 permit holders in the Ann Lake and Lake Emma watersheds so no MS4 allocations have been designated. MPCA determined a categorical WLA for industrial and construction stormwater. EPA concurs with the State's approach in determining the WLA for which the Ann Lake and Lake Emma TMDLs have been established.

Table 8. Total Phosphorus Wasteload Allocation

Lake and Standard	Load Allocation (lbs/day)	Source (lbs/day)	
Ann Lake (60 µg/L)	**0.05**	Industrial and Construction Stormwater	0.05
		CAFO	0
Lake Emma (60 µg/L)	**0.01**	Industrial and Construction Stormwater	0.01
		CAFO	0

EPA finds the MPCA's approach for calculating the WLA to be reasonable.

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:

The margin of safety (MOS) is an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The MOS can be provided implicitly through conservative analytical assumptions or explicitly by reserving a portion of loading capacity.

An implicit and explicit MOS was used in the TMDL for both lakes. 5% of the loading capacity has been set aside to account for uncertainty in the modeling, i.e., an explicit MOS. The explicit MOS for Ann Lake and Lake Emma is 0.2 lbs/day. The implicit MOS is the use of the Canfield-Bachmann lake response model in BATHTUB. The model applies conservative assumptions to internal loading since it already accounts for internal loading into the model thereby overestimating the TP internal loading. Therefore, conservative assumptions were applied to the internal loading portion of the TMDL, i.e., an implicit MOS.

Section 4.1.4 of the TMDL report provides further information on MOS.

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:

Seasonal variation was accounted for via annual loads and developing targets during the summer period (i.e., critical conditions). Annual loads capture changes in water quality that can occur over the course of a year. The TMDLs were set to meet TP standards during the summer period which is the most protective since critical conditions occur at both lakes during the summer months. BATHTUB incorporates precipitation data and flow data over a two-year period thus capturing seasonal variations such as spring rain, snowmelt, and summer low flows.

Section 4.3 of the TMDL report provides further information on seasonal variation.

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:

Reasonable assurance is discussed in detail in Section 7.0 of the TMDL report. MPCA reasonably assures that the TP water quality standard will be achieved for both lakes via the following:

1) Wright County Water Management Plan. The plan includes implementation projects aimed at improving and restoring water quality at Ann Lake and Lake Emma. Details of the plan can be found in Section 7.3.2 of the TMDL report.
2) Implementation Plan for Ann Lake and Lake Emma. Following approval of the TMDLs for Ann Lake and Lake Emma, MPCA will develop and approve an implementation plan within one year. The implementation plan will include the use of federal and state programs to improve and restore water quality in the lakes.
3) Regulatory programs under NPDES program. Although there are no NPDES permits within the Ann Lake and Lake Emma watersheds, the regulatory programs under the NPDES program will regulate stormwater discharges from industrial and construction sources. Section 7.2 of the TMDL report provides further detail.
4) MPCA's partnership with Crow River Organization of Waters. The Crow River Organization of Waters (CROW) and MPCA work closely on TMDL development activities such as data collection, stakeholder involvement, and assessment of water quality and will continue these activities post-TMDL. Section 7.3.1 of the TMDL report provides further details.
5) Projects from the Wright County Soil and Water Conservation District. The sediment erosion and sedimentation projects under the County Soil and Water Conservation District are aimed at improving and restoring water quality at Ann Lake and Lake Emma. Section 7.3.3 provides further details.
6) Clean Water Legacy Act (CWLA): The CWLA is a statute passed in Minnesota in 2006 for the purposes of protecting, restoring, and preserving Minnesota water. The CWLA provides the process to be used in Minnesota to develop TMDL implementation plans, which detail the

restoration activities needed to achieve the allocations in the TMDL. The TMDL implementation plans are required by the State to obtain funding from the Clean Water Fund. The Act discusses how MPCA and the involved public agencies and private entities will coordinate efforts regarding land use, land management, water management, etc. Cooperation is also expected between agencies and other entities regarding planning efforts, and various local authorities and responsibilities. This would also include informal and formal agreements and to jointly utilize technical educational, and financial resources. MPCA expects the implementation plans to be developed within a year of TMDL approval. The CWLA also provides details on public and stakeholder participation, and how the funding will be used. The implementation plans are required to contain ranges of cost estimates for both point and nonpoint source load reductions, as well as monitoring efforts to determine effectiveness. MPCA has developed guidance on what is required in the implementation plans (Implementation Plan Review Combined Checklist and Comment, MPCA), which includes cost estimates, general timelines for implementation, and interim milestones and measures. The Minnesota Board of Soil and Water Resources administers the Clean Water Fund as well, and has developed a detailed grants policy explaining what is required to be eligible to receive Clean Water Fund money (FY '11 Clean Water Fund Competitive Grants Policy; Minnesota Board of Soil and Water Resources, 2011).

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 Wright County Soil and Water Conservation District (SWCD) will continue to monitor Ann Lake and County Ditch 10 for TP on a monthly basis during the summer. The SWCD plans to monitor Lake Emma less frequently since large reductions in TP are needed in Ann Lake for Lake Emma to achieve TP water quality standards. Vegetation monitoring will be performed by the Ann Lake Association. DNR plans to conduct fish monitoring.

Section 6.5 and Table 6.1 of the TMDL report provides further information on monitoring.

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 MPCA policy is to require an Implementation Plan within one year of EPA approval of the TMDL. The MPCA reviews and approves the Implementation Plans. The Wright County SWCD has completed a draft TMDL Implementation Plan for Ann Lake and Lake Emma. Final approval of the Implementation Plan by MPCA will occur once EPA finalizes the TMDL.

Section 6.0 of the TMDL report includes efforts to reduce internal and external TP loadings to each lake. Implementation of activities such as monitoring, internal load reduction efforts, wetland and manure management projects, and fish population assessment and management is planned for Ann Lake and Lake Emma in partnership with the local governments in the watershed and MPCA. Further detail on the type and extent of activities for Ann Lake and Lake Emma is described in Section 6.0 of the TMDL report.

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:

Four stakeholder meetings took place throughout the TMDL development process. The first stakeholder meeting took place on March 11, 2009. The second and third meetings took place on August 18, 2010, and the fourth took place on November 18, 2010. The stakeholders in attendance were lakeshore and farm residents, MPCA, DNR, the Wright County, SWCD, local officials, and local governing agencies.

The Ann Lake and Lake Emma TMDL report was posted on the MPCA's website for public comment and review for a 30-day public comment period. The public comment period took place from August 29, 2011 to September 28, 2011. During this time the MPCA received and responded to four comment letters from the public. MPCA submitted the public comments with the TMDL report. EPA has reviewed these comments, and believes that MPCA has appropriately addressed the comments.

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 December 8, 2011, EPA received the Ann Lake and Lake Emma TMDLs, and a submittal letter dated November 29, 2011, signed by Rebecca J. Flood, Assistant Commissioner, addressed to Tinka Hyde, U.S. EPA, Region 5, Water Division. MPCA stated in the submittal letter, "I am pleased to submit the Ann and Emma Lakes Total Maximum Daily Load (TMDL) study for excess nutrients to the U.S. Environmental Protection Agency (EPA) for final approval." The submittal letter included the name and location of the waterbodies and the pollutant 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 TP TMDL for Ann Lake and the TP TMDL for Lake Emma in the North Fork Crow River watershed (HUC 07010204) satisfy all of the elements of an approvable TMDL. This decision document addresses **2** TMDLs for **2** waterbodies as identified on Minnesota's 303(d) list (Table 1 above).

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.