United States Environmental Protection Agency
Regional Administrator
Region 5
77 West Jackson Boulevard
Chicago, IL 60604-3590

JUL 2 5 2012

Cathy Stepp, Secretary
Wisconsin Department of Natural Resources
Post Office Box 7921
Madison, Wisconsin 53707-7921

Dear Ms. Stepp:

I am pleased to inform you that the U.S. Environmental Protection Agency has approved the *Wisconsin Administrative Code* Chapter NR 217, Subchapter III, "Water Quality Based Effluent Limitations for Phosphorus." This Subchapter, which Wisconsin adopted in 2010, pertains to the development of Wisconsin Pollutant Discharge Elimination System permits to implement the State's approved water quality criteria for phosphorus.

EPA reviewed Subchapter III as a revision to Wisconsin's National Pollutant Discharge Elimination System (NPDES) program and conducted the review under 40 C.F.R. §§ 123.25(a) and 123.62. As Regional Administrator, I have the authority to approve revisions to Wisconsin's NPDES program. An enclosure to this letter explains the basis for approval of the Subchapter.

During its review of Subchapter III, EPA recommended that WDNR and EPA create a new addendum to the NPDES Memorandum of Agreement between our agencies through which WDNR would commit itself to certain conditions as it implements Sections NR 217.14(2) Concentration Based Limits and 217.18 Watershed Adaptive Management Option. The conditions will ensure that permits issued consistent with the Sections also meet the requirements of 40 C.F.R. §§ 122.44, 122.45(d), 122.47, 122.62, 124.8, and 124.56. WDNR signed the addendum in April. Enclosed is a copy of the addendum with both WDNR and EPA's signatures.

Tribal Consultation

EPA consulted with Wisconsin tribes on EPA's review of Subchapter III. The Bad River Band of Lake Superior Tribe of Chippewa Indians (the Bad River Tribe) provided comments to EPA that we want to share with you.

The Bad River Tribe asks whether under Section NR 217.14(1) a mass limit will be included in permits for phosphorus discharges when the receiving water or downstream water is designated as an Exceptional Resource Water (ERW) or Outstanding Resource Water (ORW) by the Tribe. Section NR 217.14(1) states that a mass limit shall be

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included in a permit for discharges of phosphorus to receiving or downstream waters that are an ORW or ERW. In a January 19, 2012 letter to WDNR, Wisconsin's Attorney General wrote that in Wisconsin provisions allowing WDNR to establish water quality-based effluent limitations necessary to protect downstream waters, "downstream waters" includes navigable waters of the U.S. that are protected by state and tribal water quality standards. Accordingly, we understand Section NR 217.14(1) to require that mass limits be included in permits for sources that discharge phosphorus into receiving or downstream waters on tribal land that a Tribe has designated as an ORW or ERW. However, we ask that WDNR confirm this in its implementing guidance.

Secondly, the Bad River Tribe asks to be involved in the watershed adaptive management option described in Section NR 217.18 if and when Wisconsin approves this approach for a watershed affecting or having the potential to affect the waters flowing within the boundaries of its Reservation. We ask that WDNR encourage parties developing adaptive management plans to involve tribes during development of such plans if the plans will cover a watershed which affects tribal waters. Although tribes will be able to comment on draft NPDES permits that are based on adaptive management plans under the public notice and comment provisions of Wisconsin Statutes Chapter 283, we encourage you to involve tribes during plan development. The Bad River Tribe also requests that WDNR define the scale of a watershed to which the adaptive management option may apply.

Finally the Bad River Tribe asks that WNDR clarify the method it will use to determine an appropriate "similar location" under Section NR 217.13(2)(d). This provision, which addresses calculation of water quality-based effluent limits, states that "the representative upstream concentration shall be either a concentration derived by the Department based on data from the specific stream or from a similar location." The provision does not explain how WDNR will determine what is an appropriate "similar location" when data are not available from the specific stream. WDNR should be able to clarify the method in its guidance.

Reservation of Rights

EPA reserves the right to initiate a subsequent revision to the Wisconsin program under 40 C.F.R. § 123.62 if, among other things, a Wisconsin court strikes down or limits the State's authority to administer the NPDES program including, but not limited to, the legal authority on which our approval of the present revision is based. Moreover, EPA retains authority to review and object to specific proposed and draft permits in accordance with Section 402(d)(2) of the Clean Water Act, 33 U.S.C. § 1342(d)(2), for any of the grounds set forth in 40 C.F.R. § 123.44(c), even if Wisconsin developed the permit in accordance with State law or our Memorandum of Agreement, including any aspects of State law that EPA has approved as part of Wisconsin's NPDES program. EPA also retains authority to take action as appropriate under 40 C.F.R. §§ 123.63 and 123.64.

Nutrients, including phosphorus, are among the most significant remaining causes of water pollution in Wisconsin and the nation. EPA commends Wisconsin for being the first state in the Region to establish numeric water quality criteria for phosphorus in all of the State's surface waters. We also commend Wisconsin for the significant innovation in the watershed adaptive management section of Subchapter III.

If you have any questions about this approval or the Bad River Tribe's comments, please do not hesitate to contact me at (312) 886-3000.

Sincerely,

Susan Hedman
Regional Administrator

Enclosures

cc: Kenneth Johnson, WDNR

Enclosure

Revision to the Wisconsin NPDES Program
for Effluent Standards and Limitations for Phosphorus

Wisconsin amended its Chapter NR 217 "Effluent Standards and Limitations for Phosphorus" by adding Subchapter III, NR ss. 217.10-217.19 "Water Quality-Based Effluent Limitations for Phosphorus" in 2010. Except for s. NR 217.19, the U.S. Environmental Protection Agency reviewed these regulations for consistency with 40 C.F.R. § 123.25(a). In addition, EPA reviewed the compliance schedule authorizing provisions in ss. NR 217.17 and 217.18 under section 303(c) of the Clean Water Act (CWA), 33 U.S.C. § 1313.

EPA review of NR 217, Subchapter III, Wisconsin Administrative Code

Wisconsin added the following provisions in Chapter NR 217, Subchapter III:

217.10	Applicability
217.11	Definitions
217.12	General
217.13	Calculation of water quality based effluent limitations for phosphorus
217.14	Expression of limitations
217.15	Determination of necessity for water quality based effluent limitations for phosphorus
217.16	Relationship of WQBELs and TMDL based limitations
217.17	Schedules of compliance
217.18	Watershed adaptive management option
217.19	Variances for stabilization ponds and lagoon systems

EPA addressed s. NR 217.19 and the compliance schedule authorizing provision in s. 217.17 on December 30, 2010 as part of its approval of the phosphorus water quality criteria. EPA approves ss. NR 217.10, 217.11, 217.12, 217.13, 217.14, 217.15, 217.16, 217.17, and 217.18 as discussed below. EPA is approving ss. NR 217.14(2) and 217.18 based, in part, on an addendum to the National Pollutant Discharge Elimination System (NPDES) Memorandum of Agreement ("MOA") between the Wisconsin Department of Natural Resources ("WDNR" or "the Department") and EPA concerning implementation of these provisions, as discussed below. Finally, EPA approves the compliance schedule authorizing provisions in s. NR 217.18(3) under CWA § 303(c) based on the fact that compliance schedules, including those established under s. NR 217.18(3), are subject to s. NR 217.17, 40 C.F.R. § 122.47, and the signed MOA Addendum.

Prior to this approval, EPA consulted with the Wisconsin tribes on the draft MOA and WDNR's NPDES rules. On May 4, 2011, EPA issued its Policy on Consultation and Coordination with Indian Tribes. While EPA is in a transition period of determining when it is appropriate to consult under this Policy, and working with tribes as part of this process, EPA Region 5 decided in this instance to consult with tribes on its pending decision concerning

Wisconsin's NPDES rules for the new phosphorus water quality criteria, rather than wait until the process for implementing the policy is more developed. EPA participated in conference calls with the tribes and provided an opportunity for the tribes to comment. The tribes were overall supportive of the NPDES rules implementing the phosphorus water quality standards. The Bad River Band of Lake Superior Tribe of Chippewa Indians had comments which are included in the cover letter.

EPA Approval

1. s. NR 217.10 Wis. Adm. Code: Applicability. This section contains the applicability statement for Chapter NR 217, Subchapter III. It specifies that the Subchapter is applicable to four specified categories of point sources, including, but not limited to, publicly and privately owned wastewater facilities or treatment works. EPA asked WDNR to clarify that point sources not covered under s. NR 217.10 may still be subject to a requirement for a water quality-based effluent limitation (WQBEL) for phosphorus under Wis. Stat. section 283.13(5), which provides that WDNR shall establish more stringent effluent limitations if these limitations are necessary to meet applicable water quality standards, or any other state or federal law or regulations. WDNR added a footnote to clarify this point. Thus, this provision makes clear that other point sources may need phosphorus WQBELs in permits to meet the criteria in s. NR 102.06, even if they are not subject to Subchapter III, Chapter NR 217.

EPA approves s. NR 217.10 Wis. Adm. Code.

2. s. NR 217.11 Wis. Adm. Code: Definitions. This section contains definitions that apply solely for carrying out Subchapter III. WDNR added a definition of "new discharger" which, unlike EPA's definition of new discharger in 40 C.F.R. § 122.2, does not exclude new sources from the definition. However, the lack of an exclusion for new sources is not consequential given the narrow applicability of the term "new discharger" as well as its use in Subchapter III.

In addition, WDNR added a definition of "privately owned treatment works" to address EPA's concern that this term, as used in s. 217.10, could be interpreted to exclude commercial and industrial sources which discharge process wastewater. WDNR's definition makes clear that the term as used in Subchapter III includes industrial and commercial sources which discharge process wastewater.

EPA approves s. NR 217.11 Wis. Adm. Code.

3. s. NR 217.12 Wis. Adm. Code: General. This section contains the Department's authority to establish WQBELs for phosphorus. WDNR revised its proposed regulation to address EPA's comments that, to match the language in EPA's regulations at 40 C.F.R. § 122.44(d)(1)(i) and (ii), Wisconsin should revise ss. NR 217.12(1)(a), 217.15(1)(a) and 217.15(1)(c) to provide that WQBELs for phosphorus shall be included in a permit whenever

WDNR determines that the discharge from a point source contains phosphorus at concentrations which will cause, have a reasonable potential to cause, or contribute to an excursion above the phosphorus water quality criterion. WDNR did this. Section NR 217.12(a) states that the Department shall set WQBELs for discharges that will cause, have the reasonable potential to cause or contribute to an exceedance of the criteria in s. NR 102.06 in either the receiving water or downstream waters.

Regarding downstream waters, 40 C.F.R. § 122.4(d) prohibits issuance of permits when the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected states.[1] Section NR 217.12(a) is not clear on its face that it means downstream waters in other states, as well as Wisconsin waters. However, Wisconsin has authority to take downstream impacts in affected states into account in calculating effluent limits. Wis. Stats. sections 283.31(3) and (5) provide WDNR authority for applying 40 C.F.R. § 122.4(d) if necessary to ensure compliance with water quality requirements of all affected states. Wisconsin has confirmed it has this authority. In a January 19, 2012 letter to WDNR, Wisconsin's Attorney General stated that in Wisconsin provisions allowing the Department to establish WQBELs necessary to protect downstream waters, "downstream waters" includes navigable waters of the U.S. that are protected by state and tribal water quality standards. EPA expects WDNR to take the potential for downstream impacts into account and retains the authority to object to a permit if the permit does not ensure compliance with applicable water quality requirements of affected states and tribes.

Based on the foregoing discussion, EPA approves s. NR 217.12 Wis. Adm. Code.

4. <u>s. NR 217.13 Wis. Adm. Code: Calculation of water quality-based effluent limitations for phosphorus</u>. This provision provides procedures for calculating a WQBEL for phosphorus for discharges to streams and rivers, inland lakes and reservoirs, and the Great Lakes. Several paragraphs are discussed below.

Section NR 217.13(4) provides that WDNR will establish WQBELs for discharges directly to the Great Lakes consistent with near shore or whole lake model results approved by WDNR. Sections NR 217.12 and 217.15 make clear that WDNR must determine whether a discharger will cause, have a reasonable potential to cause, or contribute to an excursion beyond the applicable phosphorus water quality criterion. These sections also make clear that WDNR is required to set a WQBEL when the Department determines that a discharge will cause, have the reasonable potential to cause, or contribute to an excursion above the phosphorus water quality criterion. Thus, Wisconsin is required by ss. 217.12 and 217.15 to identify a model with which it will calculate WQBELs for discharges into the Great Lakes, and actually establish such limits when required under ss. NR 217.12 and 217.15.

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[1] 40 C.F.R. § 122.2 defines the term "state" to include Indian Tribes.

Section NR 217.13(8) provides that a new discharger will not be able to discharge phosphorus in a phosphorus impaired water unless, among other things, the discharge will "improve water quality in the phosphorus impaired segment." In response to comments on this provision, WDNR said that "New dischargers could improve water quality in a receiving water in a number of ways. For example, a large effluent volume with a very low phosphorus concentration--well below the applicable criterion--would improve water quality. The department will make this determination on a case-by-case basis." To show an "improvement" in water quality, EPA expects that the permittee will demonstrate that its discharge will result in a decrease in the phosphorus concentration or loading in the receiving water.

Section NR 217.13(8) also provides an exception for a new discharger if it can demonstrate that the new phosphorus load will be offset through a phosphorus trade. Section NR 217.17(3)(f) also addresses pollutant trading. EPA has developed guidance on pollutant trading that sets out necessary terms and conditions of a trade. *See* "The Water Quality Trading Policy" and "The Water Quality Trading Toolkit for Permit Writers" (2007, EPA-833-R-07-004, and http://water.epa.gov/type/watersheds/trading/WQTToolkit.cfm). Generally, EPA recommends that trade programs include several elements to ensure credibility and compliance with water quality standards. These elements include:

- Applying CWA regulations and established state law provisions to provide legal authority for administration of water quality trade programs.
- Clearly defining a common unit of trade.
- Generating credits before or during the same time period they are to be used to comply with permit limits.
- Including methods for managing uncertainty such as using trading ratios, modeling, and best management practice efficacy estimates.
- Ambient water quality monitoring, in addition to effluent monitoring requirements in NPDES permits. Samples should be collected at strategic locations to ensure progress in meeting water quality standards.
- Compliance and enforcement mechanisms, including a combination of record-keeping, certifications, inspections, and reporting.
- Provisions for adequate public notice through, for example, the TMDL and permit process and a public website.
- Trade programs should be evaluated in order to modify and make improvements to the program.

Sections 217.13(8) and 217.17(3)(f) do not include anything that is inconsistent with EPA's trading policy. In particular, s. NR 217.13(8) says that the offset through a phosphorus trade must be implemented prior to the new discharge, and the note to s. NR 217.14 states that trades must be incorporated into the permit and approved by the Department prior to

implementation.[2] EPA understands that WDNR is currently working on promulgating trading provisions.

EPA approves s. NR 217.13 Wis. Adm. Code.

5. s. NR 217.14 Wis. Adm. Code: Expression of limitations. Section NR 217.14(1) requires that limits be expressed as a concentration, and as a mass limit for certain identified waters, including outstanding resource waters (ORWs) and exceptional resource waters (ERWs). WDNR may establish mass limitations in permits for any other discharges of phosphorus where an increase in phosphorus load is likely to result in adverse effects on water quality in the receiving water or downstream water. Under 40 C.F.R. §122.45(f) mass limits must be included in permits except when the applicable standard is expressed in other units of measurement. Here, the phosphorus water quality criteria in s. NR 102.06 are expressed in terms of concentration, so EPA's regulations do not mandate mass limitations. The Bad River Tribe, in its comments to EPA, asked for confirmation that WDNR will include a mass limit in permits for phosphorus discharges when the receiving water or downstream water is designated as an ERW or ORW by the Tribe. As noted earlier, Wisconsin concludes that its provisions allowing the Department to establish WQBELs necessary to protect downstream waters includes authority to protect waters protected by other state and tribal water quality standards. EPA asks WDNR to confirm in guidance or by letter to EPA that the Section 217.14(1) requirement concerning mass limits applies to receiving and downstream waters on tribal lands designated by a tribe as ORW or ERW. If the confirmation is included in guidance, please provide EPA a copy of the revised guidance.

Section NR 217.14(2) and (3) provides that the Department will express effluent limits as a monthly average in permits, except for concentrations of less than or equal to 0.3 milligrams per liter (mg/L) where limitations may be expressed as annual averages. The CWA section 402(c)(2) specifically requires NPDES permits to include all the conditions that are required under 40 C.F.R. § 122.45 (made applicable to state NPDES programs by 40 C.F.R. §123.25(a)(16)). Section § 122.45(d) provides that for continuous dischargers, all effluent limitations necessary to achieve water quality standards shall, unless impracticable, be stated as maximum daily and average monthly discharge limitations for all dischargers other than publicly-owned treatment works (POTWs) and average weekly and average monthly discharge limitations for POTWs.

Based on discussions with EPA, WDNR developed a Justification Paper for use of averaging periods for expression of WQBELs for phosphorus other than the averaging periods in 40 C.F.R. § 122.45(d). WDNR set out the basis for impracticability of weekly and daily limits,

[2] In approving Subchapter III, EPA's approval does not extend to the notes to s. NR 217.14 or to notes in any other section.

and also, when the phosphorus wasteload allocation (WLA) is 0.3 mg/L or less, that monthly limits may be impracticable. WDNR explains that its phosphorus criteria were developed based on correlations between median growing season phosphorus concentrations and biotic indices, and that this is consistent with EPA guidance for nutrient criteria development. WDNR evaluated several studies on the response of fresh waters to phosphorus. Further, WDNR relied on a March 3, 2004 memorandum from James Hanlon, Director of EPA's Office of Wastewater Management, "Annual Permit Limits for Nitrogen and Phosphorus for Permits Designed to Protect Chesapeake Bay and its Tidal Tributaries from Excess Nutrient Loading under the National Pollutant Discharge Elimination System." In this 2004 memorandum, EPA concluded that annual average limits were appropriate for nitrogen and phosphorus in the Chesapeake Bay and that it was impracticable in that case to express such limits as daily/weekly/monthly average values. WDNR noted that the EPA memo indicates that the nature of the water quality problem can be used to determine impracticability.

WDNR then relied on the information above to support its conclusion that due to the nature of phosphorus loadings and the manner in which its phosphorus water quality standards were derived, daily and weekly limits were impracticable. Further, that monthly limits may be impracticable when the WLA is 0.3 mg/L or less, as is recognized in Wisconsin s. NR 217.14(2). For rivers, streams, reservoirs and lakes with residence time of less than one year, where the WLA is 0.3 mg/L or less, the Justification Paper provides that WDNR may establish a monthly average or six-month average limit. When it sets a six-month average limit, the Justification Paper provides that WDNR will also set a monthly limit of 3 times the WLA. For lakes and reservoirs with a residence time of one year or more, where the WLA is 0.3 mg/L or less, the Justification Paper provides that WDNR may establish a six-month average or annual average limit along with a monthly limit of 3 times the WLA. WDNR signed an addendum to the EPA-WDNR NPDES MOA confirming that WDNR will implement 217.14(2) in this manner. EPA expects the State will have to modify its Enforcement Management System to describe the way in which it will manage seasonal and annual average phosphorus limits in its compliance evaluation and enforcement program.

EPA approves s. NR 217.14 Wis. Adm. Code.

6. <u>s. NR 217.15 Wis. Adm. Code: Determination of necessity for water quality-based effluent limitations for phosphorus</u>. This section requires WDNR to determine when WQBELs are required for phosphorus. Sections 301 and 402 of the CWA require NPDES permits to include effluent limitations as needed for discharges to meet water quality standards. The regulation at 40 C.F.R. § 122.44(d) requires the permit-issuing agency to: (1) determine whether point source discharges will cause, have a reasonable potential to cause, or contribute to an excursion beyond applicable water quality criteria; and (2) when the agency makes an affirmative determination, set WQBELs that are derived from and comply with water quality standards. Section NR 217.15 requires a WQBEL where the Department makes an affirmative

determination on reasonable potential. It establishes procedures for the Department to make this determination.

In response to a comment from EPA to address the situation where phosphorus data are not available, WDNR revised its rule to provide that where phosphorus date are not available, it may require phosphorus sampling as part of a permit application or use effluent data from similar point sources to make a determination as to whether the point source discharge will cause, have a reasonable potential to cause, or contribute to an excursion beyond the phosphorus water quality criterion. This addressed the concern raised by EPA on the proposed rule.

EPA approves s. NR 217.15 Wis. Adm. Code.

7. s. NR 217.16 Wis. Adm. Code: Relationship of WQBELs and TMDL based limitations. Section NR 217.16 provides WDNR authority to establish a WQBEL consistent with the waste load allocation and assumptions of an EPA approved TMDL that is designed to achieve water quality standards for the waterbody. EPA expects that a limit based on a TMDL will be derived from, and comply with, the applicable phosphorus criteria in NR 102 Wis. Adm. Code in order to be in conformance with 40 C.F.R. § 122.44(d)(1)(vii)(A). Additionally, pursuant to s. NR 217.16(4) if the WQBEL based on an approved TMDL is more stringent that the WQBEL calculated under s. NR 217.13, the Department must include the more stringent TMDL based limitation in the permit. Thus, Wisconsin has the authority to issue permits consistent with the assumptions and requirements of a TMDL's wasteload allocation and is required to do so by s. NR 217.16(4).

EPA expressed a concern that the proposed rule at NR 217.16(3) appeared to allow the state to modify or reissue the permit to include a less stringent limit based on an approved TMDL. WDNR revised its rule to clarify that if a phosphorus WQBEL calculated under s. NR 217.13 has already taken effect in a permit, the Department may replace the limit with a less stringent TMDL-based limit only if allowed pursuant to antidegration procedures in ch. NR 207. In a July 2011 letter, EPA told WDNR that Wisconsin's NPDES program does not have a provision that conforms to 40 C.F.R. § 122.44(l) (antibacksliding). This regulation is applicable to states under 40 C.F.R. § 123.25(a)(15). In an October 2011 reply letter, WDNR said that it will amend the Wisconsin Administrative Code or seek a statutory amendment to establish antibacksliding provisions for the Wisconsin NPDES program. Until Wisconsin establishes antibacksliding provisions, the Department cannot replace a limit calculated under s. NR 217.13 with a less stringent TMDL-based limit unless the replacement conforms to 40 C.F.R. § 122.44(l). EPA retains its authority to review and object to a permit that contains a limit which is less stringent than contained in the prior permit.[3]

[3] EPA's approval does not extend to the note inserted at the end of s. NR 217.16(3).

Section NR 217.16 (2) provides that WDNR may include a schedule of compliance to achieve a TMDL-based limit, if the department determines a schedule of compliance is necessary. All of the compliance schedule provisions set out in s. NR 217.17, including the required findings that a schedule of compliance will lead to compliance with the WQBEL as soon as possible and that a compliance schedule is appropriate and necessary, apply to any compliance schedule developed under s. NR 217.16. EPA retains its authority to review and object to a permit if it contains a compliance schedule that is not in conformance with 40 C.F.R. § 122.47.

Based on the foregoing discussion, EPA approves s. NR 217.16 Wis. Adm. Code.

8. s. 217.17 Wis. Adm. Code: Schedules of compliance. This section sets out the conditions under which WDNR may provide a schedule of compliance for a WQBEL, and the criteria for WDNR making a determination as to whether a compliance schedule is appropriate. It also provides the terms and conditions for schedules of compliance. EPA reviewed this provision, within the context of current Wisconsin law, for consistency with the CWA section 502(17) and 40 C.F.R. § 122.47. Section 502(17) defines a schedule of compliance as "a schedule of remedial measures including an enforceable sequence of actions or operations leading to compliance with an effluent limitation, other limitation, prohibition, or standard." Wisconsin defines the term using identical language. *See* Wis. Stat. section 283.01(15) and s. NR 205.03(32) Wis. Adm. Code. Under 40 C.F.R. § 122.47, permits can include compliance schedules when appropriate, and must require compliance with the WQBEL as soon as possible. In granting a compliance schedule in a permit, WDNR must make a finding, supported by the administrative record and described in the fact sheet that a compliance schedule is appropriate and that the discharger cannot immediately comply with the WQBEL upon the effective date of the permit. Such finding should set out the basis for its determination that a compliance schedule is appropriate and that the discharger cannot immediately comply with the WQBEL. WDNR should not presume that a compliance schedule be based on the maximum time period allowed in s. NR 217.17(2). The permittee must establish the need for a compliance schedule and for how much time is necessary to achieve compliance. Where such schedules exceed one year, permits must set forth interim requirements and the dates for achievement of the interim requirements. 40 CFR § 122.47(a)(3).

Wis. Stats. section 283.01(15) and ss. NR 205.03(32) and 217.17 Wis. Adm. Code include provisions that conform to the CWA section 502(17) and 40 C.F.R. § 122.47. If a NPDES permit is issued with a compliance schedule that extends past the expiration date of a permit, then the permit must include the final effluent limitations and any interim or final requirements that apply after permit expiration must be enforceable. Interim and final requirements must be expressed in terms of actions or operations leading to compliance with the WQBEL. To the extent WDNR writes guidance implementing s. NR 217.17, WDNR should

ensure such guidance conforms to Wis. Stats. section 283.01(15), ss. NR 205.03(32) and 217.17, and 40 C.F.R. § 122.47.

Section NR 217.17(3)(f) provides that if a permittee chooses to use pollutant trading to achieve compliance with a WQBEL, then the terms and conditions related to the trade shall be incorporated into the permit. This section seems misplaced in s. NR 217.17. As previously noted, this provision does not contain any statements inconsistent with EPA's "Water Quality Trading Policy" (2003). Pollutant trading is allowed to meet a WQBEL. However, the details of the trade must be established prior to permit issuance and incorporated into the permit. If a permittee engages in pollutant trading to comply with a limit, it is not appropriate to allow a compliance schedule to give a discharger time to establish the terms of a trade. Trades must be established at the time of permit issuance or modification.

Based on the foregoing discussion, EPA approves s. NR 217.17 Wis. Adm. Code.

9. s. NR 217.18 Wis. Adm. Code: Watershed adaptive management option. Section NR 217.18 provides an option for permittees to request the issuance of an Adaptive Management NPDES permit as a means to achieve compliance with the water quality standard for the waterbody and the WQBEL. This option is based on the permittee implementing point source and nonpoint source net watershed-scale pollutant reductions that will result in certain Wisconsin waters achieving phosphorus water quality standards in s. NR 102.06 Wis. Adm. Code.

There are several key provisions to this option. Section NR 217.18(3)(e)(1) requires that the permit contain a final and enforceable WQBEL. Section NR 217.18(2)(d) requires the permittee to submit an adaptive management plan with the application for permit re-issuance, with said plan identifying specific actions to achieve the applicable phosphorus criteria through verifiable reductions of phosphorus from point and nonpoint sources. Such adaptive management actions with goals and measures must be included in the permit (s. NR 217.18(3)(b)) and the permit must include a statement that failure to implement any of the terms and conditions established under s. NR 217.18(3) is a violation of the permit. EPA will be reviewing permits issued under this option carefully.

Given that nonpoint sources may be significant contributors of phosphorus in surface water, the adaptive management approach with its focus on reducing nonpoint sources as well as point source loadings to meet the water quality criteria may be a workable solution for phosphorus pollution. This approach could result in achieving the phosphorus water quality criteria for the waterbody where the more traditional approach of relying solely on the permittee meeting its WQBEL may not.

EPA is approving s. NR 217.18 based on WDNR signing an addendum to the MOA with EPA, on April 30, 2012, agreeing to implement this provision in a manner that conforms to 40 C.F.R. §§ 122.44(d), 122.44(l), 122.47, and 122.62. More specifically, the initial permit issued

and all reissued or modified permits under the adaptive management provision will include the final WQBEL and identify the subset of adaptive management actions that offset the mass of phosphorus which corresponds to the difference between the interim effluent limitation and the WQBEL. Secondly, the initial adaptive management permits will include a complete compliance schedule that sets out all the actions in the approved adaptive management plan to achieve the phosphorus water quality criterion. The schedule can contain the interim effluent limitations, and must identify adaptive management actions that will result in verifiable pollution reductions that equate to the increment between the interim limit and the WQBEL. For all compliance schedules, WDNR needs to meet the requirements in Wis. Stats. section 283.01(15) and ss. 205.03(32) and NR 217.17 Wis. Adm. Code. In particular the record should support a determination that a compliance schedule is appropriate and necessary and will lead to compliance with the WQBEL and water quality standard as soon as possible.

Addendum to the
National Pollutant Discharge Elimination System
Memorandum of Agreement between the
U.S. Environmental Protection Agency, Region 5
and the
Wisconsin Department of Natural Resources

The U.S. Environmental Protection Agency (EPA), Region 5, and the Wisconsin Department of Natural Resources (WDNR) enter into this Addendum to their National Pollutant Discharge Elimination System (NPDES) Memorandum of Agreement to ensure that Wisconsin permits which implement ss. NR 217.14(2) and 217.18 *Wisconsin Administrative Code* (*Wis. Adm. Code*), and the fact sheets that accompany such permits, are prepared in conformance with all NPDES requirements including 40 C.F.R. §§ 122.44(d), 122.45(d), 122.47, 124.8, and 124.56. EPA retains its authority to review and object to specific proposed and draft permits in accordance with Section 402(d)(2) of the Clean Water Act, 33 U.S.C. § 1342(d)(2), for any of the grounds set forth in 40 C.F.R. § 123.44(c).

I. Section NR 217.14(2) *Wis. Adm. Code* provides that: (a) concentration effluent limitations calculated under s. NR 217.13 shall be expressed as a monthly average in permits, except for concentrations of less than or equal to 0.3 milligrams per liter (mg/L) where limitations may be expressed as annual averages; and (b) if a concentration limitation expressed as an annual average is included in a permit, a monthly average concentration limitation equal to three times the water quality based effluent limitation calculated under s. NR 217.13 shall also be included in the permit. For continuous discharges, 40 C.F.R. § 122.45(d) provides that effluent limitations shall, unless impracticable, be expressed as average weekly and average monthly limitations for publicly-owned treatment works (POTWs) and maximum daily and average monthly limitations for other than POTWs. 40 C.F.R. § 122.44(d)(1)(vii) provides that water quality-based effluent limitations (WQBELs) shall be derived from, and comply with, water quality standards and shall be consistent with the assumptions and requirements of any wasteload allocation (WLA) approved by EPA under 40 C.F.R. § 130.7.

A. For the reasons explained in the attached April 30, 2012, paper entitled *Justification for Use of Monthly, Growing Season and Annual Averaging Periods for Expression of WPDES Permits Limits for Phosphorus Discharges in Wisconsin* (Justification Paper), EPA and WDNR agree that it is impracticable to express phosphorus WQBELs as maximum daily or average weekly values and, when the magnitude of the limit calculated in accordance with s. NR 217.13 *Wis. Adm. Code* is 0.3 mg/L or less, EPA and WDNR agree that it may be impracticable to express phosphorus WQBELs as average monthly values.

B. When the magnitude of the limit calculated in accordance with s. NR 217.13 *Wis. Adm. Code* is 0.3 mg/L or less, WDNR agrees to express the WQBEL over an applicable duration provided in the table on the first page of the Justification Paper provided, however, that the duration shall be consistent with the assumptions and requirements of any applicable EPA-approved WLA. In the atypical or uncommon situations contemplated in the Justification Paper, (e.g. discharges to small inland lakes) on a case-by-case basis WDNR may express a WQBEL over a duration other than a monthly average provided that the fact sheet for the draft permit sets

forth the facts which justify conclusions that: (1) it is impracticable to set the limit as a monthly average and (2) the draft limit was derived from and complies with the applicable phosphorus water quality criterion and is consistent with the assumptions and requirements of any applicable EPA-approved WLA.

II. Section NR 217.18(3) *Wis. Adm.. Code* provides minimum terms and conditions for permits that include watershed adaptive management actions.

A. To conform to 40 C.F.R. § 122.44(d), WDNR agrees that the initial and any subsequent reissued, modified, or revoked and reissued permit issued to each point source under s. NR 217.18(3) will include the final water quality-based effluent limitation and identify the subset of adaptive management actions that offset the mass of phosphorus which corresponds to the difference between the interim effluent limitation under s. NR 217.18(3)(e) 2. or 3., as the case may be, and the water quality-based effluent limitation.

B. To conform to 40 C.F.R. § 122.47, WDNR agrees that the initial permit issued to each point source under s. NR 217.18(3) will include the s. NR 217.18(3)(b) and (e) 2., 3., and 4. compliance schedule in its entirety. 40 C.F.R. § 122.62(a) and (b) identify the causes for permit modification or revocation and reissuance, respectively. 40 C.F.R. § 122.44(l)(1) provides that interim effluent limitations, standards or conditions in a reissued permit must be at least as stringent as the previous permit unless the circumstances have changed and would constitute cause for permit modification or revocation and reissuance. Subject to 40 C.F.R. §§ 122.62, 122.44(l)(1), and s. 283.53 (2), Wis. Stats., as applicable, WDNR agrees that any reissued, modified, or revoked and reissued permit will include a continuation of the compliance schedule to meet the requirements established in the initial permit.

Wisconsin Department of Natural Resources

By: Matt Moroney for Cathy Stepp, Secretary

Date: 4/30/12

U.S. Environmental Protection Agency, Region 5

By: Susan Hedman, Regional Administrator

Date: July 12, 2012

Attachment

Justification for Use of Monthly, Growing Season and Annual Averaging Periods for Expression of WPDES Permit Limits for Phosphorus in Wisconsin

Averaging Periods by Receiving Waterbody Type and Range of WQBEL Concentrations		
WQBEL	Rivers, streams, impoundments and lakes/reservoirs with average water residence times of less than one year	Lakes with average water residence times of greater than or equal to one year
Greater than 0.3 mg/L	Monthly average	Monthly average
Less than or equal to 0.3 mg/L	Monthly* or six month average (May 1 to October 31 and November 1 to April 30). When the WQBEL as a six-month average is included in the permit, a monthly average limit of 3 times the calculated concentration limit in ss. NR 217.13 and NR 217.14, shall also be included in the permit.	Monthly*or six month average (May 1 to October 31 and November 1 to April 30) or annual average. When the WQBEL as a six-month average or annual average is included in the permit, a monthly average limit of 3 times the calculated concentration limit in ss. NR 217.13 and NR 217.14, shall also be included in the permit.
For approved TMDLs, the expression of limits must be consistent with the assumptions and requirements of the TMDL, but not greater than the periods expressed above.		
* Atypical or uncommon situations will be addressed on a case-by-case basis. These include discharges to small inland lakes with water residence times of less than one year where it is possible that a six month averaging period may not be appropriate and a monthly average limit calculated under ss. NR 217.13 and NR 217.14 may instead be necessary.		

Pertinent Federal Regulation

Section 40 CFR 122.45 (d) of Federal Regulations, requires NPDES permits, including delegated state permits, to express water quality based effluent limits for continuous dischargers, including those for phosphorus, as average weekly and average monthly limitations for POTWs and maximum daily and average monthly limitations for other than POTWs, unless impracticable. Federal regulations do not describe criteria for determining when limits are impracticable, nor does EPA provide guidance on how to make a determination of impracticability.

EPA has made a finding for Chesapeake Bay that impracticability can be based on the nature of the water quality problems. For Chesapeake Bay, EPA determined that daily maximum, weekly average and monthly average effluent limits are impracticable due to the nature of nutrient related water quality problems in the bay. In making this determination, EPA concluded that annual averaging periods were practicable for Chesapeake Bay. This does not automatically infer that annual averaging periods are practicable elsewhere. It merely states that the nature of the water quality problem can be used to determine impracticability.

Principles

- Averaging periods should be consistent with the technical analysis and rationale supporting the adopted phosphorus water quality standards criteria. The Wisconsin phosphorus criteria were developed based on correlations between median growing season phosphorus concentrations and biotic indices.

- Averaging periods should be consistent with EPA guidance for nutrient criteria development.

- The averaging period must take into account critical conditions in the receiving water or downstream water.

- Averaging periods should be compatible with tools, such as models, used to manage the lake, reservoir, stream or river.

- Shorter averaging periods should be used where the frequency, duration or magnitude of the difference between the limit and water quality standards criterion is greater. Longer averaging periods may be used where the difference is less, especially as the discharge limit is the same as the water quality criterion.

Technical Justification

A. Streams and Rivers

Conclusions:

1. It is impracticable to establish maximum daily and average weekly phosphorus limits under 40 CFR 122.45(d) due to the way waterbodies respond to phosphorus loading and due to the manner in which phosphorus water quality standards criteria for Wisconsin were derived.

2. Due to the manner in which the Wisconsin phosphorus criteria were derived, it may be impracticable to establish average monthly limits under 40 CFR 122.45(d) when the magnitude of the calculated water quality based effluent limit is 0.3 mg/L or less.

3. Based on available literature and the judgment of national experts, EPA criteria development guidance clearly calls for states to use seasonal or annual mean or median values in development of nutrient criteria.

4. Wisconsin's wadeable streams exhibit conditions similar to those described in EPA guidance.

5. Wisconsin's approved criteria for both wadeable streams and nonwadeable rivers were derived using correlations between growing season median phosphorus concentrations and community biotic indicators.

6. Although nonwadeble streams exhibit higher concentrations of suspended algae and suspended algae may be more responsive to changes in phosphorus concentrations, acute conditions, such as low dissolved oxygen concentrations, are not exhibited.

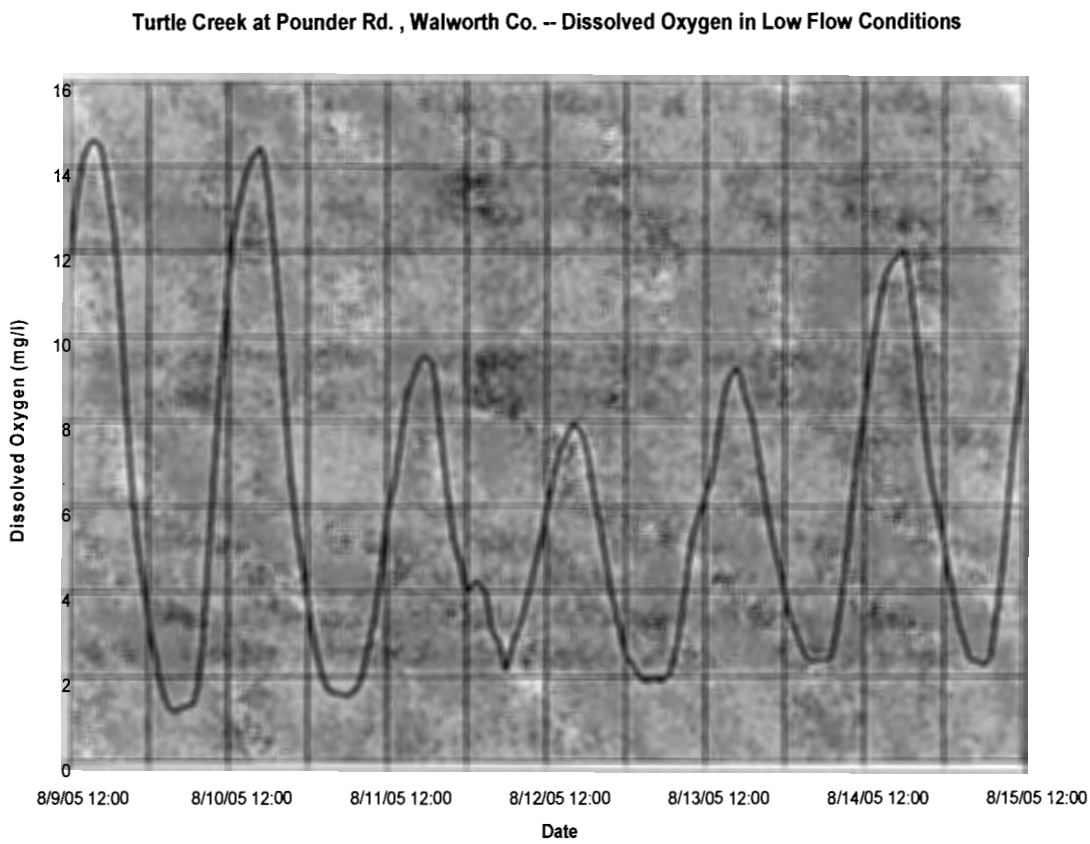
7. If averaging periods for WPDES permits should reflect methods and data used to develop phosphorus criteria, generally a growing season averaging period is warranted.

8. Since the risk of impact increases with nutrient concentrations (as well as frequency and duration), it is prudent that permits with higher concentration limits should have shorter averaging periods. Similarly, discharges with lower limits that are set at the water quality criterion concentration could have longer averaging periods taking the background concentration and available dilution into account.

EPA Guidance

EPA's "Nutrient Criteria Technical Guidance Manual: Rivers and Streams" (EPA, July 2000) based on the knowledge and experience of many experts and reviews of the scientific literature, makes numerous references and suggestions to use of seasonal or annual mean or median values in deriving nutrient criteria. For example, in Chapter 6 of the guidance manual, explicitly identifies use of annual mean nutrient concentrations in developing relationships with the 75th percentile of mean algal biomass (page 60). EPA cites work by Biggs (1995 and 2000) as justification for use of this approach and the use of the annual mean values. Also, EPA guidance suggests water quality sampling procedures and data analysis approaches based on seasonal monitoring.

For macrophyte dominated streams the EPA guidance and scientific literature infer that seasonal or even annual analyses may be appropriate. In section 3.3, EPA discusses impacts of large diurnal dissolved oxygen fluctuations due to photosynthesis/respiration by dense macrophyte masses. Later in the guidance EPA describes rooted macrophytes taking up phosphorus from interstitial waters of bottom sediments; largely uncoupling macrophyte growth with short-term fluctuations of phosphorus concentrations in water columns. Mace et. al, Wisconsin DNR researchers, found a high correlation between late-summer biomass and mean summer phosphorus concentrations in macrophyte dominated streams (WDNR 1984).



The methods and processes used by benthic algae to take up phosphorus vary with the type of benthic algae. Filamentous algae with greater exposure to the water column may be more responsive to short-term changes in phosphorus concentrations than the more prostrate forms. Regardless of the type or processes for uptake, the primary impact relates to the mass of the accumulated algae and the factors of scour and grazing relate to time and rate of accrual (growth minus scour and grazing). High flow velocities associated with rainfall scour benthic algae and reduce the accumulated biomass.

Biggs (2000) empirically expresses the mean monthly biomass as a function of the days of accrual and the nutrient supply. This, of course, takes a very complex set of interactions involving a number of factors, including light, temperature, periodic sloughing losses, grazing by invertebrates and fish, and presents a simplified relationship. Specifically, Biggs' relationship is as follows:

$$B^* = k_1 d_a + k_2 n + c,$$

Where:

B^* is the mean monthly biomass of benthic algae;

d_a is days available for biomass accrual;

n is a measure of nutrient supply;

k_1 and k_2 are coefficients; and

c is a constant.

A consequence of the Biggs relationship is that to achieve the same biomass, streams with lower concentrations of nutrients will have a shorter accrual period of time and vice versa. Biggs concludes that that the frequency of high biomass events sufficient to create eutrophic conditions (200 mg/m^2) increases greatly when the days of accrual exceed 50 days. Again, the number of days varies with the nutrient concentration. Biggs' conclusions were based on unshaded streams. Streams with partial shading will have a longer number of accrual days. Biggs also did his research on streams with gravel or cobble substrata. His model will overestimate benthic algae mass for streams with silt or sand substrata. Thus, longer accrual periods may be pertinent to streams with silty or sandy substrata.

Wisconsin Situation and Phosphorus Criteria Development

The waterbody types and common nutrient related situations for Wisconsin rivers and streams are summarized on the attached table. Wisconsin wadeable streams with high phosphorus concentrations – at least those not shaded or very turbid – tend to exhibit a

phosphorus response similar to the conditions and assumptions contained in EPA's technical guidance. That is, they tend exhibit a nutrient response as rooted macrophytes, benthic algae or a mix of the two. Generally light will penetrate through much of the water column or even to the bed of the stream to provide conditions suitable for rooted macrophyte or benthic algae growth. Relatively few of Wisconsin's wadeable streams have high suspended algae concentrations.

This situation is best documented by the study of more than 240 Wisconsin streams used to develop nutrient criteria, "Nutrient Concentrations and Their Relations to Biotic Integrity of Wadeable Streams in Wisconsin" (USGS Professional Paper 1722). Appendix 2 of this report shows the extent of benthic algae and rooted macrophyte growth in the study streams. Not unexpectedly, this study also found relatively low suspended chlorophyll a concentrations. The median growing season suspended chlorophyll-a concentrations were 1.0 to 1.7 ug/L and the upper 95-percent confidence limit were 1.6 to 2.2 ug/L, depending on the phosphorus zone within the state. (USGS Professional Paper 1722, Table 22). Only nine of 240 wadeable streams had chlorophyll a concentrations exceeding 10 ug/L, and of those nine, two had sample sites immediately downstream of eutrophic impoundments and one is more appropriately considered as a non-wadeable stream.

Given the recommendations contained in EPA's guidance and a review of the available response information, the Wisconsin phosphorus criteria were developed based on correlations between median growing season phosphorus concentrations and biotic indices. The statistical analysis of the nutrient concentrations and their correlation with selected biotic indices is discussed at great length in the USGS Professional Paper 1722.

The companion study of 42 sites on Wisconsin non-wadeable streams and rivers found greater concentrations of suspended algae and a strong correlation between the median growing season total phosphorus and suspended chlorophyll-a concentrations. For much of these rivers, the water depth is great enough to prevent sufficient light penetration to the bed of the river and benthic algae samples were not taken. Eighteen of these 42 sites had suspended chlorophyll-a concentrations of greater than 10 ug/L. Of these 18 sites, 11 had median concentrations of more than 20 ug/L. While these higher algae concentrations may raise a concern, in these larger rive systems we tend not to see the minimum dissolved oxygen concentrations that tend to be seen in wadeable streams. For example, diurnal swings in smaller streams may have a minimum dissolved concentration of 2 mg/L as shown for Turtle Creek in the figure below. For rivers, it is believed that the minimum dissolved oxygen concentrations tend to be 4 mg/L or higher, similar to what was found in Minnesota. In a study of 34 rivers, MPCA found only one site where the minimum diurnal concentration of dissolved oxygen fell below 4.0 mg/L (Figure 10, MPCA 2010).

B. Lakes and Reservoirs

Conclusions:

1. It is impracticable to establish maximum daily and average weekly phosphorus limits under 40 CFR 122.45(d) due to the way waterbodies respond to phosphorus loading and due to the manner in which phosphorus water quality standards criteria for Wisconsin were derived.

2. Due to the manner in which the Wisconsin phosphorus criteria were derived, it may be impracticable to establish average monthly limits under 40 CFR 122.45(d) when the magnitude of the calculated water quality based effluent limit is 0.3 mg/L or less.

3. Based on available literature and the judgment of national experts, EPA criteria development guidance clearly calls for states to use seasonal mean concentrations to assess in-lake conditions.

4. Some measure of water residence time, water retention time, flushing rate or some similar factor are used in all or nearly all lake models used in Wisconsin and those described in EPA guidance to relate phosphorus loading to in-lake conditions.

5. For lakes with long water residence times, the impact of phosphorus loads from the entire year will be exhibited in the growing season.

6. Wisconsin's approved criteria were derived using correlations between growing season mean phosphorus concentrations and a variety of growing season response indicators.

EPA Guidance

Chapters 5, 6 and 7 of EPA's "Nutrient Criteria Technical Guidance Manual: Lake and Reservoirs" (EPA, 2000) clearly suggests to states that in-lake response conditions should be assessed using mean seasonal concentrations. Generally, this is viewed as a "growing" season and in northern states, such as Wisconsin, the growing season of May through September is typically used.

As described in Chapter 9 of EPA's guidance, various models may be used to quantitatively relate the timing and amount of phosphorus loading to in-lake conditions. Many, if not all, use some measure of water residence time, flushing rate or similar parameter to account for mixing of phosphorus inputs within the lake, and, more importantly, settling of phosphorus. That is, the longer the residence time, the less variability of in-lake responses to phosphorus loadings and the greater the settling of phosphorus within the lake. For deeper, seasonal stratified lakes, the in-lake response

relates to annual or multi-year loadings. At the other extreme, conditions within lakes or reservoirs with short residence times may relate to seasonal loadings. For example, early spring loadings may flush through a reservoir with a relatively short residence time and have relatively limit impact on growing season in-lake response conditons.

Wisconsin Situation

Wisconsin's phosphorus criteria for lakes are based primarily on:

- Minimizing nuisance (less than 5% risk) and severe nuisance (less than 1% risk) algal conditions;
- Minimizing the shift of aquatic plant communities in shallow lakes from macrophyte dominated to algae dominated;
- Maintaining balanced fish communities.

In addition, there is a stated intent to prevent harmful aquatic bloom conditions. However, this was a lack of quantitative information to derive numerical criteria.

Critical Condition. Generally, the mid-growing season, July and August, is considered the critical period for nuisance algae conditions in most Wisconsin lakes and reservoirs. The presence of phosphorus, warm water temperatures and abundant light combine to favor the mid-to-late growing season as the critical period. This doesn't mean that discharges prior to or after this critical condition are unimportant. On the contrary, there is a lag time between the time phosphorus reaches the lake or reservoir and when the nuisance conditions are exhibited. For lakes with very long water residence times, such as more than one year, there is substantial mixing within the lake water column resulting in relatively little difference in response between phosphorus loads entering the lake in January verses those entering in June. For lakes with short residence times, the time of the year may be very important. Some form of water residence time or lake flushing rate is an important factor in nearly all lake models used in Wisconsin.

Technical Basis. Wisconsin's phosphorus water quality standards criteria for all lake types were developed using the mean or average condition is the growing season. Water quality samples are routinely collected in June through September or June or June through August depending on the parameter. The sample results are averaged over the growing season and, where possible, averaged over a number of growing seasons. Thus, both the basis for the criteria and routine use of tools for management programs base conditions on what responses will likely occur for given phosphorus conditions, but not the statistical outlier condition that is likely to occur very infrequently.

References

"Nutrient Criteria Technical Guidance Manual: Lakes and Reservoirs", EPA, April 2000.

"Nutrient Criteria Technical Guidance Manual: Rivers and Streams", EPA, July 2000.

Robertson et. al. "Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin", USGS Professional Paper 1722, 2006

Robertson et. al. "Nutrient Concentrations and Their Relations to the Biotic Integrity of Nonwadeable Rivers in Wisconsin", USGS Professional Paper 1754, 2008

"Impacts of Phosphorus on Streams", WDNR, April 1984.

Biggs, Barry, J. F., "Eutrophication of Streams and Rivers: Dissolved Nutrient-Chlorophyll Relationships for Benthic Algae", Journal of North American Benthological Society, 2000.

Heiskary et. al., "Minnesota River Nutrient Criteria Development", Minnesota Pollution Control Agency, November 2010.

Summary of Waterbody Types, primary nutrient related impacts, extent found in Wisconsin and comments related to averaging period.

Waterbody Type	Primary concerns	Extent in Wisconsin	Comments Related to Averaging Period
Streams and Rivers[1]			
Stream – rooted macrophyte dominated	Low diurnal dissolved oxygen levels (e.g. 2 mg/L) near dawn in mid summer (generally non-lethal) habitat degradation due to sediment capture	Very common; may be most common situation in wadeable streams Focus of Wisconsin DNR study report "Impacts of Phosphorus on Streams", 1984	Since rooted macrophytes receive phosphorus from interstitial waters of bottom sediments, not responsive to short-term fluctuations in water column phosphorus Growing season means or medians generally used to assess rooted macrophyte dominated streams
Stream – benthic algae, including filamentous algae and attached algae	Low diurnal dissolved oxygen in mid summer; loss of habitat for certain aquatic insects; loss of visibility for sight-feeding fish	Common throughout state Focus of Wisconsin DNR study report "Impacts of Phosphorus on Streams", 1984	Subject to scour during periods of high velocities; periods of accrual before critical conditions occur; Biggs (2000) suggests 50 day accrual period. Growing season means of median generally used to assess
Stream – floating macrophytes (duckweed)	Floating algae restricts surface water re-aeration	Found, but uncommon in wadeable streams	Not well understood; no accepted sampling protocol

[1] Many Wisconsin wadeable streams do not exhibit responses to phosphorus due to shading from trees or grasses or due to lack of light penetration due to turbid conditions. Downstream waters, however, may exhibit responses to phosphorus.

Waterbody Type	Primary concerns	Extent in Wisconsin	Comments Related to Averaging Period
Stream – suspended algae	May result in low dissolved oxygen	Uncommon in wadeable streams. 9 of 240 streams in Wisconsin wadeable stream study had median suspended chlorophyll a concentrations exceeding 10 ug/L.[2]	May see response to change in nutrient concentrations.
Rivers (non-wadeable) -- suspended algae[3]	May result in low dissolved oxygen; generally considered to have minimum dissolved oxygen concentrations of more than 4 mg/L (MPCA 2010)[4].	Common in 46 "rivers" listed in s. NR 102.06, Wis. Adm. Code. 18 of 42 study sites had median growing season suspended chlorophyll a concentrations of greater than 10 ug/L. Suspended algae contributes to turbid conditions	May see response to change in nutrient concentrations, however, response tempered by volume of water and surface area reaeration.

[2] At least two of the nine wadeable streams were sampled downstream from eutrophic impoundments. One of the nine is generally considered as a non-wadeable stream and classified as a river in s. NR 102.06, Wis. Adm. Code.
[3] Generally have great enough water depths such that adequate light does not penetrate to bottom. Bed surveys for macrophytes and benthic algae were not anticipated and, therefore, not included in the study.
[4] Conditions considered similar to those in Minnesota rivers where in nearly all study rivers minimum dissolved oxygen conditions were above 5 mg/L.

Waterbody Type	Primary concerns	Extent in Wisconsin	Comments Related to Averaging Period
Lakes and Reservoirs			
Great Lakes, excluding Lower Green Bay[5]	Accumulation of filamentous algae mats on shores inhibiting recreational uses	Common on Lake Michigan and Green Bay shores; not common along Lake Superior likely due to colder water temperatures.	Not considered responsive to short duration changes in water column concentrations due to very long water residence times. Conditions in nearshore waters likely the response to mixing of tributary waters and the upwelling of open waters. Cladophora associated with zebra and quagga mussel accumulation of phosphorus and excretion of phosphorus.
Deep stratified drainage lakes, including two-story fishery lakes	Growth of algae in epilimnion and loss of dissolved oxygen in hypolimnion. Inhibits recreational uses, may result in change in aquatic community, and may result in loss of cold water species	Common in Wisconsin, but few receive discharges from wastewater treatment plants[6]	These lakes tend to have long water residence times, some may exceed a year. Modeling of lakes generally based on annual phosphorus inputs.

[5] Lower Green Bay exhibits conditions similar to the large lakes and reservoirs. The water residence time for Lower Green Bay is less than one year.
[6] Big Green Lake is an example. Ripon POTW discharges to Silver Creek which flows to Big Green Lake.

Waterbody Type	Primary concerns	Extent in Wisconsin	Comments Related to Averaging Period
Deep stratified seepage lakes	Similar to deep stratified drainage lakes	Common in Wisconsin, but few receive discharges from wastewater treatment plants[7]	These lakes tend to have long water residence times that may or may not exceed a year. Modeling of lakes based on annual phosphorus or growing season inputs.
Shallow drainage and seepage lakes	Aquatic community shift from macrophytes to algae; inhibits recreational uses	Common in Wisconsin, but few receive discharges from wastewater treatment plants[8]	Generally have water residence times of less than a growing season.
Large shallow lakes and reservoirs	Growth of nuisance algae inhibits recreational uses, may result in change in aquatic community.	Common, including Winnebago Pool lakes and reservoirs along the Wisconsin River	Water residence times vary, but generally less than one year. For some, phosphorus loads during spring runoff events may rapidly pass through the body of water emphasizing growing season contributions. Modeling of these lakes and reservoirs may be based on either annual phosphorus loads or growing seasonal phosphorus loads.
Impoundments as defined in s. NR 102.06	Respond similar to flowing streams or rivers	Common	See streams and rivers above

[7] Silver Lake in Manitowoc County is an example. Silver Lake receives direct discharge from the Silver Lake Convent and College wastewater treatment plant.
[8] Goose Lake in Columbia County is an example. Goose Lake, a very shallow pond that supports a large goose population, received discharge from Arlington's POTW.