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

FEB 20 2013

REPLY TO THE ATTENTION OF:

WW-16J

Rebecca Flood, Assistant Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 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 the Chisago Chain of Lakes Watershed, including supporting documentation and follow up information. The Chisago Chain of Lakes Watershed is located in central-eastern Minnesota, in Chisago County. The TMDLs address Aquatic Recreation Use impairments due to excess nutrients (total phosphorus) at the following lakes: South Center Lake (13-0027), North Center Lake (13-0032), Wallmark Lake (13-0029), Little Lake (13-0033), Ogren Lake (13-0011), Linn Lake (13-0014), Pioneer Lake (13-0034), School Lake (13-0044), and Lake Emily (13-0046).

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 nine (9) TMDLs for total phosphorus. 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,

Tinka G. Hyde
Director, Water Division

Enclosure

cc: Chris Klucas, MPCA
Jeff Risberg, MPCA

TMDL: Chisago Lakes Chain of Lakes Watershed, Chisago County, MN
Date:

DECISION DOCUMENT FOR CHISAGO LAKES CHAIN OF LAKES WATERSHED TMDL

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.P.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 (chl-a) and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:

Location description/Spatial extent: The Minnesota Pollution Control Agency (MPCA) has developed TMDLs to address excess nutrient (total phosphorus) impairments at nine lakes within the Chisago Chain of Lakes watershed, within the North Central Hardwood Forest Ecoregion (NCHF) (Table 1 in this document). The Chisago Chain of Lakes drains to Sunrise River, a tributary to the St. Croix River. Chisago Chain of Lakes subwatershed (i.e., the study area) is within Chisago County, located in central-eastern Minnesota along the border with Wisconsin.

The study area is largely urbanized with three incorporated cities and five townships: Chisago (pop. 4,967), Lindstrom (pop. 4,442), and Center (pop. 628) cities; and Lent, Wyoming, North Chisago, South Chisago, and Franconia townships (Figure 6, Section 1.1, and Section 1.2 of the TMDL).

Table 1. Waterbodies addressed in the Chisago Chain of Lakes Watershed TMDL, their listing and lake classification

Lake Name	Lake ID	Year Listed	Target Start/Completion	Lake Classification
South Center	13-0027	2008	2009/2017	Lake
North Center	13-0032	2008	2009/2017	Shallow Lake
Wallmark	13-0029	2008	2009/2017	Shallow Lake
Little	13-0033	2010	2015/2020	Lake
Ogren	13-0011	2012*	2012/2013	Lake
Linn	13-0014	2012*	2012/2013	Shallow Lake
Pioneer	13-0034	2012*	2012/2013	Shallow Lake
School	13-0044	2012*	2012/2013	Shallow Lake
Emily	13-0046	2012*	2012/2013	Shallow Lake

*TMDLs were developed for the lakes identified on the draft 20121ist. (See Section 13 of this decision document for more information).

Land Use: Land cover is predominantly cropland, followed by patches of shrub, forest, and grassland. In general, the eastern area of the watershed is agricultural, developed areas are in the central watershed and along lake shorelines, while the western area is mostly wetlands and wildlife habitat. Drainage flows from eastern lakes through the central and western lakes via canals and storm trunk drainage. Soil types are predominantly loams and sands with patches of hydric soils near lake shorelines and wetlands (Figure 8 and Figure 9 of the TMDL).

Problem Identification: Total phosphorus is the pollutant of concern addressed in this TMDL (Section 1.3 of the TMDL). MPCA assessed the status of nine lakes in the Chisago Chain of

Lakes subwatershed using in-lake water quality data collected from mid-May to September (i.e., growing season) from 2001 to 2010. Lakes are placed on MPCA's impaired waters list when total phosphorous is exceeded and at least one of the two response indicators are exceeded (i.e., chl-a, Secchi disc). Table 2 below summarizes the 10-year growing season means for the impaired lakes and shows that average TP was exceeded as well as at least one of the other response variables. The lakes were placed on Minnesota's 303(d) list in 2008, 2010, and on the draft final 2012 (Section 2.1 of the TMDL).

Table 2. Mean in-lake water quality from 2001-2010 growing season data compared to the applicable standards.

Lake Name	Lake Type	10-Yr Growing Season Mean		
		TP (ug/L)	Chl-a (ug/L)	Secchi disc (m)
Lake Standard		*TP <40*	*CHL-A <14*	*SD >1.4*
South Center	Lake	50	40	1.3
Little	Lake	173	71	0.7
Ogren	Lake	64	29	2.5
Shallow Lake Standard		*TP <60*	*CHL-A <20*	*SD >1.0*
North Center	Shallow	70	45	1
Emily	Shallow	341	152	0.3
Linn	Shallow	217	88	0.4
Pioneer	Shallow	345	103	0.4
School	Shallow	216	82	0.4
Wallmark	Shallow	322	165	0.6

While total phosphorus is an essential nutrient for aquatic life, elevated phosphorus levels can lead to nuisance algal blooms that negatively impact aquatic life and recreation. Algal decomposition can deplete oxygen which stresses benthic macroinvertebrates and fish. Also excess algae can limit establishment of a healthy assemblage of aquatic vegetation. A healthy vegetation assemblage stabilizes bottom sediments and provides habitat for macroinvertebrates and fish throughout the growing season.

Priority Ranking: MPCA's target start and completion dates measure priority for TMDL completion (Table I in this document). Target dates are based on the likelihood that a TMDL can be completed expediently, that a water can be restored, and that applicable data are available ('TMDL Summary Table' of the TMDL).

Source Identification (point and nonpoint sources):
Point sources- MPCA states there are no Municipal Separate Storm Sewer System (MS4) discharges to the impaired lakes in this TMDL. MPCA designates municipalities as MS4s if the population is over 5,000. EPA requires municipalities greater than 10,000 total or 1,000 persons per square mile to receive a Phase II MS4 permit. The municipalities in the watershed do not exceed 5,000 as estimated by the U.S. 2010 census. MPCA found no industrial stormwater, municipal, or industrial wastewater treatment discharges in the Chisago Chain of Lakes subwatershed. The area is partially serviced by the Chisago Lakes

Joint Sewage Treatment Facility but this facility discharges downstream of the impaired waters in the Chisago Chain of Lakes (Figure 11 and Section 2.2 of the TMDL). MPCA found no concentrated animal feeding operations (CAFOs) in the Chisago Chain of Lakes subwatershed; however there are feedlots which have less than 1000 animal units within individual lake subwatersheds (Figure 12 and Section 2.2 of the TMDL).

Non-point sources- In general, the nonpoint loads of total phosphorus identified were upstream lakes, direct watershed runoff, groundwater, internal loading, and atmospheric deposition. More specifically, runoff and groundwater receive phosphorus from failing or illicit septic systems, feedlots, stormwater, wildlife, and fertilizers. Non-regulated stormwater is a dominant source in the central part of the watershed which is more developed (Figure 13 and Section 2.2 of the TMDL).

Septic systems service a majority of the watershed and approximately 25% are failing. According to MPCA some septic systems have been identified as imminent threats to public health (ITPH) and a subset of septic systems have been upgraded (Table 14 and 'Phosphorus Source Inventory' Sections for each lake have more details).

Future Growth: Future growth from industrial stormwater sources was accounted for by giving an explicit WLA (Table 7 in this decision document). Future growth from remaining sources was not explicitly accounted for; thus additional sources would have to comply with the existing TMDL. However, in the event that MS4s begin to discharge in the watershed, MPCA provided transfer rates in order to transfer a portion of a subwatersheds load allocation to a WLA for the new MS4. Transfer rates were calculated as the loading capacity divided by a subwatershed area (Table 3 in this document, Section 2.3, and Appendix C of the TMDL).

Table 3. Transfer rates for any future MS4 discharger in the watersheds of the below lakes.

Lake name	LA to WLA transfer rates	
	lb/ac-yr	lb/ac-day
South Center	0.18	0.00049
Little	0.073	0.0002
Ogren	0.1	0.00027
North Center	0.27	0.00074
Emily	0.056	0.00015
Linn	0.084	0.00023
Pioneer	0.0067	0.000018
School	0.23	0.00063
Wallmark	0.12	0.00033

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the first criterion.

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)(l)). 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 Uses: Minnesota Rule Chapter 7050 designates uses for waters of the state. The lakes in this TMDL are designated as Class 2B waters for aquatic recreation use (Section 1.3 of the TMDL). The Class 2 aquatic recreation designated use is described in Minnesota Rule 7050.0140 (3):

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

Standards:

Narrative Criteria- Minnesota Rule 7050.0150 (3) contains the narrative criteria for Class 2 waters of the State:

> "For all Class 2 waters, the aquatic habitat, which includes the waters of the state and stream bed, shall not be degraded in any material manner, there shall be no material increase in undesirable slime growths or aquatic plants, including algae, nor shall there be any significant increase in harmful pesticide or other residues in the waters, sediments, and aquatic flora and fauna; the normal fishery and lower aquatic biota upon which it is dependent and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of the fish and other biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters."

Numeric criteria- Numeric eutrophication criteria for total phosphorus, chl-a, and Secchi disc depth are set forth in Minnesota Rule 7050.0222. Six of the nine lakes are shallow according to MPCA shallow lake definition. Applicable numeric eutrophication criteria for these lakes are in Table 4 in this document ('TMDL Summary Table' and Section 1.3 of the TMDL).

Table 4. Applicable numeric criteria for the Chisago Chain of Lakes Watershed TMDL

Parameter	Lake Standard in NCHF Ecoregion	Shallow Lake Standard in NCHF Ecoregion
Total Phosphorus (µg/l)	TP <40	TP <60
Chlorophyll-a (µg/l)	CHL-A <14	CHL-A <20
Secchi Transparency (m)	SD >1.4	SD >1.0
Applicable Lakes	S. Center, Little, Ogren	N. Center, Emily, Linn, Pioneer, School, Wallmark

Target: MPCA selected a total phosphorus target of 60 µg/l for shallow lakes, and 40 µg/l for non-shallow lakes (Section 1.3 of the TMDL).

MPCA selected total phosphorus to address eutrophication problems based on the causal relationships between total phosphorus and chl-a, and Secchi disc depth (Section 1.3). Algal abundance is measured by chl-a, which is a pigment found in algal cells. Algal abundance can increase with increased phosphorus loads. Increased algae in the water column will decrease water clarity as measured by Secchi disc depth. The response of these two factors as a function of total phosphorus concentrations in both lakes and shallow lakes was identified during development of MPCAs lake eutrophication criteria. Based on these relationships, the TMDL is expected to attain total phosphorus, chl-a, and Secchi disc standards (Section 1.3 of the TMDL).

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the second criterion.

3. Loading Capacity- Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody 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)(l)). 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: In equation form, the TMDLs may be expressed as:

$$TMDL = WLA + LA + MOS + RC;$$

where the wasteload allocation (WLA) is the allowable discharge given to point sources, Load Allocation (LA) is the allowable load to nonpoint sources, Margin of Safety (MOS) is either implicit or an explicit load to account for uncertainty in the TMDL, and Reserve Capacity (RC) is the allowable load to future growth. The loading capacity or total maximum daily load of total phosphorus, for the Chisago lakes is in Table 5 of this decision document.

TMDL calculation summary: The TMDLs were determined in a multi-step process. First, current phosphorus loads to the lake were estimated from watershed runoff, groundwater, atmospheric, and internal loads using methods described below. Second, the TMDL was determined by the BATHTUB model. Finally, the reductions required to meet standards were determined as the difference between current loading and the loading capacity, and these phosphorus loads were allocated to the various sources.

Table 5. The current phosphorus loads, required reductions, and TMDL elements (loading capacity, WLA, LA, and MOS) for the Chisago Lakes. An asterisk (*) identifies an upstream lake.

Lake Name	Lake ID	Current TP load (lbs/yr)	TP reduction (lbs/yr)	TP Reduction (%)	Total Phosphorus TMDL			
					Loading Capacity (lb/day)	WLA (lbs/day)	LA (lbs/day)	MOS
North Center	13-0032	6013	1108	18	15	0.0066	13	10% of loading capacity
South Center	13-0027	6125	1260	21	15	0.0072	13	
Emily	13-0046	389	362	93	0.082	0.000054	0.074	
Linn*	13-0014	2719	2395	88	0.99	0.00088	0.89	
Little*	13-0033	2954	2658	90	0.9	0.0013	0.81	
Ogren*	13-0011	1043	467	45	1.8	0.0038	1.6	

Lake Name	Lake ID	Current TP load (lbs/yr)	TP reduction (lbs/yr)	TP Reduction (%)	Total Phosphorus TMDL			
					Loading Capacity (lb/day)	WLA (lbs/day)	LA (lbs/day)	MOS
Pioneer*	13-0034	1843	1771	96	0.22	5.4E-06	0.2	10% of loading capacity
School	13-0044	1807	1591	88	0.66	0.00072	0.59	
Wallmark	13-0029	4213	3997	95	0.67	0.004	0.6	

Current Load Estimates:

Runoff and groundwater loads- Phosphorus in watershed runoff and groundwater was estimated by the Soil and Water Assessment Tool (SWAT). An existing SWAT model was modified for this study. The existing model was developed for Sunrise River watershed, where the Chisago Lakes are located, and used groundwater flow and runoff data from 1990-2009 (Figure 2 of the TMDL).

Phosphorus in runoff was estimated as a daily load from each hydrologic response unit (HRU). The HRUs were determined by soil type and land use in the watershed. Land use data were from the 2007 United States Department of Agriculture (USDA) Crop Data Layer. These land uses existed within the time period that in-lake water quality data were measured (2001-2010). Because the time periods for land use and water quality data coincide, this can reduce uncertainty in the load- response model (BATHTUB).

The methodology also accounted for the effect of feedlots on phosphorus concentrations in runoff. Livestock numbers were used to estimate manure spreading on fields and therefore could be assimilated into runoff estimates from HRUs. Livestock numbers were from the National Agricultural Statistical Survey (NASS) and were vetted with Chisago Soil and Water Conservation District (SWCD).

To account for groundwater a 0.03 µg/l phosphorus concentration was included in SWAT. When scaling SWAT estimates from the larger Sunrise River scale to the Chisago lakes, loads from groundwater and runoff were not separated so that precision could be preserved. That is, the combined load from groundwater and runoff remains precise when moving from one scale to another, but to assign how much the groundwater loads contribute vs. runoff would not necessarily be precise at a smaller scale.

In order to estimate loads to lakes, lake subwatersheds were further delineated for the TMDL study using information from 2008 and 2009 LIDAR data which included pipes, channels, and weirs (Figure 3). The use of LIDAR data with this additional information improves accuracy of model estimates as these details better account for storm-trunk drainage areas than a surface elevation tool alone. Estimated phosphorus loads in the lake subwatersheds ranged from 19 to 870 lbs of phosphorus per year across subwatersheds that ranged from 168 to 11,000 acres (Section 2.2 of the TMDL).

Upstream Lakes- In-lake TP data from upstream lakes and flow data from the SWAT model were used to estimate phosphorus loads from upstream lakes. Pioneer and Linn Lake contribute phosphorus only via groundwater and this source load was calculated assuming that dissolved phosphorus in groundwater was half of the total phosphorus in the upstream lake (Section 2.2 of the TMDL).

Atmospheric loads- Atmospheric deposition was estimated using each lake's surface area and a rate of 0.27lb/ac/yr. The rate was based on average rainfall years and was determined in a prior study on deposition rates throughout major basins in Minnesota (Section 2.2 of the TMDL).

Internal loads- MPCA estimated internal loads on the best available data. Lake sediment core data provided site specific information on phosphorus content in lake sediments. Lake core data helped verify modeled estimates. Internal loads were estimated by both the Nürnberg and BATHTUB models. The Nürnberg model is a statistical regression equation that estimates the release rate of phosphorus as a function of anoxia and sediment composition. BATHTUB estimates internal loading using a mass-balance equation. Using the two methods allowed internal load estimates to be corroborated and the higher estimate among the two models was used in all cases except in North Center, South Center, and Ogren lakes which are not hypereutrophic (Section 2.2 of the TMDL).

TMDL modeling-
BATHTUB was used to estimate in-lake phosphorus concentrations as a response to incoming and internal phosphorus loads. BATHTUB estimates total phosphorus concentration using a mass-balance equation informed by lake size, residence time, sediment settling rates, and phosphorus inputs to the lake (e.g., runoff from SWAT, atmospheric, etc.) (Table 13 of the TMDL shows BATHTUB model input data). BATH-TUB has many types of mass-balance equations to select from, and MPCA selected the Canfield-Bachmann model which uses data from Minnesota lakes. Using a mass-balance model based on data from lakes in Minnesota improves model accuracy as these data are more geographically relevant to the Chisago Lakes than the default lake dataset in BATHTUB. The difference between modeled and observed in-lake phosphorus concentration represents unaccounted loads (e.g., internal load) and implicit model error.

Ten years of lake water quality and runoff/groundwater estimates were available, and this sample size reduces uncertainty of model estimates. Also, MPCA included additional internal load, when the Nürnberg derived internal loads were highest, to increase accuracy of internal load estimates (Section 2.2 of the TMDL).

Critical Conditions: MPCA determined that critical conditions occurred during the growing season (mid-May to September) when lakes are used for aquatic recreation. During the growing season, reduced inflow and residence times can cause stagnation and accumulation of nutrient loads, particularly from internal loading. Algal growth increases when nutrients accumulate during warmer periods which can lead to anoxic conditions in the hypolimnion and a release of phosphorus from bottom sediments.

MPCA stated that the water quality standards, and thus TMDL target, implicitly account

for growing season critical conditions, as standards were developed based on water quality data in the growing season. Further, the TMDL was developed based on data from the growing seasons in 2001-2010 (Section 2.3 and Section 13.2 of the TMDL).

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the third criterion.

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 nonpoint 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 nonpoint sources.

Comment:
Load Allocations (LA): To attain the TMDL, reductions will be required from watershed runoff, upstream lakes, and internal loads. Load allocations to atmospheric inputs remained equal to current loads based on an average precipitation year.

Allocations to downstream lakes were calculated assuming that loads from upstream lakes were achieving their own respective TMDL allocations. For South Center, North Center, and Ogren Lakes, reductions apply to upstream lakes such that those upstream lakes would meet TP criteria, then 50% of the remaining reductions needed were calculated for watershed runoff, and the final remaining reduction was from internal loading. For the remaining lakes (Emily, Linn, Little, Pioneer, School, and Wallmark), equal reductions are required of watershed runoff and internal sources. Table 6 in this decision document summarizes the LA for each lake. This approach provides reductions that are in relative proportion to the amount a nonpoint source contributes to the total load.

Table 6. Load Allocations for Chisago Lakes Chain of Lakes Watershed (TMDL Summary Table, Sections 4.8, 5.8, 6.8, 7.8, 8.8, 9.8, 10.8, 11.8, 12.8 of the TMDL).

Waterbody Name	LA (TP lbs/day)				Total LA (lbs/day)
	Direct runoff	Upstream Lakes	Atmospheric	Internal	
North Center	2	2.7	0.55	8.2	13
South Center	2.3	1.3	0.66	9	13
Emily	0.017	N/A	0.013	0.044	0.07
Linn	0.27	N/A	0.13	0.49	0.89
Little	0.41	N/A	0.12	0.28	0.81
Ogren	1.2	N/A	0.036	0.36	1.60
Pioneer	0.0017	N/A	0.058	0.14	0.20
School	0.22	0.052	0.11	0.21	0.59
Wallmark	0.13	N/A	0.11	0.36	0.60

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the fourth criterion.

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: A WLA was given to general NPDES construction (MNR100001) and industrial stormwater (MNR50000) permits (Table 7 in this document). Allocations to construction were calculated from the loading capacity in proportion to the percent of the Chisago Lakes Chain of Lakes watershed that was under construction over a 5-yr period (Jan 2005-Dec 2009). Industrial stormwater allocations were given for any future discharge of this type. There were no current industrial stormwater sources identified by MPCA (Section 2.2 of the TMDL).

Table 7. Wasteload Allocations in the Chisago Lakes Chain of Lakes Watershed (Sections 4.8, 5.8, 6.8, 7.8, 8.8, 9.8, 10.8, 11.8, and 12.8 of the TMDL).

Waterbody Name	WLA (TP lb/day)	
	Construction stormwater (MNR100001)	Industrial stormwater (MNR50000)
North Center	0.0033	0.0033
South Center	0.0036	0.0036
Emily	2.7E-05	0.000027
Linn	0.00044	0.00044
Little	0.00066	0.00066

Waterbody Name	WLA (TP lb/day)	
	Construction stormwater (MNR100001)	Industrial stormwater (MNR50000)
Ogren	0.0019	0.0019
Pioneer	2.7E-06	0.0000027
School	0.00036	0.00036
Wallmark	0.002	0.002

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the fifth criterion.

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)(l)(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: An explicit allocation of 10% of the TMDL was given to all lakes to account for uncertainty in estimated load-response calculations. MPCA calibrated the BATHTUB model to the in-lake water quality concentration so that the model could, with the data available, best approximate in-lake water quality as a response to pollutant loading.

There were sources of uncertainty in the internal load estimates, and estimated groundwater flow between the lakes. However, MPCA mitigated uncertainty in their source assessment and model estimates where possible. Multiple equations were used to assess the internal phosphorus loads, and the highest result was used assuming that for hypereutrophic lakes, the highest estimate was most applicable. The watershed runoff model, while built for a larger scale than the Chisago Lakes watershed, was based on over 20 years of data and represents loading under a variety of climate and watershed conditions.

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the sixth criterion.

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)(l)(C), 40 C.F.R. §130.7(c)(l)).

Comment: Phosphorus loads can vary by season, and the source loads vary with

precipitation. For example, in a dry year with little precipitation, residence time of water in lakes can increase, which causes nutrients to accumulate and stratification to intensify. These conditions support anoxia and subsequent internal loading from bottom sediments. By contrast, in a wet year, water and nutrients flush faster through shallow lakes, which limit nutrient accumulation and algal growth.

Seasonal variation was accounted for by using a 20-year period for runoff and groundwater load estimates (the 1990-2009 SWAT model period) and by using a 10-year water quality data record (2001-2010). These periods cover a range of wet, average, and dry years (approximately 16 to 28" annual rainfall) which have different effects on phosphorus loads (Section 2.2 and Section 2.3 of the TMDL).

The EPA finds that the TMDL document submitted by the MPCA satisfies the requirements of the seventh criterion.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a 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 nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint 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 nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint 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:

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 to jointly use 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 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 '11Clean Water Fund Competitive Grants Policy; Minnesota Board of Soil and Water Resources, 2011).

Point Sources: Reasonable assurance that the WLAs will be implemented is provided by regulatory actions. According to 40 CFR 122.44(d)(1)(vii)(B), NPDES permit effluent limits must be consistent with assumptions and requirements of all WLAs in an approved TMDL. MPCA implements its storm water and NPDES permit programs, and is responsible for making the effluent limits consistent with the WLAs in this TMDL. Future facilities subject to the NPDES general permit for industrial stormwater runoff from Nonmetallic Mining and Associated Activities (MNG49) would be required to properly select, install, and maintain BMPs required under the permit. This provides assurance that these future types of phosphorus sources would be required to implement BMPs to reduce phosphorus loads from these sites (Section 16.2 of the TMDL).

Nonpoint Sources: Given that an implementation plan is expected to be complete within a year of the TMDL approval, there is reasonable assurance BMPs will be implemented to reduce phosphorus loads.

MPCA states that the Chisago Lakes Lake Improvement District (CLLID) and Chisago SWCD will implement the TMDL, which was also developed by Chisago SWCD. The CLLID and Chisago SWCD demonstrate past experience in improving water quality. This provides reasonable assurance that the TMDL will be implemented by relevant and experienced entities that are familiar with the goals and requirements outlined in the TMDL. The Chisago County water plan has identified impaired waters as priority areas and this TMDL provides a framework to carry out existing priorities.

Past projects by local government agencies have demonstrated they are willing to improve water quality. From 2004-2009, Chisago County identified and upgraded ITPH septic systems, and more recently in 2010 received a Clean Water Legacy Fund grant to inspect and pump septic systems. Three communities in Chisago Chain of Lakes watershed are part of the St. Croix Minimal Impact Design Standard (MIDS) pilot program, which promotes Low Impact Development and updates stormwater ordinances (Section 15.2). The CLLID completed subwatershed delineation, using LIDAR, to include the influence of ditches, weirs, and other structures which can modify drainage areas (Section 2.2 of the TMDL).

Potential sources of funding exist to implement actions, and some have been used under existing programs administered by the local partners (e.g., CLLID, the Chisago SWCD, and Chisago County). The Clean Water Legacy fund described above is a potential source of funding, as well as cost-share dollars from SWCD, and USDA Natural Resources Conservation Service programs including the Environmental Quality Incentives Program (EQIP), and Conservation Reserve Program (CRP) (Section 16 of the TMDL).

The EPA finds that this criterion has been adequately addressed.

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 nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that assess if load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment: MPCA states that the watersheds will be monitored on 5 year intervals for 25 years, after commencement of TMDL implementation. Monitoring information would be used to determine if improvement has occurred, and if management actions need to be adapted (Section 15.1 of the TMDL).

The EPA finds that this criterion has been adequately addressed.

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: In accordance with MPCA policy, an implementation plan will be completed within one year of TMDL approval. Estimated reductions to meet the TMDL are summarized in Table 5 in this decision document and estimated to cost between 2 and 5.5 million dollars (Section 15.8).

Generally, MPCA states reductions will come from upstream lakes, watershed runoff, and internal loading. For lakes where internal loading is not expected to be a dominant source, reductions will occur in watershed runoff. The TMDL identifies reductions in lbs/yr for

watershed runoff and internal loading. Example practices to achieve reductions included lakeshore buffers, stormwater management, agricultural and feedlot BMPS, and fish and aquatic plant management (Section 15.9 of the TMDL).

On the watershed scale, MPCA stated that implementation priority may be on upstream lakes, and lakes with lower reduction goals. Any priority would be developed in the restoration plan and discussed with local citizens (Section 15.4). Other important aspects of implementation include education and outreach to gain stakeholder support for actions, funding, partnerships, and adaptive management. MPCA provides information on these topics in Section 15 of the TMDL. There are currently no 319 grant funded projects within the Chisago Chain of Lakes watershed.

The 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)(l)(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: The Chisago Lakes TMDL project began in September of 2010. Public participation took place throughout the project via steering committees, focus groups with farmers, public meetings, and updates to the lake improvement district board meetings (Section 17.1 through 17.4 of the TMDL).

The TMDL was on public notice from October 22, 2012 to November 21, 2012. Public comments were received on the suggested aquatic plant management. The public comment period was announced in an MPCA news release and published in the Minnesota State Register in October 2012. Electronic copies of the draft TMDL were published on the MPCA website along with a notification of the public comment period (Administrative Record No. 8-3, 8-4, and 8-5).

MPCA received written comments from Minnesota Corn Growers Association, St. Croix River Association, and a resident in the watershed. Topics in the comments included: improve discussion on sources, mention that some reduction goals were aggressive, and address

concerns about impacts from aquatic vegetation overgrowth if a lake returned to a clear water state. MPCA responded to comments, providing additional explanation or clarification where applicable, and improving the description of feedlots and septic sources in the TMDL. The record also indicates that MPCA spoke with comment authors to discuss matters of concern before providing a written response.

The EPA finds that the TMDL document submitted by the MPCA satisfies the 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 January 24, 2013, EPA received a submittal letter dated January 3, 2013 signed by Rebecca J. Flood, MPCA Assistant Commissioner, addressed to Tinka Hyde, EPA Region 5, Water Division Director. The submittal letter identified the names of the waterbodies for which the TMDLs were developed. The locations of the waterbodies were provided in the supporting documentation. The letter explicitly states that the Chisago Lakes Chain of Lakes Watershed TMDL was submitted for final approval by EPA under Section 303(d) of the Clean Water Act.

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

13. Conclusion

After a full and complete review, the US EPA finds that the TMDLs for excess nutrients (total phosphorus) for the following lakes meet all of the required elements of approvable TMDLs: South Center (13-0027), North Center (13-0032), Wallmark (13-0029), Little (13-0033), Ogren (13-0011), Linn (13-0014), Pioneer (13-0034), School (13-0044), and Emily Lake (13-0046).
This decision document addresses a total of nine **(9) TMDLs** as identified on Minnesota's 303(d) list. EPA is approving TMDLs for total phosphorus in the six lakes that appear on the draft final 2012 303(d) list but were not on MPCA's 2010 303(d) list, which is the most recently approved list. EPA believes it was reasonable for MPCA to develop TMDLs for the previously unlisted segments in the subwatersheds at the same time it was developing TMDLs for the listed segments. While developing the TMDLs, MPCA determined that these waters met listing requirements for phosphorus. The segments were clearly identified in the draft TMDL and the public had the opportunity to comment on these additional

impaired lakes during the MPCA public comment period. These segments were included in the final TMDL submitted to EPA. Therefore EPA believes it is appropriate to approve the additional six TMDLs at this time.

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.