Phosphorus Rule: Report to the Legislature

As required by Minnesota Session
Law 2006, Chapter 251 Section 16(b)

Minnesota Pollution Control Agency

Minnesota Pollution Control Agency

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List of Acronyms and Abbreviations Used in the SONAR

ACR	Acute to chronic ratio
Agency	Minnesota Pollution Control Agency
ASTM	American Society for Testing and Materials
AWWDF	Average [monthly] wet weather design flow
BAF	Bioaccumulation factor
BAP	Bioavailable phosphorus
BCF	Bioconcentration factor
BEACH	Beach Environmental Assessment and Coastal Health (BEACH) Act
Bio-P	Biological phosphorus removal treatment technologies
BMP	Best management practice
BOD_5	Biochemical oxygen demand; BOD_5 is BOD measured over a 5-day period
BWCAW	Boundary Waters Canoe Area Wilderness
CAS	Chemical abstract services registry number
$CBOD_5$	Carbonaceous biochemical oxygen demand; $CBOD_5$ is CBOD measured over a 5-day period
CFR	Code of Federal Regulations
cfs	cubic feet per second
cfu	colony-forming units
CGMC	Coalition of Greater Minnesota Cities
ch.	Chapter
Chl-a	Chlorophyll-a
CGMC	Coalition of Greater Minnesota Cities
CESARS	Chemical Evaluation Search and Retrieval System database
CLMP	Citizens Lake Monitoring Program
CS	Chronic standard
CSF	Cancer slope factor
CSMP	Citizens Stream Monitoring Program
CWA	Clean Water Act
CWP	Clean Water Partnership
DMR	Discharge monitoring report
DO	Dissolved oxygen
DOC	Dissolved organic carbon

EC20, EC50	Effect concentration; concentration of chemical that has a significant effect on 20 percent and 50 percent of the test organisms in a specified time period, respectively
ECOTOX	Ecotoxicolgy database
EPA	U.S. Environmental Protection Agency
Ex.	Exhibit
EU	Eutrophication
FAV	Final Acute Value
FPE	fullest practicable extent
FTE	Full time equivalent – measurement of staff resources
g/d	grams per day
GLI	Great Lakes Water Quality Initiative
IBI	Index of Biotic Integrity
IEPA	Illinois Environmental Protection Agency
HBV	Health based value
HH	Human health-based standard
HRL	Health risk limit
IRIS	Integrated Risk Information System
L	Liter
LAP	Lake Assessment Program
LC50	Lethal concentration; concentration of chemical that results in death of 50 percent of the test organisms in a specified time period
LOEC	Lowest observable effect concentration
m	meter or meters
MATC	Maximum acceptable toxicant concentration
MCEA	Minnesota Center for Environmental Advocacy
MCES	Metropolitan Council, Environmental Services
MCL	Maximum contaminant levels (EPA drinking water standards)
MDA	Minnesota Department of Agriculture
MDEP	Massachusetts Department of Environmental Protection
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MESERB	Minnesota Environmental Science and Economic Review Board
MFCA	Minnesota Fish Consumption Advice or Advisory
mg/L	microgram per liter or parts per billion
mg/kg	milligram per kilogram or parts per million

mg/L	milligram per liter or parts per million
mgd	million gallons per day
µm	micron, one millionth of a meter
MPCA	Minnesota Pollution Control Agency
Minn. R. ch.	Minnesota Rules chapter
Minn. Stat. ch.	Minnesota Statutes chapter
MeHg	Methylmercury
MS	Maximum standard
NA or na	Not applicable or not available
NALMS	North American Lake Management Society
NCHF	North Central Hardwood Forest Ecoregion
NE	No effect concentration
ng/L	nanogram per liter or parts per trillion
NGP	Northern Glaciated Planes Ecoregion
NLF	Northern Lakes and Forest ecoregion
NHD	National Hydrographic Data
NOEC	No observable effect concentration
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance
OPP	Office of Pesticide and Planning, EPA
ORVW	Outstanding Resource Value Water
P Rule	Existing Minn. R. 7050.0211, subp. 1a; proposed Minn. R. 7053.0255
PAH	Polynuclear aromatic hydrocarbons
PCB	Polychlorinated biphenyl
PMP	Phosphorus management plan
POTW	Publicly owned treatment works
ppm	parts per million
RfD	Reference dose
RSC	Relative Source Contribution Factor
SCV	Species chronic value
SD	Secchi depth or Secchi transparency
SDS	Minnesota State Disposal System permits
SONAR	Statement of Need and Reasonableness
SSS	Site-specific standard
STORET	EPA water quality data storage and retrieval system
su	standard units, units for pH measurements

TBEL	Technology-based effluent limit (limit = limitation)
TMDL	Total Maximum Daily Load
TSI	Carlson Trophic State Index
Tox	Toxicity-based standard
TP	Total phosphorus or phosphorus
TSS	Total suspended solids
UAA	Use attainability analysis
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	Volatile organic carbon
WCBP	Western Corn Belt Planes ecoregion
WDNR	Wisconsin Department of Natural Resources
WQBEL	Water quality- [standard] based effluent limit
WQS	Water quality standard
WWTP	Wastewater treatment plant

Report Overview

Minnesota Session Laws 2006, Chapter 251, Section 16 (b) requires the Minnesota Pollution Control Agency (MPCA) to report to the legislature "…on a proposed or adopted rule changing limits on phosphorus discharges. The report must address scientific justification for the new rule and the impact the proposed or adopted rule will have on needed funding to implement the Clean Water Legacy Act." This report is to fulfill that reporting requirement.

The information for this report is taken directly from the draft Statement of Need and Reasonableness (SONAR) for proposed revisions to the state's water quality standards. The exception is the section of the report considering rule revision impacts on needed funding to implement the Clean Water Legacy Act, which was evaluated specifically for this report.

The proposed revision of state water quality standards includes items in addition to those addressing phosphorus effluent limits (e.g. lake eutrophication standards, a fish tissue standard for mercury, and replacing the current fecal coliform standard with an *E. coli* standard). The SONAR therefore addresses many issues in addition to changes to nutrient standards and effluent limits. Because information in the SONAR largely addresses the requirements of the above noted Session Law, information in this report was extracted from the larger draft SONAR. Section numbering has not been reordered for the report but rather left as in the draft SONAR. Two examples of this are; the report starts with Section VII and Section X is not included in the report. Sections of the SONAR not included in this report do not pertain to phosphorus effluent limits, the focus of this report.

The SONAR and this report reference many exhibits. Exhibits are generally discussed in the text of the report but are not included with the report. However, exhibits are available from the MPCA by contacting Mark Tomasek with specific requests (mark.tomasek@pca.state.mn.us).

The report in its entirety provides an in-depth discussion of the proposed phosphorus effluent limit rule revision. However, for convenience, the remainder of this section (bulleted items) provides a broad overview of the draft rule change as it relates to phosphorus effluent limits with reference to specific sections of the report discussing session law requirements. Additionally, this overview is provided to give the reader a brief summary on significant topics of the report with reference to specific sections for more complete information. The table of contents can also be reviewed to seek out additional topics of interest.

- Part of the draft revisions to state water quality standards is to implement, through rule, the MPCA Board approved Phosphorus Strategy adopted in March 2000. Following adoption of the Phosphorus Strategy, phosphorus effluent limits of 1 mg/L have been set for new and expanding National Pollutant Discharge Elimination System (NPDES) wastewater treatment facilities discharging greater than 1,800 lbs/yr of phosphorus. These same criteria are in the draft rule revision. Section VII. F. CONSOLIDATION OF EXISTING AND PROPOSED TP LIMITS. The complete rule language as proposed is included in this

section. Specific language for new and expanding discharges is in Minn. R. 7053.0255 subp. 3, item A, subitem 3 of the proposed new rule. Section IX. B. BACKGROUND AND HISTORY. This section includes a history of phosphorus limits in Minnesota dating back to June 1967. Section IX. C. AGENCY'S PHOSPHORUS STRATEGY. Provides a discussion of the MPCA Citizens Board approved Phosphorus Strategy.

- Three exemptions to the 1 mg/L limit are included in the draft rule. Exemptions would be implemented as a seasonal phosphorus limit, or no phosphorus limit, in specific situations. The exemptions are not anticipated to be widely used but rather be the exception. Sections VII. H. NEW LANGUAGE, TP LIMITS AND EXEMPTIONS, MINN. R. 7053.0255, SUBP. 3. and IX. H. POSSIBLE EXEMPTIONS TO 1 MG/L TP LIMIT. Both sections provide a discussion of proposed exemptions to a 1 mg/L phosphorus limit for new and expanded discharges.

- The scientific basis for the rule change reflects increased recognition, beyond just aquatic scientists, and documentation that nutrients not only impact lakes but also rivers and streams. No one questions the impact excess nutrients can have on lakes and other static bodies of water, but it is less well known that excess nutrients can have significant impacts on rivers and streams. Aquatic scientists have reported for decades that nutrients impact rivers and streams. But until recently these impacts have gone largely undocumented, at least by governmental water quality monitoring programs. The increased nutrient and biological monitoring of rivers and streams by the Agency, other states and federal agencies is providing new documentation of negative impacts of nutrients on rivers and streams.

  The Agency has nutrient and algal abundance data from several rivers and streams around the state that show excess phosphorus increases the abundance of suspended algae in rivers. Recent studies and monitoring data on river systems consistently show negative impacts from nutrients where in the past it might have been assumed impacts would be negligible. In one case, the lower Minnesota River, excess phosphorus and very abundant algae have caused dissolved oxygen levels to fall below standards. This led to the Minnesota River being listed as impaired due to nutrients and the subsequent TMDL. The effect of excess nutrients in the lower Minnesota River was manifested by low dissolved oxygen (DO) levels caused by algal respiration and the die-off and decay of algae, which consume oxygen.

  In a published journal article and subsequent report, Agency staff members Heiskary and Markus looked at the impacts of nutrients on several medium to large rivers throughout Minnesota. Monitoring took place over three years. They document several impacts, such as relationships between increased phosphorus with increased algae (Chl-a), increased in-river biochemical oxygen demand (BOD_5), increased daily DO changes and poorer fish and invertebrate indices of biological integrity (IBI). The direct relationship between river TP and Chl-a has been documented in other published research as well. Also other states, as part of their programs to develop and adopt nutrient standards for rivers, are documenting similar relationships between increased nutrients and negative responses in rivers and streams. Section VII. D.

IMPACTS OF NUTRIENTS IN RIVERS AND STREAMS. This section includes detailed information on the impact of nutrients on surface waters, with a focus on rivers and streams.

- Point source contributions of phosphorus to surface waters are documented and compared to other source contributions. Load reductions from 1 mg/L phosphorus effluent limitations are estimated and detailed in the report. However, it is pointed out that future **new** discharges will mean a TP **load increase** to surface waters, although at a reduced rate due to the 1 mg/L effluent limit under the Agency's proposal. Expanding dischargers getting a 1 mg/L effluent limit probably will result in overall load reductions since in most cases the expected concentration reductions will be greater than the flow increases. Also, the rule as proposed will allow facilities that already have a 1 mg/L effluent limit to expand with no change in effluent concentration, resulting in a load increase to surface waters. Section VII. C. CONTRIBUTION OF PHOSPHORUS FROM POINT SOURCES. Phosphorus load reductions from 1 mg/L effluent limits are discussed.
- The section of the report titled POTENTIAL COSTS TO MUNICIPALITIES AND THE CLEAN WATER LEGACY ACT PROGRAM EXTENDING THE TP LIMIT, at the end of the report, is an additional assessment made specifically for this report.
- Finally it should be recognized that this is a draft proposed rule revision to state water quality standards and as such will need to proceed through the rule making process as required by the Administration Procedures Act (Minn. Stat. ch. 14). The proposed rule revisions and SONAR are expected to be on public notice around May 2007.

VII. NEED FOR PROPOSED EXTENSION OF PHOSPHORUS EFFLUENT LIMIT

A. INTRODUCTION [VII. TP limit, need]

Minnesota Stat. ch. 14 requires the Agency to explain the facts establishing the need for and the reasonableness of the rules as proposed. In general terms, "need" means that the Agency must present the reasons for making the proposed changes to Minn. R. ch. 7050, and for the proposed new Minn. R. ch. 7053. Also, need implies that a problem exists that needs to be fixed or dealt with through administrative attention. This Section of SONAR Book II will discuss why the proposed amendment to the 1 mg/L phosphorus effluent limit is needed.

B. PETITIONS TO ADOPT RULES [VII. TP limit, need]

1. Introduction [VII.B. TP limit, need]

While still in the planning stages for this rulemaking the Agency received two formal petitions from outside parties to consider rule-language changes pertaining to the 1 mg/L phosphorus effluent limit currently in Minn. R. 7050.0211, subp. 1a. The first petition was from the Coalition of Greater Minnesota Cities (CGMC), the Minnesota Environmental Science and Economic Review Board, the League of Minnesota Cities, and the Minnesota Association of Small Cities (referred to as the CGMC petition). The CGMC petition and cover letter from Flaherty & Hood, P.A. dated December 15, 2003 is Exhibit A-28. The Agency's response letter dated January 13, 2004 is Exhibit A-29. The CGMC petition prompted the Agency to review its approach to the setting phosphorus effluent limits under the current rule and the Phosphorus Strategy. Staff recommended to Agency management that the phosphorus limit should be extended to new and expanding facilities that discharge more than 1,800 pound of phosphorus per year (Exhibit PL-9).

The second petition was from the Minnesota Center for Environmental Advocacy (MCEA). The MCEA petition and cover letter dated July 27, 2004 is Exhibit A-30. The Agency's response letter dated August 18, 2004 is Exhibit A-31.

2. CGMC Petition [VII.B. TP limit, need]

The CGMC petition asked the Agency to define the following terms in the context of existing Minn. R. 7050.0211, subp. 1a.

- Lake
- Reservoir
- Affects

The petitioners suggested that the Agency adopt the following underlined language in the context of existing Minn. R. 7050.0211, subp. 1a.

> [Minn. R. 7050.0211, subp. 1a.] ***Total phosphorus effluent limits.*** *Where the discharge of effluent is directly to or affects a lake or reservoir, phosphorus removal to one milligram per liter shall be required. For purposes of this rule, "lake or reservoir" means a body of water with an average annual hydraulic residence time exceeding 14 days, and the term "affects" means the measurable impact of an individual facility's phosphorus discharge on scientifically- documented algal growth in a lake or reservoir. The limit must be a calendar month arithmetic mean unless the commissioner finds, after considering the criteria listed in items A and B, that a different averaging period is acceptable.* …

The Agency is proposing definitions for "reservoir" and "affects" that are similar to what the petitioners suggest. Our definition of "reservoir" includes a minimum residence time of 14 days, and our definition of "affects" clarifies that the TP loading causing the affect is from an individual point source discharger. However, the Agency feels that to do **only** what the CGMC petition asks with regard to the existing TP effluent limit could mean a significant step backwards in the control of phosphorus and jeopardize the progress made in reducing TP loading from point sources over the last five years under the Phosphorus Strategy (Exhibit PL-1c). The Phosphorus Strategy (Strategy) has been the impetus for assigning TP effluent limits to 35 to 40 facilities across the state since 2000, including situations where the downstream "affects" due to the added TP may not have been measurable. The Agency wants to continue this five-year record of progress. The Agency feels that the best way to do that is to "codify" in rule portions of the Strategy by proposing to extend the phosphorus effluent limit to new and expanding

dischargers above a certain size.

The Agency, in its response to CGMC and the other petitioners (Exhibit A-29) said that it intended to define the three terms mentioned in the petition, but preferred to do it as part of this triennial review of water quality standards rather than enter into a separate rulemaking that would address only the petitioner's request. Given the time and costs associated with even a minor rulemaking, this was a reasonable and prudent response.[1]

While the Agency is proposing definitions for the three terms that are similar to the petitioner's suggested language, there are some details in the latter with which the Agency disagrees. The first pertains to the 14-day residence time in the suggested definition of "lake." The Agency does not feel that a reference to a specific residence time is needed in the definition of "lake." A lake with a residence time as short as 14 days would be very rare; including lakes with control structure at the outlet (Agency staff is not aware of any examples). Any waterbody with a residence time approaching 14 days would clearly be a run of the river reservoir

The petitioners and the Agency agree on the length of time used to distinguish between reservoirs and rivers; i.e., 14 days. But we disagree on the flow used to determine the residence time. The petitioners suggest an average flow and the Agency is proposing a lower flow, the four-month summer average low flow with a once in ten-year recurrence interval (122-day Q_{10}). Phosphorus loading to a reservoir typically requires static or near-static (lake-like) conditions for 14 days or longer to be reflected in increased algal growth. Clearly the greater the flow moving through the reservoir, the shorter the length of time the water spends in the reservoir and the less time the algae have to take advantage of the available TP. The Agency's proposed use of the $122Q_{10}$ is more protective than an average flow. The Agency is using a $122Q_{10}$ for this purpose now under the Phosphorus Strategy. For example, this flow was used by the Agency to determine the residence time for the Mississippi River Coon Rapids reservoir in the recent contested case hearing related to St. Cloud's NPDES permit. In this instance, the residence time for the Mississippi River pool up stream of the Coon Rapids dam was shorter than 14 days at the $122Q_{10}$. The pool behind the dam did not meet the requirements to be considered a reservoir[2]. The rationale for using the 122-day low flow is also discussed in Section X.B.5 in SONAR Book I.

[1] The relatively minor "assessment factor" rulemaking, which was in response to a petition from essentially the same parities plus the Minnesota Farm Bureau required two years to complete.

[2] City of St. Cloud NPDES/SDS Permit, (A04-1323, Minn. App. 2005), May 24, 2005.

The second point of disagreement, albeit minor, is the petitioner's inclusion of the words "scientifically-documented" in the suggested definition of "affects." The Agency's decisions on the effects of phosphorus loading on downstream resources and whether or not a limit should be imposed ("affects") are always data-driven and scientifically-documented. The Agency's proposed definition for "affects" does not use the term "scientifically-documented" but goes one step further by providing examples of the type of scientific data needed to show effects, such as increases in Chl-a, reductions in water clarity and an increase in algae blooms. The Agency feels the addition of this term is unnecessary.

As noted, both the petitioner's and Agency's proposed definition of "affects" clarify that when assessing the need for a TP effluent limit it is the effects from the individual point source that is considered. The Agency's proposed definition is below:

> [Minn. R. 7053.0255, subp.2] *B. "Affects" means a measurable increase in the adverse effects of phosphorus loading as determined by monitoring or modeling, including, but not limited to, an increase in chlorophyll-a concentrations, a decrease in water transparency, or an increase in the frequency or duration of nuisance algae blooms, from an individual point source discharge.*

3. MCEA Petition [VII.B. TP limit, need]

The petition from the Minnesota Center for Environmental Advocacy (MCEA, Exhibit A-30) includes several suggested changes to what the Agency proposes, which the Agency rejected in its response (Exhibit A-31). The Agency will respond to MCEA's main suggestion, but not to all the claims in their petition, in this SONAR, (see Exhibit A-31). The heart of the MCEA proposed language is quoted below.

> [Minn. R 7050.0211] *Subp. 1a.* ***Total phosphorus effluent limits.*** *Phosphorus removal to one milligram per liter shall be required of all discharges where the discharge of effluent contributes phosphorus, excess algae, or excess Biological Oxygen Demand to a downstream nutrient-impaired lake or reservoir.* …

In essence, the MCEA suggested approach would have the Agency:

- Continue to focus the setting of TP limits on the interpretation of "affects;"
- Assign TP effluent limits based on the "affects" of cumulative TP loading from all point sources in the watershed; and
- Link the setting of TP limits for discharges only when the receiving waterbodies have been determined to be impaired.

The setting of TP effluent limits based on the current rule for a discharge not directly to a lake relies on the demonstration of measurable "affects" in the downstream lake or reservoir. These determinations are made for each applicable permit on a case-by-case basis. The process requires a considerable amount of data and staff time for the analysis, including modeling the projected impacts and, finally, a decision as to whether the added load exceeds a threshold of measurable affects. These demonstrations have proven to be a source of uncertainty, potential controversy, and an invitation for litigation. For example, in the last several years MCEA has contested several NPDES permits when the Agency determined that the threshold of measurable affects from the individual source had not been exceeded and no TP limit was imposed.[3] The Agency believes that the MCEA proposal could acerbate the problems of resolving the "measurable affects" question, particularly when the cumulative affects of all point sources must be assessed. This could increase the uncertainties in the analysis and expand opportunities for controversy, delay and potential litigation.

The MCEA proposal includes the word "contributes," which we interpret to mean that any discharger that contributes any amount of TP to the downstream lake or reservoir would get a TP limit. That is, the "affects" analysis would be expanded to consider the cumulative load from all point sources in the watershed. As noted, this could further complicate the "affects" analysis. Or, the result could be that even the smallest discharge would get a TP limit regardless of how small they are and how little they contribute to the cumulative load. While any addition, no matter how small, contributes to the cumulative load (and nominally at least to eutrophication), controlling the very small sources may not be cost effective and might drain resources from the more significant larger sources (see percent contribution from small point sources in Tables II-13 and II-14). Also, this might force small dischargers to seek a variance from this provision on the basis of economic hardship.

MCEA's proposal appears to apply TP limits only in situations where the discharge is to a

[3] NPDES permits for Mankato, St. Cloud, Faribault and Owatonna.

waterbody already impaired due to excess nutrients. This is a curious proposal given MCEA's mission. Certainly the Agency does not want to wait until a lake becomes impaired before a TP limit is imposed for a discharger that impacts a downstream lake, and we do not believe that is MCEA's goal either.

MCEA also suggested deleting the Agency's proposed definition of "affects," and suggested changes to the proposed definitions of "lake," "shallow lake" and "reservoir." The need for a definition of "affects" became apparent in the assessment factor rulemaking, and it is an important part of the Agency's proposal. The separation of shallow lakes (< 15 feet deep) from lakes in general is an integral part of the Agency's proposed eutrophication standards. Also, the 14-day residence time is a vital component of the Agency's proposed definition of "reservoir." The Agency rejected these proposals (see Exhibits A-30 and A-31).

The Agency believes that its proposal is a better approach to advancing reductions in point source TP loading in the future at less cost in time and money to the Agency, and possibly less cost to outside parties as well by avoiding protracted contested case hearings or litigation. The Agency's approach is much more clear-cut and easy to implement. It requires neither a demonstration of "affects," nor an assessment of cumulative loading.

In summary, the Agency decided not to adopt the suggestions of either the CGMC or MCEA petition in favor of the Agency's own proposal.

C. CONTRIBUTION OF PHOSPHORUS FROM POINT SOURCES [VII. TP limit, need]

Phosphorus entering surface waters comes from both point and nonpoint sources. Point sources of phosphorus are relatively constant over time while nonpoint sources are largely dependent on the amount of precipitation falling on the landscape. The TP Loading Study introduced in SONAR Section II.A (Exhibit EU-6) estimated the amount of phosphorus entering Minnesota's surface waters from both point and nonpoint sources under three flow conditions, low, average and high. Total phosphorus (TP) and bioavailable phosphorus (BAP) contributions were evaluated in this study. TP is all forms of phosphorus present in water (unfiltered sample) while BAP is the fraction of total phosphorus that is more readily available for algal growth. Table II-12 shows the relative importance of point source loads as compared to nonpoint sources for the three flow conditions.

The study estimated phosphorus loading three ways.

1. Loading estimates using TP concentrations assuming TP in wastewater treatment plant effluents remains at their current reported levels;
2. Loading estimates using only the fraction of BAP in the point and nonpoint sources; and
3. Loading estimates using TP concentrations assuming all point source effluent concentrations were at 1 mg/L.

Significantly, the relative contribution of TP from point sources is reduced by half, and even more during high flow, when it is assumed that all point sources are meeting 1 mg/L. The relative contribution from point sources goes up by 13 - 17 percent when only BAP is considered in the analysis. This points out that more of the TP in point source effluents in readily available for algae growth than the TP from nonpoint sources.

Table II-12. Point Source TP and BAP Loads as a Percent of Total Load to Minnesota Surface Waters (Exhibit EU-6).

Conditions	River Flows		
	Low	Average	High
Loadings at current effluent flow and TP concentrations	45%	31%	19%
Loadings at current effluent flow and BAP concentrations	62%	47%	32%
Loadings at current effluent flow but effluent TP at 1mg/L	23%	15%	8%

The TP Loading Study also provides information of the relative contribution of TP to surface waters based on the size of the wastewater treatment plants. Table II-13 shows the greatest number of facilities are small in size (less than 0.2 mgd AWWDF). Relatively few small facilities have 1 mg/L TP effluent limits while 44 percent of medium and 62 percent of large facilities have 1 mg/L limits (two have lower limits).

The very large Metro Plant (Metropolitan Council Environmental Services, MCES) alone was 41 percent of the total statewide point source load. On December 31, 2005 the Metro Plant was required to meet a 1 mg/L effluent limit. The facility actually reduced effluent concentrations from 2.9 mg/L to less than 1 mg/L a year earlier. Because of the size of this single facility (251 mgd AWWDF), there are separate columns in Table II-13 to show relative loads with this facility at 2.9 mg/L and at 1 mg/L effluent TP concentrations. Among point sources, the greatest relative TP load is from large domestic facilities, industrial facilities have the second largest, and medium size domestic facilities contribute the third largest load.

Table II-13. Number of Facilities and Point Source TP Loads by Category as Percent of Point Source Total Load (Exhibit EU-6).

Facility Size and Type	No. of facilities:		Percent TP Loading at Current Plant Flows, And:		
	Total	With TP limits (% with limits)	Current effluent concentrations & Metro Plant at 2.9 mg/L	Current effluent concentrations & Metro Plant at 1 mg/L	Effluent concentrations, all facilities at 1 mg/L
POTW, Small (< 0.2 mgd)	316	49 (15%)	3%	4%	3%
POTW, Medium (0.2 – 1.0 mgd)	149	65 (44%)	7%	10%	7%
POTW, Large (> 1.0 mgd)	68	42 (62%)	72%	61%	69%
Privately Owned WWT Systems for Domestic Use	na	na	< 1%	< 1%	< 1%
Commercial & Industrial WWT Systems	na	na	18%	25%	21%

na = not available

The data in Table II-14 show the TP load reductions that would be achieved if **all** facilities met 1 mg/L TP at their current discharge flow rates now. Load reductions of nearly 50 percent for all point source categories would be expected if all current discharges were to discharge at 1 mg/L TP. The greatest reduction in TP load is from large POTWs followed by industrial facilities (Exhibit EU-6).

Table II-14. Percent TP Load Reduction by Category of Point Sources if All Point Sources Met a 1 mg/L Effluent Concentration (Metro Plant at 1 mg/L).

Category	Percent Reduction in TP Loading at Current Effluent Flow and TP Concentration of 1 mg/L
Small POTWs (< 0.2 MGD)	2 %
Medium POTWs (0.2 – 1.0 MGD)	6 %
Large POTWs (> 1.0 MGD)	26 %
Privately Owned WWT Systems for Domestic Use	< 1 %
Commercial Industrial WWT Systems	14 %
Total	49 %

The proposed extension of the TP limit will require 1 mg/L limits as facilities expand or build new, if they discharge more than 1,800 pounds of TP per year. We have equated an annual load of 1,800 lbs. to an AWWDF of 0.2 mgd. Thus, based on these data, the Agency's proposal could reduce TP loading by as much as 47 percent if fully implemented across the whole state. This is probably a best-case figure however as explained in the next paragraph.

A number of factors complicate estimating just how much the proposed extension of the TP limit will reduce TP loading in the future. Some factors result in an increase in TP loading while others do the opposite. It is important to understand that future **new** discharges will mean a TP **load increase** to surface waters, although at a reduced rate due to the 1 mg/L effluent limit under the Agency's proposal. Expanding dischargers getting a 1 mg/L effluent limit probably will result in overall load reductions since in most cases the expected concentration reductions will be greater than the flow increases. For example, a doubling in design flow combined with a four fold (e.g., 4 mg/L to 1 mg/L) reduction in TP concentrations would cut the load in half. Expansions will result in load reductions smaller than those shown in the Table II-14 however because the percentages in Table II-14 are calculated at current plant flows. Also, the rule as proposed will allow facilities that already have a 1 mg/L effluent limit to expand with no change in effluent concentration, resulting in a load increase to surface waters. However, other considerations could result in an effluent limit lower than 1 mg/L, such as a freeze of the mass loading or a more stringent limit required to meet the proposed eutrophication standards (Sections VI.M.4 and X.D). Finally, new TP limits will be phased in within the five-year life of the NPDES permits for the impacted facilities. While the proposed extension of the 1 mg/L effluent limit will achieve nutrient load reductions to the state's surface waters, at some future

time the reduction gains achieved will be at least partially offset by continued population growth (particularly in the attractive lake-rich counties) and the resulting need to increase wastewater flows.

D. IMPACTS OF NUTRIENTS IN RIVERS AND STREAMS [VII. TP limit, need]

No one questions the impact excess nutrients can have on lakes and other static bodies of water, but it is less well known that excess nutrients can have significant impacts on rivers and streams. A common misconception is that, while nutrients (i.e., phosphorus) may be present in relatively high concentrations in moving water systems, because the water is moving there is not enough time for the plant community to "take advantage" of the extra nutrients; and that most of the TP load is flushed out and moved harmlessly downstream. Aquatic scientists have reported for decades that nutrients impact rivers and streams.[4] But until recently these impacts have gone largely undocumented, at least by governmental water quality monitoring programs. The increased nutrient and biological monitoring of rivers and streams by the Agency, other states and federal agencies is providing new documentation of negative impacts of nutrients on rivers and streams.

The Agency has nutrient and algal abundance data from several rivers and streams around the state that show excess phosphorus increases the abundance of suspended algae in rivers. Recent studies and monitoring data on river systems consistently show negative impacts from nutrients where in the past it might have been assumed impacts would be negligible. In one case, the lower Minnesota River, excess phosphorus and very abundant algae have caused dissolved oxygen levels to fall below standards. This led to the Minnesota River being listed as impaired due to nutrients and the subsequent TMDL. The effects of excess nutrients in the lower Minnesota River was manifested by low dissolved oxygen (DO) levels caused by algal respiration and the die-off and decay of algae, which consume oxygen.

In a published journal article and subsequent report, Agency staff members Heiskary and Markus looked at the impacts of nutrients on several medium to large rivers throughout Minnesota (Exhibits PL-7 and PL-8). Monitoring took place over three years. They document several impacts, such as relationships between increased phosphorus with increased algae (Chl-a), increased in-river biochemical oxygen demand (BOD_5), increased daily DO changes and poorer

[4] For example, Hynes, H.B.N. 1970. The ecology of running water. University of Toronto Press. 555 p.

fish and invertebrate indices of biological integrity (IBI). Highly significant regression equations were established between TP, Chl-a and BOD_5. Summer average Chl-a concentrations ranged from about 3 to 120 µg/L in the water column of rivers sampled (1999 and 2000). As stated, as algal biomass increases the demand on oxygen resources also increases. The direct relationship between river TP and Chl-a has been documented in other published research as well[5]. Also other states, as part of their programs to develop and adopt nutrient standards for rivers, are documenting similar relationships between increased nutrients and negative responses in rivers and streams.

The increased amplitude of daily DO cycles also is an indicator of increased algal growth. Abundant algae generate oxygen during the day through photosynthesis driving concentrations up; at night photosynthesis stops but respiration continues dropping DO concentration to low levels. Of the variables reviewed, Chl-a and BOD_5 exhibit the highest correlation (inverse relationships) with indices (IBI scores) measuring the quality of the fish and invertebrate communities, although IBI scores are also influenced by habitat quality. Based on these negative responses related to changes in TP concentrations, the report recommends a strategy of maintaining existing TP concentrations for protection of good quality resources; and reductions in TP to achieve improved BOD_5 and Chl-a levels, reductions in the magnitude of DO cycles, and improvements in other response variables in impacted waterbodies.

Excess phosphorus loading to rivers and streams is likely to increase the growth of attached algae as well, which appears as the green "slime" or long green filaments growing on rocks and other substrates. This is a more typical response to added nutrients in smaller, shallower streams than in larger rivers. Impacts to the rivers themselves is a concern, but several major river systems in Minnesota eventually drain to a lake or reservoir, such as Lake Pepin, Lake of the Woods or Lake Winnipeg in Manitoba. Once there, the phosphorus loading can be expressed in the well known negative effects of cultural eutrophication in static waterbodies, such as algae blooms and loss of water clarity.

Algal growth does not cease during the winter season. While most assessments on river trophic conditions focus on warmer seasons, algal growth can also be excessive in winter. Algae can grow under the ice in rivers and in backwater areas, depending on light conditions. Monitoring of the Minnesota River at river mile 39.4 (39.4 miles upstream from the mouth) showed algal bloom conditions throughout the winter of 1990/1991. Average Chl-a at this site was 177 µg/L in December through February with a maximum concentration of 454 µg /L. These Chl-a levels

[5] For example, Van Nieuwenhuyse and Jones 1996, and Basu and Pick 1996

indicate severe to very severe algae bloom conditions. BOD_5 concentrations were also elevated during this time, and daytime DO was higher than saturation levels. Diurnal DO change was not monitored but can be expected to be large with such algal populations. This is not an isolated condition at this one monitoring location. Additional river monitoring locations exhibit elevated winter Chl-a concentrations, although not every winter season.

Phosphorus discharged in the winter can adhere to particulates. As particulates move downstream some will settle to the bottom in slack-water reaches and pools in the river system. Depending on where these particulates settle out, the attached phosphorus may become resuspended or released and available for algal growth during the summer months. The Mississippi River, for example, has extensive backwater areas, which respond more like lakes to nutrient inputs than rivers. Backwater areas often act as sinks for sediments rich in nutrients, which can contribute to eutrophication during the summer.

Minnesota has the enviable position geographically of being "upstream" of much of the rest of North America. Minnesota is home to the headwaters of three major river basins, the Mississippi, Red/Rainy and Lake Superior. This means that, for most of the state, we don't have to be concerned about pollutant loading via rivers from states or provinces upstream of us. However, our downstream neighboring states or provinces may have cause to be concerned about what we send downstream to them. Minnesota has an obligation to consider the downstream ramifications of our actions. Nutrients that are carried downstream beyond Minnesota's borders can have impacts far downstream. For example, the load of nitrogen and phosphorus from the Minnesota River contributes to the hypoxia problem (a large zone of low oxygen levels) far downstream in the coastal waters off the mouth of the Mississippi River.

In conclusion:

- The deleterious impacts excess nutrients have on rivers, streams and run-of-the-river reservoirs has been known for decades and is being well documented with new data. Organisms at all levels of the food chain, algae, higher plants, invertebrates and fish, can be negatively impacted.
- The Agency has documented negative responses in Minnesota rivers. High Chl-a, loss of dissolved oxygen and wide swings in daily dissolved oxygen levels, for example, have been documented.
- Impacts are not limited to the warmer months. Winter nutrient loading can result in spring blooms of diatoms, zooplankton, and bacteria. These blooms, through their release of bio-available nutrients can exacerbate summer blooms further downstream.

E. PROMULGATION APPROPRIATE ACTION [VII. TP limit, need]

In general the Agency has an obligation to promulgate in rule policies and practices it has implemented based on guidance and policy documents. Implemented policies that have economic repercussions especially should be adopted into administrative rules. The acceptance of 1 mg/L TP limits under the Phosphorus Strategy by dischargers (for a variety of reasons) has made this a very successful policy for over five years. It has resulted in dramatic reductions in the amount of TP discharged, but it has had economic ramifications as well. This policy was formally approved by the Agency Board in March 2000 which enhanced its authority. Promulgation of the Strategy is the proper course of action. The rulemaking process means the Agency must:

- Follow the requirements of the Administration Procedures Act (Minn. Stat. ch. 14);
- Assess the economic impacts;
- Contact all potentially impacted parties;
- Provide ample opportunity for public involvement;
- Publish a formal notice in the *State Register*;
- Hold public hearings; and
- Respond to comments.

By promulgating what essentially is being implemented now under the Strategy, the Agency is assuming the responsibility to meet all the burdens listed above. Most significantly, this process guarantees public exposure and the assessment of costs, steps that go beyond what the Agency felt obligated to do for the development and implementation of the Strategy.

F. CONSOLIDATION OF EXISTING AND PROPOSED TP LIMITS [VII. TP limit, need]

This Section is largely a repeat of Section V.E.10 in SONAR Book I that discusses the need for consolidating and reorganizing all the phosphorus effluent (TP) limit provisions in one place, including those now in Minn. R. ch. 7065. Consolidation is associated with the proposed extension of the TP limit to new and expanding dischargers. The proposed additions and changes to the TP effluent limit provisions, including possible exemptions to the extension of the TP limit, requiring treatment to the fullest practicable extent and options for effluent limit averaging periods, are treated separately in Sections VII.G to VII.J.

The consolidation of all TP limit provisions in a newly created subpart of Minn. R. 7053.0255 will bring all the provisions that deal directly with TP limits into one place in the proposed new rule, Minn. R. ch. 7053. The separation of Minn. R. ch. 7050 into two rules provides an ideal time to consolidate the TP effluent limit requirements in one place and to repeal the outdated Minn. R. ch. 7065 (see Sections VI.J.3 and X.J in SONAR Book I).

The title of proposed Minn. R. 7053.0255 includes the term "point source" because the TP limits apply only to point source discharges. The definition of "other wastes" is broadly inclusive and some of the sources listed in the definition could be interpreted as nonpoint sources (Minn. Stat. § 115.01, subd. 9). Including "point source" in the title will eliminate any confusion. Proposed Minn. R. 7053.0255 in its entirety follows.

7053.0255 PHOSPHORUS EFFLUENT LIMITS FOR POINT SOURCE DISCHARGES OF SEWAGE, INDUSTRIAL, AND OTHER WASTES.

Subpart 1. ***Scope****. The phosphorus effluent limits in this part are in addition to the effluent limits specified elsewhere in this chapter. In the event of any conflict between this part and other applicable regulations, the more stringent requirement applies.*

Subp. 2 ***Definitions****. For the purposes of this part, the following definitions apply. Other relevant definitions are found in part 7050.0150, subpart 4.*

A. "122-day ten-year low flow" or "$122Q_{10}$" means the lowest average 122-day flow with a once in ten-year recurrence interval. A $122Q_{10}$ is derived using the same methods used to derive a $7Q_{10}$, and the guidelines regarding period of record for flow data and estimating a $7Q_{10}$ apply equally to determining a $122Q_{10}$ as described in part 7053.0135, subpart 3.

B. "Affects" means a measurable increase in the adverse effects of phosphorus loading as determined by monitoring or modeling, including, but not limited to, an increase in chlorophyll-a concentrations, a decrease in water transparency, or an increase in the frequency or duration of nuisance algae blooms, from an individual point source discharge.

C. "Expanded discharge" means a disposal system that after July 1, 2007, discharges more than 1,800 pounds of total phosphorus per year to a surface water on an annual average basis, and increases in wastewater treatment capacity as indicated by an

increase in the:

(1) design average wet weather flow for the wettest 30-day period for point source dischargers of sewage with a continuous discharge, typically a mechanical facility;

(2) design average wet weather flow for the wettest 180-day period for point source dischargers of sewage with a controlled discharge, typically a pond facility; or

(3) design average daily flow rate for dischargers of industrial or other wastes.

D. "Lake" means an enclosed basin filled or partially filled with standing fresh water with a maximum depth greater than 15 feet. Lakes may have no inlet or outlet, an inlet or outlet, or both an inlet and outlet.

E. "Measurable increase" or "measurable impact" means a change in trophic status that can be discerned above the normal variability in water quality data using a weight of evidence approach. The change in trophic status does not require a demonstration of statistical significance to be considered measurable. Mathematical models may be used as a tool in the data analysis to help predict changes in trophic status.

F. "New discharge" means a discharge that was not in existence before July 1, 2007, and discharges more than 1,800 pounds of total phosphorus per year.

G. "Reservoir" means a body of water in a natural or artificial basin or water course where the outlet or flow is artificially controlled by a structure such as a dam. Reservoirs are distinguished from river systems by having a hydraulic residence time of at least 14 days. For purposes of this item, residence time is determined using a flow equal to the $122Q_{10}$ for the months of June through September, a $122Q_{10}$ for the summer months.

H. "Shallow lake" means a lake with a maximum depth of 15 feet or less or with 80 percent or more of the lake area shallow enough to support emergent and submerged rooted aquatic plants (the littoral zone). It is uncommon for shallow lakes to thermally stratify during the summer. The quality of shallow lakes will permit the propagation and maintenance of a healthy indigenous aquatic community and they will be suitable for boating and other forms of aquatic recreation for which they may be usable. For purposes of this chapter, shallow lakes are differentiated from wetlands, lakes, and reservoirs on a case-by-case basis. Wetlands are defined in part 7050.0186, subpart 1a.

*Subp. 3. **Total phosphorus effluent limits**.*

A. Phosphorus removal to one milligram per liter is required when subitems 1, 2, or 3 applies:

(1) the discharge of effluent is directly to or affects a lake, shallow lake or reservoir;

(2) the discharge is to the specific basins and water bodies designated in subpart 5; or

(3) the discharge is new or expanded as defined in subpart 2, except when the discharger can demonstrate to the commissioner that the discharger qualifies for an alternative phosphorus limit as provided in subpart 4.

B. ~~In addition,~~ If a phosphorus effluent limit is required under item A, removal of nutrients from all wastes ~~shall~~ must be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients ~~by~~ under this ~~subpart~~ part are subject to the variance provisions of ~~part~~ parts 7000.7000 and 7053.0195.

*Subp. 4. **Alternative phosphorus effluent limits for new or expanded discharges**. New or expanded discharges subject to a one milligram per liter phosphorus effluent limit in subpart 3, item A, subitem 3 may request an alternative limit or no limit if one or more of items A to C apply. New or expanded discharges are defined in subpart 2. The exemptions in this subpart do not apply to facilities that discharge directly to or affect a lake, shallow lake or reservoir or to discharges to the waters listed in subpart 5. Dischargers seeking an alternative limit due to very high per capita treatment costs or economic hardship must apply for a variance under parts 7000.7000 and 7053.0195.*

The information submitted to the commissioner for consideration of an alternative limit must include, at a minimum, a description of the treatment technology used, influent and effluent total phosphorus concentrations, a phosphorus management plan for the facility, descriptions of any measures already taken to reduce phosphorus sources to the facility, and expected reductions in phosphorus concentrations following implementation

of the phosphorus management plan. The discharger may qualify for an alternative total phosphorus limit or no limit if it can demonstrate:

A. the discharge is to or upstream of a water body listed on the applicable impaired water list (section 303(d) of the Clean Water Act) and the total maximum daily load study is complete and approved by the United States Environmental Protection Agency at the time the new or expanding facility is in the planning and design phase. The total maximum daily load study must have considered impacts from phosphorus loading on the impaired water body;

B. the environmental benefits to be achieved by meeting a phosphorus limit are outweighed or negated by the environmental harm caused by meeting a limit; or

C. the treatment works, regardless of the type of treatment technology, must use chemical addition to achieve compliance with the one milligram per liter limit, and the discharge is to a receiving stream in a watershed listed in subitems (1) to (3). In this case the discharger may be granted a seasonal one milligram per liter limit, applicable from May 1 through September 30 and not applicable from October 1 through April 30:

(1) the lower Mississippi River and its tributaries from the mouth of the Chippewa River in Wisconsin to the Minnesota border;

(2) the Bois de Sioux and Red Rivers and their tributaries from the southern end of Lake Traverse at Browns Valley to the Canadian border; and

(3) the Missouri, Des Moines and Cedar Rivers and their tributaries in Minnesota.

Subp. 5 ***Designated waters****. The one milligram per liter phosphorus limit established in subpart 3 applies to the waters designated in items A to F.*

A. All intrastate waters lying within the drainage basin of Lake Superior in the counties of Aitkin, Carlton, Cook, Itasca, Lake, Pine, and St. Louis (Townships 45 to 65 North, Ranges 7 East to 23 West).

B. The interstate waters of Lake St. Croix in Washington County (Townships 26 to 30 North, Range 20 West).

C. The St. Louis River from its source at Seven Beaver Lake (Township 58 North,

Range 12 West) to and including St. Louis Bay (Townships 49 and 50 North, Ranges 14 and 15 West) and Superior Bay (Townships 49 and 50 North, Ranges 13 and 14 West).

D. The Mississippi River from its source to the Blandin Dam at the outlet of Paper Mill Reservoir in the City of Grand Rapids approximately 400 feet upstream from the bridge on U.S. Highway 169 including Lake Andrusia (Township 146 North, Range 31 West), Lake Bemidji (Townships 146 and 147 North, Range 33 West), Cass Lake (Townships 145 and 146 North, Ranges 30 and 31 West), Lake Itasca (Township 143 North, Range 36 West), Pokegama Lake (Townships 54 and 55 North, Ranges 25 and 26 West), and Winnibigoshish Lake (Townships 145, 146, and 147 North, Ranges 27, 28, and 29 West).

E. The Little Minnesota River and Big Stone Lake from the South Dakota border crossing to the outlet of Big Stone Lake at the dam immediately upstream from the U.S. Highway 12 bridge in Ortonville.

F. Albert Lea Lake (Township 102 North, Ranges 20 and 21 West) in Freeborn County.

*Subp. 6. **Averaging period for phosphorus limit**. The phosphorus limit required under subpart 3 must be a calendar month arithmetic mean unless the commissioner finds, after considering the criteria listed in items A and B, that a different averaging period is acceptable. In no case shall the one milligram per liter limit exceed a moving mean of 12 monthly values reported on a monthly basis, or a simple mean for a specified period, not to exceed 12 months. Calendar month effluent limits in effect on February 7, 2000, must remain in effect unless an assessment of the criteria listed in items A and B indicate a different averaging period is acceptable. An ~~different~~ averaging period other than monthly is acceptable when:*

A. ~~the effects of the phosphorus loading from the facility on the receiving water or downstream water resources is generally not measurable.~~ there is no measurable or predictable difference in the adverse effects of the phosphorus loading from the facility on the receiving water or downstream water resources compared to the loading that would result using a 30-day average limit; and

B. the treatment technologies being considered offer environmental, financial, or other benefits

In summary, the consolidation of the TP limits in one place is needed. This will simplify application of TP limits as they become more commonplace in permits. A reorganization of the TP limits is needed to accommodate the proposed extension of the TP limit and the proposed move of the waterbody-specific limits, now in Minn. R. ch. 7065, into Minn. R. 7053.0255.

G. NEW LANGUAGE, SCOPE AND DEFINITIONS, MINN. R. 7053.0255, SUBPS. 1 and 2. [VII. TP limit, need]

Proposed subpart 1 of Minn. R 7053.0255 is a brief statement of the scope of this part, followed by eight pertinent definitions in subpart 2. The definitions are for terms used in Minn. R. 7053.0255 as listed below. The need for these definitions is discussed in Section VI.B of SONAR Book I.

- $122Q_{10}$
- Affects
- Expanded discharge
- Lake
- Measurable increase or measurable impact
- New discharge
- Reservoir
- Shallow lake

H. NEW LANGUAGE, TP LIMITS AND EXEMPTIONS, MINN. R. 7053.0255, SUBP. 3. [VII. TP limit, need]

1. TP Limits [VII.H. TP limit, need]

Proposed new Minn. R. 7053.0255, subp. 3 contains the 1 mg/L TP limits for three categories of waterbodies or situations (see language in Section VII.F).

The first category (subitem (1)) is the TP limit applicable to discharges directly to or affecting a lake, shallow lake, or reservoir. This is the existing TP limit that has been in Minn. R. ch. 7050 since 1973. This provision is not being changed but is being moved to the new location. The term "shallow lake" is being added because the Agency plans to make a distinction between "shallow" and "deep" lakes in the proposed eutrophication standards. The application of the

existing TP limit (existing Minn. R. 7050.0211, subp. 1a) has not differentiated lakes by depth in the past. This addition is needed to be sure the existing TP limit continues to be applicable to all lakes, both deep and shallow, as has been the case since 1973. This addition does not change the existing TP limit or how it is applied.

The second category (subitem (2)) is the TP limit applicable to dischargers to any of the specific waterbodies listed in the existing Minn. R. ch. 7065. The Agency proposes to move these TP limits from Minn. R. ch. 7065 to Minn. R. 7053.0255, subp. 5. Again, this will consolidate the TP limits in one place and allow for the repeal of Minn. R. ch. 7065 (see Sections VI.J.3 and X.J in SONAR Book I).

The third category (subitem (3)) is the proposed 1 mg/L TP limit applicable to new or expanding discharges that discharge more than 1,800 pounds of TP per year. This subitem references the three possible exemptions from a TP effluent limit that a new or expanding facility may qualify for upon request. The exemptions in Minn. 7053.0255, subp. 4 are needed to allow dischargers potential relief from a TP limit in certain situations.

2. Possible Exemption to TP Limit if TMDL is Complete [VII.H. TP limit, need]

Proposed Minn. R. 7053.0255, subp. 4, item A states that if a TMDL for a waterbody impaired due to nutrients or a nutrient-related pollutant has been completed, and the new or expanding facility is in a planning or design phase, the TMDL may determine the TP effluent limit to be included in the NPDES permit for that discharger (see language in Section VII.F). The waterbody must be on the 303(d) list because of exceedance of the eutrophication standards or because the excess nutrients have caused exceedances of another standard, such as dissolved oxygen. This provision applies in situations where the TMDL is complete and approved by EPA, and the reductions in TP loading from point sources needed to restore the waterbody has addressed the possible need for permit limits. The new or expanding facility must be in a planning and design phase at the time the TMDL is approved to incorporate the TMDL's recommendations into the permit. The TMDL-determined limit may be 1 mg/L or lower than 1 mg/L. And, while probably less likely, if the TMDL determines that a limit more lenient than 1 mg/L or no limit at all is needed then the permit will reflect those recommendations. This potential exemption applies to any facility that discharges to the impaired waterbody or to an upstream waterbody flowing into the impaired waterbody.

Originally the Agency had proposed rule language that automatically allowed the TMDL to determine the TP effluent limit if certain conditions were met. That is, dischargers would not have to petition for the TMDL exemption. However, as the Agency has gained more experience with nutrient-caused or nutrient-related TMDLs, it has become clear that the solutions recommended by a TMDL are complex, somewhat site-specific, and may not be applicable to all discharges in the watershed. Developing rule language that tries to cover all the possible situations and conditions becomes too complex and awkward. Therefore, the Agency is now proposing to include the "TMDL exemption" as one of three potential exemptions to the TP limit that a discharger can apply for. The Agency believes that this is the best way to deal with the site-specific aspects of each TMDL situation (see *reasonableness* section, Section IX.H.3).

In summary, a provision is needed that allows, upon request, the TMDL to determine a TP limit if certain conditions are met. The basic conditions are:

- The discharge is to or upstream of a waterbody listed on the 303(d) impaired waters list;
- The total maximum daily load has considered impacts from phosphorus loading on the impaired waterbody;
- The total maximum daily load is complete and approved by the EPA at the time the new or

expanding facility is in the planning and design phase; and

- The phosphorus loading from the new or expanding discharge is included as part of the point source waste load allocation in the total maximum daily load study. In other words, this exemption does not apply to discharges upstream of the impaired waterbody but outside the scope of the TMDL study.

The purpose of TMDLs is to assign point and nonpoint source loading reductions necessary to bring the impaired water into compliance with standards. If the TMDL is approved at the time the expansion or new construction is being planned, and the other site-specific conditions are met, it is appropriate for the TMDL to determine the TP permit limit. By placing the burden on the discharger to request a TMDL-related exemption, the Agency is not trying to put roadblocks in the way of dischargers, or discourage dischargers from petitioning the Agency. If it is clear that the TMDL-determined limits are appropriate in a particular case, the Agency will advise the discharger to submit a petition. The granting of an exemption in these situations should be straightforward and proceed smoothly.

3. Possible Exemption to TP Limit if Environmental Harm Outweighs Gain [VII.H. TP limit, need]

The Agency's overall goal and purpose is to improve water quality and environmental conditions through its regulations and programs. If it can be demonstrated that an action, in this case the imposition of a TP permit limit, results in net harm to the environment, then that action should be modified or not be taken at all, consistent with federal and state laws. The opportunity to demonstrate such a situation is needed in the context of the proposed extension of the TP effluent limit. The wording of this exemption is simple and straightforward, and it gives the Agency the latitude needed to evaluate the data presented and decide if the exemption should be granted. The Agency believes latitude is needed in this context because each situation will be unique and must be evaluated on a case-by-case basis (language in Section VII.F). The Agency Citizens' Board may be asked to approve the staff decision on an exemption and the permittee can contest the decision through the permit process.

4. Possible Exemption to TP Limit, No Winter Limit in Certain Watersheds [VII.H. TP limit, need]

Excess nutrients may be less of a concern during the winter months in some Minnesota watersheds than in others. The Agency is proposing to provide the opportunity for a discharger that must use chemicals to meet the TP limit to show that a winter limit (from October 1 through

April 30) is not needed. This potential exemption is needed because there may be evidence available that shows the loading of TP during the winter in the designated watersheds does not contribute to an excess nutrient problem downstream (language in Section VII.F). The watersheds, which includes all their tributaries in Minnesota, are shown below.

- Lower Mississippi River below Lake Pepin to the Iowa border;
- Bois de Sioux and Red Rivers to the Canadian border;
- Missouri, Des Moines, and Cedar Rivers to the Minnesota border.

It is important to restate that this exemption, and the exemptions discussed in the previous sections, is not automatically granted. The discharger must request an exemption and submit the data the Agency will need to evaluate the merits of the request.

I. CLARIFICATION OF FULLEST PRACTICABLE EXTENT LANGUAGE, MINN. R. 7053.0255, SUBP. 3. [VII. TP limit, need]

The Agency believes that with the proposed extension of the TP limit to new and expanded dischargers there is a need to clarify the "fullest practicable extent" language in Minn. 7053.0255, subp. 3, item B. This provision, which has been in the water quality rules since 1971, says that wastewater treatment plants should remove TP from the effluent to the "fullest practicable extent." The provision showing the proposed changes is shown below.

> [Minn. 7053.0253, subp. 3] *B.* ~~*In addition,*~~ *If a phosphorus effluent limit is required under item A, removal of nutrients from all wastes* ~~*shall*~~ *must be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients* ~~*by*~~ *under this* ~~*subpart*~~ *part are subject to the variance provisions of* ~~*part*~~ *parts 7000.7000 and 7053.0195.*

There has been some question and disagreement about whether this provision:

- Applies to any and all dischargers regardless of whether or not they have a 1 mg/L TP limit, or
- Applies only to dischargers that have a 1 mg/L permit limit.

The Agency believes strongly that the latter interpretation is the correct one and this interpretation needs to be clarified (see discussion of history in Section IX.G.4). It can be

clarified with minor changes to the paragraph.

J. CLARIFICATION OF AVERAGING PERIOD FOR TP LIMITS, MINN. R. 7053.0255 SUBP. 6. [VII. TP limit, need]

In 2000 the Agency added language to Minn. R. 7050.0211, subp. 1a that allowed the option of setting TP effluent limits in NPDES permits that could be averaged over a period longer than the previously required one month. TP limits with a longer averaging period are usually 12-month moving averages; or, in a few cases, the limits are simple calendar-year averages. Since this change to the rule, approximately 35 municipal dischargers and several industrial discharges have been given a 1 mg/L TP limit with an averaging period longer than one month (numbers include both interim and final TP permit limits).

The Agency is proposing to clarify one of the two criteria the Commissioner can use to decide when a TP limit with a longer averaging period is appropriate, and to make some very minor clarifying language changes. The proposed changes, which will be in the new Minn. R. 7053.0255, subp. 6 are repeated below:

> *Subp. 6.* ***Averaging period for phosphorus limit****. The phosphorus limit required under subpart 3 must be a calendar month arithmetic mean unless the commissioner finds, after considering the criteria listed in items A and B, that a different averaging period is acceptable. In no case shall the one milligram per liter limit exceed a moving mean of 12 monthly values reported on a monthly basis, or a simple mean for a specified period, not to exceed 12 months. Calendar month effluent limits in effect on February 7, 2000, must remain in effect unless an assessment of the criteria listed in items A and B indicate a different averaging period is acceptable. An ~~different~~ averaging period other than monthly is acceptable when:*
>
> *A. ~~the effects of the phosphorus loading from the facility on the receiving water or downstream water resources is generally not measurable.~~ there is no measurable or predictable difference in the adverse effects of the phosphorus loading from the facility on the receiving water or downstream water resources compared to the loading that would result using a 30-day average limit; and*
>
> *B. the treatment technologies being considered offer environmental, financial, or other benefits.*

As mentioned before, the proposed consolidation of TP limits into one part, plus the other proposed changes to the TP effluent limit rule, provide an opportunity to make this proposed clarification. The change will not affect the process the Agency uses now to decide case-by-case when a longer averaging period is appropriate.

The purpose of proposing the longer averaging period in 1999 is summed up by the following two quotes from the SONAR for the 1999 triennial review of Minn. R. ch. 7050.

> Page 25. "This change is needed to encourage the use of treatment technologies other that chemical addition to remove phosphorus, specifically to encourage the use of the biological phosphorus removal process, and to promote the implementation of the Agency's phosphorus reduction strategy."
>
> And on page 91: "In conclusion, the proposal to allow a longer averaging period for the phosphorus limit of 1 mg/L is reasonable because it will, 1) facilitate the reduction of phosphorus loading to watersheds, 2) encourage the use of the Bio-P technology, 3) facilitate the implementation of the Agency's phosphorus control strategy, and 4) allow flexibility in the implementation of, and choice of treatment options to meet, the phosphorus limit."

The language in the existing Minn. R. 7050.0211, subp. 1a includes two criteria the Commissioner and his/her staff uses to determine when the longer averaging period is appropriate. The existing first criterion, "*the effects of the phosphorus … is generally not measurable*" seems inconsistent in general with the way the current TP limit has been implemented over the years, which is to require a demonstration of measurable "affects" in the downstream resource due to the TP loading from the individual discharger.

The Agency is proposing to clarify the language in the first criterion so that the lack of a measurable or predictable impact (e.g., though modeling) relates to the difference in the loading that would occur with a limit averaged over a longer period compared to the loading that would occur with a monthly limit. This clarification is needed in light of the Agency's proposed definition of the word "affects" and the extension of the TP limit to new and expanded dischargers that discharge more than 1,800 pounds of TP per year. The Agency is proposing no change to the second criterion.

K. SUMMARY, NEED [VII. TP limit, need].

In summary, the Agency's fundamental rationale for the proposed extension of the phosphorus limit is listed below:

- To help reduce phosphorus loading to essentially all watersheds in Minnesota in the knowledge that anthropogenic phosphorus contributes to water quality degradation.
- To be proactive in the effort to protect waterbodies that are not impaired.
- To help achieve watershed-specific or TMDL driven nutrient reduction goals.
- To help protect downstream water resources including those beyond Minnesota's borders.
- To support and encourage consideration of the phosphorus removal capabilities using biological phosphorus removal treatment technologies.
- To codify in rule the progress in phosphorus removal that has taken place since March 2000 under the Phosphorus Strategy.
- Implementation is straightforward, which should help reduce the number of contested case hearings and legal challenges.
- The proposal is consistent with statewide efforts to improve Minnesota's water quality through major initiatives at the executive and legislative levels of state government.

VIII. REASONABLENESS OF PROPOSED EXTENSION OF PHOSPHORUS EFFLUENT LIMIT, REQUIRED INFORMATION

A. INTRODUCTION [VIII. TP limit, reasonableness]

Minnesota Stat. § 14.131 requires that this SONAR include information about 11 aspects of the potential impacts of this rulemaking. The discussion in Sections VIII.B to VIII.L that follows pertains only to the proposed extension of TP limits to new and expanded discharges above a certain size.

B. CLASSES OF PERSONS AFFECTED BY THE PROPOSED RULE AMENDMENTS, INCLUDING THOSE CLASSES THAT WILL BEAR THE COSTS AND THOSE THAT WILL BENEFIT [VIII. TP limit, reasonableness]

Most citizens of Minnesota should benefit from the proposed extension of the TP limit to new and expanded discharges that discharge more than 1,800 pounds of TP per year. The benefits will be largely intangible, and the expected improvements in water quality are likely to go unnoticed by most Minnesotans. Reduced loading of TP from point sources should reduce the growth of attached algae in streams and rivers, and suspended algae in larger rivers, and it could improve dissolved oxygen conditions in rivers already impacted by excess nutrients. The Agency realizes that the costs of meeting TP limits for new and expanding facilities will not be borne equally by Minnesota citizens. People living in communities just large enough to surpass the *de minimis* load of 1,800 pounds per year (equates approximately to a population of 2000) as a result of a planned expansion or new wastewater treatment plant, could see higher costs than those living in larger communities, or people in rural areas with individual septic systems.

A conservative or high estimate of the total capital and total annual operation and maintenance (O&M) costs (i.e., annual O&M costs for five years) for 35 POTWs in a range of sizes, projected to be impacted by the proposed change to the TP limit over the next five years, is estimated to be about $134 million. The number of POTWs (35) projected to be impacted in the next five years is based on the number of new and expanding facilities that got TP limits from March 2000 through December 2005. The $134 million figure assumes that the limits for all 35 facilities go into effect today, and all use chemical addition as the sole means of meeting a 1 mg/L limit with

no benefit from Bio-P. To repeat, this figure is the total capital and total annual O&M costs for all 35 POTWs projected to be impacted over the next five years. Most of these TP treatment costs will be incurred regardless, even if the Agency did not propose the extension of the TP limit, as explained in Section XI.F.

A conservative or high estimate of the total capital and total O&M costs to industries to be impacted by the proposed change to the TP limit over the next five years, is estimated to be about $5 million. This estimate is based on projections of six new or expanded facilities in seven industrial categories getting TP limits over the last five years. Similar to the estimates for POTWs this figure assumes that the limits go into effect today, and all use chemical addition to meet a 1 mg/L limit.

The municipal and industrial costs and the methods used to arrive at the estimates are discussed in detail in Sections XI.D and XI.E, respectively.

C. ESTIMATE OF THE PROBABLE COSTS TO THE AGENCY AND OTHER AGENICES OF IMPLEMENTING AND ENFORCING THE RULE AMENDMENTS AND ANY ANTICIPATED EFFECT ON STATE REVENUES [VIII. TP limit, reasonableness]

The proposed extension of the TP limits will not significantly affect Agency staff needs or work loads and overall Agency costs. As stated, to a large extent the Agency has been implementing the proposed extension of the TP limit for the last five years under the Phosphorus Strategy. The Agency has two staff people whose primary responsibility is to review permits being reissued, particularly the permits for new or expanding facilities, for possible inclusion of a TP limit in the NPDES permit. This level of staff commitment is not likely to change due to the proposed extension of the TP limit.

No other state or federal agency will incur any costs due to this proposed change, because it is the sole responsibility of the Agency to issue NPDES permits and to determine the appropriate effluent limits (subject to public comments, possible contested case hearings, and EPA review). The Department of Natural Resources regularly reviews NPDES permits when they go on public notice, and they often provide comments to the Agency. The MDNR looks for consistency between the proposed effluent limits and their policies and responsibilities for protection of surface waters. This is an ongoing activity by the MDNR and the proposed change should not change their current staff and time requirements. There should be no impact on state revenues.

The Environmental Protection Agency (EPA) has an interest in these proposed amendments. The EPA has been an active partner in the promulgation of Minnesota's standards for lakes. Under the Clean Water Act, the EPA Regional Administrator (Region 5 in Chicago) must approve all changes to Minnesota's water quality standards (40 CFR 131.5).

D. DETERMINATON OF WHETHER THERE ARE LESS COSTLY OR LESS INTRUSIVE METHODS FOR ACHIEVING THE RULE AMENDMENT'S PURPOSE [VIII. TP limit, reasonableness]

To not promulgate the proposed extension of the TP effluent limit to new and expanding dischargers would be less costly and less intrusive. In all probability, the Agency would continue to put TP limits in NPDES permits based on the Phosphorus Strategy as we have been doing for the last five to six years. But the Agency believes that inaction risks losing the momentum for point source TP reductions established under the Strategy. In the absence of rules there is the possibility of retreat from the gains achieved. As explained, the Agency believes that codification of the Strategy is the more straightforward course of action and the best way to maintain the momentum in reducing TP loading from point sources.

E. DESCRIBE ANY ALTERNATIVE METHODS FOR ACHIEVING THE PURPOSE OF THE PROPOSED RULE AMENDMENTS THAT THE AGENCY SERIOUSLY CONSIDERED AND THE REASONS WHY THEY WERE REJECTED IN FAVOR OF THE PROPOSED AMENDMENTS [VIII. TP limit, reasonableness]

The Agency evaluated the options suggested in the CGMC and MCEA petitions, but neither option would achieve the purpose of the rule amendments as effectively in the opinion of the Agency. The Agency's reasons for rejecting the petitioner's approaches are described in Section VII.B. Other than doing nothing, the options presented by the petitioners are the only options the Agency has seriously considered outside of what is being proposed.

F. ESTIMATE OF THE PROBABLE COSTS OF COMPLYING WITH THE PROPOSEPD RULE AMENDMENTS, INCLUDING COSTS BORNE BY CATEGORIES OF AFFECTED PARTIES [VIII. TP limit, reasonableness]

The estimated costs to outside parties due to the proposed extension of the TP limits are discussed in detail Section XI.

G. ESTIMATE OF THE PROBABLE COSTS OF NOT ADOPTING THE PROPOSED RULE AMENDMENTS, INCLUDING COSTS BORNE BY CATEGORIES OF AFECTED PARTIES [VIII. TP limit, reasonableness]

In general it is unlikely that there would be any direct costs to any party if the proposed extension of the TP limit was not adopted. Any costs would be the largely intangible real or perceived "costs" by the public of perpetuating poor water quality conditions in rivers and streams.

H. DIFFERENCES BETWEEN THE PROPOSED RULE AND EXISTING FEDERAL REGULATIONS AND THE NEED FOR AND REASONABLENESS OF EACH DIFFERENCE [VIII. TP limit, reasonableness]

The proposed extension of the TP effluent limit is consistent with federal regulations and guidance.

I. CONSIDERATION AND IMPLEMENTATION OF THE LEGISLATIVE POLICY UNDER MINN. STAT. §§ 14.002 AND 14.131 [VIII. TP limit, reasonableness]

Minnesota Stat. §§ 14.002 and 14.131 require state agencies, whenever feasible, to develop rules and that are not overly prescriptive and inflexible, and rules that emphasize achievement of the Agency's regulatory objectives while allowing maximum flexibility to regulated parties and to the Agency in meeting those goals.

The proposed extension of the TP limits combines a "prescriptive" component with a more flexible component. The former is the 1 mg/L limit itself, which is prescriptive. The latter is

exemplified by the three possible exemptions available to dischargers, which allows them to request an alternative limit or no limit at all. Any petition the Agency receives from a discharger for relief under one of the exemptions (Section IX.H) will need to be reviewed and processed on a case-by-case basis. The Agency will have discretion as to the disposition of future petitions. It may be prudent for the Agency to establish a policy framework for the consideration of petitions, and to write technical guidance to help dischargers prepare a petition.

The general concepts of how prescriptive or flexible a rule should be are discussed more in SONAR Book I, Section VIII.I.

J. ADDITIONAL NOTIFICATION OF THE PUBLIC UNDER MINN. STAT. §§ 14.131 AND 14.23 [VIII. TP limit, reasonableness]

Minnesota Stat. §§ 14.131 and 14.23 require the Agency to include in its SONAR a description of its efforts to provide additional notification to persons or classes of persons who may be affected by the proposed rule, or the Agency must explain why these efforts were not made.

The Agency has outlined its efforts to inform and involve interested and affected parties and the public in general in Section III of SONAR Book I. As noted, the Agency has gone beyond these statutory requirements in its efforts to involve the public in this rulemaking. The Agency has made significant changes to the scope and content of the proposed amendments in response to public comments.

Section V.J lists all the parties the Agency intends to send a copy of the notice of intent to adopt the rule amendments to and includes other information about public notice that is not repeated here. A copy of the notice, proposed rule amendments and SONAR will be posted on the Agency's public notice Web site at: http://www.pca.state.mn.us/news/index.html

Pursuant to Minn. Stat. § 14.143, subd. 1a, the Agency believes its regular means on notice, including publication in the *State Register* and on the Agency's public notice Web page will adequately provide notice of this rulemaking to persons interested in or potentially regulated by these rules.

K. CONSULTATION WITH THE COMMISSIONER OF FINANCE REGARDING FISCAL IMPACTS ON LOCAL GOVERNMENTS [VIII. TP limit, reasonableness]

Minnesota Stat. § 14.131 requires the Agency to consult with the Department of Finance to help evaluate the fiscal impact and benefits of proposed rules on local governments. In accordance with the interim process established by the Department of Finance on June 21, 2004, the Agency provided the Department of Finance with a copy of the proposed rule and SONAR at the same time as these items were sent to the Governor's Office. This timing allows the fiscal impacts and fiscal benefits of the proposed rule to be reviewed by the Department of Finance concurrent with the Governor's Office review.

L. AGENCY DETERMINATION REGARDING WHETHER COST OF COMPLYING WITH PROPOSED RULE IN THE FIRST YEAR AFTER THE RULE TAKES EFFECT WILL EXCEED $25,000 [VIII. TP limit, reasonableness]

The Administrative Procedures Act was amended in 2005 to include a section on potential first-year costs attributable to the proposed amendments (Minn. Stat. § 14.127, subds. 1 and 2). This amendment requires the Agency to determine if the cost of complying with a proposed rule in the first year after the rule takes effect will exceed $25,000 for:

- Any one business that has less than 50 full-time employees, or
- Any one statutory or home rule charter city that has less than ten full-time employees.

The Agency believes it is highly unlikely that the cost of complying with the proposed extension of the TP limit to new and expanding dischargers will exceed $25,000 in the first year after it takes effect, for the two categories of outside parties listed above, for two reasons.

First, the proposal will not impact most small business and small cities due to the *de minimis* threshold of 1,800 pounds of TP discharged in one year. An annual discharge of 1,800 pounds of TP equates to cities with a population of about 2000 at a TP concentration of 3 mg/L, which is roughly the median TP effluent concentration for POTWs without TP removal. Agency staff contacted representatives of the League of Minnesota Cities and the Minnesota Association of Small Cities and, while there are no hard data they could point to, based on their experience both

(independently) felt that cities with fewer than 10 employees generally had populations in the 1000-1200 range. A city with a population of 1200 would need a TP effluent concentration of about 5 mg/L to exceed the 1,800 pound *de minimis* threshold. An analysis of 2005 effluent TP data for municipalities without TP removal, 20 out of 111 (18%) had an average TP effluent concentration greater than 5 mg/L. Thus, few small cities, those with fewer than 10 employees, are likely to trigger the *de minimis* threshold.

Second, the number of parties of any size that will incur costs in the first year after adoption is likely to be small because of the time it takes to issue permits for new or expanding facilities and the time it takes for the city or business to let contracts for planning, design and construction of the new facilities. Estimated municipal and industrial costs are discussed in Sections XI.D and XI.E.

IX. REASONABLENESS OF PROPOSED EXTENSION OF PHOSPHORUS EFFLUENT LIMIT

A. INTRODUCTION [IX. TP limit, reasonableness]

Minnesota Stat. ch. 14 requires the Agency to explain the facts establishing the reasonableness of the proposed rules. "Reasonableness" means: 1) that there is a rational basis for the Agency's proposed actions, 2) that the Agency's proposed amendments are appropriate and consistent with its mandate to protect Minnesota's water resources, and 3) due consideration has been given to the potential economic impacts of the proposals. .

B. BACKGROUND AND HISTORY [IX. TP limit, reasonableness]

The Agency has a long history of controlling the discharge of phosphorus from point sources. The following chronology outlines the major steps in the evolution the 1 mg/L TP limit. Also discussed are other provisions or rules pertaining to the control of nutrients.

1. The Phosphorus Rule [IX.B. TP limit, reasonableness]

June 1967, WPC 15[6]. Water quality standards and treatment requirements for discharges to **interstate** waters are adopted. This first version of WPC 15 included a 1 mg/L TP effluent limit applicable to any discharge to a dilution-limited receiving water. That is, a TP limit was applicable to any discharger that must provide better than minimum secondary treatment of its wastewater in order to protect downstream water quality standards under low flow conditions.

The 1967 language is quoted below.

> *"In any instance where it is evident that natural mixing or dispersion of an effluent is not effective in preventing pollution, …. In addition, the following effluent standards may be applied without any allowance for dilution where stream flow or other factors are such*

[6] WPC means "Water Pollution Control".

as to prevent adequate dilution or where it is otherwise necessary to protect the interstate waters for the stated uses:

…

Total phosphorus 1 mg/L "

It is worth emphasizing that this early 1 mg/L limit applied to any discharger discharging to a receiving water with limited dilution regardless of whether the discharge was to a lake or affected a downstream lake or reservoir.

August 1967, WPC 14. Water quality standards and treatment requirements for discharges to **intrastate** waters are adopted with the same TP limit shown above for WPC 15. WPC 14 and 15 together are the state's first statewide water quality rules.

July 1969, WPC 15. Language was added to the standards for interstate waters (but not to WPC 14, intrastate waters) to supplement the 1 mg/L limit applicable to discharges to low flow situations. The new language immediately follows the numeric effluent limits for BOD, TSS and TP in the rule, and is:

*"It is the intent of the Agency to require the removal of nutrients from **all sources** to the fullest practicable extent whenever sources of nutrients are considered to be actually or potentially inimical to preservation or enhancement of the designated uses."* (emphasis added)

As in 1967, the context of this statement is effluent limits applicable to discharges with limited dilution, to which the 1 mg/L TP limit applies. This would seem to confirm that the 1 mg/L was more applicable to discharges to rivers than discharges to lakes, because, unlike rivers, lakes do not have a "low flow." Also, the 1969 language included the words "all sources;" whereas in 1967 "sources" seemed to be implied by the context.

A statement in a 1973 document[7] prepared for the proposed 1973 amendments to WPC 15 suggests that the Agency, at this early date, intended for nutrients to be removed wherever necessary to preserve and enhance the designated water uses. It is not entirely clear at this time whether or not the Agency intended the removal of nutrients to apply broadly; i.e., to discharges to low flow rivers (and lakes?) from all sources. However, following the 1973 amendments and subsequent amendments, plus the Agency's history of applying the TP limit after 1973, a more

[7] MPCA 1973. Statement for Public Hearing on Proposed Revisions to Regulation WPC 15.

narrow interpretation emerged as the intent of the Agency, as described below.

October 1973, WPC 14 and WPC 15. Both the intra- and interstate water quality rules were amended to change the applicability of the TP limit from any discharger with limited dilution to facilities discharging directly to or affecting a downstream lake or reservoir. The TP limit was moved from the part of the rule containing advanced treatment requirements (low dilution situations) to the part of the rule containing minimum technology-based (secondary treatment) requirements. The 1973 TP language is quoted below:

*Phosphorus***	*1 milligram per liter*

*** Where the discharge of effluent is directly to or affects a lake or reservoir. Removal of nutrients from all wastes shall be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses.*

This is the introduction of the requirement that has become known as the "phosphorus rule" or "P rule" that is still in place today. The P rule has been the cornerstone for the Agency's efforts to reduce point source nutrient loading to the state's lakes and reservoirs for over 30 years. The P rule has resulted in 1 mg/L TP limits in the permits of about 148 POTWs.[8] This is about 25 percent of all permitted domestic facilities. But when this percentage is put in terms of the amount of treated wastewater that receives TP removal relative to the total amount of treated domestic wastewater statewide, it jumps to about 72 percent.[9] Thus, TP is being removed from nearly three fourths of all the treated domestic wastewater covered by NPDES permits in Minnesota. The removal of TP at the MCES Metro plant in St. Paul, by far the state's largest with an AWWDF of 251 mgd, is a major reason this figure is as high as it is.

There were other changes made in 1973 worth noting. Also moved from the part of the rule specifying requirements for dischargers to low-dilution situations to the secondary treatment requirements was the "*Removal of nutrients from all wastes shall be provided to the fullest practicable, extent"* language. The "fullest practicable extent" (FPE) language follows immediately after the TP limit as part of the double asterisk footnote shown above. Also, the wording of the FPE clause was changed from the 1969/1971 version. The earlier version said

[8] Current as of July 2006. In the last 6 years some of the 148 limits would be attributable to the Phosphorus strategy and pemittee/Agency negotiations.

[9] This percentage is based on treatment plant design flows, not actual flows.

the Agency required nutrient removal from "*all sources;*" the 1973 version requires nutrient removal from "*all wastes*" to the fullest practicable extent wherever "*sources*" are detrimental. Thus, in 1973 the FPE language becomes closely associated only with situations that require the 1 mg/L limit. From this time forward the Agency has been consistent in its interpretation of the FPE language as applicable to those facilities that have a TP limit and not all facilities (see Section VII.I). The FPE language has been used as the basis for requiring TP limits more stringent than 1 mg/L.

The Agency modified the P rule language in subsequent rulemakings – amendments completed in 1984, 1988, 1990, and 1994. The details of these mostly minor changes are not important for this discussion and rulemaking. In 2000 the Agency added the option of allowing an averaging period for the TP limit longer than one month, up to one year. At the same time the FPE language become a separate paragraph. Through all these amendments the heart of the P rule remained the same. That is, a 1 mg/L TP limit applied to discharges directly to, or discharges that significantly impact a downstream lake or reservoir, and the FPE provision applied only to dischargers that received a TP limit due to the "to or affects" language.

February 1971, WPC 27, 28 and 30. Former WPC 27 is a reflection of Canadian and U.S. efforts to protect the Great Lakes from eutrophication in the late-1960s and early-1970s. To reduce the loading of nutrients, states bordering the Great Lakes adopted basin-wide 1 mg/L TP effluent limits applicable to all dischargers in watersheds draining to the lakes. Minnesota adopted WPC 27 in February 1971 to protect the Minnesota portion of the Lake Superior basin; it established a 1 mg/L limit for all point source dischargers in the basin. Michigan, for example, requires essentially all point source dischargers in the state to meet a 1 mg/L TP limit because the entire state (except for a tiny portion in the SW corner) drains to one of the Great Lakes. A limit of 1 mg/L has been widely adopted because it can be achieved by proven and readily implementable treatment technologies (chemical addition).

TP limits were adopted for other basins or waterbodies in Minnesota at the same time in separate rules, WPC 28 and 30. These two rules plus WPC 27 are now combined in existing Minn. R. ch. 7065. The combined rule establishes a 1 mg/L TP effluent limit for discharges in: 1) all waters in the Lake Superior basin, 2) portions of the upper Mississippi River, Lake St. Croix, and 3) the Little Minnesota River, Big Stone Lake and Albert Lea Lake. The Agency is proposing to combine all TP limits now in Minn. R. chs. 7050 and 7065 into new Minn. R. 7053.0255 (Section VII.F, and Section V.E.10 of SONAR Book I).

2. Other Provisions and Rules With Phosphorus Control Measures [IX.B. TP limit,

reasonableness]

Several parts of existing Minn. R. ch. 7050, outside of Minn. R. 7050.0211, subp. 1a, incorporate phosphorus or nutrient control for point source dischargers. For the most part these provisions refer back to the 1 mg/L TP limit in existing Minn. R. 7050.0211, subp. 1a and the "to or affects" language. Table II-15 is a list of these provisions. Again, the TP provisions in existing Minn. R. ch. 7050 are to be moved into the proposed new Minn. R. ch. 7053.

Table II-15. References to Point Source Phosphorus Effluent Limits in Existing Minn. R. ch. 7050 and Proposed New Minn. R. ch. 7053.

Existing Minn. R. ch. 7050	Proposed New Minn. R. ch. 7053	Provision; References are to Proposed Minn. R. 7053
7050.0211, subp. 1a	7053.0255	Phosphorus rule
7050.0212, subp. 2a	7053.0225, subp. 3	Exempts dredge disposal return water from the phosphorus limit, contingent on certain conditions.
7050.0212, subp. 4	7053.0225, subp. 4	Industries must meet requirements of Minn. R. 7053.0255
7050.0213	7053.0235, subp. 1	Advanced treatment requirements include limits in Minn. R. 7053.0255
7050.0214, subp. 1	7050.0245, subp. 1	Treatment requirements for discharges to limited resource value waters include limits in Minn. R. 7053.0255
7050.0215, subp. 2	7050.0305, subp.2	Treatment requirements for animal feedlots include limits in Minn. R. 7053.0255, except feedlots are not included in the definitions of "new" or "expanding" discharges.
7050.0216, subp.3, item B	7050.0405, subp.3, item B	Requirements for aquaculture facilities include the requirements in 7053.0405, subp. 3, which in turn refers back to the phosphorus limit in Minn. R. pt. 7053.0255.
7050.0216, subp. 5, item E	7050.0405, subp.5, item E	Closure plan for abandoned aquaculture facilities; must restore the affected waterbody back to its mean pre-aquaculture trophic condition.

The parts of existing Minn. R. ch. 7050 listed below contain general narrative provisions dealing with nutrient control. Also, the nondegradation evaluations include an assessment of potential impacts of nutrients on outstanding resource value waters and all waters of the state.

- Minn. R. pt. 7050.0210, subp.2. Nuisance Conditions Prohibited. No point or nonpoint sources should cause pollution resulting in excessive plant growth
- Minn. R. pt. 7050.0222, subp. 7. Additional Standards. There should be no material increase in undesirable slime growth or aquatic plants including algae to Class 2 waters.

- Minn. R. pt. 7050.0180. Nondegradation for Outstanding Resource Value Waters.
- Minn. R. pt. 7050.0185. Nondegradation for All Waters.

Existing Minn. R. 7100.0210 (Nutrient Limitation) limits the nutrient (phosphorus) content of cleaning products. The Agency is not proposing any changes to this rule.

Minnesota Stat. § 18C.60 restricts the use of lawn fertilizers containing phosphorus to certain special situations, such as new lawns or where a soil test indicates that the home owner's soil is deficient in phosphorus.

C. AGENCY'S PHOSPHORUS STRATEGY [IX. TP limit, reasonableness]

In 1996, in response to the threat to the state's water resources from phosphorus loading, the Agency set out to develop a comprehensive Phosphorus Strategy (Strategy), Exhibits PL-1a is a copy of the Strategy Web page, PL-1b is a fact sheet and PL-1c is the complete Strategy with the decision tree. The "decision tree" guides the reader through the steps to determine when a phosphorus limit is called for. The purpose of the Strategy is to:

- Promote the reduction of TP loading from both point and nonpoint sources to lakes and reservoirs;
- Provide a consistent framework for applying phosphorus controls (primarily the P rule) in setting TP limits in NPDES permits;
- Serve as a guide to Agency staff and to outside parties on how TP issues will be addressed, particularly in NPDES permits;
- Clarify or define terms that have been used in setting TP limits for years, such as "affects," "lake" and "reservoir;" and
- Define new concepts introduced as part of the Strategy such as *de minimis* loading.

In the fall of 1999, the Agency held informal meetings with interested parties such as watershed districts, environmental groups, cities, lake associations and other state agencies to discuss the Strategy. The Agency received hundreds of comments, and several changes were made to the Strategy as a result (Exhibit PL-1b).

The Strategy also laid out seven action steps to be taken by the Agency to reduce the loading of TP from both point and nonpoint sources; they are:

1. Develop education/outreach information on environmental impacts of phosphorus.
2. Co-sponsor basin-wide phosphorus forums.
3. Use basin management as the main policy context for implementing the phosphorus strategy.
4. Broadly implement Minnesota's point-source phosphorus controls.
5. Broadly promote lake protection activities.
6. Address phosphorus impacts on rivers.
7. Modify water-quality standards if necessary.

Action steps 4 and 7 are the most relevant to this rulemaking. Eutrophication water quality standards are being "modified" by proposing numeric eutrophication standards to supplement the existing narrative standards (not part of this report). The proposed extension of the TP limit to new and expanded facilities will broaden the implementation of the P rule.

The Citizens' Board approved the Strategy as Agency policy in March 2000. At that time the Board expressed interest in adopting a "universal" 1 mg/L phosphorus effluent limit for all discharges. The Agency's proposed extension of the P Rule is consistent with the Strategy's general purpose and goals; and more specifically, it incorporates into the rule the *de minimis* threshold for implementation of TP limits for new or expanding dischargers. The proposed extension of the phosphorus limit is to a large extent being implemented now under the Phosphorus Strategy. The proposed rule represents a codification of the strategy except the rule will allow certain exemptions (see Section IX.H).

By any measure, the Strategy has been very successful. Under the Strategy dischargers that previously may not have had to reduce effluent phosphorus have, 1) accepted a 1 mg/L TP limit, 2) adopted treatment options that reduce effluent phosphorus such as Bio-P, or 3) taken other measures to reduce effluent TP. As permits come up for reissuance, Agency staff evaluates them for possible TP limits. Over the last five to six years there has been a clear trend that when new facilities are built or existing facilities expand, 1 mg/L TP limits have been added to the permit. Since March 2000, about 34 POTWs that have design flows (AWWDF) greater than 0.2 mgd have gotten limits that are attributed to the Strategy (Exhibit PL-10). An additional nine POTWs with AWWDFs less than 0.2 mgd have gotten limits under the Strategy. Facilities smaller than 0.2 mgd may be below the *de minimis* loading of 1,800 pounds per year (depending on effluent TP concentrations); if so, they would not be impacted by the proposed extension of the TP limit. Such facilities may, however, continue to get TP limits in the future for other reasons including the Strategy.

Also under the Strategy, in addition to or in lieu of a numeric limit, many dischargers were asked to develop and implement a phosphorus management plan (PMP) when their permit was reissued. A PMP asks the facility to monitor influent and effluent TP, monitor the contributions of TP from industries or other sources discharging to the POTW and identify sources with high TP concentrations. Major sources are asked to review their practices and use of phosphorus containing products, and to make changes or product substitutions if possible to reduce the discharge of TP to the sanitary sewer. The Agency has used an average effluent TP concentration of 4 mg/L as a rule-of-thumb threshold for requiring a PMP in a permit (Exhibit PL-1c). Recent data assembled for POTWs with mechanical treatment (continuous discharges) and with no TP limit indicate that 54 percent have TP effluent concentrations greater than 4 mg/L.[10] In general, the lower the concentration of influent TP, the lower the concentration of effluent TP. As of July 2006 nearly 74 percent of all NPDES permittees (424 out of 577) are required to prepare a PMP; 26 percent have actual TP limits.

The Strategy for all its effectiveness and public involvement is not a rule; it has no intrinsic authority. The proposed extension of the phosphorus limit will codify what has taken place under the Strategy, and continue the gains made in reducing phosphorus loadings state-wide. Critical elements of the Strategy will become rule as part of this rulemaking (Exhibit PL-1b).

In summary, the proposed extension of the 1 mg/L phosphorus limit is, to a large extent, being implemented now under the Phosphorus Strategy. This is due at least in part to the popularity and inherent advantages of the Bio-P technology. Depending on the watershed in which they are located, many communities are already being encouraged if not mandated under the terms of a TMDL, for example, to reduce effluent TP as they build new facilities or expand (next Section). Also, the proposal seeks to protect major watersheds **before** they become impaired and a TMDL is required. If society waits until a waterbody is impaired (i.e., water quality standards are exceeded and beneficial uses are actually or potentially lost), not only will water quality of surface waters suffer, but the cost to bring these waterbodies back to health, if possible at all, is usually far more than the cost of preventive measures. The Agency believes it is reasonable to codify portions of the Strategy in rule.

[10] MPCA, February 2006. Phosphorus performance of mechanical facilities. Marco Graziani.

D. ONE MG/L PHOSPHORUS LIMITS BEING INPLEMENTED NOW THROUGHOUT MUCH OF STATE [IX. TP limit, reasonableness]

The removal of phosphorus from point sources is required now in several major watersheds in Minnesota. The proposed extension of the TP limit to new and expanding facilities will have no impact in these watersheds. In other major watersheds in Minnesota pending TMDLs, adopted nutrient reduction goals, watershed management plans or downstream concerns about the impact of nutrient loading is likely to result in additional limits for facilities in these watersheds independent of the proposed extension of the TP limit. While some focus more on non-point sources of nutrients rather than point sources, the basin management plans for the Rainy, Red, Lower Mississippi and Cedar River watersheds have established nutrient management goals for the protection of surface waters[11]. Also, essentially every permittee is being asked to do a phosphorus management plan (to look for ways to reduce influent TP) whether or not they get a numeric TP limit.

Lake Superior Basin and Lake St. Croix. As described in Section IX.B, rules adopted in 1971 require all dischargers in the Lake Superior basin, discharges to Lake St. Croix and to several other specific waterbodies, to meet a 1 mg/L effluent limit. And, as stated, the limits in existing Minn. R. ch. 7065 are proposed to be moved into the new Minn. R. 7053.0255.

Minnesota River TMDL. Requirements for phosphorus removal at facilities throughout the Minnesota River are being driven by the lower Minnesota River dissolved oxygen TMDL. The implementation plan for the Minnesota River TMDL includes a general permit that establishes seasonal TP limits applicable from May through September for the 40 largest facilities in the basin (> 1,800 pounds TP/yr.). However, the two largest discharges, the MCES operated Seneca and Blue Lake plants, will have year-round limits in 2008. Also, two new ethanol facilities with individual permits will have essentially year-round limits. Under the proposed rule, if facilities in the basin with seasonal limits expand in the future (to over 1,800 pounds TP/yr.), they would be subject to a year-round limit, unless they qualify for one of the proposed exemptions (Section IX.H).

It should be noted that the Minnesota River TMDL is a result of exceedances of the Class 2 dissolved oxygen (DO) standard in the lower 22 miles of the Minnesota River under low flow conditions. The low DO is caused by the decay of the abundant algae which result from excess phosphorus. This has a bearing on the fact that the general permit includes seasonal TP limits

[11] See Agency Basins/Watersheds Web page, http://www.pca.state.mn.us/water/basins/index.html

rather than year-round limits. The low DO is a side effect of excess nutrients but low DO itself is usually not a problem in rivers during the winter (except sometimes under total ice cover). Cold water holds more DO than warm water before it becomes saturated, and the metabolic rate of living organisms is much slower at cold temperature reducing their DO requirements. Also, warm water fish are not spawning in the winter, thus the more low-DO-sensitive early life stages are not present in the winter. The problem to be remedied in the lower Minnesota is a DO problem not a eutrophication problem *per se*. Year-round limits might be appropriate if the impairment was based on exceedance of nutrient criteria. Nutrient loading during the winter months can have direct negative impacts, and phosphorus that attaches to particulates in the winter can settle to the bottom and become available for algal growth the following summer.

At the present time rivers are not being directly assessed for impairment due to excess nutrients because the Agency has not developed numeric nutrient criteria applicable to rivers as it has for lakes.

Upper Mississippi River Basin and Lake Pepin TMDL. Lake Pepin is a natural lake on the Mississippi River downstream from Red Wing, Minnesota. Lake Pepin exceeds the Agency's nutrient criteria for lakes and is impaired due to excess nutrients (also impaired for turbidity). Lake Pepin was added to the impaired waters list in 2004. The watershed above Lake Pepin includes about half of the area of Minnesota. The Lake Pepin nutrient TMDL is well underway but the implementation plan will not be complete for some time. In all likelihood, however, the implementation phase of this TMDL will call for TP limits for at least the larger discharges in the watershed that do not already have them.

St. Croix Basin. An interstate agreement to achieve ambitious nutrient reduction goals for the St. Croix basin was signed by the Commissioner of the Agency and the Secretary of the Wisconsin Department of Natural Resources on April 6, 2006 (Exhibit PL-2b). The Agreement formalizes a 20 percent TP loading reduction goal for the St. Croix basin. Achievement of this goal will reduce TP levels in Lake St. Croix to 1950 levels, which is projected to mean a decrease in the current average TP concentration of 50 µg/L to about 40 µg/L (Exhibit PL-2b). An earlier Report (August 2004) containing the recommended water quality goals of the St. Croix Basin Water Resources Planning Team established the same goal of a 20 percent reduction TP loading to Lake St. Croix (Exhibit PL-2a).

Phosphorus limits are commonly issued to dischargers in the St. Croix basin now because of the importance of this national scenic and recreational river and the sensitivity of Lake St. Croix to impacts from excess nutrients. The recently sanctioned nutrient reduction goals can only

increase the likelihood that point sources will get TP limits when their permits come up for reissuance, independent of the proposed extension of the TP limit to new and expanding dischargers.

Rainy River Basin. Lake of the Woods is an important recreational lake in northern Minnesota and is an international border water. Limited monitoring was conducted historically to assess lake conditions; however, lake monitoring has increased in intensity the past three years due to concerns over periodic algae blooms. A 2005 lake trophic status report shows mean TP, Chl-a and Secchi depth in the lake are near the proposed NLF ecoregion standards.[12] Additionally, occasional high concentrations of Chl-a are found in the lake and the algal community is dominated by the less desirable blue-green algae most of the time. Follow-up sampling was conducted in 2006 to determine whether the lake should be placed on the 2008 impaired waters list. There is an extensive volunteer monitoring network on the Canadian side of the lake and the water quality in this portion is often better than the more southerly portion of the lake. The Rainy River is the largest water source entering the lake, making up 80 percent of the lake's drainage basin. The 2005 report (footnote 45) documents that TP concentrations in the Minnesota portion of the lake reflect the TP concentration in the Rainy River. Additional lake monitoring is being conducted that will facilitate 303(d) assessment in 2008. Maintaining or improving the quality of Lake of the Woods will require management of phosphorous loads in the Rainy River upstream of the lake.

Red River Basin. The high level of suspended sediments and turbidity in the Red River appears to reduce the impact of nutrient loading to the river itself. The proposed third exemption is in partial recognition of this situation (Section IX.H.5). Downstream, however, Lake Winnipeg in Manitoba is becoming eutrophic.[13] Manitoba has adopted a Lake Winnipeg Action Plan that, among other things, calls to:

> *"identify further actions necessary to reduce nitrogen and phosphorous to pre-1970 levels in the lake" and "commencement of cross-border nutrient management discussions".*[14]

The Red River flows into Lake Winnipeg downstream from the city of Winnipeg. Clearly Manitoba and the city of Winnipeg have a large stake in slowing and reversing the

[12] http://www.pca.state.mn.us/publications/reports/wq-lar39-0002.pdf

[13] http://www.lakewinnipeg.org/web/downloads/Nutrient_Literature_Review_LakeWinnipeg_Final_May_2006.pdf

[14] http://www.gov.mb.ca/waterstewardship/water_quality/lake_winnipeg/action_plan.html

eutrophication of this large lake (about the size of Lake Erie). The city of Winnipeg has three wastewater treatment plants. One plant (west end) has a permit requirement to meet a 1 mg/L TP limit that became effective at the end of 2006. Limits for the other two plants will follow.[15] Because the Minnesota portion of the Red River basin is upstream of Lake Winnipeg, reducing the TP loading from Minnesota will help Canada in its efforts to improve the water quality in Lake Winnipeg.

Des Moines Basin. Heron Lake in the Des Moines River Basin has a history of excess nutrients, resulting in an overabundance of algae that shade the growth of rooted aquatic plants. This has had serious detrimental effects on duck populations on this historic prime waterfowl resource. The lake has been on the impaired waters list since 2002. The lower reaches of the Des Moines River have been on the impaired waters list for dissolved oxygen since 1994. Recent evaluations suggest high levels of algae in the river that stagnate behind small main-stem dams as a possible cause of the low DO. Nutrient reductions may be necessary to mitigate the low DO problem in the river as is the case in the lower Minnesota River Dissolved Oxygen TMDL.

Lower Mississippi River basin (below Lake Pepin). Nutrients influence the function of the diverse surface water resources in the Lower Mississippi River Basin. The basin contains the Mississippi River, which is a large floodplain river, and tributaries, such as the Zumbro, Whitewater, and Root. There are many trout streams which drain the bluffs of the "Driftless Area" ecoregion. Lakes are most prevalent in the western portion of the Cannon River Watershed. Development of river nutrient standards will help us determine the ultimate nutrient goals for the waters of the Lower Mississippi River Basin.

The Mississippi River is an extremely productive river that contains a mosaic of impounded areas, side channels, backwaters and main channel habitats. The portion of the Mississippi River downstream of Lake Pepin is part of the Upper Mississippi River National Wildlife Refuge. The river serves as a nationally important resting area for migratory birds, a productive fishery and a navigational channel for the upper Midwest. The implications of nutrient loading to this system are not fully understood, but there are several indications that nutrients are an issue of concern for riverine health. Excess algal production can be detrimental to submersed aquatic plants (in shallow backwater and impounded areas) which are very important to the ecology of the Mississippi River. Wisconsin has recently expressed concern regarding excessive amounts of filamentous algae which may be negatively impacting submersed aquatic plants. Concentrations

[15] E-mail from Dwight Williamson, Director Water Science and Management Branch Manitoba Water Stewardship, May 9, 2005.

of TP often exceed 200 µg/L in the main channel and backwaters of the Mississippi River downstream of Lake Pepin. Average Chl-a levels exceed 50 µg/L especially during spring and summer. Concentrations of Chl-a can exceed 100 µg/L in channel areas during low flow conditions.

Algal growth occurs in winter, but it is difficult to determine its significance as a contributor to low dissolved oxygen in relatively isolated backwaters due to high densities of submersed aquatic vegetation that are also present in these areas. Also, it is difficult to determine the impact of winter TP influx due to a large pulse of water that is routed through the riverine systems during spring flooding. Relatively isolated backwaters are flushed during this period. Detention time in most areas in the Lower Mississippi Basin are generally measured in days rather than weeks. Low DO is less problematic in channel areas and some fish can move to channel habitats during periods of low dissolved oxygen in backwaters, but fish such as bluegills and largemouth bass typically do not move due to low temperatures and high water velocities which they prefer to avoid in the winter.

Two lakes on the impaired waters list, Lakes Byllesby and Zumbro are located in the lower Mississippi Basin. The TMDLs for these waterbodies will determine the significance of winter discharges of TP above these lakes.

Cedar and Missouri Basins. The Cedar and Missouri Basins in Minnesota are smaller geographic headwater areas of the state and are characterized by small tributaries. As a result, fewer nutrient assessments have been undertaken in these basins. However, select assessments in these areas are of note. Excess nutrients were evaluated in a Clean Water Partnership project for Lakes Okabena, Ocheda and Bella near Worthington. Nutrient goals were established in these projects. The Iowa Department of Natural Resources has developed a TMDL for Little Spirit Lake on the Iowa Minnesota border in the Missouri River Basin. The TMDL is for impairments of algae and turbidity due to excess nutrient (phosphorus) loading to the lake. A 60 percent phosphorus load reduction is needed to meet the TMDL and achieve the designated use for Little Spirit Lake. A general review of water quality data shows elevated phosphorus and chlorophyll concentrations in the rivers in these basins. Considering the close proximity of these basins to the Minnesota River Basin and the land use similarity between the basins it is not unexpected that river nutrient conditions are similar.

E. COMMENTS FROM MESERB [IX. TP limit, reasonableness]

The Minnesota Environmental Science and Economic Review Board (MESERB) commented in Exhibits A-34 and A-35 that Minn. Laws 2005 ch. 1, art. 2, § 151 Subdivision 1. (g) prevents the Agency from adopting the proposed extension of the TP limit to new and expanding discharges above a certain size.[16] The part of the Session law that MESERB cites is shown below:

> Sec. 151. [WATER QUALITY ASSESSMENT PROCESS.]
> Subd. 1. [RULEMAKING]
>
> (g) The rules must provide that the agency, in considering impairment due to nutrients and application of nutrient objectives and effluent limitations related to riverine systems or riverine impoundments, must consider temperature and detention time effects on algal populations when the discharge of nutrients is expected to cause or contribute to algal growth that impairs existing or attainable uses.

The Session law says the Agency must take the effects temperature and hydraulic detention time have on algae populations into account when considering effluent limits for dischargers to "riverine systems" and river impoundments when the discharge is expected to cause or contribute to impairment of existing or attainable uses.

It is the opinion of the Agency that this part of the Session Law does not preclude the Agency from promulgating the changes to the 1 mg/L phosphorus effluent limit as proposed (Exhibit A-36). The Agency has broad authority to set effluent limits to prevent the pollution of waters of the state and to prevent the physical chemical or biological degradation of receiving waters (Minn. Stat. § 115.03). Also, the Session law does not specify an outcome from consideration of the factors mentioned, and it does not restrict our basic authority to set or promulgate effluent limits.

The Agency takes the role temperature, river flow and the hydraulic residence time in reservoirs into account now when implementing the existing P Rule in Minn. R. 7050.0211, subp. 1a. This is part of the "affects" analysis, especially for reservoirs for which the question of residence time is relevant. It is true that the implementation of the proposed extension of the TP limit to new

[16] The rulemaking required by this Session Law was adopted by the Agency Board in October 2006. The SONAR for the separate Session Law rulemaking is Exhibit A-4.

and expanded facilities (> 1,800 pounds TP per year) does not require this analysis. The Agency recognizes that local data that demonstrates a measurable benefit as a result of the TP limit will not exist in many situations where the proposed limit applies.

Apart from MESERB's issues regarding Agency authority to set effluent limits, the Agency believes that MESERB's basic concern about TP limits being imposed in situations where no negative impacts have been demonstrated are substantially mitigated by the facts presented in the *reasonableness* section of this SONAR as highlighted below.

- Under the proposal TP limits will not apply to small dischargers (more than half of all POTWs) – those discharging less than 1,800 pounds of TP in a year (next Section).
- Twenty six percent of all POTWs have TP limits now.
- The Proposal is being substantially implemented now under the Phosphorus Strategy. Under the Strategy about 34 POTWs (> 0.2 mgd) got TP effluent limits over the last five years that may not have gotten them before.
- TP effluent limits are already required in much of the state due to existing rules, nutrient - related TMDLs or nutrient reduction goals.
- Dischargers may request relief from the TP limit under one or more of the proposed exemptions. The third exemption provides for the possibility of summer-only limits in certain watersheds.

Phosphorus has been shown to be one of the most pervasive and damaging nontoxic pollutants the Agency deals with. Nutrient loading to rivers has negative impacts that often go unmeasured or undetected because of the lack of monitoring. Phosphorus is not degraded and it can be carried far downstream. Some portion of the TP released under conditions of high flow and low temperatures, if not manifested under these conditions, can contribute to a degraded condition when flows decline and temperatures increase.

F. *DE MINIMIS* SIZE EXEMPTION [IX. TP limit, reasonableness]

Included in the proposed extension of the TP effluent limit to new and expanded discharges is a *de minimis* mass TP loading from point sources. Municipal and industrial facilities that discharge less than the *de minimis* load, 1,800 pounds of TP per year, are not subject to the proposed 1 mg/L effluent limit. Wisconsin adopted a *de minimis* of 1,800 pounds in their "P-rule" (Exhibit PL-13), and the Agency used the Wisconsin experience as a starting point in their own investigation of an appropriated *de minimis*.

The selection of 1,800 pounds of TP per year is a result of research carried out for the development of the Strategy (Exhibit PL-1c, page 3). This analysis was completed in 2000. The concept of *de minimis* in the context of TP loading implies a diminishing return that would be realized if TP limits were to be applied to facilities discharging this amount or less. The *de minimis* loading does not apply to dischargers to or affecting a lake, shallow lake or reservoir, or waterbodies covered by existing Minn. R. ch. 7065, as is the case today.

Exhibit PL-1c describes in detail the data and the analysis that supports the selection of the *de minimis* amount. In brief, data for publicly owned treatment works (POTW) in three major basins were investigated (Upper Mississippi, Minnesota, and St. Croix basins). The data for the POTWs in these three watersheds are assumed to be representative of POTWs state-wide. The data used includes:

- Size of the treatment facility as indicated by the monthly average wet weather design flow (AWWDF), which is used to divide POTWs into two categories: those with AWWDFs $\leq$ 0.2 mgd and > 0.2 mgd;
- Number of mechanical and pond treatment systems;
- Population served;
- Effluent TP concentrations; and
- TP mass loading.

The AWWDF of 0.2 mgd is used as a convenient estimate of the size facility that will discharge about 1,800 pounds of TP per year, or be at the threshold of the *de minimis* loading. Table II-16 shows the data from the three watersheds used in the Strategy to estimate the number of POTWs likely to be above and below the *de minimis* loading. Also included in Table II-16 is more recent data for all POTWs state-wide. These data show that the majority of all POTWs have AWWDFs less than 0.2 mgd. Mechanical wastewater treatment plants have a continuous discharge and tend to be the treatment choice of larger communities. The typical stabilization pond discharges twice per year for about two to three weeks in the spring and fall. Stabilization ponds are more likely to be the choice of smaller communities. This is reflected in the data in Table II-16. Roughly a third of all mechanical POTWs and over 80 percent of all pond systems will be exempt from the proposed extension of the TP limit to new and expanded discharges.

Table II-16. Number of All, Mechanical, and Pond POTWs with Average Monthly Wet Weather Design Flows Below 0.2 mgd (percentages in parentheses).

POTW Category*	Data Used in the Strategy, Exhibit PL-1c			State-wide Data
	Upper Miss. R. Basin	Minn. R. Basin	St. Croix R. Basin	
No. of POTWs				
Total, All	123	133	23	566
Less than 0.2 mgd	69 (56%)	85 (64%)	17 (74%)	347 (61%)
Total, Mechanical	65	56	6	279
Less than 0.2 mgd	24 (37%)	25 (45%)	2 (33%)	100 (36%)
Total, Ponds	57	77	17	295
Less than 0.2 mgd	45 (79%)	60 (78%)	11 (65%)	242 (83%)

* Number of facilities in each category will vary slightly depending on how some less typical facilities are counted, and the plant design flows were not available for a few facilities.

The information in Table II-17 shows that the mass loading of phosphorus from POTWs smaller than the *de minimis* loading (0.2 mgd) represents a small fraction of the total basin-wide loading from all sources, point and nonpoint – about eight percent or less at low river flows and about two percent or less at average river flows. Thus, exempting small discharges from the proposal will have little impact on overall TP loading; and, conversely including them will gain little in the way of TP loading reductions basin-wide. The TP Loading data in Table II-17 is based on median effluent TP concentrations and AWWDFs. Therefore, the percentages should be considered high-end estimates because plant design flows are larger than the actual plant flows (see Exhibit PL-1c for details).

Table II-17. Percent Mass Contribution of TP from Facilities with a Design Flow Less Than 0.2 mgd Relative to Basin-wide TP Loading.

Flow Conditions in Receiving Stream	Upper Miss. R. Basin	Minn. R. Basin	St. Croix R. Basin
Low Flow	6.5 %	8.2 %	2 %
Average Flow	1.8 %	1.3 %	1 %

The Strategy investigated TP loading data for industries located in the same three basins listed in Table II-17, plus industries in the Lower Mississippi, Cedar and Des Moines River basins. The

Agency concluded that the 1,800 pound TP *de minimis* could be applied to industries as well as POTWs. In general, industries of all sizes contribute a very small fraction of the total TP loading in these watersheds (the Des Moines being the major exception). The contribution from industries with design flows below 0.2 mgd, of which there are very few in any basin, contributed less than 0.1 percent of the cumulative basin-wide TP mass loading. Also, the mean or median effluent TP concentration of the industries below 0.2 mgd in size were less than 1 mg/L (Exhibit PL-1c, page 10).

In conclusion, the proposed extension of the TP limit to new and expanding dischargers will include a *de minimis* size facility; facilities below this size will not be impacted. This is a continuation of the policy adopted in the Phosphorus Strategy. Data for POTWs state-wide indicates that the proposal will not apply to more than half of all POTWs because of the *de minimis* threshold. Less than 20 percent of communities with pond systems will be impacted. Facilities discharging less than the *de minimis* (1,800 pounds TP per year or about 0.2 mgd AWWDF) contribute very little to the overall nutrient loading to rivers and streams. Excluding these facilities will not have measurable impact on the environment. Including a *de minimis* threshold in the proposal is a reasonable and cost effective means to assure that phosphorus removal dollars will be spent where they will have the greatest impact.

G. TP EFFLUENT LIMIT LANGUAGE CHANGES [IX. TP limit, reasonableness]

1 Introduction and Proposed Language in Minn. R. 7053.0255 [IX.G. TP limit, reasonableness]

As described in the *need* section (Section VII.F), the Agency is proposing to consolidate all the TP effluent limits in one part of the proposed new rule, Minn. R. ch. 7053. All of proposed Minn. R. 7053.0255 is repeated below and should be referred to for the discussion of the six subparts in the sections that follow.

7053.0255 PHOSPHORUS EFFLUENT LIMITS FOR POINT SOURCE DISCHARGES OF SEWAGE, INDUSTRIAL, AND OTHER WASTES.

*Subpart 1. **Scope**. The phosphorus effluent limits in this part are in addition to the effluent limits specified elsewhere in this chapter. In the event of any conflict between this part and other applicable regulations, the more stringent requirement applies.*

Subp. 2 ***Definitions****. For the purposes of this part, the following definitions apply. Other relevant definitions are found in part 7050.0150, subpart 4.*

A. "122-day ten-year low flow" or "122Q_{10}" means the lowest average 122-day flow with a once in ten-year recurrence interval. A 122Q_{10} is derived using the same methods used to derive a 7Q_{10}, and the guidelines regarding period of record for flow data and estimating a 7Q_{10} apply equally to determining a 122Q_{10} as described in part 7053.0135, subpart 3.

B. "Affects" means a measurable increase in the adverse effects of phosphorus loading as determined by monitoring or modeling, including, but not limited to, an increase in chlorophyll-a concentrations, a decrease in water transparency, or an increase in the frequency or duration of nuisance algae blooms, from an individual point source discharge.

C. "Expanded discharge" means a disposal system that after July 1, 2007, discharges more than 1,800 pounds of total phosphorus per year to a surface water on an annual average basis, and increases in wastewater treatment capacity as indicated by an increase in the:

(1) design average wet weather flow for the wettest 30-day period for point source dischargers of sewage with a continuous discharge, typically a mechanical facility;

(2) design average wet weather flow for the wettest 180-day period for point source dischargers of sewage with a controlled discharge, typically a pond facility; or

(3) design average daily flow rate for dischargers of industrial or other wastes.

D. "Lake" means an enclosed basin filled or partially filled with standing fresh water with a maximum depth greater than 15 feet. Lakes may have no inlet or outlet, an inlet or outlet, or both an inlet and outlet.

E. "Measurable increase" or "measurable impact" means a change in trophic status that can be discerned above the normal variability in water quality data using a weight of evidence approach. The change in trophic status does not require a demonstration of statistical significance to be considered measurable. Mathematical models may be used as a tool in the data analysis to help predict changes in trophic status.

F. "New discharge" means a discharge that was not in existence before July 1, 2007, and discharges more than 1,800 pounds of total phosphorus per year.

G. "Reservoir" means a body of water in a natural or artificial basin or water course where the outlet or flow is artificially controlled by a structure such as a dam. Reservoirs are distinguished from river systems by having a hydraulic residence time of at least 14 days. For purposes of this item, residence time is determined using a flow equal to the $122Q_{10}$ for the months of June through September, a $122Q_{10}$ for the summer months.

H. "Shallow lake" means a lake with a maximum depth of 15 feet or less or with 80 percent or more of the lake area shallow enough to support emergent and submerged rooted aquatic plants (the littoral zone). It is uncommon for shallow lakes to thermally stratify during the summer. The quality of shallow lakes will permit the propagation and maintenance of a healthy indigenous aquatic community and they will be suitable for boating and other forms of aquatic recreation for which they may be usable. For purposes of this chapter, shallow lakes are differentiated from wetlands, lakes, and reservoirs on a case-by-case basis. Wetlands are defined in part 7050.0186, subpart 1a.

Subp. 3. ***Total phosphorus effluent limits****.*

A. Phosphorus removal to one milligram per liter is required when subitems 1, 2, or 3 applies:

(1) the discharge of effluent is directly to or affects a lake, shallow lake, or reservoir;

(2) the discharge is to the specific basins and water bodies designated in subpart 5; or

(3). the discharge is new or expanded as defined in subpart 2, except when the discharger can demonstrate to the commissioner that the discharger qualifies for an alternative phosphorus limit as provided in subpart 4.

B. ~~In addition,~~ If a phosphorus effluent limit is required under item A, removal of nutrients from all wastes ~~shall~~ must be provided to the fullest practicable extent wherever

sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients ~~by~~ under this ~~subpart~~ part are subject to the variance provisions of ~~part~~ parts 7000.7000 and 7053.0195.

*Subp. 4. **Alternative phosphorus effluent limits for new or expanded discharges**. New or expanded discharges subject to a one milligram per liter phosphorus effluent limit in subpart 3, item A, subitem 3 may request an alternative limit or no limit if one or more of items A to C apply. New or expanded discharges are defined in subpart 2. The exemptions in this subpart do not apply to facilities that discharge directly to or affect a lake, shallow lake or reservoir or to discharges to the waters listed in subpart 5. Dischargers seeking an alternative limit due to very high per capita treatment costs or economic hardship must apply for a variance under parts 7000.7000 and 7053.0195.*

The information submitted to the commissioner for consideration of an alternative limit must include, at a minimum, a description of the treatment technology used, influent and effluent total phosphorus concentrations, a phosphorus management plan for the facility, descriptions of any measures already taken to reduce phosphorus sources to the facility, and expected reductions in phosphorus concentrations following implementation of the phosphorus management plan. The discharger may qualify for an alternative total phosphorus limit or no limit if it can demonstrate:

A. the discharge is to or upstream of a water body listed on the applicable impaired water list (section 303(d) of the Clean Water Act) and the total maximum daily load study is complete and approved by the United States Environmental Protection Agency at the time the new or expanding facility is in the planning and design phase. The total maximum daily load study must have considered impacts from phosphorus loading on the impaired water body;

B. the environmental benefits to be achieved by meeting a phosphorus limit are outweighed or negated by the environmental harm caused by meeting a limit; or

C. the treatment works, regardless of the type of treatment technology, must use chemical addition to achieve compliance with the one milligram per liter limit, and the discharge is to a receiving stream in a watershed listed in subitems (1) to (3). In this case the discharger may be granted a seasonal one milligram per liter limit, applicable from May 1 through September 30 and not applicable from October 1 through April 30:

(1) the lower Mississippi River and its tributaries from the mouth of the Chippewa River in Wisconsin to the Minnesota border;

(2) the Bois de Sioux and Red Rivers and their tributaries from the southern end of Lake Traverse at Browns Valley to the Canadian border; and

(3) the Missouri, Des Moines and Cedar Rivers and their tributaries in Minnesota.

*Subp. 5 D**esignated waters**. The one milligram per liter phosphorus limit established in subpart 3 applies to the waters designated in items A to F.*

A. All intrastate waters lying within the drainage basin of Lake Superior in the counties of Aitkin, Carlton, Cook, Itasca, Lake, Pine, and St. Louis (Townships 45 to 65 North, Ranges 7 East to 23 West).

B. The interstate waters of Lake St. Croix in Washington County (Townships 26 to 30 North, Range 20 West).

C. The St. Louis River from its source at Seven Beaver Lake (Township 58 North, Range 12 West) to and including St. Louis Bay (Townships 49 and 50 North, Ranges 14 and 15 West) and Superior Bay (Townships 49 and 50 North, Ranges 13 and 14 West).

D. The Mississippi River from its source to the Blandin Dam at the outlet of Paper Mill Reservoir in the City of Grand Rapids approximately 400 feet upstream from the bridge on U.S. Highway 169 including Lake Andrusia (Township 146 North, Range 31 West), Lake Bemidji (Townships 146 and 147 North, Range 33 West), Cass Lake (Townships 145 and 146 North, Ranges 30 and 31 West), Lake Itasca (Township 143 North, Range 36 West), Pokegama Lake (Townships 54 and 55 North, Ranges 25 and 26 West), and Winnibigoshish Lake (Townships 145, 146, and 147 North, Ranges 27, 28, and 29 West).

E. The Little Minnesota River and Big Stone Lake from the South Dakota border crossing to the outlet of Big Stone Lake at the dam immediately upstream from the U.S. Highway 12 bridge in Ortonville.

F. Albert Lea Lake (Township 102 North, Ranges 20 and 21 West) in Freeborn County.

Subp. 6. ***Averaging period for phosphorus limit****. The phosphorus limit required under subpart 3 must be a calendar month arithmetic mean unless the commissioner finds, after considering the criteria listed in items A and B, that a different averaging period is acceptable. In no case shall the one milligram per liter limit exceed a moving mean of 12 monthly values reported on a monthly basis, or a simple mean for a specified period, not to exceed 12 months. Calendar month effluent limits in effect on February 7, 2000, must remain in effect unless an assessment of the criteria listed in items A and B indicate a different averaging period is acceptable. An ~~different~~ averaging period other than monthly is acceptable when:*

A. ~~the effects of the phosphorus loading from the facility on the receiving water or downstream water resources is generally not measurable.~~ there is no measurable or predictable difference in the adverse effects of the phosphorus loading from the facility on the receiving water or downstream water resources compared to the loading that would result using a 30-day average limit; and

B. the treatment technologies being considered offer environmental, financial, or other benefits.

2. Scope and Definitions, Minn. R. 7053.0255, Subparts 1 and 2 [IX.G. TP limit, reasonableness]

Proposed 7053.0255, subpart 1 outlines the contents of this new section.

Proposed 7053.0255, subp. 2 contains eight new definitions relevant to TP effluent limits. SONAR Book I describes the need and reasonableness of the proposed definitions (Sections VI.B and X.B. in SONAR Book I). It is reasonable to define terms that have been used for decades but have not been defined in rule; the terms are: "affects," "measurable increase" and "measurable impact," "lake" and "reservoir." It is also reasonable to define new terms relevant to the proposed extension of the TP limit to new and expanded dischargers; these are: "new discharge," "expanded discharge", $122Q_{10}$" and "shallow lake."

3. TP Effluent Limits, Minn. R. 7053.0255,subp. 3 [IX.G. TP limit, reasonableness]

Three bases for applying a TP effluent limit to a point source discharge are consolidated into this subpart. They are:

1. The discharge is directly to or affects a lake, shallow lake or reservoir. This is the existing P rule which is not being changed except for the addition of "shallow lake."

2. The discharge is to a specific basin or waterbody listed in existing Minn. R. ch. 7065. The TP limits in this rule are not being changed except to move the list of waterbodies affected to Minn. R. ch. 7053, subp. 5.

3. The discharge is from a new or expanding facility that discharges more than 1,800 pounds of TP per year. The proposal being considered in this part of SONAR Book II.

Minnesota R. 7053.0255, subp. 3 also contains proposed new language related to TP limits and TMDLs and proposed changes to existing language dealing with the "fullest practicable treatment" paragraph. These are discussed separately in the next two sections.

4. Fullest Practicable Extent for TP Treatment Applies to Dischargers with a TP Limit [IX.G. TP limit, reasonableness]

The proposed extension of the TP limit to new and expanded dischargers and the other changes that are part of the restructuring and consolidation of the TP limits provide a good opportunity to clarify this provision (Minn. 7053.0255, subp. 3, item B.). This long-standing provision says that wastewater treatment plants should remove TP from the effluent to the "fullest practicable extent." The provision showing the proposed changes is shown above.

As stated in the *need* section (Section VII.I), there has been some misunderstandings about the interpretation of this provision; i.e., whether it means all dischargers regardless of whether or not they have a 1 mg/L TP limit, or only dischargers with a TP limit, have to provide nutrient removal to the "fullest practicable extent" (FPE).

The Agency has interpreted FPE as applying only to facilities that have a TP limit. This is based on the context of the provision and the long history of how this provision has been applied for over 30 years and reviews of this interpretation by Attorneys General staff. This paragraph was originally, and continues today, to be in the part of the rule that includes the TP effluent limit. This context clearly suggests that the paragraph is associated with TP effluent limits. The Agency has consistently interpreted this paragraph as applying only to dischargers that have a phosphorus limit. The following quote from the SONAR for the rulemaking completed in 2000 in which the option of a longer averaging period for TP limits was adopted illustrates this point.

"Also it [TP limits with averaging periods longer than one month] is consistent with the existing narrative concerning nutrient removal **associated with the 1 mg/L phosphorus limit** which is quoted below." (emphasis added) [17]

"In addition, removal of nutrients from all wastes shall be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients by this subpart are subject to the variance provisions of part 7050.0190."

The Minnesota Environmental Science and Economic Review Board (MESERB) commented that the intent of this paragraph needs clarification. The Agency agrees and that is what we are proposing. The Agency is reluctant, however, to completely remove the paragraph as suggested by MESERB (Exhibit A-34, page 3, no. 9). The Agency believes that removing the paragraph is neither needed nor desirable, as opposed to simply clarifying the language. The general concept of requiring a wastewater treatment plant to perform at their best is a sound policy and it has important environmental benefits. Also, the same provision, only applicable more broadly, is included in existing Minn. R. 7050.0210, subp. 4. The Agency's proposed clarification is reasonable.

5. Possible Exemptions from TP Limit [IX.G. TP limit, reasonableness]

The reasonableness of the three proposed exemptions to the 1 mg/L TP limit to new or expanded discharges is discussed in Section IX.H, below. The exemptions allow possible relief for dischargers impacted by the proposed extension of the TP limit.

6. Clarification of Criteria for Longer Averaging Period for TP Limits [IX.G. TP limit, reasonableness]

The Agency has the option of setting TP effluent limits in NPDES permits that can be averaged over a period longer than one calendar month, up to one year (Minn. R. 7053.0255 subp. 6). Permits with a longer averaging period are usually 12-month moving averages. Approximately

[17] SONAR, In the matter of proposed revisions of Minnesota Rules Chapter 7050, page 90, June 16, 1999.

35 municipal dischargers and several industrial discharges now have 1 mg/L TP limits with an averaging period longer than one month. Such facilities typically use Bio-P technology to remove TP, but most use some chemical as well.

The Agency is proposing to clarify the first of two criteria the Commissioner can use to decide when a TP limit with a longer averaging period is appropriate, and to make some other very minor clarifying language changes. The need for this clarification is found in Section VII.J; the proposed language changes are shown above.

In retrospect, the language in the existing first criterion, *"the effects of the phosphorus … is generally not measurable"* (Minn. R. 7050.0211, subp. 1a, item A) seems to conflict with the way the current TP limit has been implemented over the years. That is, in order for a limit to be issued, regardless of the averaging period, the impacts of the phosphorus loading should be measurable in the downstream lake or reservoir. This is consistent with the way the Agency proposes to define the word "affects."

The proposed new language will indicate that the lack of a measurable impact or predictable impact (e.g., though modeling) refers to the difference in the loading that would occur with a limit averaged over a longer period compared to the loading that would occur with a monthly limit. Thus, a discharger with a longer averaging period should not have a greater impact on the downstream resources than they would have if the limit were a monthly average; that is, any difference should not be discernable. The duration of the TP limit should not have a significant or measurable difference in downstream trophic conditions. However, the longer averaging period provides permittees with a possible "compliance cushion," and it allows operators to place greater confidence in the performance of Bio-P – that over the long-term the 1 mg/L limit can be met. This was the intended outcome when the longer averaging period was adopted in 2000.

It is the Agency's intent that the option of a longer averaging period for a TP limit should apply to any TP limit issued under proposed Minn. R. 7053.0255; i.e.:

- When the discharge is to or affects a lake, shallow lake or reservoir;
- New and expanded dischargers (> 1,800 pounds TP per year);
- To the specific waterbodies listed in the current Minn. R. ch. 7065.

The Agency's reasoning regarding the 1 mg/L limits in existing Minn. R. ch. 7065 when the longer averaging period was proposed was that no averaging period was specified for the limits in this rule. The Agency believed that it was reasonable, since the rule is silent as to any

averaging period, that assignment of an averaging period is left to the discretion of the Commissioner. The Agency suggested that the same criteria included in the proposed rule language (as revised in this rulemaking) would apply to the dischargers to the waterbodies listed in Minn. R. ch. 7065. Thus, averaging periods longer than a calendar month would be a possibility. The Agency believes that it is reasonable to extend this option to any facilities impacted by the proposed extension of the TP limit as well.

7. TP Limits Applicable to Limited Resource Value Waters [IX.G. TP limit, reasonableness]

Limited resource value waters (Class 7) are surface waters able to support only a very limited aquatic community, and offer only very limited opportunities for water recreation. Most are short headwater stream segments, usually channalized ditches that often have no flow in dry years. They range in length from less than a mile to about 20 miles. Class 7 waters are not afforded the same level of protection for aquatic life and recreation that Class 2 waters are. All candidate Class 7 waters undergo a use attainability analysis and the change in classification must be adopted through rulemaking (see SONAR Book III, Section XI).

Despite the limited beneficial uses assigned to Class 7 waters the Agency believes that the proposed extension of the TP limit to new and expanding dischargers should apply to dischargers to Class 7 waters. Class 7 dischargers have not been exempt from TP limits under the current rule. Fourteen of the 96 POTWs that currently discharge to Class 7 waters have TP limits. This course of action is consistent with the fact that phosphorus is conservative (not degraded), and it will move downstream potentially impacting downstream Class 2 resources. Most Class 7 reaches are only a few miles in length, thus the possibility for downstream impacts is real. Existing Minn. R. 7050.0214, subp. 3 provides for the protection of downstream Class 2 waters and associated beneficial uses.

From a practical standpoint probably less than half of the existing dischargers to Class 7 waters will be eligible for a TP limit, at least in the foreseeable future, because most will not exceed the *de minimis* loading of 1,800 pounds per year. Using current design flows, 55 of the total of 96 POTWs than discharge to Class 7 waters are below 0.2 mgd, 41 are equal to or greater than 0.2 mgd. Nine of the 14 discharges that have TP limits now are in the larger size group.

Dischargers to Class 7 waters can petition for relief under one or more of the proposed exemptions. While each request will be evaluated individually and protection of the downstream Class 2 water must be considered, dischargers to Class 7 waters may be able to bolster their case

for an exemption simply by the fact that the receiving waterbody is a limited resource value water.

H. POSSIBLE EXEMPTIONS TO 1 MG/L TP LIMIT [IX. TP limit, reasonableness]

1. Introduction and Removal of an Originally Proposed Exemption [IX.H. TP limit, reasonableness]

The proposed extension of the 1 mg/L TP limit to new and expanded dischargers larger than 1,800 pounds TP per year provides options for dischargers to seek relief from the requirement if they meet certain criteria. Dischargers may request a TP limit more lenient than 1 mg/L (alternative limit) or no limit at all. The potential exemptions are also called "off ramps." The three proposed off ramps are not mutually exclusive; that is, a discharger may indicate in their request that they qualify for relief under one or more. Each will be discussed in turn.

The Agency is aware that the proposed extension of the TP limit may result in a limit being imposed in situations where the benefits will not be discernable, or meeting the limit may not seem cost-effective. This does not mean that there is no environmental gain in reducing TP from wastewater treatment plant effluents, even when the improvements to the receiving stream may not be measurable. In general, the less TP discharged to receiving waters the better. However, the Agency believes that there will be situations when the imposition of a TP limit may have minimal benefits for the environment, and the proposed rule needs to provide for these situations. The Agency intends to evaluate each request for an exemption on a case-by-case basis using a weight of evidence approach, consistent with the fundamental rationale and goal of the proposed extension of the phosphorus limit, which is to prevent the eutrophication of surface waters by reducing the loading of TP from point sources.

The Agency originally proposed an exemption that has now been removed and is no longer part of the proposed rule. The draft rule amendments that have been available to interested parties for about the last two years included the now deleted off ramp. In November 2006 after final discussions among the staff, the Agency decided that one of the three original off ramps was unworkable. This off ramp allowed for no limit if the amount of TP discharged in one year without a limit was essentially the same (no more than five percent more) as the amount of TP that would be discharged with a limit. The off ramp was aimed at facilities that use biological phosphorus removal technologies (Bio-P) that might not be able to consistently meet a 1 mg/L

limit. The Agency continues to be encouraged by the promise of Bio-P technologies, partly because it can achieve low effluent TP while minimizing the use of chemicals. But we felt this off ramp as worded was unworkable and not needed. The Agency decided to remove it for the reasons outlined below.

1. The off ramp required the Agency to predict TP removal performance with and without a limit before the facility was operational. While confidence seems to be growing that Bio-P facilities can and will achieve TP effluent concentrations of about 1 mg/L without chemical addition, it would be difficult to predict beforehand whether any facility could achieve essentially the same TP removal with or without a permit limit. Each facility is unique and many variables influence TP removal performance.
2. The proposal to allow up to five percent more TP discharged without the limit is too small a difference to measure consistently and it provides almost no real "relief" to the discharger.
3. It would be difficult (and time consuming) to develop a more realistic and supportable "no-limit" cap to replace the five percent cap, based on the experience to date of TP removal performance of Bio-P plants in Minnesota.
4. Effluent limits must be met virtually 100 percent of the time for the facility to remain in compliance with a monthly mean limit (or as an annual mean for many Bio-P facilities). It is a well accepted concept that the permit limit is a strong incentive for operators to provide better wastewater treatment over the long-term in order to stay in compliance. Given the uncertainties and variability associated with the wastewater treatment process, it is common for wastewater treatment plant operators to produce an effluent that is considerably better in quality than the permit allows to provide a margin of compliance safety. This is true generally for any pollutant controlled by a permit limit, not just TP. The off ramp as proposed gave up much of this inherent advantage and the resulting reduction in TP loading to the receiving stream.

The other proposed off ramps can accommodate situations where relief for a Bio-P facility is warranted.

2. Exemption Rule Language, General [IX.H. TP limit, reasonableness]

The proposed exemptions are loosely based on the exemptions included in Wisconsin rules, Chapter NR 217 adopted in 1992 (NR 217.04(2), Exhibit PL-13, see Section IX.J). The Agency's proposed exemptions represent a consolidation and, we believe, a logical and appropriate refinement of the exemptions adopted by Wisconsin. The exemptions in Chapter NR

217 are not applicable to dischargers in Wisconsin's Lake Superior and Lake Michigan watersheds (NR 217.04(2)(B)1). Similarly, the proposed exemptions in Minn. R. 7053.0255 do not apply to dischargers in Minnesota's Lake Superior basin or the other waterbodies listed in existing Minn. R. ch. 7065, or dischargers that discharge "to or affect" a lake or reservoir. The Wisconsin Department of Natural Resources developed an implementation guidance document that outlines how the four exemptions in NR 217 will be administered (Exhibit PL-14). The Agency will consider developing a similar guidance document for Minnesota.

It is our belief that the three proposed off ramps, plus the variance option, can adequately address the anticipated variety of situations – that they are broad enough to apply to a wide range of individual situations. It is impossible to anticipate every scenario that might warrant an alternative limit or no limit. In this situation it is appropriate to provide enough flexibility in the rule language to accommodate the inevitable unforeseen situations.

Alternative limits granted under an exemption can be a monthly average or an annual average if appropriate under Minn. R. 7053.0255, subp. 6.

Once granted, an exemption is not necessarily permanent. Situations can change and the Agency may have reason to revoke an exemption in the future. For example a future TMDL may call for all discharges in the watershed to implement treatment for TP. Revocation of an exemption and the addition of a TP limit would be done at the time the permit is reissued, or through a permit modification if necessary, as with any change to a permit condition. Such changes are made in consultation with the discharger and their consultants. The public at large will have the opportunity to comment on the change as part of the NPDES permit process.

The granting of an exemption is in the context of the proposed extension of the TP limit to new or expanding facilities. The exemptions are not applicable to facilities that already have a TP limit. Antibacksliding provisions would apply to facilities with existing TP limits unless they expand. Expansion (> 1,800 pounds TP/yr.) triggers the proposed TP limit, and expansion generally negates antibacksliding requirements; therefore, the exemptions would be applicable. However, it is unlikely that an expanding facility that already has a TP limit would be a candidate for an exemption.

The proposed exemptions in Minn. R. 7053.0255, subp. 4 are repeated below in the context of the proposed reorganization of the TP limits in Minn. R. ch. 7053.

[Minn. 7053.0255] *Subp. 3.* ***Total phosphorus effluent limits***.

A. Phosphorus removal to one milligram per liter is required when subitems 1, 2, or 3 applies:

(1) the discharge of effluent is directly to or affects a lake, shallow lake, or reservoir;

(2) the discharge is to the specific basins and water bodies designated in subpart 5; or

(3). the discharge is new or expanded as defined in subpart 2, except when the discharger can demonstrate to the commissioner that the discharger qualifies for an alternative phosphorus limit as provided in subpart 4.

B. ~~In addition,~~ If a phosphorus effluent limit is required under item A, removal of nutrients from all wastes ~~shall~~ must be provided to the fullest practicable extent wherever sources of nutrients are considered to be actually or potentially detrimental to preservation or enhancement of the designated water uses. Dischargers required to control nutrients ~~by~~ under this ~~subpart~~ part are subject to the variance provisions of ~~part~~ parts 7000.7000 and 7053.0195.

*Subp. 4. **Alternative phosphorus effluent limits for new or expanded discharges**. New or expanded discharges subject to a one milligram per liter phosphorus effluent limit in subpart 3, item A, subitem 3 may request an alternative limit or no limit if one or more of items A to C apply. New or expanded discharges are defined in subpart 2. The exemptions in this subpart do not apply to facilities that discharge directly to or affect a lake, shallow lake or reservoir or to discharges to the waters listed in subpart 5. Dischargers seeking an alternative limit due to very high per capita treatment costs or economic hardship must apply for a variance under parts 7000.7000 and 7053.0195.*

The information submitted to the commissioner for consideration of an alternative limit must include, at a minimum, a description of the treatment technology used, influent and effluent total phosphorus concentrations, a phosphorus management plan for the facility, descriptions of any measures already taken to reduce phosphorus sources to the facility, and expected reductions in phosphorus concentrations following implementation of the phosphorus management plan. The discharger may qualify for an alternative total phosphorus limit or no limit if it can demonstrate:

A. the discharge is to or upstream of a water body listed on the applicable impaired water list (section 303(d) of the Clean Water Act) and the total maximum daily load study is complete and approved by the United States Environmental Protection Agency at the time the new or expanding facility is in the planning and design phase. The total maximum daily load study must have considered impacts from phosphorus loading on the impaired water body;

B. the environmental benefits to be achieved by meeting a phosphorus limit are outweighed or negated by the environmental harm caused by meeting a limit; or

C. the treatment works, regardless of the type of treatment technology, must use chemical addition to achieve compliance with the one milligram per liter limit, and the discharge is to a receiving stream in a watershed listed in subitems (1) to (3). In this case the discharger may be granted a seasonal one milligram per liter limit, applicable from May 1 through September 30 and not applicable from October 1 through April 30:

(1) the lower Mississippi River and its tributaries from the mouth of the Chippewa River in Wisconsin to the Minnesota border;

(2) the Bois de Sioux and Red Rivers and their tributaries from the southern end of Lake Traverse at Browns Valley to the Canadian border; and

(3) the Missouri, Des Moines and Cedar Rivers and their tributaries in Minnesota.

3. Possible Exemption to TP Limit if TMDL is Complete [IX.H. TP limit, reasonableness]

The Agency believes it is important for the rule to state how the proposed extension of the TP limit to new and expanding facilities will be implemented in conjunction with nutrient-related TMDLs. A TMDL is required when a waterbody is listed as impaired. Impairment means a water quality standard is exceeded and beneficial uses are actually or potentially lost. The addition of a paragraph in the rule that addresses TMDLs and the proposed extension of the TP limit was in response to public comments mostly from MESERB. The proposed language is shown in the previous Section (Minn. R. 7053.0255, subp. 4, item A).

As explained in the need section (Section VII.H.2) the Agency's original proposal was to have relevant TMDLs determine the TP limits for affected dischargers without the dischargers needing to make a request. However, rule language that would allow an automatic TMDL

exemption that covers all possible situations and TMDL conditions proved to be unworkable. The Agency believes now that the petition process will facilitate the site-specific aspects of deciding whether the TMDL exception is applicable to a particular discharger. Therefore, the Agency is now proposing to include the "TMDL exemption" as one of three potential exemptions to the TP limit that a discharger can apply for. The reasons for this change will be discussed in this Section.

The proposed language says that if the discharge is to or upstream of a waterbody impaired due to exceedance of the eutrophication standards (or the precursor nutrient criteria) or other nutrient-related standard, and the TMDL is complete and approved by EPA at the time a new or expanding discharger is in the planning and design phase, then the TMDL will determine the need for and magnitude of the TP effluent limit. Also, the discharge in question must be within the scope of the TMDL study. The TMDL study first quantifies nutrient loading from both point and nonpoint sources that caused the impaired condition. Next the TMDL study determines the load reductions needed from all sources to bring the waterbody back into compliance with standards. Reductions needed from point sources will be achieved through TP effluent limits in NPDES permits. Thus, if applicable, the TMDL will determine:

- If a limit more stringent than 1 mg/L is needed;
- If a 1 mg/L limit is needed;
- If a limit less stringent than 1 mg/L is adequate; or
- If no limit at all is needed.

If the timing of the TMDL and the plan to build new or expand coincide, it is logical and reasonable for the TMDL to be the basis for the TP limits for the affected dischargers assuming other conditions are met. The basic conditions that must be met are:

- The discharge is to or upstream of a waterbody listed on the 303(d) impaired waters list;
- The total maximum daily load has considered impacts from phosphorus loading on the impaired waterbody;
- The total maximum daily load is complete and approved by the EPA at the time the new or expanding facility is in the planning and design phase; and
- The phosphorus loading from the new or expanding discharge is included as part of the point source waste load allocation in the total maximum daily load study. In other words, this exemption does not apply to discharges upstream of the impaired waterbody but outside the scope of the TMDL study.

Discharge to or upstream of impaired waterbody. If the discharge is directly to the impaired waterbody, which currently is usually a lake, the discharge most likely has a TP limit under the current rule. In this situation, the TMDL is the appropriate means to determine new limits needed to restore the waterbody to compliance with standards. A limit more stringent than 1 mg/L is a strong possibility. A new discharger would be discouraged from discharging to an impaired lake or reservoir.

The situation is more complex if the new or expanded discharge is upstream of the impaired waterbody. To be eligible for the TMDL exemption, the discharge must be included among the discharges whose TP loading was assessed in the TMDL study. In other words, if the discharge is upstream of the impaired waterbody but so far removed as to be outside the scope of the TMDL (or beyond the scope for any reason), then the TMDL will not determine the TP limit for that discharge.

The Lake Pepin TMDL provides a good example of why the qualifications for the TMDL-related exemption are needed and reasonableness.

The upper Mississippi River watershed is so large that discharges far upstream of Lake Pepin, either on the main stem of the river or on a tributary, may be beyond the scope of the Lake Pepin TMDL. The TMDL study is about two to three years from completion, but at this time it is anticipated that the TP loading from point sources upstream of approximately Little Falls will not be included in the waste load allocation for this TMDL. If this holds true, the loading from discharges upstream of this point will be considered too inconsequential and too far upstream to impact Lake Pepin. The TMDL is likely be silent on the need for TP limits for facilities upstream of this point. The concern for the Agency is that, while the TP loading from these discharges may have very little impact on Lake Pepin, it very well could have an impact on the immediate receiving stream or other more local waterbodies within the Lake Pepin watershed. The upper Mississippi River watershed includes some highly valued and heavily used resources that should be protected from excess nutrients. Besides the head waters of the Mississippi River itself, examples of important tributaries are the Shell, Crow Wing, Boy and Prairie Rivers.

The Minnesota and St. Croix Rivers are part of the Lake Pepin watershed, but the point sources in these two major watersheds may not be included in the Lake Pepin TMDL. The Minnesota River is covered by its own nutrient-related TMDL. However, as discussed below, this TMDL may not fully address the eutrophication problems in the Minnesota River. The need to reduce phosphorus loading to the St. Croix basin from point sources is already being driven by the importance of protecting the trophic status of Lake St. Croix (plus the required 1 mg/L TP limit

for discharges to Lake St. Croix under existing Minn. R. ch. 7065), and ambitious bi-state nutrient reduction goals and nondegradation requirements applicable to the watershed.

In summary, the focus of a TMDL is to restore the impaired waterbody to compliance with standards. The TP loading from dischargers far upstream in the watershed may have little impact on the impaired waterbody itself, but the discharge may impact the local receiving stream or other local resources not germane to the TMDL. It is reasonable to have the proposed extension of the TP limit apply to dischargers outside the scope of a nutrient-related TMDL.

The impairment must be nutrient-related. The TMDL must to be based on the exceedance of eutrophication standards (or the predecessor nutrient criteria) directly, or based on an impairment caused by excess nutrients. The Lake Pepin TMDL is an example of the former and the TMDL for the lower Minnesota River is an example of the latter.

When the TMDL is based on an exceedance of the eutrophication standards, the resulting TMDL becomes the direct basis for TP effluent limits for dischargers that are included in the scope of the TMDL analysis. Since eutrophication is the problem being addressed, the use of the TMDL as the basis for the permit limits should be straightforward. However, when the TMDL is based on the exceedance of a standard that is nutrient-related such as dissolved oxygen (DO), the recommendations of the TMDL may not fully address potential eutrophication problems in the watershed. Again the TMDL for the lower Minnesota River provides a useful example. This TMDL is complete and implementation has started.

The lower Minnesota River is impaired due to low DO traced to excess nutrients. The high levels of nutrients (phosphorus) produce a very abundant algal population, which, when the algae die and decay, create a demand for oxygen that the river cannot meet. The result is exceedances of the DO standard. Low DO in the lower Minnesota River is more likely to be a problem when temperatures are warm and flow is low. To correct the DO problem, reductions in phosphorus loading needs to occur in the summer months and possibly only during periods of relatively low-flow. The implementation plan for reducing point source TP loading in the watershed is to impose summer (May through September) TP limits on all the larger dischargers in the basin. The TMDL considers a five-year period and has set a goal to reduce TP loading to the lower river by 35 percent. The TMDL determined that the TP limits should be applicable at all flows. The point of this discussion is that, while the imposition of seasonal TP limits may be appropriate to solve the DO problem in the lower Minnesota River, seasonal limits may not be adequate to reduce the overall eutrophication problem in the Minnesota River. If impairment was based directly on the eutrophication of the river, year-round TP limits may have been the

recommended TMDL solution. It is reasonable for these situations to be assessed on a case-by-case basis. Requiring the discharger to petition the Agency to consider relief under the TMDL exemption is an appropriate means to accomplish this.

The assignment of TP permit limits to future expansions or newly constructed facilities in a watershed once the TMDL is complete and implemented also helps make the case for a site-specific approach. Such "post-TMDL" TP limit questions are best evaluated on a case-by-case basis because the nature of the new point source(s) and possibly timing issues will affect how the TMDL addresses the new TP loading.

If the facility is all new (or the expansion is large) and the TMDL study is complete and being implemented, the facility represents a potential future increase in TP loading to the watershed that the TMDL did not directly consider. The TMDL has already allocated the acceptable point source TP loading in the watershed. Presumably the TMDL includes a process to deal with potential increases in future loadings. Future increases in TP loading may be accommodated by "using" some of the loading allocated to a "reserve capacity" by the TMDL, by a TP load trading process, or possibly absorbed as part of the TMDL "safety factor."[18] TMDLs are expected to allocate some loading to a reserve to accommodate future growth. The TMDL safety factor is typically not a quantifiable "reserve" but a margin of safety that reflects uncertainties in the analysis. However, the safety factor may help accommodate some future increases in loading.

If the post-TMDL change is an expansion of an existing facility, the TMDL most likely considered the loading from the existing facility in its point source waste load allocation. This may make it easier to accommodate the potential increased loading from the expanded facility within the waste loads considered by the TMDL. It is possible, however, that the expanded facility may be required to stay within the previously allocated load amount.

Applicability of proposed TP limit if TMDL not complete. The proposed rule says that the new or expanding facility must be in the planning or design phase at the time the TMDL is complete for the TMDL to determine the TP limit. The timing of TMDL completion and the timing of the design of the facility, therefore the applicability of the TMDL exemption, will be case-specific. As noted above, potential questions related to timing are another reason for a case-by-case approach.

[18] The TMDL study assesses the loading of the pollutant causing the exceedance, determines the total load that will meet standards (and reductions needed to achieve that load), and "allocates" the acceptable load between point sources, nonpoint sources and a reserve for future growth, all with a margin of safety due to uncertainties.

If the new or expanded discharge is to, or upstream of, a nutrient-impaired waterbody (or a waterbody impaired due to exceedances of a standard caused by excess nutrients) and the TMDL study has not started or is incomplete, then the 1 mg/L TP limit applies to that discharger.[19] The Agency believes that the proposed extension of the TP limit and TMDLs must proceed independently except when the timing allows the TMDL to determine the limit. TMDLs are about restoring impaired waterbodies. The proposed phosphorus limit is about reducing phosphorus loading to surface waters, not only to help restore impaired waters but to help prevent waters from becoming impaired in the first place. Also, it will take decades to complete all the pending TMDLs. It is very likely that the number of waterbodies considered impaired due to eutrophication will continue to increase. This includes the possibility that more non-lake waterbodies will be listed in the future as impaired for nutrients or nutrient-related pollutants as more data, both chemical and biological, are accumulated showing the negative impacts of nutrients on rivers and streams.

The Agency believes it would be shortsighted to wait for a clear demonstration of impairment before action is taken, and then count on the TMDL to restore the waterbody to health. If we wait until a waterbody is impaired not only will more surface waters be in a degraded condition, but the cost to bring these waterbodies back to health, if possible at all, is usually far more than the cost of preventive measures.

The Agency will make the timing decisions. A decision will need to be made whether a nutrient-related TMDL that is pending approval from EPA, for example, will be available in time to determine the TP limit for a facility that has advanced through the planning and design phase and may be under deadlines to complete construction. The requirement that EPA must approve the TMDL helps establish a firm date for that part of the process. These decisions will be case-by-case and permit-specific. The Agency will make these decisions in consultation with the discharger and with other interested parties. The staff may ask the Agency Citizens' Board to approve a staff decision, and any decision can be challenged during the NPDES/SDS permit process.

Summary. The Agency is confident that the TMDL process will correctly determine the TP effluent limits needed to restore nutrient-impaired waterbody to health. However, a new or expanding discharger in the watershed of an impaired waterbody should get a 1 mg/L limit under the proposed extension of the TP limit if certain conditions are not met. Because each TMDL is potentially unique, the Agency believes that the assessment of whether the TMDL should or

[19] The federal requirements of 40 CFR 122.4(i) also apply.

should not determine the TP limit needs to be done on a case-by-case basis. Requiring the discharger to petition for relief under the TMDL exemption will facilitate the case-by-case analysis. By placing the burden on the discharger to request a TMDL-related exemption, the Agency is not trying to put roadblocks in the way of dischargers, or discourage dischargers from petitioning the Agency. If it is clear that the TMDL-determined limits are appropriate in a particular case, the Agency will advise the discharger to submit a petition. The granting of an exemption in these situations should be straightforward and proceed smoothly.

The following is an outline of the basic steps that must be met for the Agency to consider using the TMDL as the basis for a TP limit.

1. The discharge will get a TP limit if it is new or expands after July 1, 2007 and the annual loading of phosphorus from the facility will exceed 1,800 pounds per year, unless: (To reiterate, the Agency's goal for this proposed change to the TP effluent limit is to maintain the gains in reducing point source TP loading made under the Phosphorus Strategy over the last six years, and to codify the Strategy in rule.)

2. The new or expanding discharge is to or upstream of a waterbody on the 303(d) impaired waters list (the other two potential exemptions are discussed in the next two sections); and:

3. The impairment is due to excess nutrients. The impairment may be due to the exceedance of the nutrient criteria or eutrophication standards directly, or due to exceedance of another standard caused by the excess nutrients such as dissolved oxygen; and:

4. The TMDL study for the impaired waterbody is complete and approved by EPA at the time the new or expanding discharger is in the planning or design phase; and:

5. TP loading from the discharge is included in the phosphorus waste load allocation for point sources upstream of the impaired waterbody. That is, the discharge in question must be included in the scope of the TMDL study; then:

6. The TMDL may determine the TP effluent limit for the new or expanding discharge pending the site-specific analysis.

If the expansion or new construction occurs before the TMDL is complete and approved, or it is outside the scope of the TMDL, it is reasonable to require the 1 mg/L limit as a means to reduce phosphorus loading to Minnesota's receiving waters.

4. Environmental Harm Exceeds Gain [IX.H. TP limit, reasonableness]

The second proposed exception considers a situation where the environmental harm may outweigh or negate the environmental benefit from meeting a 1 mg/L TP effluent limit. The Agency is mindful that the removal of TP from wastewater does not come without costs, both environmental and monetary. Examples of environmental costs may include additional sludge production from chemical addition, energy consumption and nonrenewable resource depletion, and materials transport. Environmental benefits, besides reduced TP loading and improvements to water quality may include a generally better quality effluent all around and reduced concentrations and loadings of non-target (non-TP) pollutants (see next Section).

Under this off ramp, a discharger may be granted either an alternative limit less stringent that 1.0 mg/L or no limit. While the Agency has not specified a cap on an alternative limit, it is unlikely that any alternative limit would exceed 1.5 mg/L as a monthly mean or a mean for a longer period.

A situation in which this off ramp may be applicable, and the types of information that would be relevant in the request, is illustrated by the following hypothetical example.

A growing city discharges to a large river and needs to expand their wastewater treatment facility. The current population is about 3,000 and the current TP loading of about 3,200 pounds per year exceeds the *de minimis* of 1,800 pounds per year. The city decides to adopt biological phosphorus removal treatment technologies (Bio-P). This much information alone is not enough to qualify the city for this off ramp. However, if the following information is presented to the Agency, relief under the second exemption might be applicable.

- The receiving river provides extensive dilution even under low-flow conditions (e.g., > 100:1), and there are no lakes or reservoirs downstream.
- The city's contribution of the total TP loading to the river at the point of discharge is very small relative to all other sources.
- In spite of the increased flow due to the expansion, the adoption of Bio-P technology will reduce overall TP loading below current levels.
- The city has implemented a phosphorus management plan and can document reduced influent and effluent TP concentrations as a result.
- The capital and operation and maintenance costs of adding chemical treatment to guarantee meeting a 1 mg/L limit are relevant to the consideration of this (and any) off ramp, but

economics may not be a major factor (see Section IX.H.6).

- The operator plans to use some chemical to assure compliance with the 12-month average 1 mg/L TP limit. Local options for disposal of additional sludge are limited and costly.
- The Bio-P technology will achieve an effluent TP concentration close to 1 mg/L without use of chemical.

The last bullet above merits some further explanation. The Agency believes that Bio-P treatment technologies have proven to be a very viable option for Minnesota POTWs and we wish to avoid any rule amendments that might be a disincentive for someone to consider Bio-P. Therefore, a new or expanded Bio-P facility that can demonstrate the ability to meet an effluent TP concentration of 1 mg/L without a limit and without the use of chemical addition might be a candidate for this off ramp, if other facts such as those outlined above also apply. Some pond systems may be able to qualify under this off ramp.

In conclusion, it is the intent of this exemption that achievement of a 1 mg/L TP effluent limit not be at the expense of other environmental considerations. The exemption provides an opportunity to consider in a more comprehensive or holistic manner the balance between environmental gains, and the environmental and monetary costs of a TP limit.

5. Potential Winter Exemption [IX.H. TP limit, reasonableness]

The third proposed exemption would allow a seasonal limit applicable only during the warm months rather than year-round in certain watersheds, and when chemicals need to be added to meet the limit. This exemption recognizes the relatively higher overall potential costs, both in dollars and environmentally, of removing phosphorus by chemical addition. Under this off ramp a discharger can request relief from a TP effluent limit from November 1 through April 30 each year; the limit would be enforced from May 1 through October 31. This off ramp is patterned after the seasonal TP limit in the general permit developed for the Minnesota River TMDL. The potential exempted winter months match those in the general permit. The watersheds this off ramp is applicable to are:

- The lower Mississippi River and its tributaries from the mouth of the Chippewa River in Wisconsin (below Lake Pepin) to the Minnesota border;
- The Bois de Sioux and Red Rivers and their tributaries from the southern end of Lake Traverse at Browns Valley, Minnesota to the Canadian border; and
- The Missouri, Des Moines and Cedar Rivers and their tributaries in Minnesota.

In general, these watersheds are proposed for this exemption because at the current time they do not include river segments with TMDLs for nutrients or nutrient-related pollutants. In general, they do not have major lakes or reservoirs immediately downstream, and none of the watersheds includes rivers with TP removal required by rule or recommended by major nutrient reduction agreements such as in place for the St. Croix River. The geography and land use patterns in these watersheds suggests that nonpoint sources of TP may overshadow the loading from point sources. Also, the rivers in these watersheds may have characteristics or factors that limit algal growth. For example, the turbidity of the Red and Bois de Sioux Rivers seems to limit algal growth such that TP loading may not have the same impact it would have in a less turbid river. The lower Mississippi River is a very large system with a large flow and most point sources represent a small fraction of the total TP loading to the main stem. Finally, the off ramp recognizes that TP loading is generally less likely to have as direct or obvious a negative impact when temperatures are cold.

In general, the Missouri, Des Moines and Cedar River watersheds have similar watershed and water quality characteristics as the adjacent Minnesota River watershed, and it seems reasonable to make this off ramp available to dischargers in these watersheds at this time.

It is worth emphasizing that this off ramp (as for the other off ramps) is not automatic, that dischargers must request the exemption and the Agency will need to evaluate each request. Otherwise the limit will be year-round. TP loading is an issue in essentially all watersheds; in fact the basin management plans for Lower Mississippi and Cedar Rivers list nutrients and phosphorus specifically as a pollutant of concern. Also, if the discharge impacts a trout stream in the lower Mississippi River watershed, the special importance and unique water quality concerns for these resources will need to be carefully considered as part of any request.

6. Economic Hardship -Variance [IX.H. TP limit, reasonableness]

The Agency believes that cities or industries seeking relief from the proposed 1 mg/L TP limit based wholly on economic concerns do so through the variance process (Minn. R. 7050.0190, Minn. R. 7053.0195 and 7000.7000). While economic issues are likely to be part of the justification for a request for an alternative limit under one of the exemptions discussed above, if the primary basis for the request is high treatment costs or economic hardship for the residents, then the variance is the proper approach. Example economic considerations would be the total or amortized capital and projected annual operation and maintenance costs to meet a 1 mg/L limit, the overall economic vitality of the community, the per capita treatment costs compared to the costs in similar sized communities, and the average or median household income.

The proposed rule language that suggests seeking a variance for economic concerns is in the first paragraph of Minn. R. 7053.0255, subp. 4.

7. Review of Requests for an Exemption [IX.H. TP limit, reasonableness]

The criteria the Agency staff will use to evaluate the requests are broadly articulated in the proposed rule language shown above. The criteria listed consider the overall environmental cost/benefit, facility operation, effluent quality and the type and location of the receiving water. Additional information likely to be needed by the Agency to make a decision includes influent and effluent TP data, the discharger's phosphorus management plan and progress made implementing it, water quality data for the receiving water, anticipated TP treatment costs, and the comments of concerned and interested parties.

There is no way to predict the number of requests for an alternative limit the Agency will receive, but based on the experience of the last six years under the Strategy, it is anticipated that utilization of these exceptions will be infrequent (i.e., anywhere from none to three per year). It is the Agency's intent to carefully review all requests, assess the merits of the request, and make a fair and reasonable decision, consistent with the stated overall purpose of the proposed extension of the TP limit, which is to prevent the eutrophication of surface waters through the reduction of TP loading from point sources. Depending on the number of requests and public input, the Agency may find it advantageous to prepare guidance that advises parties on how to prepare and support a request along the lines of the Wisconsin Department of Natural Resources guidance (Exhibit PL-14).

It is anticipated that the process for the review and disposition of requests will unfold more or less as follows.

1. A community or industry plans to build a new or expand an existing wastewater treatment facility which will exceed the *de minimis* loading of TP.
2. The responsible party is submitting a permit application and decides to request an alternative limit. The request can accompany the permit application or it can be submitted at any time prior to the permit being finalized. Logically the request would be made in the initial phase of preparing the permit and while the facility is in a planning or design phase prior to any construction.
3. The Agency receives the request which is forwarded to staff that review permits for possible TP limits, and permit engineers and writers, as needed.

4. The request is reviewed for completeness, and if found to be incomplete, the petitioner is contacted to obtain the needed information.
5. Once complete, Agency staff will complete their review and make a preliminary determination to grant or deny the request.
6. Discussions about the preliminary decision are held with the responsible party and the broader public, if appropriate.
7. If the request is denied the Agency will spell out its reasons in writing to the petitioner and provide the supporting data/information used to make the decision.
8. If denied, the permit is issued with the 1 mg/L TP limit.
9. The Commissioner may ask the Agency Board to approve a decision in a high profile or controversial case.
10. Any party can comment on the limit during the public comment period for the permit, and any party can request a contested case hearing to have the limit reviewed.
11. If the exemption request is granted, the permit is issued with a more lenient limit or no limit, as appropriate, and steps 9 and 10 follow as outlined above.

Just as there is no way to know how many requests will be received, it is also impossible to guess how many requests might be granted or denied. But, as stated previously, it is the Agency's intent to seriously and carefully review all requests. While the goal is to reduce point source phosphorus loading, the Agency is not interested in requiring treatment when the weight of evidence suggests that there is little to be gained for the costs. Costs can be both environmental as well as monetary.

8. Conclusions [IX.H. TP limit, reasonableness]

The proposed rules requiring a 1 mg/L TP effluent limit for new and expanding discharges of greater than 1,800 pounds per year provide for the possibility of an alternate TP effluent limit or no limit. The Agency will review all requests consistent with the overall purpose of this provision, which is to reduce anthropogenic sources of phosphorus to the state's surface waters. The Agency does not anticipate getting a large number of petitions. The exemptions do not apply to discharges determined to be directly to or affecting a lake, shallow lake or reservoir or to waters listed in 7053.0255 Subpart 5 of the rule.

The first exemption allows the TMDL for a nutrient-impaired waterbody to determine the TP effluent limit if certain conditions are met. The second exemption considers environmental harm that may outweigh or negate environmental benefit from a 1 mg/L TP effluent limit. This exemption is applicable to situations where the discharger can demonstrate a net environmental

disadvantage from the TP limit (including a consideration of costs). This exemption, under some conditions, might apply to Bio-P facilities that can achieve an effluent TP concentration of 1 mg/L without use of chemicals. An alternative limit or no limit is possible under this exemption. The third exemption recognizes the properties of certain watersheds that may minimize the impacts of TP loading in the winter months, and the greater requirements of TP removal by chemical addition. A variance is the proper avenue for dischargers if they are seeking relief mainly on economic considerations.

I. INCIDENTAL REDUCTION OF POINT SOURCE MERCURY [IX. TP limit, reasonableness]

Phosphorus removal from wastewater carries significant benefits beyond reductions in TP loading to surface waters. In general any wastewater treatment process that enhances the reduction of total suspended solids (TSS) will also reduce the levels of pollutants that adhere to particulates. Trace metals including mercury are good examples of such pollutants. Because both chemical addition and the Bio-P treatment technologies are efficient in removing solids, effluents from these facilities generally have low concentrations of mercury and other metals. The draft regional mercury TMDL identifies implementation of mercury minimization plans and **enhanced phosphorus removal** as the two means of achieving point source wasteload reductions of mercury (Exhibit M-2, page 37).

One of the advantages of the Bio-P treatment process is improved sludge handling qualities and reduced levels of suspended solids (see Section XI.B). Data from three facilities that use the Bio-P process show average total mercury effluent concentrations of 2.56, 3.26 and 3.65 ng/L. Wastewater treatment plants with conventional non-Bio-P secondary treatment average about 5.5 ng/L mercury in their effluents. These concentrations are below the current mercury water quality standard of 6.9 ng/L.

Mercury (shaded rows), phosphorus and TSS data from two Metropolitan Council Environmental Services (MCES) plants, Eagles Point and Metro are shown in Table II-18. Both plants use Bio-P. The Eagles Point data are shown graphically in Figure II-11. These data illustrate the effectiveness TP removal has in reducing effluent mercury concentrations.[20]

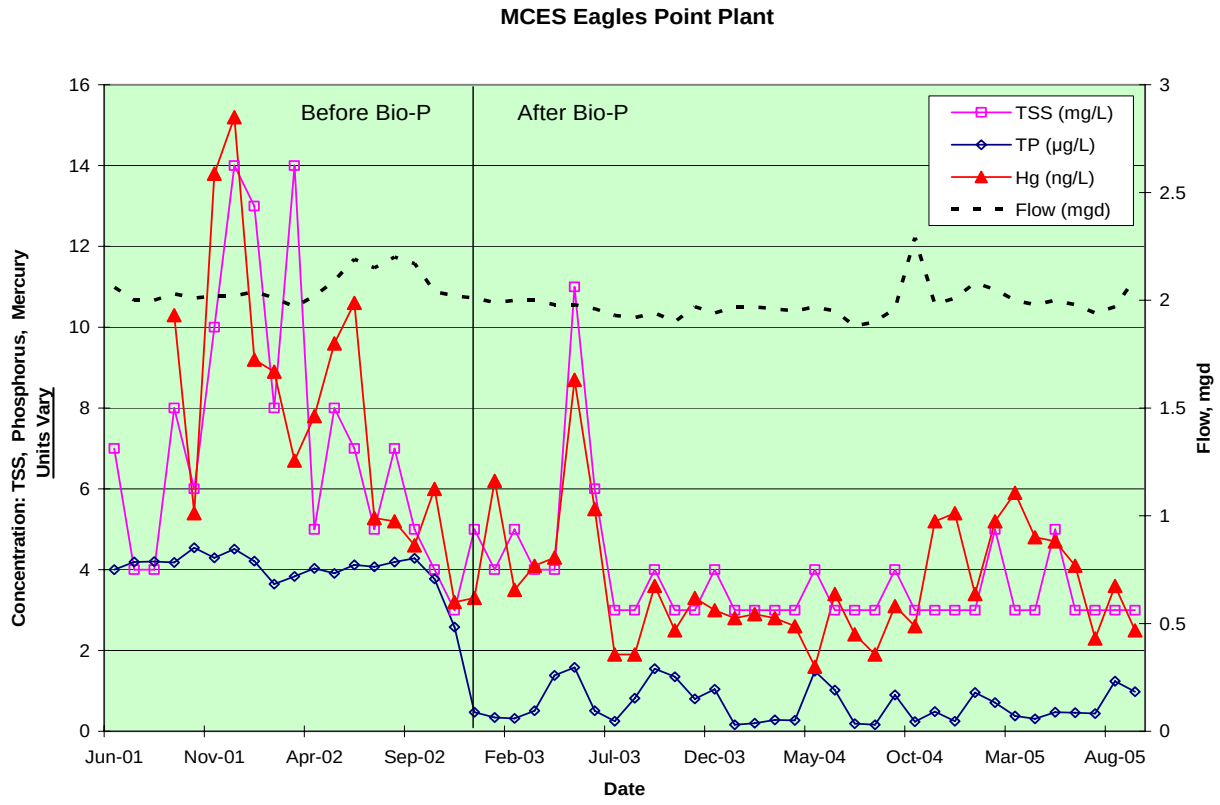
[20] It should be noted that the mean mercury concentration in the Metro plant effluent for the first six months of 2006 is 7.8 ng/L. We do not know the reason for this increase.

Table II-18. Mercury Concentrations in the Effluent of Two MCES Plants Before and After the Approximate Dates of Implementing TP Removal by Bio-P.

Parameter	Eagles Point		Metropolitan	
	Before June 2001 to December 2002	After June 2003 to September 2005	Before December 2001 to June 2003	After July 2003 to September 2005
Mercury, ng/L*				
Median	7.3	3.4	6.1	4.6
Mean	7.8	3.7	6.7	5.0
Total Suspended solids, mg/L				
Median	7.0	3.0	4.5	3.0
Mean	7.2	3.7	7.3	3.0
Phosphorus, µg/L				
Median	4.1	0.50	1.4	0.60
Mean	3.8	0.67	1.5	0.65

*Eagles Point and Metro plants have 6.9 and 9 ng/L monthly average mercury limits, respectively.

Figure II-11. Mercury, TP and TSS Data from the MCES Eagles Point Plant Showing Reductions in Effluent Mercury Concentrations After Bio-P was Initiated.



J. PHOSPHORUS LIMITS OF OTHER STATES [IX. TP limit, reasonableness]

Other states have adopted rules governing phosphorus discharges from wastewater treatment plants. Discussed below are phosphorus effluent limit requirements from the states of Wisconsin, Illinois and Massachusetts.

Wisconsin In 1973 the Wisconsin Department of Natural Resources (WDNR) adopted rules similar to those in Minnesota for dischargers tributary to the Great Lakes requiring a 1 mg/L TP effluent limit. In December 1992 the WDNR adopted a statewide 1 mg/L TP effluent limit applicable to municipal and industrial dischargers (chapter NR 217, Exhibit PL-13). The rule includes *de minimis* TP loadings, below which the rule does not apply. The *de minimis* TP loadings are 150 and 60 pounds of TP per month for POTWs and industries, respectively A loading of 150 pounds per month equates to 1,800 pounds per year. TP effluent limits have been incorporated into existing permits as they were reissued. The rule offers alternate effluent limits based on the following four considerations.

- Where achieving the 1 mg/L TP effluent limit is not practically achievable.
- Where the operation of specific biological phosphorus removal technologies will achieve a level of performance equivalent to a 1 mg/L TP effluent standard.
- Where phosphorus deficient wastewaters necessitate the addition of phosphorus to a biological treatment system to assure efficient operation and compliance with other effluent limits.
- Where achieving the 1 mg/L effluent standard will not result in an environmentally significant improvement in water quality.

Wisconsin published guidance for implementing NR 217 in 1999 (Exhibit PL-14). Statewide the rule has resulted in approximately 340 TP limits in NPDES permits. Of these about one third are industrial discharges and two thirds are municipal. About 100 of those with TP limits have alternate effluent limits greater than 1 mg/L. The majority of the alternate limits are based on the first two exemptions listed above. The third exemption is applicable to essentially only pulp and paper facilities (5 permits with effluent limits greater than 1 mg/L) which typically have very nutrient deficient wastewater. The final exemption has been used only once and is currently discouraged from consideration.

Alternate effluent limits are reevaluated with each permit reissuance. Over time the number of facilities with alternate effluent limits is decreasing and this trend is expected to continue. This is largely the result of facility upgrades and expansions, and improved understanding of treatment operations with biological phosphorus removal and resultant lower TP effluent concentrations.

As noted in Section IX.H the Agency carefully reviewed the exemptions in the Wisconsin rule and the similarities between that rule and the exemptions in the proposed Minnesota rule are apparent.

Illinois The Illinois Environmental Protection Agency (IEPA) has existing rules that require 1 mg/L TP effluent limits for discharges within the Lake Michigan Basin. Additionally, existing rules require 1 mg/L effluent limits for discharges to lakes or reservoirs of 20 acres of surface area or greater and their tributaries with the following considerations.

- Limits do not apply to lakes or reservoirs with mean hydraulic retention times of 18 days or less.
- Tributary limits apply only to discharges of 0.25 mgd or greater but not to third-stage

treatment lagoon (pond) treatment systems.

Dischargers to lakes or reservoirs may apply for an adjusted effluent limit if it can be shown that the effluent resulting from the adjusted limit will not contribute to cultural eutrophication, unnatural plant growth or algal growth or dissolved oxygen deficiencies in the lake or reservoir.

New and more universal TP removal requirements were adopted by the IEPA on February 2, 2006 (Exhibit PL-15). These new amendments require removal of TP to 1 mg/L for new and expanding municipal discharges with a design flow of 1.0 mgd or greater, and treatment facilities other than those treating primarily municipal or domestic wastewater (i.e. industrial facilities) with a TP load of 25 lbs per day (equivalent to a flow of 1 mgd at a concentration of 3 mg/L) or more. New and expanding dischargers can be considered for an exemption from the 1 mg/L TP limit provided the discharger demonstrates that phosphorus from the treatment works is not the limiting nutrient in the receiving water. The rule lets IEPA set alternative TP limits where supportive information warrants the adjusted limit. This rule change is meant to be an interim requirement until numeric water quality standards for phosphorus are adopted by the state.

There are many similarities between Illinois' new rule and what the Agency is proposing for Minnesota. One obvious difference is the size of the facility that is exempt due to the *de minimis*, 1.0 vs. 0.2 mgd. Given the differences between Illinois and Minnesota in population density, overall land use and their water resources, we view this difference as understandable and not very significant.

Massachusetts The Massachusetts Department of Environmental Protection (MDEP) has been issuing NPDES permits with 1 mg/L TP effluent limits since the early-1970s. Presently the MDEP has included phosphorus effluent limits in permits for 56 of the 90 larger facilities in the state. Of the 56 with phosphorus effluent limits, 26 have limits more stringent than 1 mg/L, and four of these have a very low limit of 0.1 mg/L.[21]

Few discharges in the state go directly to lakes, rather they are to river systems that contain small impoundments where eutrophication is a concern. Recent efforts to meet water quality criteria in these impoundments has resulted in the low level TP effluent limits (less than 1 mg/L). Additionally, TMDL wasteload allocations are responsible for setting low level TP limits. In determining the lowest TP effluent limit to issue, the MDEP requires the "highest and best

[21] E-mail and information sent to Mark Tomasek (Agency staff) from Bryant Firmin, Massachusetts Department of Environmental Protection, July 26, 2006.

practicable treatment." A MDEP draft policy defines a TP effluent limit of 0.1 mg/L as achievable through the highest and best practicable treatment. Implementation of this draft policy has been the basis for the four 0.1 mg/L TP limits noted above. MDEP is adopting rules that codify this draft policy, and define "highest and best practicable treatment" and its relationship to "best available technology economically achievable" (the latter is EPA terminology in Section 301(b) of the Clean Water Act). The draft rules do not set a specific TP effluent concentration as meeting "highest and best practicable treatment." Instead it defines this term such that the rule will accommodate new treatment technologies that are capable of meeting low effluent concentrations.

K. SUMMARY, REASONABLENESS [IX. TP limit, reasonableness]

The Agency's fundamental rationale for the proposed extension of the phosphorus limit to new and expanding dischargers that discharge more than 1,800 pounds TP per year is listed below:

- To be proactive in the prevention of the eutrophication of Minnesota's water resources through the reduction of point source phosphorus loading.
- To protect the water quality of waterbodies that have water quality better than standards.
- To help restore waterbodies that are impaired due to excess nutrients.
- To help achieve TMDL driven or watershed-specific nutrient reduction goals.
- To help protect downstream water resources including those beyond Minnesota's borders.

The proposal will codify in rule the Agency's Phosphorus Strategy. It will assure a continuation of the impressive gains made in phosphorus removal from point sources that has taken place since March 2000 under the Strategy. It will continue to encourage biological phosphorus removal treatment technologies. It will have a significant secondary benefit of reducing effluent concentrations of other solids-associated pollutants such as mercury.

The proposed TP limit will only impact municipalities and industries as they expand or build new treatment facilities, and only if they discharge more than 1,800 pounds of TP per year. This will automatically exempt more than half of all permitted POTWs. Excluding the smaller facilities will have very little negative environmental effect. Implementation of the Agency's proposal is straightforward and simple; it will avoid the uncertainties and potential controversy of determining the meaning of "affects," which can be a stumbling block under the current rule. This could reduce the number of contested case hearings and legal challenges generated by proposed TP limits.

Other states including Wisconsin have rules similar to what the Agency is proposing already in place. The proposal is consistent with statewide efforts to improve Minnesota's water quality through major initiatives at the executive and legislative levels of state government.

The treatment costs attributed to this proposal described in Section XI are substantial, but a significant portion of these costs will be incurred independent of the proposed rule. The combination of TP limits in existing rules (Lake Superior basin), major nutrient-related TMDLs (Lake Pepin and Minnesota River), significant basin-wide nutrient reduction goals (St. Croix), means point source TP removal is already, or soon will be, required in much of the state. Also under the Strategy, TP limits for new and expanding facilities were becoming commonplace. The proposal includes three potential exemptions, plus the option of a variance, to a TP limit that a discharger may qualify for upon request.

XI. CONSIDERATION OF ECONOMIC FACTORS, EXTENSION OF PHOPHORUS EFFLUENT LIMIT

A. INTRODUCTION [XI. TP limit, economics]

The Agency has made a concerted effort to estimate as accurately as possible the costs some municipalities and industries may incur as a result of the proposed extension of the 1 mg/L phosphorus (TP) limit to new and expanded discharges. At the same time the Agency believes that the full costs of removing TP from point sources cannot be attributed to the extension of the TP effluent limit alone. In other words, the costs due to this proposal will be substantially mitigated for the reasons discussed in Section XI.F.

The possibility of costs to any small business or city exceeded $25,000 in the first year the proposed extension of the TP limit is discussed in Section VIII.L.

Isolating the treatment costs that can be attributed to just one phase of a complex treatment facility is difficult. Wastewater treatment costs are not usually broken out in such a way that the costs for removing just CBOD or TSS or, in this case TP, are readily available. This is probably even more true for facilities designed for biological phosphorus removal (Bio-P). Bio-P seems to be the treatment technology of choice today for many cities because of the advantages it offers, in addition to the removal of TP. A full discussion of this technology is outside the scope of the SONAR, but the following brief description is warranted.

B. BIOLOGICAL PHOSPHORUS TREATMENT TECHNOLGIES [XI. TP limit, economics]

In general, Bio-P technology is a variation of the standard activated sludge secondary treatment process. The Bio-P variation creates an environment that promotes the growth of phosphorus accumulating bacteria. This is accomplished by exposing the microorganisms in the wastewater to a sequence of anaerobic then aerobic zones in the biological treatment process. The bacteria first release the small amounts of phosphorus that are naturally stored in their cell mass into the wastewater, but in the aerobic step the organisms take up the readily bio-available phosphorus from the wastewater. The organisms become heavy and settle out in the final clarifiers. The phosphorus containing organisms are removed with the waste sludge. Bio-P can be

accomplished through design (new or expansion); or, in some cases, it can be achieved by altering operation modes or making other alterations to existing facilities to provide an anaerobic step to enhance the phosphorus removing bacteria (retrofits). In some cases the motivation to operate an existing facility in a "Bio-P" mode is the savings in energy costs the technology offers, and TP removal is a secondary benefit.

As with most biological treatment process there are advantages and disadvantages associated with Bio-P that need to be considered before a decision is made whether or not to convert to, or build an enhanced Bio-P facility. From the results achieved so far by the increasing number of Bio-P facilities in the metro area and throughout Minnesota (conservatively 30 to 35 facilities statewide), the advantages seem to outweigh the disadvantages. The advantages and disadvantages are listed below:

Advantages:

- Effluent phosphorus concentrations average 1 to 2 mg/L or less over the long-term (recent information indicates that Bio-P should be able to meet 1 mg/L);
- Chemical addition for phosphorus removal can be eliminated or at least substantially reduced. This can also reduce or eliminate alkalinity addition required to restore what is consumed by chemical phosphorus precipitation;
- Better settling of solids resulting in improved clarification, dewatering, and sludge handling;
- Produces less sludge compared to the chemical addition process;
- Can reduce aeration requirements, equipment and energy costs;
- Can accommodate simple and low-cost retrofits to existing wastewater treatment facilities; and
- Potential exists for total nitrogen removal providing additional improvement in effluent quality.

Disadvantages:

- Can be more complicated to operate;
- Needs a more consistent influent, waste loads that vary in strength or quality can be problematic;
- Requires more careful design considerations; and
- May only be reliable for an effluent concentration of 1.0 to 2.0 mg/L total phosphorus on any given month.

C. ECONOMIC BENEFITS OF EXTENDING THE TP LIMIT [XI. TP limit, economics]

The Agency believes that the extension of the TP limit to new and expanding dischargers (above 1,800 pounds of TP per year) will have economic benefits for the state by preventing declines in the biology and water quality of rivers and steams. The Agency has not attempted to quantify assumed benefits; to do so would be extremely difficult and time consuming, if not impossible in our opinion. The expected nutrient reductions will more directly benefit rivers and streams. Essentially all the discharges affected by this proposal are to rivers and streams, but downstream lakes and reservoirs will benefit as well. Discharges directly to lakes or discharges that measurably affect a downstream lake will be covered by the existing P Rule (Minn. R. 7053.0255, subp. 3, item A, subitem 1) and by the proposed eutrophication standards for lakes.

The study of the negative impacts anthropogenic sources of excess nutrients have on riverine systems is relatively new, compared to the long history and extensive literature on the eutrophication of lakes. One such study is: "Economic value of aesthetic amenities of rivers" (Exhibit PL-6, also see Exhibit EU-48, page 21). Important work by Agency staff in this area have been reported in Exhibits PL-7 and PL-8. Other states in EPA Region 5 (e.g. Michigan, Ohio and Indiana), and elsewhere around the country, are beginning to document the impact nutrients have on rivers and streams as they assemble data for the promulgation of numeric nutrient standards. These data show that, in general, as nutrients increase in streams and rivers the quality of the aquatic community declines. Negative impacts have been demonstrated in fish, invertebrate, and plant communities. Some of these states plan to adopt numeric standards for rivers and streams at the same time or before they adopt standards for lakes. The Agency plans to adopt nutrient standards for rivers and streams in a future triennial review.

D. POTENTIAL COSTS TO MUNICIPALITIES ATTRIBUTED TO EXTENDING THE TP LIMIT [XI. TP limit, economics]

1. TP Limits Under the Phosphorus Strategy as Model for Future [XI.D. TP limit, economics]

The Agency is using the five-year record of establishing TP limits under the Phosphorus Strategy (Strategy) to estimate future costs to facilities expected to be impacted by the proposed extension of the TP limit. The role the Strategy has played in establishing TP limits in POTW and

industrial NPDES permits is described in Section IX.C. The Agency believes that this record, spanning from March 2000 to September 2005, provides a reasonably accurate model to estimate the number of discharges expected to be impacted over the next five years. The Agency has not explicitly tried to project costs beyond the first five years for the proposed rule change but has for this report (see last section). It is probably reasonable to assume that costs to municipalities that build new or expand (and discharge more than 1,800 pounds of TP per year) in the second five-year time frame will incur treatment costs comparable to costs projected for the first five years (with adjustments for inflation). It seems likely, however, that overall costs should decline over the long term, because of the declining number of facilities that do not already have a TP limit based on this or some other requirement.

The municipal (POTW) and industrial permittees that have gotten limits from 2000 - 2005 are shown in Exhibits PL-10 and PL-11, respectively. The Agency determined that 34 POTWs with average wet weather design flows (AWWDF) of 0.2 mgd or larger got TP limits based on implementation of the Strategy. An additional nine POTWs with AWWDF smaller than 0.2 mgd, shown in the shaded part of Exhibit PL-10, also got limits during this five-year period. Not listed in Exhibit PL-10 are about 10 POTWs that got TP limits over the last five years based on the current requirements in Minn. R. 7050.0211, subp.1a, because they discharge to or affect a downstream lake.

2. Methods Used to Estimate Costs [XI.D. TP limit, economics]

Listed below are the assumptions and approaches used by the Agency to estimate future costs to POTWs due to the extension of the TP limit.

1. The history of giving TP limits during the five year period the Strategy has been in place is a reasonable time frame from which to projects future costs. Also, five years is the life of NPDES permits.
2. Facilities that got limits for the reasons listed in Exhibit PL-10 as "P strategy", "Volunteered for limit", or "Negotiated" are attributed to the Strategy. It is assumed that these facilities would have gotten a limit also if the proposed extension of the TP limit to new and expanding facilities had been in place since March 2000.
3. Facilities with AWWDF of 0.2 mgd or larger are assumed to be large enough to exceed the *de minimis* TP loading of 1,800 pounds per year. This assumes an effluent TP concentration of about 3 mg/L (3 mg/L X 0.2 mgd X 8.337 [conversion to pounds] X 365 days = 1826 pounds per year).
4. Essentially the same number of POTWs (34) will get TP limits in the next five years that

got limits from March 2000 to September 2005. The Agency does not have any solid basis to project that either more or fewer facilities will be impacted in the next five years.

5. TP treatment costs are estimated for seven size categories of POTWs based on AWWDFs (see Table II-25). Estimates were not made for the > 100 mgd category because no new or expanded plants this large are expected in the next five years.
6. No POTW in the 5-10 mgd size category got a limit in the previous five years. The Agency is assuming that one facility in this relatively large size group will be impacted by the proposal in the next five years. This brings the total number of POTWs projected to be impacted to 35.
7. Estimated capital costs are the costs attributed to the portion of the treatment facility directly related to the removal of phosphorus; they are total costs, **not** amortized costs.
8. Estimated costs have been updated to February 2005 dollars where appropriate.
9. The Agency is aware that the cost of some materials and construction costs in general have increased in 2006, which might make the estimated "high" costs more plausible. However, the Agency still believes the "average" costs are the best estimates of expected costs over the next five years.

Agency wastewater treatment plant design and NPDES permit review engineers estimated the costs attributable to phosphorus removal for POTWs. The Agency's analysis of potential costs to municipalities is described in Exhibit PL-3. The discussion in the next six sections is taken from this Exhibit. Total capital construction costs and annual operational and maintenance (O&M) costs **attributed to TP removal** have been estimated. Any extra costs associated with the handling and disposal of sludge due to use of chemical is included in the cost estimates.

Costs are estimated for three different removal technologies: 1) chemical addition (including stabilization ponds), 2) Bio-P with chemical addition for polishing, and 3) Bio-P alone. Projected costs for the three treatment options are the complete costs of phosphorus removal for each option alone. For example, the costs for chemical addition alone are not added to the costs for Bio-P with chemical back-up to arrive at the total costs for the latter option. All cost estimates are based on meeting a monthly average effluent limit of 1 mg/L total phosphorus (TP).

Cost estimates are based on:

1. Previous work and cost estimates for TP removal completed by Agency staff;
2. Research in the published literature on the subject of estimating costs for wastewater treatment projects, particularly for TP removal;

3. TP removal project cost estimates provided by consulting engineers based on their experience in Minnesota;
4. A report prepared by Hydroqual, Inc. for MESERB on wastewater phosphorus control (Exhibit PL-4); and
5. Information from a survey, conducted by the League of Minnesota Cities and the Agency, of Minnesota wastewater treatment facilities that have completed construction of phosphorus removal projects, or have prepared estimates contemplating future phosphorus removal related construction projects at their facilities, (Exhibit PL-5).

3. Chemical Addition [XI.D. TP limit, economics]

The most common phosphorus removal technique currently practiced by mechanical wastewater treatment facilities in Minnesota is chemical addition; i.e., coagulation and precipitation with salts of aluminum or iron. Alum (aluminum sulfate), or ferric chloride (including possible addition of a polymer) is typically fed into the wastewater flow path prior to or at entry points into primary or secondary clarifiers to provide for mixing, coagulation, and then settling of the phosphorus into the sludge blanket in the clarifiers. The phosphorus is then removed from the clarifiers with the waste sludge (solids), which is usually applied to tillable farmland.

Several internal and external references were reviewed to determine the best method to arrive at the cost estimates for chemical removal of phosphorus.[22] Chemical treatment cost estimates using alum include costs for a chemical feed system with a 15 day storage supply, incremental costs of clarifier improvements, and sludge treatment and handling to accommodate the increased sludge volume above the amount normally generated when using chemical phosphorus removal.

The Agency was able to make high and low cost estimates for the seven size categories, as shown in Tables II-25 and II-26 (Table A in Exhibit PL-3). The Agency believes making high, low and average cost estimates is a reasonable way to bracket the range in possible costs. Costs

[22] 1. Memo from Bill Priebe. Preliminary cost estimates for phosphorus removal. November 18, 1992.

2. Spreadsheet from Bruce Henningsgaard . Rough cost estimates for phosphorus removal. January 17, 2002.

3. MPCA Staff document. Research document for the Clean Water Legacy Act. September 2, 2004, updated on February 17, 2005.

4. EPA. The cost digest: cost summaries of selected environmental control technologies.

5. Information from Water Environment Federation

6. Information from state of Wisconsin

are often very site-specific. Even facilities that have similar design flows may not have the same costs associated with chemical phosphorus removal processes and sludge handling. The average cost estimate is the average of the high and low estimates for each category. The Agency believes that overall, the **average** costs represent the most likely or reasonable estimates of future costs. The low costs may under estimate and the high costs may over estimate true costs.

A summary of total capital costs and annual O&M costs for chemical addition (using alum) are shown in Tables II-25 and II-26, respectively. The low capital cost estimates are for alum dosages based on influent TP concentrations of approximately 5 to 9 mg/L, which is a typical range for Minnesota POTWs.[23] The high capital cost estimates are for alum dosages based on high influent TP concentrations of 13 to 17 mg/L.

Table B in Exhibit PL-3 shows estimated costs for TP removal for a number of specific facilities in Minnesota using ferric chloride, based on February 2005 dollars. The ferric chloride costs were compared to cost estimates completed by the state of Wisconsin to support revisions to their water quality rules (Table C in Exhibit PL-3). A comparison of capital cost estimates in Table A to those in Table B (Exhibit PL-3) indicates that the total capital cost estimates for ferric chloride generally fall into the lower part of the total capital cost ranges for alum. Annual O&M costs for ferric chloride also appear to fall in the lower range of the O&M cost estimates for alum.

[23] A recent Agency analysis of permittee discharge monitoring report data showed a mean influent TP of 6.4 mg/L for 166 POTWs.

Table II-25. Total Capital Costs for TP Removal – Estimated High, Low, and Average Capital Costs for Alum Addition for Seven Size Categories of Municipal Wastewater Treatment Plants, Projected Over the Next Five Years.

Plant Size AWWDF Mgd	No. of N/E Projected Over Next 5 Years	Estimated Total Capital Costs for Alum Addition					
		Cost Per Plant $ in millions			Total Cost Over 5 Years $ in millions		
		Low	Avg.	High	Low	Avg.	High
0.2-0.5	6	0.20	0.46	0.71	1.2	2.76	4.26
0.5-1.0	13	0.30	0.65	1.0	3.9	8.45	13.0
1.0-5.0	11	0.40	0.93	1.45	4.4	10.23	15.95
5-10	1	1.05	4.53	8.0	1.05	4.53	8.0
10-20	1	1.2	6.10	11.0	1.2	6.1	11.0
20-40	2	5.0	8.0	12.0	10.0	17.0	24
40-100	1	10.0	12.5	15.0	10.0	12.5	15
> 100	0	na	na	na	na	na	na
Total	35				$31.75	$61.57	$91.21

N/E = New or expanded; na means not applicable or not available.

Table II-26. Operation and Maintenance Costs for TP Removal – Summary of Estimated High, Average, and Low O&M Costs for Alum Addition for Seven Size Categories of Municipal Wastewater Treatment Plants, Projected Over the Next Five Years.

Plant Size AWWDF Mgd	No. of N/E Projected Over Next 5 Years	Estimated Total Annual O&M Costs for Alum Addition					
		Cost Per Plant $ in millions			Total Cost Over 5 Years $ in millions		
		Low	Avg.	High	Low	Avg.	High
0.2-0.5	6	0.04	0.08	0.12	0.24	0.48	0.72
0.5-1.0	13	0.05	0.13	0.20	0.65	1.63	2.60
1.0-5.0	11	0.08	0.49	0.90	0.88	5.39	9.90
5-10	1	0.35	0.72	1.08	0.35	0.72	1.08
10-20	1	0.7	2.1	3.50	0.7	2.1	3.50
20-40	2	1.08	4.0	7.0	2.16	8.1	14.0
40-100	1	2.60	6.8	11.0	2.60	6.8	11.0
> 100	0	na	na	na	na	na	na
Total	35				$7.58	$25.22	$42.8

N/E = New or expanded; na means not applicable or not available.

4. Verification of Estimated Costs for Chemical Addition [XI.D. TP limit, economics]

The Agency sought to verify or "crosscheck" the cost estimates shown in Tables II-25 and II-26 by comparing them to estimates from references other than those identified in footnote 22, and information from a small number of actual costs for phosphorus removal projects completed in Minnesota. Agency cost figures were also crosschecked with cost information from:

- A study of 17 facilities in Minnesota by Hydroqual (Exhibit PL-4). This work provides useful cost estimates for possible chemical and biological phosphorus removal enhancements for these facilities, but it does not include costs for sludge handling. Thus, its value as a "crosscheck" is limited.
- Information from a consulting engineering firm in the Twin Cities (Bonestroo), and
- A joint League of Minnesota Cities/Agency (LMC/Agency) Bio-P cost survey (Exhibit PL-5).

Details about how the capital cost information from the Bonestroo and the LCMR/Agency survey are provided in Exhibit PL-3 under "Chemical Capital Cost Analysis". The crosschecks in general are very helpful in determining if the Agency's estimated ranges are reasonable, and to narrow the range of the cost estimates. Also, it helps the Agency characterize the cost ranges as high, low or average.

5. Cost Information for Stabilization Ponds [XI.D. TP limit, economics]

Stabilization pond treatment systems represent a subset of chemical phosphorus treatment, but limited information on costs to pond systems is available. Pond treatment systems typically store and passively treat the wastewater in a series of connected primary and secondary ponds or cells. If TP removal is required, it is usually accomplished by adding chemical to one of the secondary cells to precipitate the TP from the water. Pond treatment systems normally discharge twice a year, once in the spring and once in the fall.

Most pond systems have a design capacity of less than 0.2 mgd, and therefore most will not trigger the *de minimis* annual load of 1,800 pounds of TP. Facilities below the *de minimis* loading will not get a TP limit under the proposal. Of the 295 pond treatment systems in Minnesota, 52 have an AWWDF greater than 0.2 mgd. Nine of these 52 larger pond systems already have a TP limit of 1 mg/L under the existing rule, Minn. R. 7050.0211.[24]

Information, albeit limited, was obtained from Bonestroo and the LMC/Agency survey on estimated capital and O&M costs for stabilization pond systems. The first facilities listed in Tables D and E in Exhibit PL-3 under the treatment type heading "chemical" show estimated capital costs for TP removal in stabilization ponds. Based on the design flow of 0.07 mgd for the facility listed in Table E of Exhibit PL-3, it is unlikely it would trigger a limit (i.e., annual TP loading less than 1,800 pounds per year), but it is included in this discussion because of the small amount of data available for ponds. TP treatment costs for a third pond system are available from Agency files. The costs for these three facilities, and the projected costs over the next five years, are shown in Table II-27. The small number of municipalities with pond systems projected to be impacted, a total of six, is based on the Agency's experience over the last five years. The ability to crosscheck estimated costs for stabilization pond systems is very limited. An indirect approach that can provide a reasonable estimate of total capital and annualized O&M costs for ponds is to use the average costs for mechanical systems in the appropriate size

[24] Numbers based on information from October 2005. Thirty four of all 295 ponds currently have TP limits. There are an additional 74 pond systems covered under a general permit, and two of these have TP limits.

category (Tables II-25 and II-26).

Table II-27. Pond Systems – Total Capital and Annual O&M Costs for Alum Addition for Three Pond Wastewater Treatment Facilities, and Projected Costs Over the Next Five Years.

Plant Size AWWDF Mgd	No. of N/E Projected Over Next 5 Years	Estimated Total Costs for Alum Addition in Pond Systems			
		Average Cost Per Pond Facility, $ in millions		Total Average Cost Over 5 Years, $ in millions	
		Total Capital	Annual O&M	Total Capital	Annual O&M
0.07	na	0.050	na	na	na
0.236	4	0.093	0.021	0.37	0.084
0.5	2	0.1717	0.1522	0.34	0.30
Total	6			$0.71	$0.384

N/E = New or expanded; na means not applicable or not available.

6. Costs for Biological Phosphorus with Chemical Back-up [XI.D. TP limit, economics]

The biological phosphorus removal (Bio-P) process is described in Section XI.B. Almost all facilities that have built new or expanded in the last five years have incorporated Bio-P into the design. This treatment technology is gaining popularity because of its TP removal capabilities as well as other advantages.

Very little information seems to be available in the published literature that discusses costs for just the TP removing components of a Bio-P plant or for Bio-P with chemical back-up. This may be because the design of Bio-P facilities is still fairly new in the United States, although it has been successfully applied in Minnesota starting in the late-1990s. Due to the lack of published literature on costs, we used the cost information provided by Bonestroo, the LMC/Agency survey, and the MESERB study (Tables D, E and F, respectively, in Exhibit PL-3). The Bonestroo information provides the only estimates for annual O&M costs. The cost figures shown for Bio-P plus chemical back-up in Table II-28 are the average of the "high" and "low" values from Table F in Exhibit PL-3, so that these costs might be more comparable to the "average" Bio-P alone costs (Table D in Exhibit PL-3), and the chemical addition costs in Table II-25. Costs are not available for facilities larger than 40 mgd.

There is a fairly wide range in reported Bio-P plus chemical back-up costs when costs for TP removal are expressed as a **percentage** of the total project capital costs. Percentages range from

1 to 29 percent, but mean percentages center around 8 to 15 (percent values are in *italics* in Table II-28). The 8 to 15 percent range may be a reasonable rule of thumb estimate of the increase in total capital costs attributable to removing TP for the Bio-P plus chemical backup option.

Table II-28. Bio-P with Chemical Back-up – Estimates of Average Total Capital Costs for TP Removal Using Bio-P with Chemical Back-up from Three Sources. Annual O&M Costs from One Source for Just Two Size Categories.

Plant Size AWWDF Mgd	TP Capital Costs $ in millions	*% Costs for TP of Total Project Capital Costs*	TP Capital Costs $ in millions	*% Costs for TP of Total Project Capital Costs*	TP Capital Costs $ in millions	Annual O&M $ in millions
Source:	Bonestroo		LMC/Agency		MESERB	Bonestroo
0.2-0.5			0.390 (2)	*8.2 (1.4-15)*	0.39	
0.5-1.0	0.545 (1)*	*8*	0.929 (4)	*12 (1.2-29)*	0.65	0.0033 (1)
1.0-5.0	0.563 (6)	*10 (1-21)***	1.63 (2)	*15 (6-23)*	1.0	0.0049 (6)
5-10					1.65	
10-20					2.75	
20-40					5.0	

Blank cells means there is no information.

* Number in parenthesis is number of facilities for which costs are averaged.

** Number in parenthesis is range of percent values.

7. Costs for Biological Phosphorus Removal [XI.D. TP limit, economics]

Cost estimates for Bio-P processes alone are limited to the information shown in Table E in Exhibit PL-3. Most of the designs for existing Bio-P facilities in Minnesota incorporate chemical back-up, as a guarantee that the facility can consistently meet the 1 mg/L TP effluent limit. Operating experience, as reported in the Hydroqual/MESERB study (Exhibit PL-4) indicates that Bio-P processes, in general, are capable of removing about 80 to 90 percent of the influent phosphorus. Therefore, if influent TP concentrations are in the normal 5 to 9 mg/L range, one could expect effluent concentrations in the 0.5 to 1.8 mg/L range. With the current state of the Bio-P technology in Minnesota, Bio-P facilities with a 1 mg/L TP limit generally need to polish with chemical to consistently meet the limit. Major exceptions to the need for chemical polishing are some of the metro area wastewater treatment facilities operated by the Metropolitan Council Environmental Services (MCES), including the very large Metro Plant

(AWWDF of 251 mgd). The Metro Plant and several other MCES facilities are meeting a 1 mg/L limit with Bio-P alone.[25]

Verification of the cost figures for Bio-P removal only is not possible, due to a lack of information. Agency staff (reference 2 in Exhibit PL-3) offers a possible range of capital costs for Bio-P removal for newly designed treatment facilities, and for retrofitted facilities. Through contacts with consultants and the MCES, the Agency has estimated Bio-P capital construction costs of $0.30 to $0.50 per gallon for new designs, and $0.10 to $1.00 per gallon for retrofitted facilities. The Bio-P capital cost figures for the projects shown in Table E in Exhibit PL-3, expressed as cost per gallon treated, range from $0.03 to $0.21 per gallon, which is considerably less than the figures from Agency staff. The latter are based on estimates reported by the municipalities themselves; they should reflect real-world Bio-P costs in Minnesota. These costs are shown in Table II-29 (the $36 million figure for the > 100 mgd category is the MCES Metro Plant).

Table II-29. Bio-P Alone – Estimates of Total Capital Costs for TP Removal Using Bio-P Alone from LMC/Agency Survey (Table E in Exhibit PL-3).

Plant Size AWWDF Mgd	TP Capital Costs $ in millions	*% Costs for TP Removal of Total Project Capital Costs*
1.0-5.0	0.1 (1)*	*0.2*
10-20	0.9 (1)	*1.8*
20-40	5.0 (2)	*27 (1.3-53)***
40-100	8.0 (1)	*6.4*
> 100	36 (1)	*45*

* Number in parenthesis is number of facilities for which costs are averaged.

** Number in parenthesis is range in percents.

Capital costs for Bio-P with chemical back-up and Bio-P alone, projected to be incurred over the next five years, are summarized in Table II-30. Total cost figures are not provided because data is missing for some size categories.

[25] Including Seneca, Blue Lake and Eagles Point as well as the Metro Plant.

Table II-30. Summary of Estimated Average Capital Costs for Bio-P with Chemical Back-up and for Bio-P Alone, Projected Over the Next Five Years.

Plant Size AWWDF Mgd	No. of N/E Projected Over Next 5 Years	Estimated Average Capital Costs for TP Removal Using Bio-P with Chemical Back-up In $ millions		Estimated Average Capital Costs for TP Removal Using Bio-P Alone In $ millions	
		Per Plant	Total Cost Over 5 Years	Per Plant	Total Cost Over 5 Years
0.2-0.5	6	0.39	2.34	na	na
0.5-1.0	13	0.65	8.45	0.1	1.3
1.0-5.0	11	1.0	11.0	na	na
5-10	1*	1.65	1.65	0.9	0.9
10-20	1	2.75	2.75	5.0	5.0
20-40	2	5.0	10.0	16	16.0
40-100	1	na	na	na	na
> 100 (251)	0	na	na	36	36

N/E = New or expanded; na means not available or not applicable

*No plant in the 5-10 mgd size range got a TP limit in the last five years; we are assuming that one will get a limit over the next five years for purposes of this cost estimate.

8. Conclusions on Costs to POTWs [XI.D. TP limit, economics]

The Agency has made a good faith effort to estimate TP treatment costs that might be incurred by new or expanding municipal wastewater treatment plants (> 1,800 pounds of TP discharged per year) over the next five years. The Agency believes it is important to estimate the total costs for phosphorus removal over the next five years for this rulemaking, **but most of these costs should not be attributed to the proposed extension of the TP limit** to new and expanding facilities, as discussed in Section XI.F.

The Agency believes that where high, low and average cost estimates can be made, that the average costs represent our best estimate of likely true costs. Estimated capital costs for TP removal are total, not amortized costs. Most estimates of annual O&M costs are for facilities that rely only on chemical addition to remove TP. Our own experience and information on Bio-P facilities from the LMC/Agency survey suggest strongly that chemical costs are reduced when bio-P technology is used.

The total estimated average capital costs for TP removal using chemical addition for the

estimated 35 municipalities likely to be impacted over the next five years is over 61 million dollars (Table II-31). The total O&M costs for chemical addition for 35 municipalities over the next five years is over 25 million dollars (Table II-26). Comparable **totals** cannot be determined for the other two treatment options (Bio-P with chem. back-up and Bio-P alone) because cost values are missing for some POTW size categories. Gaps in the data are indicated by "na" in Table II-31. With possibly one exception (the 1-5 mgd size) the capital costs for chemical addition tend to be larger than the costs for Bio-P with or without chemical back-up (Table II-31).

Table II-31. Estimated Average Total Capital Costs for TP Removal for Municipal Wastewater Treatment Plants Projected Over the Next Five Years for the Three Treatment Options.

Plant Size AWWDF Mgd	No. of N/E Projected Over Next 5 Years	Chemical Treatment In $ Millions	Bio-P with Chemical Back-up In $ Millions	Bio-P Alone In $ Millions	Stabilization Ponds* Chem. Treat. In $ Millions
0.2-0.5	6	2.76	2.34	na	0.37
0.5-1.0	13	8.45	8.45	0.1	0.34
1.0-5.0	11	10.23	11.0	na	na
5-10	1	4.53	1.65	0.9	na
10-20	1	6.1	2.75	5.0	na
20-40	2	17.0	10.0	16	na
40-100	1	12.5	na	na	na
> 100	0	na	na	36**	na
Total	35	$61.57	na	na	na

N/E = New or expanded; na means not applicable or not available.

*The Agency is projecting four and two new or expanding pond facilities in the 0.2-0.5 and 0.5-1.0 mgd categories over the next five years, respectively.

** Costs attributed to the 251 mgd MCES Metro Plant

E. POTENTIAL COSTS TO INDUSTRIES ATTRIBUTED TO EXTENDING THE TP LIMIT [XI. TP limit, economics]

1. Introduction and Industry Categories [XI.E. TP limit, economics]

The treatment technologies used for total phosphorus (TP) removal at municipal wastewater treatment plants are also applicable to industrial facilities. Typically, facilities to remove TP from an industrial waste stream means adding wastewater treatment capacity at the end of the existing treatment process. In most cases industrial wastewater treatment plants use chemical addition of alum and/or ferric chloride for precipitation and removal of TP in their discharge effluents. However, some industrial facilities may also use biological wastewater treatment processes or Bio-P processes to removal TP. Biological treatment processes for TP removal at industries is generally more applicable to industrial categories that generate higher organic loadings in their wastewater and discharge directly to receiving waters in Minnesota (as opposed to discharging to a sanitary sewer). In some cases Bio-P processes are not applicable to certain industries because biological treatment is not needed to remove other pollutants generated in the industrial process wastewater.

For the estimation of costs, industrial plants are described according to industrial categories rather than by size or flow as in the case of municipalities. This is primarily because dry versus wet weather flow is typically not applicable to industrial plants. Although a range of process wastewater flows and pollutant loadings may occur, a specific industry typically generates a certain pollutant concentration level and loading, which is related primarily to the industrial category and the specific industry's production rate. For example an industry category may generate a specific mass loading (e.g., pounds per day) of a pollutant per production rate. In addition, pollutant characteristics vary from one industrial category to another. Some industries generate minimal amounts of phosphorus in their wastewater, such as mining and power generating facilities. In some cases industrial wastewater with biological treatment processes are phosphorus deficient with respect to nutrient requirements, and therefore may need to add phosphorus for efficient biological treatment to occur. For other industry categories, for example food processing, dairy related production, rendering, meat processing, etc., high concentrations of TP are often generated in the process.

Therefore, the applicability of the proposed extension of the TP limit is very industry specific. Some industries within an industrial category may not discharge wastewater but treat wastewater via land application systems. In those instances treatment technologies to remove TP are usually not applicable or required and there will be no costs. To analyze the cost for removal of TP at industries, an evaluation of industries which may discharge significant loadings of TP was completed. Examples of these industries include, but are not limited to, wet mill corn processing, food processing, beet sugar processing, dairy processing, rendering and pulp and paper. As a starting point, calculations were completed to determine the existing TP discharge mass loadings from industries discharging to a receiving water in Minnesota. Total capital and

annual operation and maintenance (O&M) costs are estimated.

It is difficult to predict over what time frame the estimated costs will be incurred by Minnesota industries. The Agency can't be sure which types of industries may expand or be newly constructed over the next five years. Industrial development is dependent on many factors, most prominently market conditions. Therefore, determining which industries may potentially expand or construct new facilities, and subsequently generate TP to levels of concern (>1,800 pounds TP per year), is an estimate at best. The following assumptions were used to determine the number of new or expanded facilities expected to generate at least 1,800 lbs of phosphorus per year in process wastewater:

1. The Agency assumes the costs estimated in this analysis will be incurred over a five-year period, which correlates with the term of NPDES permits. Only three of the TP limits given to roughly 14 industries over the last five years are attributed to the Phosphorus Strategy (Exhibit PL-11), which is an indication of the number that may get limits over the next five years due to this proposal. For the purpose of estimating costs, the Agency is projecting that about six facilities in the seven categories described below may get TP limits (Table II-32).
2. Only industries that may generate TP in wastewater at appreciable levels that may trigger a TP treatment or removal requirement were evaluated.
3. A flow and TP concentration level in the effluent was used for a specific industry category based on TP and flow information from the Agency's discharge monitoring reports (DMR) for specific existing industrial permittees.
4. If flow and TP concentration information are not available from DMRs, information from EPA categorical development documents and literature were used.

The following industries that generate TP at levels that may trigger a TP discharge limit and would also potentially discharge to a receiving water were used in this analysis:

Ethanol Industry. The ethanol industry in Minnesota is expanding rapidly with several new plants anticipated. Costs are considered for one new ethanol production plant and one expanding plant. New ethanol plants recycle and internally treat all process wastewaters which contain high organic loadings. Therefore, no process wastewater is discharged. However, ethanol plants must pre-treat water used in the production process, typically using reverse osmosis systems, and they also discharge cooling tower blowdown. In most cases TP is kept at relatively low levels in the discharge. However, in some cases greater amounts of TP may be generated and potentially discharged. This may be due to the higher levels of TP in the source water. Phosphorus may also be used as an additive for cooling tower treatment purposes, and in addition the "concentration effects" of reverse osmosis and closed cycle cooling tower systems serve to increase TP concentrations. Therefore, one new ethanol plant was evaluated which may trigger a TP discharge limit. In general, however, ethanol plants do not comprise a significant source of TP to receiving waters.

The second example is an ethanol plant in Minnesota planning an expansion, and assumed to have TP levels in the discharge that will exceed 1,800 pounds per year.

Dairy Processing Industry. Dairy processing generates TP, sometimes at significant levels, due to TP in raw materials and cleaning processes. Most of these plants use land application as a wastewater treatment technology and do not discharge to receiving water. However, for purposes of estimating costs we assume one dairy processing facility with a discharge to receiving water is expanding, and will discharge above the *de minimis* amount.

Rendering Industry. Animal rendering is a potential industry which may undergo expansion in the current market. We assume one facility will expand over the next five years.

Poultry Processing Industry. An expanding chicken processing plant was selected to represent a food or meat processing industry expansion. Minnesota has a relatively high number of food processing facilities, although many of these plants do not directly discharge to receiving waters but use land application as a wastewater treatment technology.

Corn Processing Industry. The corn processing industry employing wet milling may potentially undergo expansion due to market conditions.

Pulp and Paper Milling Industry. Pulp and paper mills have completed a number of expansions in the past 10 to 15 years in Minnesota, and while future expansions may be possible they are likely to be limited within the next five years.

Refining Industry. Expansion of existing petroleum refining may occur in the next five years due to market conditions.

In addition to the seven categories listed above, there are a number of other industrial categories that could potentially undergo an expansion or be proposed for new construction within Minnesota in the next five years. However, most industrial expansions and/or new industry construction are related to industries that do not generate TP or generate TP at minimal levels. Therefore, these industries, for example power cogeneration, mining, power plants, etc., are not included in this analysis.

2. Estimated Costs by Industry Category [XI.E TP limit, economics]

The Agency anticipates that the economic impact of the proposed extension of the TP limit on industries that do not already have an existing TP discharge limit and discharge directly to a receiving water, is likely to be relatively minimal. If anything, we believe the estimated costs shown in Table II-32 are likely to overstate the true costs.

Estimates for capital and O&M costs to meet a 1.0 mg/L TP effluent concentration are shown in Table II-32. Annualized capital cost is based on 20 year useful life (equivalent uniform annual cost) and an eight percent interest rate. The costs for the industry examples listed in Table II-32 represent our estimates for the industries likely to be impacted over approximately a five-year period. The $1.115 million total figure in Table II-32 represents the estimated **annual amortized** capital costs plus the **annual** O&M costs for all eight examples.

Table II-32. Estimated Total Average Capital and Annual O&M Costs for TP Removal for Seven Categories of Industries (see text below).

Industry	Flow MGD	Influent TP mg/L (range)	Capital Cost $ millions	Annualized Capital Cost $ millions	Annual O and M $ millions	Total Annual Cost $ millions
New Ethanol Plant	0.25	2.4 (low)	0.92	0.094	0.08	0.174
Expansion Ethanol Plant	0.278	2.38	0.92	0.094	0.08	0.174
Dairy Processing	seasonal pond discharge	3.53	0.08	0.008	0.035	0.043
Rendering Plant	Seasonal pond discharge	8.25	0.15	0.015	0.08	0.095
Poultry Processing Plant	1.10	6.98	0.90	0.092	0.125	0.217
Corn Wet Milling Plant	1.50	11.65	0.70 to 1.3	0.132	0.20 to 0.28	0.412
Pulp and Paper Plant	11.62	2.625	0	0	0	0
Petroleum Refining	4.25	0.73	0	0	0	0
Total (all plants)			**4.27**	**0.435**	**0.68**	**1.115**

Ethanol. Estimates for the new ethanol plant are based on a hypothetical plant with a production level of 50 million gallons ethanol per year or more, discharging reverse osmosis and cooling tower blowdown wastewaters at a continuous rate of about 0.25 mgd, with an anticipated TP generated per year at 1,800 lbs. The TP removal is anticipated to occur through a chemical addition treatment system added to the end of the treatment process already in place (chemical storage, chemical feeding equipment and pumps, rapid mixing, coagulation and flocculation, and clarification). The estimated total capital cost of this system is estimated to be $920,000 with annual O&M costs of $80,000.

Estimates for an expanding ethanol plant are based on a plant assumed to expand from a production rate of about 45 million gallons to about 57 million gallons of ethanol per year. Flow is continuous and is estimated to increase from an average of 0.2 mgd to an expanded flow rate of 0.3 mgd. TP generated annually and discharged would be projected to increase from a current level of about 1,460 lbs per year to 2,190 lbs per year, at an effluent concentration of 2.4 mg/L. As for the new ethanol plant, TP removal is anticipated to occur post process wastewater treatment through chemical addition (chemical storage, chemical feeding equipment and pumps, rapid mixing, coagulation and flocculation, and clarification). The estimated total capital cost of this system is estimated to be $920,000 with annual O&M costs of $80,000.

Dairy Processing. Estimates for the dairy processing plant are based on a 20 percent hypothetical expansion of a milk processing rate of about 1.25 million pounds per day into natural and aseptic cheese and whey products. Current TP discharged is about 3,100 lbs/year, average TP concentration of effluent discharged is 3.5 mg/L, with a discharge flow average of 2.2 mgd based on a total discharge of about 90 million gallons per year. Wastewater treatment at the plant consists of the screening, dissolved air flotation, holding tank, two trickling filter towers, a 2.5 million gallon oxidation ditch, final clarification, and a two-cell stabilization pond system consisting of a 19-acre primary cell and a 15-acre secondary cell. Treated effluent is stored in the stabilization ponds and is discharged seasonally (spring and fall, totaling 52 days in 2005).

Based on a 20 percent expansion of the dairy processing production rate, a proportional increase in flow and TP mass load was used to estimate costs. Effluent TP concentration (untreated) remains the same. Because of the seasonal discharge, TP removal would be anticipated to be achieved most cost effectively through chemical addition at the existing final stabilization pond (chemical addition to pond method), with chemical addition used seasonally. A capital cost of $80,000 is based on boat application and chemical feed equipment for seasonal treatment only. An annual O&M cost of about $30,000 is based on alum treatment cost of $8.00 per pound phosphorus.

Rendering Plant. The rendering plant example is based on a theoretical 20 percent expansion of a rendering plant. The principal activity at the rendering plant is the rendering, feather processing, hide curing, and pet food processing from animal meat by-products. The facility currently processes approximately 300,000 tons of raw materials (meat by-products) each year. Currently the TP mass discharged is about 8100 lbs., the total discharge flow was about 136 million gallons, and the average TP concentration in the discharge was 8 mg/L. Based on a 20 percent expansion of the plant production rate, a proportional increase of 20 percent flow and TP

mass load generated was used to estimate costs. TP concentration (untreated) remains the same. Wastewater from the rendering plant is treated at a series of wastewater treatment ponds including an anaerobic pond, four aerobic ponds, two aerated holding ponds and a final polishing pond. The discharge occurred intermittently for 95 days via the final polishing pond throughout the year (intermittently for eight months in 2005).

It is possible that chemical precipitation for TP removal could be accomplished in this system by pond treatment application at the final polishing pond, discharging on an intermittent basis. It would be more efficient to adjust operations such that only periodic additions of chemical to the final polishing pond are made, by extending the periods of time for discharge. The capital cost for pond application method for chemical precipitation is estimated at about $150,000 with annual O&M at about $80,000 based on a cost of about $8.00 per pound phosphorus treated.

Poultry Processing. The poultry processing plant example is based on a theoretical 20 percent expansion of a poultry processing plant. The plant processes chickens at an average rate of 170,000 birds per day, five days per week. The plant packages whole, cut-up, chill pack, marinated, and de-boned chicken, and stores these products in coolers until shipped, either fresh or frozen. It is assumed that the plant currently discharges 19,375 lbs. of TP per year at a total annual flow of 332 million gallons, and an average TP concentration in the discharge of 7.0 mg/L. Based on a 20 percent expansion of the plant production rate, a proportional increase of 20 percent flow and TP mass load generated was used to estimate costs. TP concentration (untreated) remains the same. Wastewater treatment at the plant consists of screening, grit removal, final screening, dissolved air flotation, equalization, activated sludge, final clarification, tertiary filtration (for recycle of treated effluent for process waster makeup), and UV disinfection. The effluent is discharged continuously. The TP removal technology would likely occur by chemical addition treatment utilizing the existing final clarifiers with modifications (adding chemical storage and feeding systems, and rapid mixing for the alum and/or ferric chloride feed). Additional sludge handling capacity could be required. The estimated capital cost for the modifications required to the wastewater treatment system are $900,000 (includes additional sludge handling) with annual O&M at $125,000.

Corn Wet Milling. The corn wet milling plant example is based on a theoretical 20 percent expansion of a corn wet milling plant. The existing corn wet milling plant is assumed to have a production capacity of about 180,000 bushels of corn per day and processes corn into corn syrup, fructose, gluten, fiber feed, and ethanol. It is assumed that the plant currently discharges 42,000 lbs. of TP per year at a total annual flow of 420 million gallons (~ 1.15 mgd), and an average TP concentration in the discharge of 12 mg/L. Based on a 20 percent expansion of the plant

production rate, a proportional increase of 20 percent flow and TP mass load generated was used to estimate costs. TP concentration (untreated) remains the same. Wastewater treatment at the plant consists of equalization, anaerobic fluidized bed reactor, sequential batch reactors (aerobic system), effluent equalization, polymer feed, sand filtration, and effluent aeration. The TP removal technology would likely occur by chemical addition treatment utilizing the existing treatment system with chemical addition prior to sand filtration. Modifications would be required including addition of chemical storage and handling systems, rapid mixing for the alum and/or ferric chloride feed). Additional sand filtration capacity could be required. The estimated capital cost for the modifications required to the wastewater treatment system are $700,000 with annual O&M at $200,000. If additional sand filtration capacity is needed due to TP treatment the additional capital cost to add a pressurized sand filter is estimated at about $600,000 with an additional annual O&M cost of about $80,000.

Pulp and Paper. The pulp and paper example is based on a theoretical 20 percent expansion of a pulp and paper mill. The hypothetical paper mill manufactures uncoated and coated publication grade (magazine) paper using groundwood pulp via thermo-mechanical process, purchased bleached kraft pulp, and other raw materials. The mill produces 240 tons/day of supercalendered printing paper, 480 tons/day of coated magazine grade paper, and 360 tons/day of thermo-mechanical pulp. It is assumed that the plant currently discharges 76,000 lbs. of TP per year at a total annual flow of 3,500 million gallons (~ 9.6 mgd), and an average TP concentration in the discharge of 2.6 mg/L. Based on a 20 percent expansion of the plant production rate, a proportional increase of 20 percent flow and TP mass load generated was used to estimate costs. The untreated TP concentration remains the same. Wastewater treatment at the mill consists of cyclone degritting, polymer feed, primary clarification, nutrient feed system, activated sludge, final clarification, activated sludge reaeration, and sludge processing equipment.

Under normal conditions pulp and paper mill influent wastewater is nutrient deficient and phosphorus and nitrogen must be added to provide for efficient biological wastewater treatment. In most cases the chemical addition is managed such that only the required mass of phosphorus and nitrogen are added, and the effluent TP is usually well below 1.0 mg/L. For example, a pulp and paper mill in Minnesota achieves an average effluent TP of 0.40 mg/L by managing the nutrient feed ratios properly. For this mill the expectation is that through proper management of nutrient feed rates of phosphoric acid and ammonia, in accordance with established BOD:nitrogen:phosphorus treatment ratios, the TP in the effluent will be reduced to well below a 1.0 mg/L concentration[26]. Therefore, there would be no capital and O&M costs to meet a 1.0

[26] As of June 2006 the pulp and paper mill on which our example is based indicated to the Agency that they would

mg/L TP in the effluent.

Petroleum Refining. The petroleum refining example is based on a theoretical 18 percent expansion of a petroleum refinery. The refinery processes crude oil at a rate of about 280,000 barrels per day into petroleum products such as gasoline, diesel, propane, butane, heating fuels, asphalt, sulfur, petroleum coke, and jet fuel. It is assumed that the refinery currently discharges 7,600 lbs. of TP per year at a total annual flow of 1,300 million gallons (~ 3.56 mgd), and an average TP concentration in the discharge of 0.7 mg/L. Based on a possible 18 percent expansion of the plant production rate by 50,000 barrels per day, a proportional increase of 18 percent flow and TP mass load generated was used to estimate costs, although flow would not necessarily be expected to increase by 18 percent due to potential internal recycling. TP concentration (untreated) remains the same or less. Wastewater treatment at the refinery consists of oil/water separation, dissolved air flotation, activated sludge process, powdered activated carbon system, final clarification, and polishing ponds, in addition to in-plant process water recycling and reuse systems.

Phosphorus may be added to refinery cooling water systems for scaling control, and pose a limited TP contribution source in the wastewater from cooling tower blowdown. However, phosphorus concentrations in refinery process wastewaters are generally low. The refinery has maintained TP levels in the treated effluent through proper management of phosphorus additions and maintaining overall wastewater treatment efficiency. Powdered activated carbon addition may also serve to lower TP by removal of particulate attached phosphorus. Expansion of refinery production would not cause an increase in the effluent TP concentration beyond current levels. Accordingly there would be no costs expected for TP removal as a result of a refinery expansion. Also, current Agency policy is to not impose a TP limit on facilities that discharge at a concentration less than 1 mg/L, unless the discharge impacts or is expected to impact a downstream lake.

In summary the Agency has estimated potential costs to seven categories of industries that potentially may get TP limits due to the proposed extension of the TP limit to new and expanding facilities that discharge more than 1,800 pounds TP per year. Projected cost for two of the seven categories is zero. While it is very difficult to predict the number of industries likely to be impacted over the next five years, the Agency has estimated costs for eight examples (one new and one expanded ethanol plant plus the other six, Table II-32). Costs will be incurred over time. The total estimated capital costs are $4.27 million and the annual operational and

be making changes to substantially reduce the TP concentration in their effluent to below 1 mg/L, possibly significantly below 1 mg/L.

maintenance (O&M) costs are $0.68 million (Table II-32). The estimated total (annual) cost for five years (annualized capital cost times 5 plus 5 years of O&M) is about $5.6 million, and the total costs (total capital cost plus 5 years of O&M) is about $7.8 million.

Current Agency policy is to not impose a TP limit on facilities that discharge at a concentration less than 1 mg/L, unless the discharge impacts or is expected to impact a downstream lake or reservoir.

F. TRUE COSTS DUE TO PROPOSED EXTENSION WILL BE FAR LESS THAN FULL ESTIMATES [XI. TP limit, economics]

As noted in the introduction to this Section, there are several reasons why much of the costs for removing TP from municipal and industrial dischargers, as discussed in the previous two sections, **cannot** be attributed just to the proposed extension of the TP effluent limit in this rulemaking. The Agency believes it is better to start with full cost estimates, which can be determined with some degree of accuracy, and then discuss the reasons why a significant portion of these costs should not be attributed to the proposal. Determining exactly what fraction of the total future costs should be attributed to the proposed extension of the TP limit is very difficult. The reasons full costs should not be attributed to the proposal have been mentioned throughout the *reasonableness* sections and will be summarized in this Section.

1. There has been a clear trend over the last five years that as permits are reissued, especially when a facility expands (or builds new), that the permit will include a limit for phosphorus. There are a number of reasons for this. A general reason is the increased awareness that phosphorus is a conservative (not degraded over time) pollutant of major concern not only for lakes but for rivers and stream as well, and the growing number of waterbodies (mostly lakes) listed as impaired due to nutrients. Phosphorus removal generally provides a higher quality effluent, lower in suspended solids and possibly lower in $CBOD_5$. Reduced solids generally mean lower effluent concentrations of some other pollutants such as mercury.

2. TP effluent limits have been issued to new and expanding facilities under the Phosphorus Strategy. About 35 facilities have gotten limits that can be attributed to the strategy since the Strategy was approved in March of 2000. To a large extent the proposed extension of the TP limit to new or expanding facilities is already being implemented, and has been for five years, as Agency policy under the Strategy.

3. TP limits are being or will be required in several major watersheds in Minnesota, which includes a large portion of the state (see Section IX.D).

- Lake Superior basin: 1 mg/L TP limits under existing Minn. R. 7065.
- Minnesota River TMDL: seasonal TP limits for about 40 larger dischargers.
- Lake Pepin TMDL: the implementation plan for this TMDL has not been completed yet but it seems likely that any plan would include 1 mg/L TP limits for at least the larger facilities. The Lake Pepin watershed includes half of the area of Minnesota.
- St. Croix: newly signed interstate agreement reinforces a previous goal to reduce TP loading to Lake St. Croix by 20 percent. Most permits reissued for facilities in the basin include a TP limit.
- Rainy River basin: there is increased concern about the eutrophication of Lake of the Woods. The Rainy River watershed makes up 80 percent of the lake's drainage basin, which means the TP concentrations in the river most certainly have a major impact on the trophic status of this very large lake. The Rainy River basin plan calls for managing TP loading to surface waters to minimize impacts.
- Basin plans for the Red, Lower Mississippi and Cedar Rivers have established nutrient reduction goals.

4. The discharge of a pollutant(s) to a waterbody listed as impaired for that same pollutant(s) is controlled by federal requirements. A new discharge to any waterbody cannot cause or contribute to a violation of water quality standards (40 CFR 122.4(i)). Also the Agency cannot issue a permit to an existing facility that would cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard (40 CFR 122.44(d)(1)(i)). Since impaired waterbodies by definition exceed one or more water quality standards, additional loading of the pollutant(s) causing the impairment is severely limited.

A strict interpretation of these federal requirements was upheld by the Minnesota Court of Appeals in August 2005.[27] The court reversed the Agency's issuance of the NPDES permit for a new Annandale/Maple Lake treatment plant that would have increased the loading of TP to the North Fork of the Crow River.[28] The Crow River flows into the Mississippi River upstream of Lake Pepin, which is impaired due to excess nutrients. The additional loading from Annandale/Maple Lake would have contributed to the impairment of Lake Pepin. The Agency's

[27] Cities of Annandale & Maple Lake NPDES/SDS Permit, (A04-2033) 702 N.W.2d 768 (Minn. App. 2005), review granted (Minn. Oct. 26, 2005).

[28] The Agency has asked the State Supreme Court to review this case but the Court has not ruled as of October 2006.

position was that the permit could be issued (consistent with the federal requirements) because the increased TP loading from Annandale/Maple Lake was more than offset (by a factor of more than 20) by dramatic reductions in TP loading from the new Litchfield plant, located in the same watershed. The appellate court found that the plain reading of 40 CFR 122.4(i) does not allow trading or offsets. The implications of this decision are significant because the Lake Pepin watershed covers about 50 percent of the land area in Minnesota, and it contains 60 percent of the state's POTWs which treat over 80 percent of the state's wastewater. Permitting of any new facility in this watershed has been curtailed until the TMDL is complete (or pending the outcome of the Agency's appeal of the court's decision). Permitting of any expanded facility in this watershed is possible only by "freezing" the TP mass loading at the pre-expansion rate, which means treating to a lower effluent TP concentration to offset the increased flow.

5. Permittees may request relief from the extension of the TP limit through one or more of the three proposed exemptions or through the variance process. The estimated costs for POTWs and industries discussed in the previous two Sections assume the Agency will receive no requests for relief.

6. The Clean Water Legacy Act passed by the 2006 legislature and signed by the Governor provides funding to help pay for phosphorus removal. In its first year the act provides grants totaling $3.2 million to cover 75 percent of the capital cost for TP removal infrastructure. The money can go to communities building new or to cover costs already incurred retroactively; however, new construction will be given priority. Requests for funding have already exceeded the first year's allocation of funds. The Agency is hopeful the legislature will continue funding TP removal and will increase the allotment.

7. TP limits will be implemented gradually over time. First the facility must expand or build new and exceed the *de minimis* loading of 1,800 pounds TP per year after July 1, 2007. The issued permit normally includes a compliance schedule which gives the community time to complete construction and bring the new treatment components on line before the limit becomes effective.

POTENTIAL COSTS TO MUNICIPALITIES AND THE CLEAN WATER LEGACY ACT PROGRAM EXTENDING THE TP LIMIT

The Agency has been directed by the Legislature to report on the impact that extending the 1 mg/L TP limit will have on funding needed to implement the Clean Water Legacy Act. This section of the report will address this issues. Section XI of the report considers the cost of extending the 1mg/L limit to treatment facilities over the next five years.

In this section the Agency has analyzed the current databases of municipal NPDES permitted plants that discharge to surface waters in Minnesota, that currently do not have a 1 mg/L TP final effluent limitation. This analysis has determined there are 64 mechanical continuously discharging plants and 46 controlled discharge stabilization pond system plants that are above the 0.2 mgd *de minimis* design flow that would be impacted by extending the TP limit.

The first subset of this cost analysis will be for the mechanical plants. Since the impact to the Clean Water Legacy Act would be measured in capital costs, this analysis will be limited to using average capital cost estimate figures only (for a range of low to high capital cost estimates, additional information is available in Tables II-25 & II-30). For the purpose of this analysis, the Agency will again assume that alum addition will be the treatment method. Table II–25 shows the Estimated Capital Costs for Alum Addition, and the average estimated capital per plant costs have been used in Table A to show the calculated Total Capital Cost for the 64 mechanical plants in their respective plant size ranges.

Table A. Total Capital Costs for TP Removal – Using Estimated Average Capital Costs for Alum Addition for Seven Size Categories of Mechanical Municipal Wastewater Treatment Plants.

Plant Size AWWDF Mgd	Number of Facilities	Estimated Average Capital Costs for Alum Addition	
		Cost Per Plant $ in millions	Total Cost $ in millions
0.2-0.5	23	0.46	10.58
0.5-1.0	18	0.65	11.70
1.0-5.0	15	0.93	13.95
5-10	5	4.53	22.65
10-20	3	6.10	18.30
20-40	0	8.0	na
40-100	0	12.5	na
> 100	0	na	na
Total	**64**		**$77.18**

The second subset in this analysis is to estimate the average total capital costs for the 46 stabilization pond system plants. Table II-27 shows the limited information available to estimate the possible Total Average Capital Costs for Alum Addition for stabilization pond system plants to meet the TP limit. Using the 0.093 million dollar capital cost for the 0.236 mgd design flow stabilization pond system, and the 0.1717 million dollar capital cost for the 0.5 mgd design flow stabilization pond system, a straight line relationship equation was developed to extend the possible estimates for some larger stabilization pond systems that would be effected by extending the TP limit. This straight line relationship equation likely over estimates the average costs for some of the larger pond systems, because most cost estimate relationships are not a straight lines, they are more typically curve relationship equations. However, this is a best available calculation method for establishing the costs at this time*. Table B shows the Total Capital Cost for the 46 stabilization pond systems in the respective plant size ranges.

Table B. Total Capital Costs for TP Removal – Using Estimated Average Capital Costs for Alum Addition for Stabilization Pond System Wastewater Treatment Plants.

Plant Size AWWDF Mgd	Number of Facilities	Estimated Average Capital Costs for Alum Addition	
		Cost Per Plant $ in millions	Total Cost $ in millions
0.2-0.35	23	0.093	2.14
0.35-0.7	15	0.172	2.58
0.7-1.5	7	0.32	2.24
1.5-3.0	1	0.92	0.92
Total	**46**		**$7.88**

*The Hydroqual/MESERB report does indicate a capital cost estimate of $0.09 million for 0.824 mgd pond system, and a capital cost estimate of $0.147 million for 2.6 mgd pond system, which may indicate that the relationship is a curve relationship equation.

The Agency estimates that the Total Capital Cost impact of extending the TP limit on the Clean Water Legacy Act is potentially equal to adding the Total Costs of adding alum addition for the 64 mechanical plants and the 46 stabilization pond systems, and Table C is a summary of these costs.

Table C. Summary of Total Capital Costs for TP Removal for Alum Addition for Mechanical and Stabilization Pond System Municipal Wastewater Treatment Plants.

Facility Type	Number of Facilities	Estimated Total Capital Costs for Alum Addition $ in millions
Mechanical	64	77.18
Pond Systems	46	7.88
Total	**110**	**$85.06**

The third and final subset in this analysis recognizes that some of the 64 mechanical treatment plants may be able to employee Bio-P treatment with chemical back-up, and a more realistic total cost scenario will include a combination of mechanical plants that will use alum addition only and mechanical plants using Bio-P treatment with chemical back-up. Tables II-25 and II-30 have shown in the average capital cost per plant

columns, there is little difference in the estimated capital cost ranges for either alum addition or Bio-P treatment from the 0.2 mgd up to the 5 mgd design plant size. Above the 5 mgd design plant size, the Bio-P treatment capital costs go down, so there appears to be a real capital cost advantage as the treatment plant size goes above the 5 mgd design plant size.

The Agency has roughly applied similar principles proposed by the Hydroqual/MESERB report, to analyze the 64 mechanical plants for possible candidates that may choose to employee the Bio-P treatment technology (absent site specific information such as BOD to P ratio, pH and temperature). This analysis shows that 33 of the 64 mechanical facilities may have favorable existing treatment plants to choose to use a Bio-P technology with chemical back-up. The estimated reduction to the Total Capital Costs (see Table A) for the mechanical plants using Bio-P treatment with chemical back-up is approximately $12.74 million. Table D gives a summary of the Total Capital Costs including a mix of mechanical plants with alum addition and Bio-P with chemical back-up plants.

Table D. Summary of Total Capital Costs for TP Removal for Alum Addition for Mechanical Plants, Bio-P with Chemical Back-up Mechanical Plants and Alum Addition for Stabilization Pond System Municipal Wastewater Treatment Plants.

Facility Type	Number of Facilities	Estimated Total Capital Costs for Alum Addition $ in millions
Mechanical	31	77.18
Bio –P	33	(12.74)
Sub Total		64.44
Pond Systems	46	7.88
Total	**110**	**$72.32**

The Agency conclusion is that the most probable estimated Total Capital Costs for extending the 1 mg/L TP limit will likely be in the range from approximately $72.32 million to $85.06 million, and this is the approximate funding level needed to implement the Clean Water Legacy Act.