Guidance for Implementing Wisconsin's Phosphorus Water Quality Standards for Point Source Discharges

Wisconsin Department of Natural Resources

02/08/2017

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This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

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Summary

Revisions to Wisconsin's Phosphorus Water Quality Standards became effective on December 1, 2010. These revisions are reflected in two separate chapters of the Wisconsin Administrative Code. Chapter NR 102 (Wis. Adm. Code) includes water quality criteria for the protection of fish and aquatic life as well as human health. Chapter NR 217 (Wis. Adm. Code) includes regulations on how the water quality criteria for phosphorus will be used to establish water quality based effluent limitations for point source discharges subject to permits under the Wisconsin Pollution Discharge Elimination System (WPDES).

Revisions to Chapter NR 151, Wis. Adm. Code- Wisconsin's agricultural performance standards and prohibitions- were also derived in order to affirm the need to minimize phosphorus sources from nonpoint sources. These revisions became effective on January 1, 2011 and will not be discussed in detail in this document as they do not directly relate to WPDES permits. For specific rule content for chs. NR 102, NR 151, and NR 217, Wis. Adm. Code, please visit http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

The intent of this document is to provide guidance primarily to Wisconsin Department of Natural Resources (WDNR) staff. This guidance document may also be useful to WPDES permittees and their associates on how to implement the procedures in chs. NR 102 and NR 217, Wis. Adm. Code, to ensure the protection of surface waters receiving effluent discharges containing phosphorus. As guidance, this document may evolve with time as more experience is gained in phosphorus implementation. Other guidance documents may also aid in phosphorus implementation including:

- TMDL Implementation Guidance
- Adaptive Management Technical Handbook
- Water Quality Trading How-To Manual
- Implementing Water Quality Trading in WPDES Permits

This document is intended to solely provide guidance for procedures in chs. NR 102 and NR 217, Wis. Adm. Code, not regulatory conditions in s. 283.16, Wis. Adm. Code (Act 378). For more information about the phosphorus multi-discharger variance visit http://dnr.wi.gov/topic/surfaceWater/phosphorus/statewideVariance.html.

Phosphorus implementation questions that are not addressed by this document can be directed to WDNR staff assigned to work on a particular WPDES permit. Any remaining unanswered questions can be directed local wastewater staff or to DNRphosphorus@wisconsin.gov.

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Abbreviations and Acronyms

This list contains the most common abbreviations used in this document.

AM	Adaptive Management
DMR	Discharge monitoring report
EPA	United States Environmental Protection Agency
HUC	Hydrologic unit code
LAL	Limited aquatic life system pursuant to s. NR 104, Wis. Adm. Code
MGD	Million gallons per day
mg/L	Milligrams per liter. Common metric measurement used in measuring amount of phosphorus in liquid, 1000 mg/L equals 1 gram/L or 1000 parts per million (ppm)
MZ	Mixing zone
P	Phosphorus
P_{99}	99th percentile of the dataset; P_{99}= Mean + (2.327 X standard deviation)
POTW	Publicly Owned Treatment Works
PS	Point source
Qe	Effluent flow
Qs	Stream flow
Qs:Qe	Ratio of stream flow to effluent flow
RET	Representative effluent temperature
ROW	Register of Waterbodies
SWDV	Surface Water Data Viewer
SWIMS	Surface Water Integrated Monitoring System
TBEL	Technology-based effluent limit
TMDL	Total Maximum Daily Load
µg/L	Microgram per liter. Common metric measurement used in measuring amount of phosphorus in liquid, 1000µg/L equals 1 mg/L
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System
WQBEL	Water quality-based effluent limit
WQC	Water quality criteria
WQT	Water quality trading
WWTF	Wastewater treatment facility

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Chapter 1- Introduction to Phosphorus Standards

Chapter 1 is designed to provide the reader with basic information about content in the phosphorus rules, as described in chs. NR 102, NR 151, and NR 217, Wis. Adm. Code. The specific rules are available for download at: http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

Additional resources are also available at this website including the phosphorus rule factsheet, webinar series, adaptive management handbook, water quality trading guidance, and the impracticability analysis for phosphorus. The phosphorus rule factsheet, in particular, is a good tool for those people who are looking for basic information about the rule, and how this rule will potentially affect WPDES permit requirements.

Staff, permittees, consultants, and others interested in the implementation of phosphorus water quality standards in Wisconsin are encouraged to submit questions or comments to the following e-mail box:

DNRPhosphorus@wisconsin.gov

Questions may also be sent directly to your local wastewater staff.

Chapter 1

Section 1.01: Determining the Applicable P Criteria

Author: Amanda Minks

Last Revised: April 9, 2013

The applicable phosphorus (P) criteria for rivers, streams, lakes and reservoirs are described in s. NR 102.06, Wis. Adm. Code, and are summarized in Table 1. A technical support document was developed to justify these criteria, which is available for download at http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

Table 1. Applicable statewide P criteria pursuant to s. NR 102.06, Wis. Adm. Code.

Waterbody Type	Applicable Criteria (µg/L)
Rivers	100
Streams	75
Reservoirs:	
• **Stratified**	30
• **Not stratified**	40
Lakes:	
• **Stratified, two-story fishery**	15
• **Stratified, seepage**	20
• **Stratified, drainage**	30
• **Non-stratified, drainage**	40
• **Non-stratified, seepage**	40
Great Lakes:	
• **Lake Michigan**	7
• **Lake Superior**	5
Impoundments	Varies by inflowing waterbody type
Ephemeral streams, lakes and reservoirs of less than 5 acres in surface area, wetlands (including bogs), and limited aquatic life waters	None

Although ephemeral streams, lakes and reservoirs of less than 5 acres in surface area, wetlands (including bogs), and limited aquatic life (LAL) waters do not have applicable statewide phosphorus criteria at this time, criteria may be derived for these waterbody types as more data become available. Dissolved oxygen and other criteria may still be applicable, however, to address localized eutrophication concerns. Additionally, phosphorus limits may be needed for point sources that discharge to these waterbody types to protect downstream waters. See Section 2.04 (p. 48) for details on downstream protection determinations.

Department staff will need to determine which of the statewide P criteria are applicable to make permitting and water assessment decisions. The following guidance is provided to help make these determinations. Tools are also available to help Department staff including:

- Register of waterbodies (ROW)
- Surface Water Integrated Monitoring System (SWIMS)
- Surface Water Data Viewer (SWDV)

It may also be advantageous to contact the Lake Specialist if uncertainty exists:

Lakes Specialist:
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608-264-8895

Determining Rivers vs. Streams: The applicable phosphorus criteria for rivers is 100 µg/L, while the applicable phosphorus criteria for all other unidirectional flowing waterbodies (aka "streams") is 75 µg/L. Rivers are specifically identified in s. NR 102.06(3)(a), Wis. Adm. Code (below). If a waterbody is exhibits unidirectional flow, and is not defined as a river, it is typically given the stream criterion, unless it is an ephemeral or limited aquatic life (LAL) system.

Figure 1 illustrates those waterbodies that are defined in s. NR 102.06(3)(a), Wis. Adm. Code, as rivers.

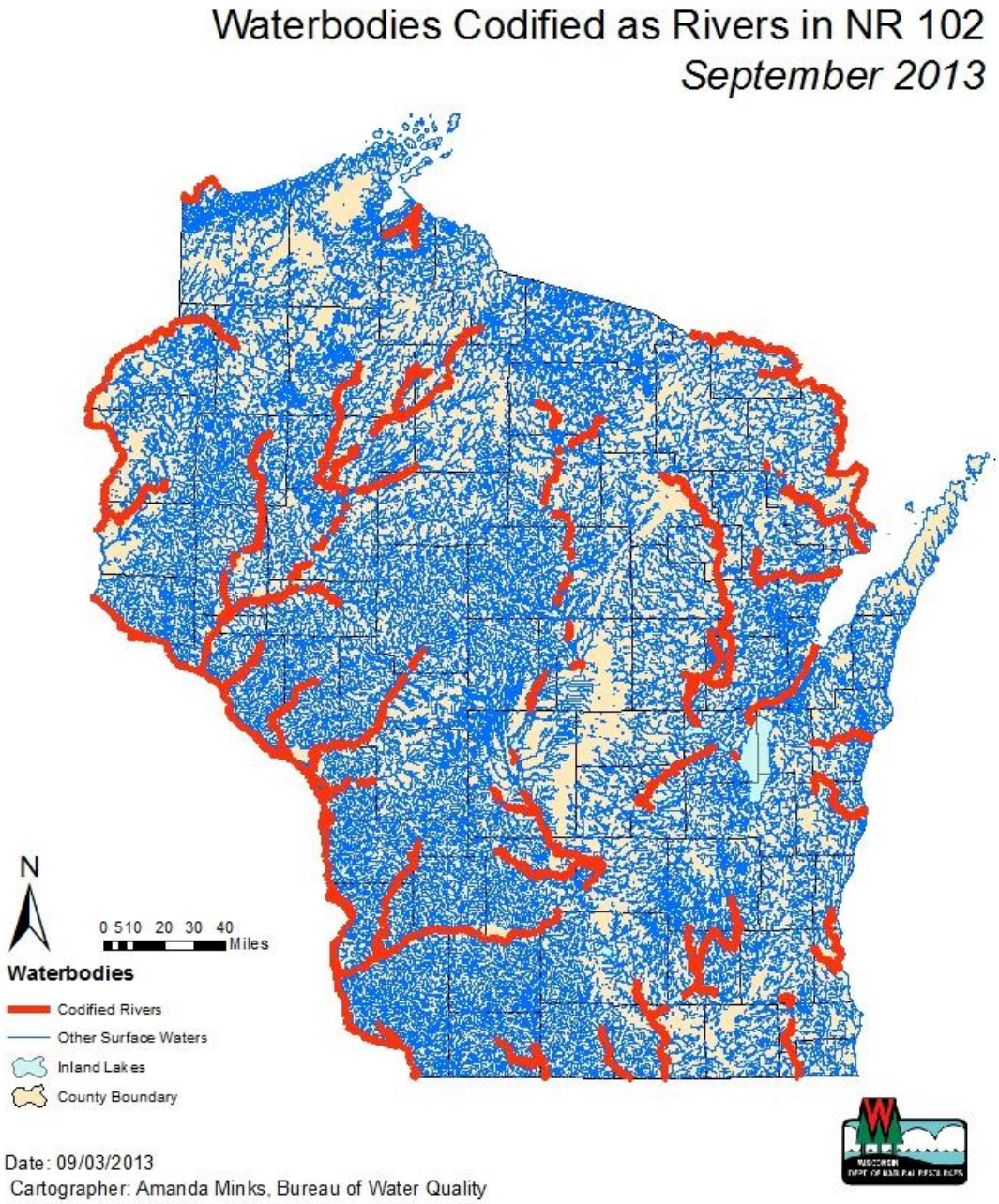

Figure 1. Visual of rivers that receive a phosphorus water quality criterion of 100 µg/L pursuant to s. NR 102.06(3)(a), Wis. Adm. Code.

Limited Aquatic Life and Ephemeral Systems: Waterbodies must be classified in ch. NR 104, Wis. Adm. Code, as LAL before they can be treated as such. Ephemeral streams, on the other hand, are not specifically identified in code, so a case-by-case decision should be made to determine whether or not specific waterbodies meet the definition of an ephemeral stream. Pursuant to s. NR 102.06(2)(b), Wis. Ad. Code, an ephemeral stream is a channel or stream that only carries water for a few days during and

after a rainfall or snowmelt event and does not exhibit a flow during other periods, and includes, but is not limited to, grassed waterways, grassed swales, and areas of channelized flow as defined in s. NR 243.03 (7), Wis. Adm. Code.

If a stream has historically been considered an ephemeral stream for assessment or permitting decisions, it can continue to be treated as such. Some of these waterbodies are identified in the surface water data viewer[1] or in SWIMS. Permit staff can also use professional discretion to make a case-by-case determination for ephemeral streams. Staff should consider the natural flow condition in addition to the effluent flow when making this determination. Regional biologists should be contacted with determination questions.

Lakes and Reservoirs: Most of Wisconsin's lakes are already classified using the Natural Community classification system. Although the Natural Community classification system uses different nomenclature than the lake/reservoir types specific in s. NR 102.06, Wis. Adm. Code, they directly relate to one another, as illustrated in Table 2. To determine the applicable natural community classification for a specific waterbody, activate the "designated use" layer on the SWDV, or access the information in ROW. Contact the local biologist or statewide lake specialist with questions on specific lakes or reservoirs.

Table 2. Translating lake and reservoir types specified in s. NR 102.06, Wis. Adm. Code, to Natural Community type.

Phosphorus Rule Classification	Lake/Reservoir Natural Communities Classification	Criteria (mg/L)
Non-stratified drainage	Shallow Headwater Drainage	0.04
	Shallow Lowland Drainage	
Non-stratified seepage	Shallow Seepage	0.04
Stratified drainage	Deep Headwater Drainage	0.03
	Deep Lowland Drainage	
Stratified seepage	Deep Seepage	0.02
Stratified two-story fishery	Deep Two-story Fishery	0.015

Determining Reservoirs vs. Impounded Flowing Waters: An impounded water on a river or stream may be classified as a reservoir if it has "a constructed outlet structure intended to impound water and raise the depth of the water by more than two times relative to the conditions prior to construction of the dam, and that has a mean water residence time of 14 days or more under summer mean flow conditions using information collected over or derived from a 30 year period".

For impounded waters that do not meet the definition of a reservoir outlined above, the criteria is the same as that of the primary river or stream entering the impounded water (s. NR 102.06(4)(c), Wis.

[1] To access this information on the SWDV, activate the "designated use" layer in the "Clean Water Act Standards & Uses" folder.

Adm. Code). For example, if a river with a criterion of 100 µg/L flows into an impoundment, that impoundment would also have a phosphorus criterion of 100 µg/L.

Wetlands: If a discharge has historically been considered a wetland discharge for permitting decisions, it can continue to be treated as such. Wetlands are also identified in the wetland inventory in the SWDV. There are two SWDV layers that are important to identify wetlands: Wisconsin Wetland Inventory and the Wetland Indicator Soils. If the Wisconsin Wetland Inventory indicates that an area is a wetland, it can be presumed correct. If the Wetland Indicator Soils layer indicates that wetland soils are present but is not shown as a wetland polygon in the Wisconsin Wetland Inventory, a case-by-case determination is required and regional biologists should be conferred. Wetland staff may also be contacted if there are any wetland delineation questions such as if channelized flow occurs within the wetland. Regional wetland staff should be contacted with wetland delineation questions: http://dnr.wi.gov/topic/wetlands/assessment.html.

Other Applicable Criteria: Section NR 102.06(7), Wis. Adm. Code, also allows Department staff and external parties to derive site-specific criteria for phosphorus. Site-specific criteria create alternative phosphorus targets for a specific waterbody or group of waterbodies that supersede the statewide phosphorus criteria. Department staff are currently developing guidance on phosphorus site-specific criteria. In the interim, interested parties should contact the Water Evaluation Section for details. For more information, see Section 1.04, p. 22.

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Chapter 1

Section 1.02: Types of Phosphorus Limits

Author: Amanda Minks
Last Revised: April 9, 2013

There are six types of phosphorus limits that are specified in administrative code: technology-based limits (TBELs), water quality-based effluent limits (WQBELs), total maximum daily load (TMDL-derived) limits, interim limits, s. 217.14 mass limits, and adaptive management interim limits. The purpose of this Section of guidance is to briefly explain the purpose for the phosphorus limit, and when the phosphorus limit may be included in WPDES permits. Additional guidance on calculating and comparing phosphorus limits is available in Chapter 2, p. 26.

Note: It is possible that a discharge may be subject to several types of phosphorus limits.

TBELs:
Wisconsin has had TBELs for phosphorus since 1993. The intent of phosphorus TBELs is to require a minimum level of treatment of pollutants for point source discharges based on available treatment technologies, while allowing the discharger to use any available control technique to meet the limits.

Phosphorus TBELs are required for any point source discharge that exceeds the thresholds as described in s. NR 217.04(a)(1-6), Wis. Adm. Code. Specifically, any industrial discharge that discharges more than 60 lbs of TP/day, or any municipal discharge that discharges more than 150 lbs of TP/day, is required to have a TBEL for phosphorus. Because point sources have been evaluated for phosphorus TBELs since 1993, many facilities that exceed these thresholds already have TBELs in their permit. Typically, TBELs are set equal to 1.0 mg/L, unless an alternative technology based limit (APL) is granted.

Chapter NR 217 Subchapter II, Wis. Adm. Code procedurally describes phosphorus TBELs and APLs.

WQBELs:
Phosphorus WQBELs are also concentration-based limits, but are based on the quality of the receiving water, rather than available treatment technologies. Phosphorus WQBELs are required as of December 1, 2010, and are required if a point source discharge has the potential to cause phosphorus criteria exceedance in either the receiving water or downstream waters [(s. NR 217.12(1)(a), Wis. Adm. Code)]. In order to ensure the protection of water quality and the designated uses of the receiving water, WQBELs can be set as low as the applicable phosphorus criterion, or can exceed the TBEL, depending on the quality of the receiving water and effluent.

Discharges that need to be evaluated for phosphorus WQBELs include industrial and municipal wastewater discharges, and, in some cases, animal feeding operations. Section NR 217.13, Wis. Adm. Code, procedurally describes the methods for calculating phosphorus WQBELs. Additional guidance is also available in Chapter 2, p. 26, of this guidance.

TMDL-Derived Limits:

If a point source is located in a watershed with an EPA approved TMDL, TMDL-derived phosphorus limits are applicable. Unlike TBELs and WQBELs calculated under s. NR 217.13, Wis. Adm. Code, TMDL-derived limits are mass limits, rather than concentration limits. A TMDL create a balanced approach to address point and nonpoint sources of pollution in watersheds not meeting their water quality goals and currently listed on the 303(d) impaired waters list. Simply put, a TMDL creates a plan to reduce pollutant loads so that water quality improvements can be made. Eventually, TMDLs strive to de-list these impaired waters.

Point sources will be given phosphorus TMDL-derived limit if they discharge in, or upstream, of a watershed with an EPA approved TMDL addressing excess phosphorus. Because TMDLs take a balanced approach to address excess phosphorus pollution, rather than solely relying on point source reductions to meet water quality goals, TMDL-derived limits to be less stringent than s. NR 217.13, Wis. Adm. Code, WQBELs. DNR has developed total maximum daily loads (TMDLs) for many watersheds in Wisconsin including the Rock River, Lower Fox, and St. Croix watersheds, and, is actively developing TMDLs in several other watersheds around the state (Figure 2).

See Section 2.05, p. 55, and "*TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs, Edition No. 2 (2013)"* available at http://dnr.wi.gov/topic/tmdls/implementation.html for details.

It is noted that in some unique situations s. NR 217.13, Wis. Adm. Code, may be needed in addition to TMDL-derived limitations. This may occur in situations where the TMDL only addresses downstream protection concerns, and is not adequately protective of local water quality. See Section 2.05, p. 55, for further discussion.

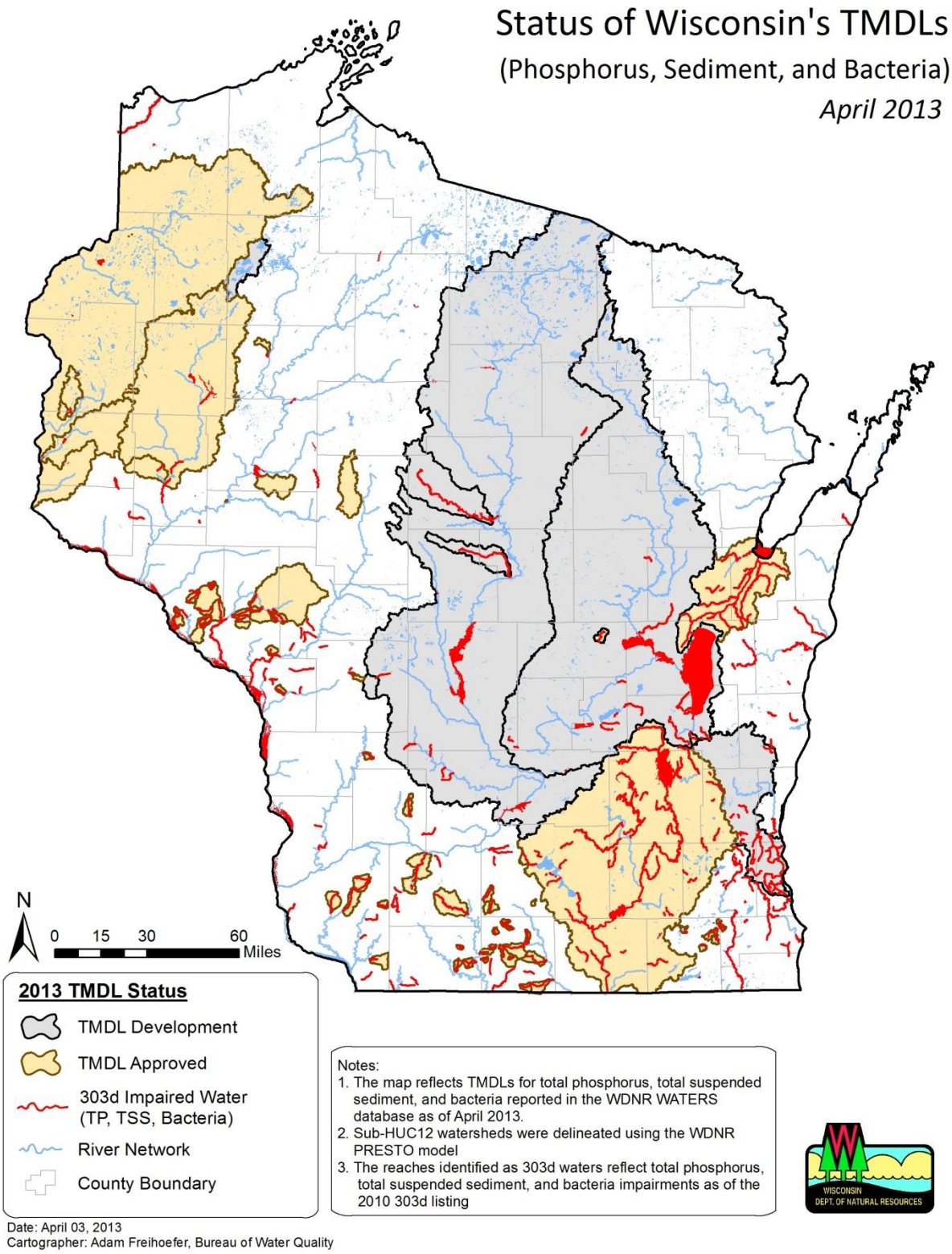

Figure 2. Watersheds with approved TMDLs or TMDLs being actively developed (as of April 2013).

Interim Limits:
Interim phosphorus limits are typically concentration-based limits, and are necessary whenever a phosphorus compliance schedule is given to a point source to comply with a phosphorus WQBEL, or a facility is granted a phosphorus variance. The purpose of the interim phosphorus limit is to hold a point source at their current phosphorus discharge levels, while they explore compliance options and work to achieve compliance with the final phosphorus WQBEL. This will prevent a facility from "back sliding" during the permit term. Interim phosphorus limits are required whenever a phosphorus compliance schedule is granted, regardless of the duration of that schedule. See s. NR 217.17, Wis. Adm. Code, and Section 2.03, p. 38, for additional guidance on interim limits.

Section 217.14 Mass Limits:
Section 217.14, Wis. Adm. Code, mass limits are required for point sources that require a s. 217.13 WQBEL, and discharge directly to, or upstream of, a lake or reservoir, a state or Tribal outstanding or exception resource water, or a phosphorus impaired water whether or not it has an approved TMDL. See s. NR 217.14, Wis. Adm. Code, and Section 2.03, p. 38, for additional guidance on these mass limits.

Adaptive Management Interim Limits:
Adaptive Management is a unique compliance option for phosphorus that focuses on improving water quality in those receiving waters that are currently exceeding the applicable phosphorus criterion. If a facility chooses to enter into adaptive management as their preferred phosphorus compliance option, and is approved to do so, they will be given adaptive management interim limits in lieu of phosphorus WQBELs or mass limit. The adaptive management interim limit is a concentration limits, and varies by permit term. For example, in the first permit term of adaptive management, the adaptive management interim limits are set equal to 0.6 mg/L as a six-month average, and 1.0 mg/L as a monthly average. See s. NR 217.18, Wis. Adm. Code or the Adaptive Management Technical Handbook for additional guidance on adaptive management and adaptive management interim limits.

Chapter 1

Section 1.03: Implementation Matrix and Flow Diagrams

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Last Revised: November 17, 2011

The flow diagrams (i.e. logic diagrams) provided in this chapter are intended to help the reader follow the decision order of the Administrative Rules:

- **Flow Diagram 1 and 1B:** Determining applicable total phosphorus water quality criteria
- **Flow Diagram 2 and 2B:** Selecting effluent limits for existing discharges
- **Flow Diagram 3:** Permit process for applicant and potential outcomes for compliance schedules
- **Implementation Matrix**

Throughout the flow diagrams, the following abbreviations are used:

LAL Limited Aquatic Life

P **Phosphorus**

PS **Point Source**

POTW Publicly Owned Treatment Works

TBEL Technology Based Limit

TMDL Total Maximum Daily Load

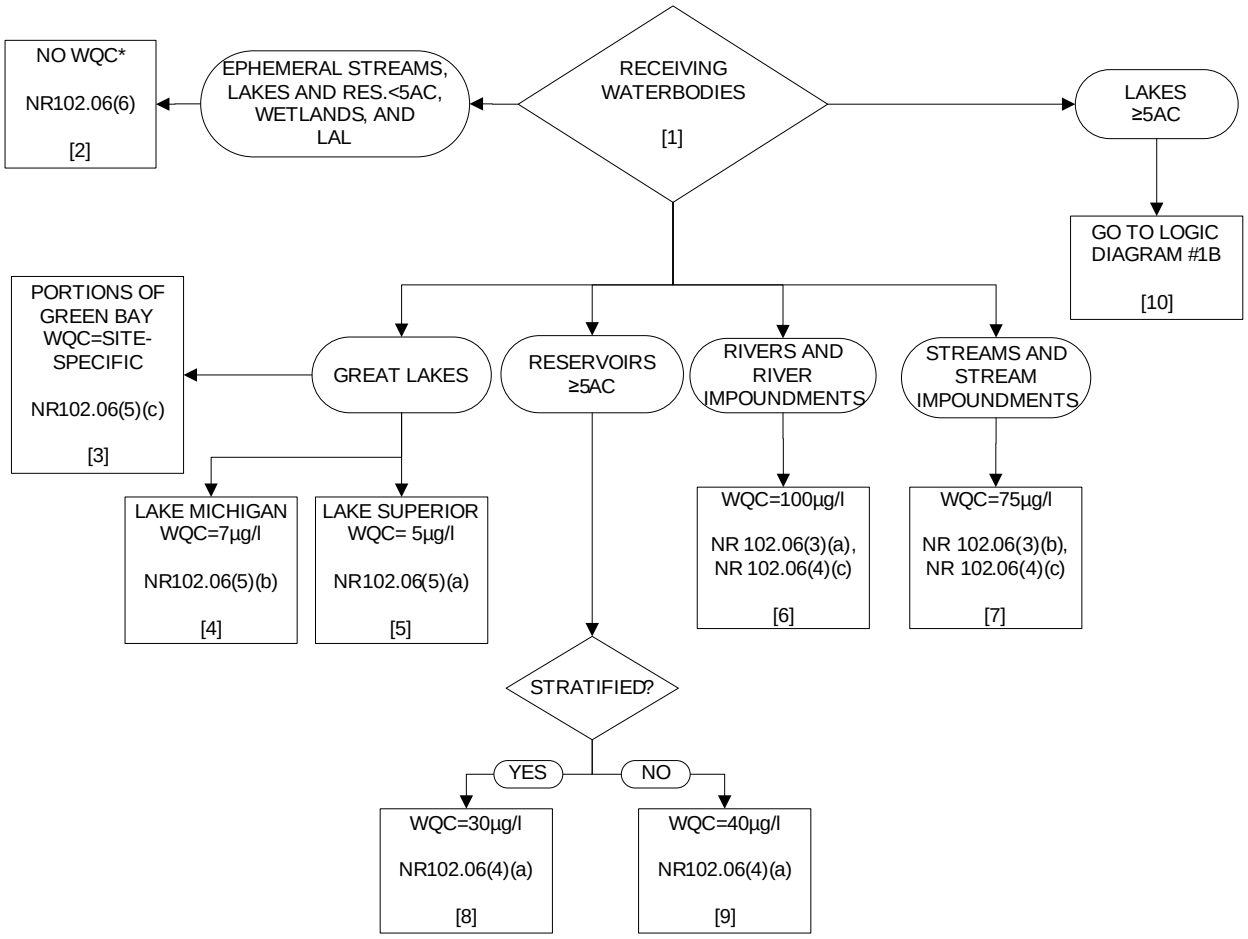
WLA Wasteload Allocation

WQBEL Water Quality Based Effluent Limits

WQC Water Quality Criteria

LOGIC DIAGRAM 1

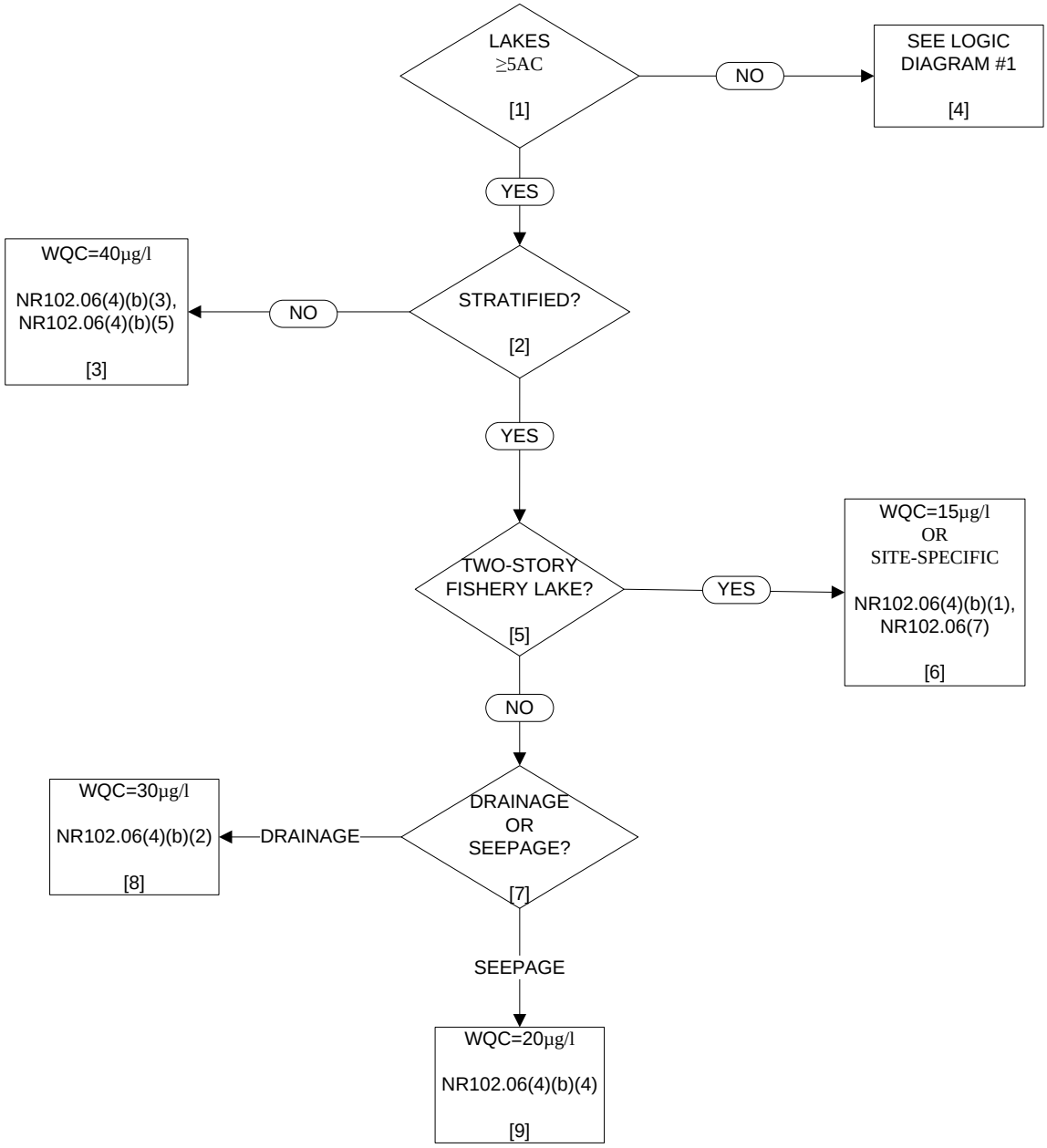
DETERMINING APPLICABLE TOTAL PHOSPHORUS WATER QUALITY CRITERIA (WQC)



**- Dissolved oxygen, narrative, and other criteria may still be applicable to address localized eutrophication concerns in these waterbodies.*

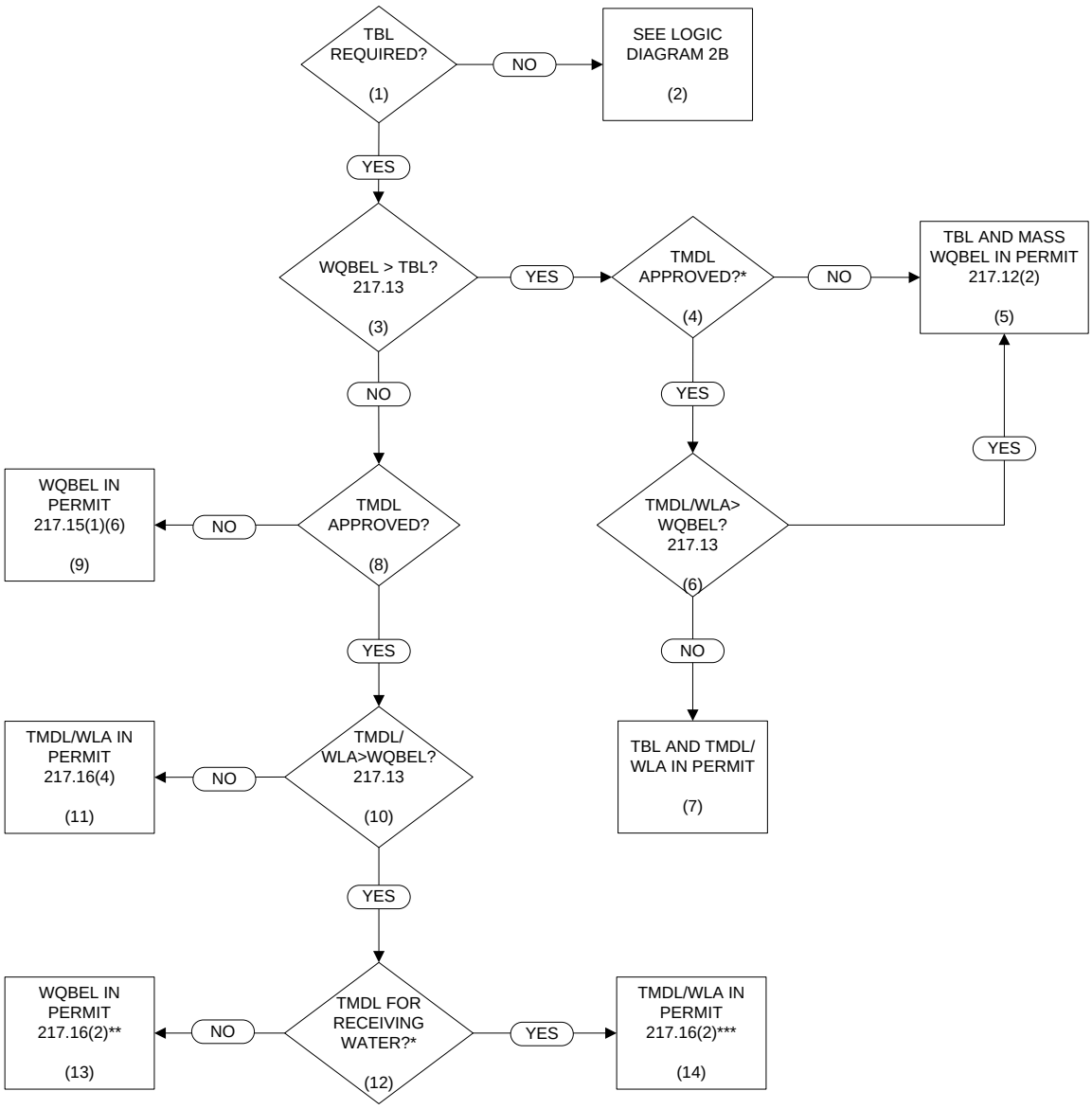
LOGIC DIAGRAM 1B

DETERMINING APPLICABLE TOTAL PHOSPHORUS WATER QUALITY CRITERIA (WQC) FOR LAKES≥5 ACRES



LOGIC DIAGRAM 2

Selecting Effluent Limits for Existing Dischargers



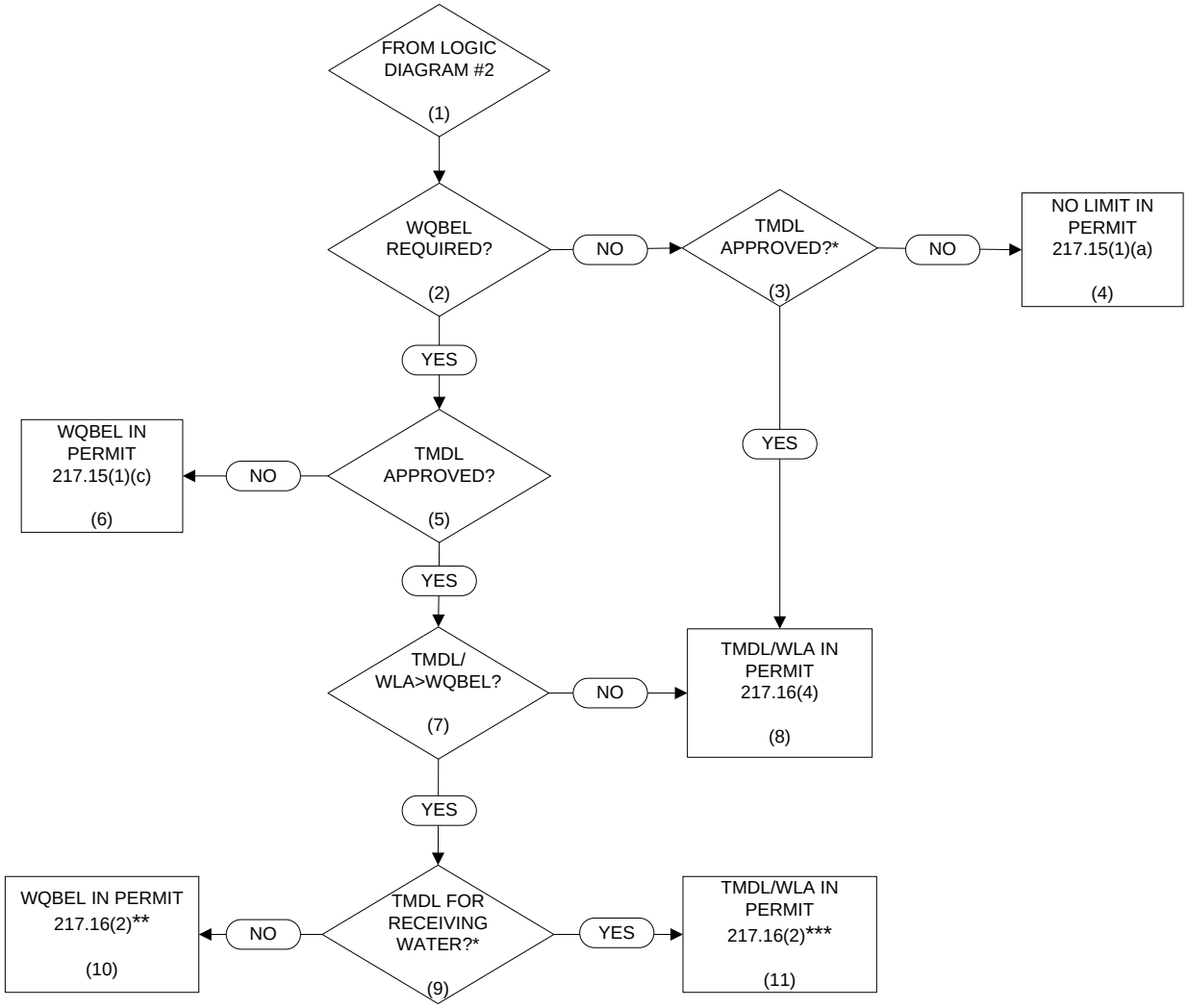
*- When a point source discharges to a surface water that is not impaired, it still may have a WLA from a TMDL for a downstream reach that is impaired.

**- If the surface water to which the point source discharges is not impaired, the WQBEL should be included in the permit in lieu of the TMDL/WLA to assure the applicable water quality criteria continues to be met in the immediate receiving water..

***- If WQBEL has already taken effect in a permit, TMDL/WLA may replace WQBEL pursuant to antidegradation procedures in NR 217.16(3)

LOGIC DIAGRAM 2B

Selecting Effluent Limits for Existing Dischargers



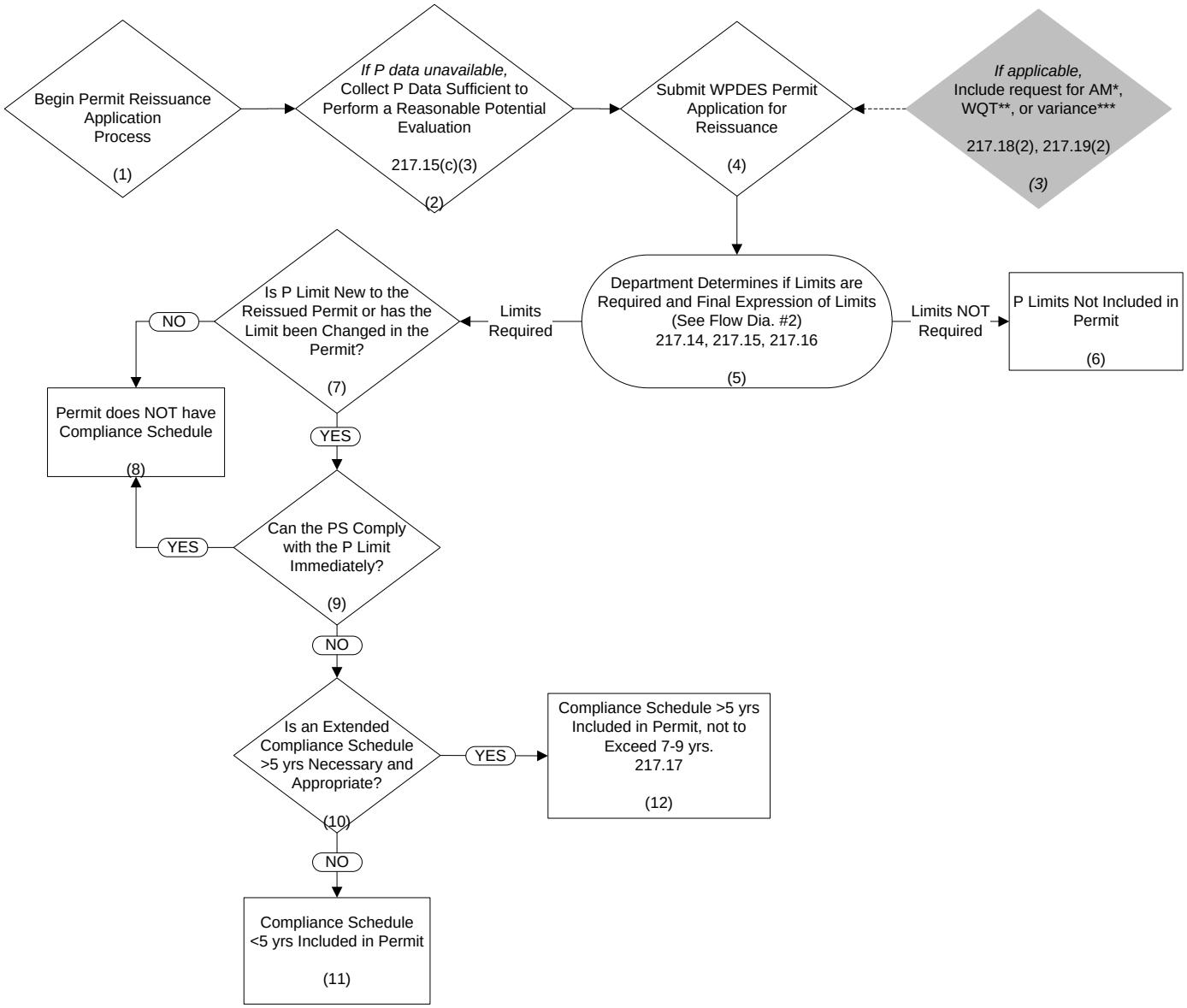
*- When a point source discharges to a surface water that is not impaired, it still may have a WLA from a TMDL for a downstream reach that is impaired.

**- If the surface water to which the point source discharges is not impaired, the WQBEL should be included in the permit in lieu of the TMDL/WLA.

***- If WQBEL has already taken effect in a permit, TMDL/WLA may replace WQBEL pursuant to antidegradation procedures in NR 217.16(3)

LOGIC DIAGRAM 3

Permit Process for Applicant and Potential Outcomes for Compliance Schedules



*- AM requests must be submitted with the WPDES permit application for reissuance pursuant to 217.18(2). However, the Department may allow time for facility planning in a compliance schedule. If during the facility planning process the AM option is selected, the permitee may include the AM request in the next WPDES permit application.

*- WPDES permits must be modified or reissued with WQT requirements built into the WPDES permit before the permittee can utilize WQT to demonstrate compliance with a WQBEL pursuant to s. 283.84, Wis. Stat.

***- Variance applications for lagoon systems may be submitted with the WPDES permit application for reissuance, or within 30 days after the permittee receives written notification of the proposed P limits pursuant to 217.19(2); all other variance applications must fulfill timeline set for in s. 283.15(4)(a).

Table 3. Phosphorus Rule Limits Implementation Matrix.

WQ Evaluation Cases	How to Set Limits	Limit Type	Implementation Option		Expression of WQBELs (see separate section of guidance)
			Adaptive Management?	Trade?	
Waterbody with an EPA approved TMDL	TMDL (see Section 2.03, p. 38)	- TMDL limit w/comp. schedule (if needed) - TMDL limit and WQBEL w/comp. schedule (if needed)	√	√	Mass limit derived from the TMDL Concentration WQBEL may also apply
2) Impaired waterbody on 303(d) list without an approved TMDL	WQBEL = WQC	- WQBEL w/comp. schedule	√	√	Concentration and mass If > 0.3 - Monthly avg. If < 0.3 – Six-month avg. with monthly avg. = 3 X Six-month avg.
3) Background > WQC but not on 303(d) impaired water listed	Same as 2)	Same as 2)	√	√	Monthly avg. conc. and maybe mass limits if increase in load is likely to result in adverse effects in the receiving or downstream water s. NR 217.14(1)(b).
4) Background (assumed or measured) < WQC *Note: Background P data is available on the P Data Layer on the SWDV*	Mass balance formula a) WQBEL >1 b) WQBEL <1 c) R.P. indicates that discharge is less than WQBEL	Technology based limit w/comp. schedule (if needed) WQBEL w/comp. schedule (if needed) Monitoring only in permit	√	√	a) Monthly avg. conc. and maybe mass limits based on the WQBEL ** b) and c) If > 0.3 - Monthly avg. conc.; maybe mass ** If < 0.3 – Six-month avg. with monthly avg. = 3 X Six-month avg.; maybe mass **

*See *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs, Edition No. 2* available at http://dnr.wi.gov/topic/tmdls/implementation.html.

** *Mass limits must be imposed in a permit for a discharge to a receiving or downstream water if the receiving or downstream water is a lake or reservoir, a state or Tribal outstanding or exceptional water (as designated in ss. NR 102.10 or 102.11, Wis. Adm. Code), and a phosphorus-impaired water whether or not it has an approved TMDL.*

Chapter 1

Section 1.04: Options for Permit Flexibility

Author: Amanda Minks
Last Revised: May 4, 2015

As previously stated, any permit reissued after December 2010 will be evaluated for phosphorus WQBELs. Some phosphorus limits are very restrictive, while others can be easily met. The phosphorus rules were developed with several options for flexibility to help point sources achieve compliance with restrictive phosphorus WQBELs. Flexibility is available to help adjust the phosphorus WQBELs directly, or to achieve compliance with the applicable phosphorus WQBELs in the most economically efficient manner possible. These options are described below and are also summarized in Table 4, p. 25.

TMDL-derived limits, site-specific criteria, and variance water classifications can be used to adjust restrictive phosphorus limits.

TMDL-derived limits: As previously mentioned in Section 1.02, p. 10, TMDL-derived limits tend to be less restrictive than WQBELs calculated under s. NR 217.13, Wis. Adm. Code. DNR has developed TMDLs for many watershed basins in Wisconsin and, in many cases, is granting less stringent TMDL-derived phosphorus limits for the point sources discharging in these watersheds. DNR is working to develop TMDLs elsewhere in the state to expand the use of TMDL-derived phosphorus limits (see Figure 2, p. 12).

Limits based on monthly flows: For discharges to rivers, streams, and impounded flowing waters, phosphorus WQBELs are typically calculated using annual stream flow (Qs) values. However, s. NR 217.13(2)(b), Wis. Adm. Code, provides flexibility for DNR staff to use monthly average low flow values in lieu of annual flows if these data are available. Because monthly flows tend to be greater than annual average flows, phosphorus WQBELs calculated using these values tend to be less restrictive than if these limits were calculated using annual flows. Limits calculated using this approach will vary by month, so it is not possible to offer an extended averaging period for these limits beyond a monthly average. This option is only available when assimilative capacity is present in the receiving water (i.e. when the background phosphorus concentration is less than the applicable phosphorus criteria) because limits are automatically set equal to criteria whenever the ambient phosphorus concentration exceeds the applicable phosphorus criteria.

Site-specific criteria: Wisconsin's phosphorus criteria are meant to be reflective of water quality across the state and are derived from water quality reference conditions. Although this methodology provides the most protection on a statewide basis, some waterbodies may have unique physical and/or biological characteristics that a state criterion cannot account for. Site-specific criteria can account for these unique characteristics and adjust the applicable phosphorus criteria to ensure that it is not over or under-protective more than necessary to maintain a balanced indigenous biological community. Site-specific criteria may be appropriate in the following cases:

- The ambient phosphorus concentration is exceeding the statewide water quality criterion but nutrient response variables indicate the recreation and fish and aquatic life uses are supported (e.g., good/excellent biological condition scores), then a less stringent SSC may be warranted;
- The ambient phosphorus concentration is meeting the statewide water quality criterion but one or more nutrient response variables indicate an impairment due to phosphorus, then a more stringent SSC may be warranted; OR
- A use attainability analysis (UAA) has been completed and a site-specific phosphorus criteria is appropriate to adequately protect the adjusted designated uses of that particular receiving water.

The Federal water quality standards regulation at section 131.11(b)(l)(ii), CWA, and s. NR 102.06(7), Wis. Adm. Code, gives Wisconsin the opportunity to adopt site-specific water quality criteria for phosphorus to account for these unique characteristics.

Site-specific criteria, as with all water quality criteria, must be based on a sound scientific rationale in order to protect the designated use(s) of the site. In the case of phosphorus, the primary designated uses of concern are recreational uses, human health, and fish and aquatic life. Site-specific criteria may be derived by the Department or other parties in partnership with the Department, and are subject to review and approval by the EPA. The Department is currently working to develop additional guidance to help these audiences derive site-specific criteria for phosphorus. For more information, contact the Water Evaluation Section, Water Quality Standards Specialist.

Water Evaluation Section:
Kristi Minahan
Kristi.Minahan@wisconsin.gov
608-266-7055

Variance waters: In some cases, surface waters are not capable of meeting the fishable or swimmable goals DNR would normally set for them due to natural or anthropogenic factors. For example, some streams have too little flow to support a healthy fish community. In these instances, DNR can list the waters as "variance waters" or "limited aquatic life" (LAL) systems, and can adjust permit limits according to the revised classification. Currently, waterbodies designated as LAL waters are found in ch. NR 104, Wis. Adm. Code. This Chapter also specifies criteria for classifying a waterbody as a LAL water [see NR 104.01(1)(a-d)][2]:

- The presence of in place pollutants,
- Low natural stream flow,
- Natural background conditions, and
- Irretrievable cultural alterations.

For more information contact the Water Evaluation Section, Water Quality Standards Specialist listed above.

[2] These factors are similar to EPA's "Six Factors" for Use Attainability Analyses.

There are also several options available to comply with phosphorus limits in the most economically effective manner possible; these options include facility upgrades, water quality trading, adaptive management, and water quality standard variances pursuant to Wis. Stat. s. 283.15.

Facility Upgrades: Facilities can choose to add treatment technology to their plant to comply with the new phosphorus limits. This is the traditional method used to comply with permit limits. In some cases, the costs of facility upgrades may not be overly burdensome, particularly when P limits are not overly restrictive.

Water Quality Trading: Water quality trading allows point sources to offset their pollution load, and comply with phosphorus limits, by taking credit of other phosphorus reductions within the watershed. These reductions can occur within urban or agricultural areas, or from other point sources within the watershed. Trading is a viable compliance option in most watersheds, and should be utilized when the cost of purchasing offset credits is less than the cost of facility upgrades. A permittee may also choose to participate in trading in conjunction with a facility upgrade to comply with phosphorus limitations. Several guidance documents are available to help implement water quality trading, and DNR staff are available to help facilities explore trading feasibility. Visit http://dnr.wi.gov/topic/SurfaceWater/WaterQualityTrading.html for more information. Additional information is also provided in Appendix A, p. 110 of this Guidance.

Adaptive Management: Similar to water quality trading, adaptive management allows a point source to reduce other sources of phosphorus pollution within a watershed to achieve compliance with phosphorus requirements. Unlike water quality trading, however, adaptive management focuses on improving water quality, rather than simply offsetting a permit limit. The role of the permittee under adaptive management is to work with others to reduce the overall phosphorus load from nonpoint and/or other point sources in the watershed so that water quality improvements can be made. Adaptive management should be considered in situations where point sources meet the eligibility requirements pursuant to s. NR 217.18, Wis. Adm. Code, water quality improvements can be demonstrated over time, and the cost of the watershed project is less than the cost of facility upgrades. The Adaptive Management Technical Handbook is available to help implement adaptive management, and DNR staff are available to help facilities explore adaptive management feasibility. Additional information is also provided in Appendix A, p. 110 of this Guidance.

Economic variances: In some cases, the available compliance options are simply too costly, and would result in an economic hardship for the community or industry. In these cases, the discharge can request an economic variance. Variances allow communities to take economically viable steps towards compliance. Besides economic considerations, there are other factors listed in Wis. Stat. s. 283.15(4) that may apply when seeking a variance to a water quality standard. See Section 3.03, p. 86, for additional information about economic variances. WDNR must seek EPA approval of a variance before an economic variance can be authorized. Forms have been developed to help streamline the variance request process for s. 283.15, Stat., and s. NR 217.19, Wis. Adm. Code, variance requests and are available at \\central\Water\WQWT_PROJECTS\WY_CW_Phosphorus\Forms and http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

Table 4. Flexibility options that may be applied towards meeting total phosphorus criteria.

	Purpose	When to use	Results & Benefits
TMDL-Derived P Limits	To improve water quality by taking a balanced approach to account for all sources of P pollution to a receiving water, not just point source contributions	Can only be used in watersheds with an approved TMDL. See Section 2.05 (p. 55) for details.	• May create less stringent P limits by accounting for all sources of pollution to the receiving water • Allows everyone to be part of the solution to address excess P
Limits Based on Monthly Flows	Calculate limits using monthly stream flow data in lieu of annual average data	For discharges to streams/rivers where dilution is present	• Typically results in less restrictive limits, but limits must be expressed as monthly average
Site-Specific Criteria (SSC) for phosphorus	To adjust the phosphorus criteria that is applied to an individual waterbody, in cases where the criteria are either overly stringent or under protective of local water quality	If the statewide phosphorus criteria are over- or under-protective of the local water quality	• Provides an appropriate level of protection for a Wisconsin's surface waters • Can result in less restrictive permit limits if local water quality is not experiencing impacts from P pollution
Variance Waters (in NR 104)	For waters that cannot meet full Fish & Aquatic Life uses, to apply less stringent criteria and less stringent effluent limits for certain substances	Meet EPA and DNRs protocols and factors for consideration. *Note: EPA has identified 6 factors for consideration in guidance.*	• If a water is categorized as a variance water, phosphorus criteria may no longer be necessary to protect this water or a site-specific criteria may be developed.
Facility Upgrades	To comply with P limits by adding treatment technology to the facility.	A point source should consider this option if adding treatment is economically viable and/or preferable compared to the other compliance options available	• Provides point sources with certainty that limits will be attained • Comply with limits without relying on partnerships
Adaptive Management (AM)	To achieve phosphorus compliance for point sources by addressing both point and nonpoint sources in the watershed to improve water quality	A point source should consider AM if they are eligible for AM, and working in the watershed to improve water quality is economically preferable to facility upgrades. See AM Technical Handbook for details	• Addresses both point and nonpoint sources in a watershed • May be economically preferable • Dischargers are given less restrictive interim phosphorus limits for up to 15 years; may be permanent if AM successfully meets water quality criteria
Water Quality Trading (WQT)	To attain compliance with a permittee's effluent limit, through a facility's acquisition of pollutant reduction credits to offset part of its discharge.	A point source should consider WQT if there are credits available in the watershed, and purchasing credits is economically preferable to facility upgrades. See Trading Guidance.	• Addresses both point and nonpoint sources in a watershed • Can provide economic relief to point sources
Economic Variances	To allow an exceedance of a P limit for socioeconomic reasons	A facility must demonstrate a significant economic hardship to comply with P limits. See Section 3.03 (p. 86) for details.	• Facility receives a less stringent discharge limit during permit term while making progress toward P reductions • Potential cost-savings for the community by not requiring immediate technical upgrades

Chapter 2- Calculating Water Quality Based Effluent Limits for Phosphorus

Chapter 2 is designed to provide guidance on calculating and various elements of water quality-based effluent limits (WQBELs). As described in Section 1.02, p. 10 of this Guidance, there are several types of phosphorus limits including technology-based phosphorus limits (TBELs), WQBELs, TMDL-derived limits, and interim P limits. Department staff are responsible for calculating WQBELs in permits and determining which of these P limits needs to be included in WPDES permits. Department staff are, therefore, the primary audience in this Chapter.

This Chapter provides information about how to calculate, express, and determine the need for phosphorus WQBELs as well as interim limits. Separate guidance has been developed to provide guidance on calculating TMDL-derived phosphorus limits. This guidance, entitled *"TMDL Development and Implementation Guidance (2013)"*, is available for download at http://dnr.wi.gov/topic/tmdls/implementation.html.

The regulated community and other groups may also be interested in calculating WQBELs, particularly for facility planning purposes. Flow diagram 2 and 2B in Chapter 1 Section 1.03, p. 14 of the Guidance are designed to provide the regulated community with a general understanding of limit expression. The regulated community is responsible to collect sufficient information to calculate WQBELs. See Chapter 4, p. 90 of the Guidance for details on monitoring and data collection.

Chapter 2

Section 2.01: Calculation of Phosphorus WQBELs

Author: Mike Hammers, Diane Figiel, and Amanda Minks
Last Revised: March 27, 2014

Water Quality Based Effluent Limits for Phosphorus for Rivers and Streams

For discharges of phosphorus to flowing streams and rivers, WQBELs are calculated using the formula from s. NR 217.13(2), Wis. Adm. Code. This is the same conservation of mass equation from s. NR 106.06(4)(b).

$$\text{Limitation} = [(WQC)\ (Q_s+(1-f)\ Q_e) - (Q_s - f\ Q_e)\ (C_s)]/\ Q_e$$

Where:

Limitation = Water quality based effluent limitation (in units of mass per unit of volume),

WQC = The water quality criterion concentration (in units of mass per unit volume) from s. NR 102.06,

Q_s = Receiving water design flow (in units of volume per unit time)

Q_e = Effluent flow (in units of volume per unit time)

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

C_s = Upstream concentration (in units of mass per unit volume)

<u>Water Quality Criteria</u>

Applicable water quality criteria are found in s. NR 102.06, Wis. Adm. Code, and discussed in Section 1.01, p. 5 of this Guidance.

<u>Receiving Water Flow (Q_s)</u>

The receiving water flow (Q_s) used in calculating phosphorus effluent limitations for discharges to flowing waters should be either:

1. The average minimum 7−day flow that occurs once every 2 years (7−day Q_2), or
2. The average low 30−day flow that occurs once every 3 years (30−day Q_3).

The full 7-day Q_2 or 30-day Q_3 is used because phosphorus impacts are due to long-term exposure after full mixing has occurred.

The 7-day Q_2 will be the more likely available low flow as this is used in the calculation of other limits. If it is not and a 30-day Q_5 is available the 7-day Q_2 can be estimated as the 30-day Q_5 divided by 85%. As another option the facility may contact the United States Geological Survey (USGS) to obtain low flows. Seasonal or monthly low flows can be used to calculate seasonal or monthly limits in lieu of year-round values.

Effluent Flow (Q_e) (s. NR 217.13(2)(c))

For municipal discharges subject to ch. NR 210, Wis. Adm. Code, Q_e is the annual average design flow. For discharges that are not subject to ch. NR 210, the maximum demonstrated annual average flow or a monthly average flow may be used.

For non–continuous discharge situations such as seasonal discharges and discharges proportional to stream flow, Q_e is determined on a case-by-case basis. This includes fill-and-draw discharges from municipalities even though they are subject to ch. NR 210. There is a need to evaluate the variability of the effluent flow over time to determine if an annual value or some alternative value should be used. Chapter 4 of the "Implementation Guidance for Wisconsin's Thermal Water Quality Standards" gives examples of how to evaluate Q_e in these cases.

Upstream Concentrations (s. NR 217.14(1)(d))

Representative upstream background data is needed to calculate water quality based effluent limits for phosphorus. Existing phosphorus data has been included and summarized on the surface water data viewer in the "Calculated Total Phosphorus Data" layer. The data and a summary of how the ch. NR 217 total phosphorus concentrations were calculated can be found http://dnr.wi.gov/topic/surfacewater/datasets/monit_stations/river_phos_stations.html. Data in this layer should be validated with the most recent in-stream phosphorus data available as this layer is only updated periodically, and may not account for the most recently collected TP data. See DNR's Surface Water Integrated Monitoring System (SWIMS) for the full database of phosphorus data- http://prodoasint.dnr.wi.gov/swims/login.jsp. A calculator tool has been developed for staff to streamline the process of calculating ambient phosphorus concentrations.

When data for the actual receiving water is not available a similar, comparable stream based on size, drainage basin, topography and land use may be used. The facility may also want to consider collecting additional background data. Guidance on ambient phosphorus monitoring is included in Section 4.01, p. 95 of this document. While existing data, which may not meet the strict definition of the code, can be used, future monitoring should be consistent with this guidance and the determination of upstream concentrations will be evaluated at each permit reissuance.

If the upstream concentration is greater than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, for the water body the calculated water quality based effluent limitation will be less than

the criterion and should be set equal to the criterion per s. NR 217.13(7), Wis. Adm. Code. If not, the calculation procedures in s. NR 217.13, Wis. Adm. Code, are used.

Water Quality Based Effluent Limits for Phosphorus for Inland Reservoirs and Lakes

For discharges of phosphorus directly to inland lakes, reservoirs, and other receiving waters, which do not exhibit a unidirectional flow at the point of discharge, the effluent limit is set equal to the criterion for the receiving water or the downstream water. The applicable phosphorus criteria for each lake/reservoir type are specified in Section 1.01, p. 5 of this Guidance. As mentioned, the Register of Waterbodies (ROW) and Surface Water Integrated Monitoring System (SWIMS) are tools available to help Department staff make waterbody classification determinations. It may also be advantageous to contact the Phosphorus Implementation Coordinator and Lake Specialist, if uncertainty exists:

Phosphorus Implementation Coordinator:
Amanda Minks
Amanda.Minks@wisconsin.gov
608-264-9223

Lakes Specialist:
Scott Van Egeren
scott.vanegeren@wisconsin.gov
608-264-8895

Waters impounded on rivers or streams that do not meet the definition of reservoir are required to meet the river and stream criterion (either 100 µg/L or 75 µg/L) that applies to the primary stream or river entering the impounded water. The methodology described above for rivers and streams should be used to calculate WQBELs for discharges to impounded flowing waters.

Water Quality Based Effluent Limits for Phosphorus for Great Lake Discharges

Pursuant to s. NR 217.13(4), Wis. Adm. Code, a model shall be used to calculate effluent limitations for discharges to the Great Lakes. In collaboration with EPA, Tetra Tech was enlisted to investigate available models that could be utilized to calculate effluent limitations for discharges to the Great Lake. This investigation highlighted the complexity of this type of modeling, and the need for additional data collection, particularly in the nearshore area of the Great Lakes. Additional work is ongoing to develop a more robust data set and improve modeling capabilities to be used to develop WQBELs for discharges to the Lakes. Based on current information available, and the modeling effort completed by Tetra Tech, WDNR has concluded the following in consultation with EPA:

- Nearshore and lake data indicate that assimilative capacity is available throughout the coastline of Lake Michigan and Lake Superior in Wisconsin. Given that there appears to be assimilative capacity is most situations, it is not appropriate to establish effluent limitations equal to criteria at this time.

- Phosphorus limitations for discharges to rivers/streams that flow into the Great Lakes should be based on the applicable criteria for the direct receiving water; based on what is known at this point, these limitations appear to be generally protective of Lake Michigan and Lake Superior. Once additional modelling or site-specific information becomes available, these limitations will be crosschecked to ensure that they are sufficiently protective of Lake Michigan and Lake Superior.

- Optimization requirements and interim effluent limitations should be included in WPDES permits for discharges into the Great Lakes. Based on model development work done up until this time, focused on assimilative capacity, it appears that optimization requirements and the use of interim limitations will be generally protective of nearshore and lake water quality.

- In addition to developing a more robust data set, additional monitoring should be conducted to further investigate areas that may be more sensitive to phosphorus such as bays and harbors.

Based on the above, WDNR staff should include a phosphorus limitation equal to 0.6 mg/L, expressed as a six-month average, in the WPDES permit for a Great Lakes discharger [s. NR 217.13 (4), Wis. Adm. Code]. If a discharger cannot feasibly comply with a 0.6 mg/L limitation, a limit equal to a calculated P_{99} or maximum effluent P concentration may be included in the WPDES permit. A limit based on a calculated P_{99} may also be appropriate if the phosphorus effluent concentration has consistently been below 0.6 mg/L and will continue to be below this concentration. WDNR staff should use best professional judgment when deciding if a 0.6 mg/L limitation or alternative limitation is appropriate. The general recommendation is that phosphorus limits may be set above 0.6 mg/L if a major facility upgrade is required to comply with the limit.

Additionally, all Great Lakes dischargers will be required to optimize their treatment technology upon permit reissuance. See Section 4.03, p. 106, for additional information regarding optimization requirements. As previously stated, dilution models indicate that phosphorus limitations for discharges to receiving waters upstream of Lake Michigan or Lake Superior should be based on local water quality concerns. These limitations are believed to be sufficiently protective of the Great Lakes based on currently available information.

Following the successful implementation of an approved optimization plan, WDNR staff should consider including a limit equal to a calculated P_{99} or maximum effluent P concentration in the WPDES permit upon permit reissuance. Such a limitation would ensure that backsliding does not occur. Additionally, WDNR staff will continue to re-evaluate available modeling and ambient data to ensure that these limitations are adequately protective of water quality as part of the permit reissuance and water quality assessment programs.

Questions on phosphorus WQBELs for Great Lake discharges may be submitted to the Phosphorus Implementation Coordinator:

Phosphorus Implementation Coordinator:
Amanda Minks
Amanda.Minks@wisconsin.gov
608-264-9223

Exclusions from Phosphorus Water Quality Criteria

As stated in s. NR 102.06(6)), Wis. Adm. Code, water quality criteria are not provided for (a) Ephemeral streams (b) Lakes and reservoirs of less than 5 acres in surface area (c) Wetlands, including bogs and (d) Waters identified as limited aquatic life waters in ch. NR 104. However downstream impacts should be considered as described in Section 2.04, p. 48, of this Guidance.

If a discharge has previously been treated as a wetland, LAL, or ephemeral stream discharge, it should continue to be treated as such. For discharges where a determination has not yet been made, ch. NR 104, Wis. Adm. Code, and/or the wetland inventory in the Surface Water Data Viewer should be consulted. There are two layers that are important to identify wetlands in the Surface Water Data Viewer: Wisconsin Wetland Inventory and the Wetland Indicator Soils. If the Wisconsin Wetland Inventory indicates that an area is a wetland, it can be presumed correct. If the Wetland Indicator Soils layer indicates that wetland soils are present but is not shown as a wetland polygon in the Wisconsin Wetland Inventory, a case-by-case determination is required and regional biologists should be conferred. Wetland staff may also be contacted, if there are any wetland delineation questions.

Site-Specific Criteria

Section NR 217.13(5), Wis. Adm. Code, allows for a site−specific criterion in place of the generally applicable criteria as long as it is protective of the designated use of the specific surface water segment or waterbody, and does not interfere with designated use attainment in downstream waters. This requires site−specific data and analysis using scientifically defensible methods and sound scientific rationale. Guidance is being developed to derive site-specific criteria for phosphorus. Contact the Water Quality Standards Specialist for further details:

Water Quality Standards Specialist:
Kristi Minahan
Kristi.Minahan@Wisconsin.gov
608-266-7055

Other Considerations

Factors such as reasonable potential, TMDL based limits, downstream waters, multiple and new dischargers need to be considered and are addressed in other sections of the Guidance.

Chapter 2

Section 2.02: Reasonable Potential

Author: Jim Baumann and Amanda Minks

Last Revised: January 6, 2014

Consistent with EPA regulations, s. NR 217.15, Wis. Adm. Code, contains requirements for making a "reasonable potential" determination. That is, for all point sources that discharge phosphorus and are subject to ch. NR 217 subchapter III, Wis. Adm. Code, the Department must make a determination whether the discharge (or discharges) from the point source has a reasonable potential to cause or contribute to a water quality impairment by exceeding the calculated WQBEL. See Section 1.02, p. 10, for details on the applicability of ch. NR 217 subchapter III, Wis. Adm. Code. A phosphorus limitation is required to be included in a WPDES permit if there is the reasonable potential for that limit to be exceeded in the discharge covered under that permit.

Section NR 217.15 (1) (b), Wis. Adm. Code, Permits with Phosphorus Technology Based Limits

Pursuant to s. NR 217.15 (1) (b), Wis. Adm. Code, a permittee is deemed to have reasonable potential to cause or contribute to an exceedance of a phosphorus WQBEL, if the permittee already has a technology based phosphorus limit (TBEL) in its permit and that TBEL is less restrictive than the WQBEL expressed as a concentration. In cases where the facility is subject to ch. NR 210, Wis. Adm. Code, the comparison is straightforward as both the WQBEL and the TBEL are expressed as monthly averages. The phosphorus WQBEL will be included in the WPDES permit and no further reasonable potential analysis is required, such as the P_{99} calculation.

In the case of industries, the comparison is slightly more complicated as the TBEL is expressed as a 12-month rolling average. In these instances, the guidance in EPA's Technical Support Document for Water Quality-Based Toxics Control[3] can be used to statistically convert the 12-month rolling average limit into a monthly equivalent limit, which than can be directly compared with the WQBEL:

$$MTBL = TBL * e^{\left[2.326\sigma_n - 0.5\sigma_n^2\right]}$$

Where:

MTBEL = monthly equivalent limit

TBEL = 12-month rolling average technology-based effluent limit

$\sigma_n^2 = \ln(CV^2/n + 1)$

[3] United States Environmental Protection Agency (USEPA). 1991b. Technical Support Document for Water Quality-based Toxics Control. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

By knowing the coefficient of variation (CV) which equals the standard deviation divided by the mean of representative effluent data of the effluent phosphorus data and sampling frequency, the following look-up table can be used to simplify the procedure:

	TBEL Multipliers $e^{\left[2.326\sigma_n - 0.5\sigma_n^2\right]}$						
	Sample Frequency						
CV	1/Month	2/Month	Weekly	2xWeek	3xWeek	5xWeek	Daily
0.1	1.25	1.18	1.12	1.09	1.07	1.05	1.04
0.2	1.55	1.37	1.25	1.18	1.14	1.11	1.09
0.3	1.90	1.59	1.40	1.27	1.22	1.16	1.13
0.4	2.27	1.83	1.55	1.37	1.30	1.22	1.18
0.5	2.68	2.09	1.72	1.48	1.38	1.28	1.23
0.6	3.11	2.37	1.90	1.59	1.47	1.34	1.28
0.7	3.56	2.66	2.08	1.71	1.56	1.41	1.33
0.8	4.01	2.96	2.27	1.83	1.66	1.47	1.39
0.9	4.46	3.28	2.48	1.96	1.75	1.54	1.44
1	4.90	3.59	2.68	2.09	1.86	1.61	1.50

Example 1:

> Facility FF has a 12-month rolling average TBEL of 1.2 mg/L and the calculated WQBEL is 2.0 mg/L. The CV of the effluent data is 0.6 and the effluent is sample once per week, which results in a TBEL multiplier of 1.90. The monthly equivalent limit is then calculated as 1.90 * 1.2 mg/L = 2.28 mg/L. As this is greater than the WQBEL of 2.0 mg/L, the TBEL is less restrictive, and the WQBEL would be included in the WPDES permit.

Example 2:

> This example is the same at Example 1, except the CV of the effluent data is 0.4 and the effluent is sample three times per week, which results in a TBEL multiplier of 1.30. The monthly equivalent limit is then calculated as 1.30 * 1.2 mg/L = 1.56 mg/L. As this is less than the WQBEL of 2.0 mg/L, the TBEL is more restrictive, and the TBEL would be included in the WPDES permit.

As specified in s. NR 217.12 (2), Wis. Adm. Code, a technology based limit will be included in the WPDES permit if the technology based limit is more stringent than the WQBEL expressed as a concentration. Any water quality based mass limits calculated pursuant to ss. NR 217.14 (1) and (3), Wis. Adm. Code, will also be included in the WPDES permit to accompany the technology based phosphorus limit. Mass limits shall be required for phosphorus discharges to a lake or reservoir, outstanding or exceptional resource waters (O/ERWs), phosphorus impaired waters on the 303(d) impaired waters list, or a surface water with an approved TMDL. Mass limits may also be required to protect downstream waters. For additional information on mass limits, see Section 2.01, p. 27.

Section NR 217.15 (1) (c), Wis. Adm. Code, Permits without Phosphorus Technology Based Limits

A reasonable potential determination is required and the procedures in s. NR 217.15 (1) (c), Wis. Adm. Code, are to be used for dischargers subject to phosphorus WQBELs that do not have TBELs. Generally, dischargers that fall under s. NR 217.15 (1) (c), Wis. Adm. Code, tend to be smaller in size and don't meet the phosphorus mass thresholds in Subchapter II of ch. NR 217, Wis. Adm. Code.

To make a reasonable potential determination, a P_{99} calculation will be performed pursuant to s. NR 217.15(1)(c)1, Wis. Adm. Code, provided there are at least 11 representative daily discharge concentrations that are greater than the appropriate level of detection.

Representative data means:

In general, discharge data should be no more than five years old at the time of the permit application. If the data is more than five years old, additional samples should be collected and analyzed by the permittee to determine whether or not the older data is representative. At least two additional samples per month should be collected to validate data collected more than five years ago. If collected data does not represent normal operating conditions it may be censored from the dataset. Unrepresentative operating conditions may include significant fluctuations in the size of the wasteload being treated, changes in manufacturing processes, short-term treatment failure, or emergency conditions.

Less than 11 representative data points:

According to s. NR 217.15 (c) 2, Wis. Adm. Code, if fewer than 11 representative samples are available, the determination of reasonable potential may be based on the arithmetic mean of available and representative effluent concentrations being greater than one-fifth of the calculated water quality-based effluent limit.

No representative data:

Where no representative data exists, s. NR 217.15 (1) (c) 3, Wis. Adm. Code, gives the Department two options: require collection of discharge concentration samples or extrapolate information from similar point source dischargers. If no representative data is available, the Department strongly recommends that permittees collect sufficient data to perform an upper 99th percentile (P_{99}) calculation prior to permit application. Pursuant to s. NR 217.15 (1) (d), Wis. Adm. Code, the Department may require collection of the samples as part of the permit application for reissuance. See Section 4.01, p. 95, for details on effluent monitoring.

If the permittee does not submit sufficient data, extrapolation can be used to perform a P_{99} calculation. To extrapolate data, information should be obtained from dischargers of similar size, manufacturing processes, and treatment process. The Department must then use conservative assumptions about the facilities. To avoid overly conservative limits being generated, it is recommended that permittees collect sufficient data rather than relying on extrapolation.

Reasonable Potential P_{99} Analysis - s. NR 217.15(1)c 1, Wis. Adm. Code:

If there are at least 11 daily discharge concentrations considered representative of current discharges, an upper 99th percentile (P_{99}) of a 30-day average discharge is calculated using the procedures in s. NR 106.05 (5), Wis. Adm. Code. This is the same equation that is used for reasonable potential determination for many toxic substances. The equation in s. NR 106.05 (5) (a), Wis. Adm. Code, is as follows:

$$P_{99} = \exp(mu_{dn} + Z_p * sigma_{dn})$$

P_{99}	=	Upper 99th percentile of n-day average discharge concentrations.
d	=	Ratio of the number of daily discharge concentrations less than the limit of detection to the total number of discharge concentrations. Generally, all sample results should exceed the limit of detection.
n	=	Number of discharge concentrations used to calculate an average over a specified monitoring period (n=1 for daily concentrations,4 for 4-day averages and 30 for 30-day averages). The 30-day average should be used.
exp	=	Base e (or approximately 2.718) raised to the power shown between the parentheses in the original equation.
Z_p	=	Z value corresponding to the upper pth percentile of the standard normal distribution.
P	=	(0.99-dn)/(1-dn).
mu_{dn}	=	mu_d+[($sigma_d$)2 -($sigma_{dn}$)^2]/2+ln[(1-d)/(1-dn)] = estimated log mean of n-day average discharge concentrations greater than the limit of detection. *(Note: mudn = mud if n = 1).*
$(sigma_{dn})^2$	=	ln [(1-dn) ([1+(s/m)^2]/[n(1-d)]+ (n-1)/n)] = estimated log variance of n-day average discharge concentrations greater than the limit of detection. *(Note: $(sigma_{dn})^2$= $(sigma_d)^2$ if n = 1.)*

mu_d	=	ln m - 0.5 $(sigma_d)^2$ = estimated log mean of discharge concentrations greater than the limit of detection.
$(sigma_d)^2$	=	ln $[1 + (s/m)^2]$ = estimated log from variance of discharge concentrations greater than the limit of detection.
ln	=	Natural logarithm.
m	=	Mean of discharge concentrations greater than the limit of detection.
s	=	Standard deviation of discharge concentrations greater than the limit of detection.

Note: Department limit calculator staff do not need to modify the reasonable potential excel spreadsheets for the phosphorus reasonable potential determination. The same general procedure to calculate the reasonable potential for toxic substances can be used for phosphorus.

Example 1:

Facility FF discharges phosphorus on a daily basis to a river listed in s. NR 102.06, Wis. Adm. Code, with a phosphorus criterion of 100 µg/L and the river exceeds the criteria. As such, there is no assimilative capacity and the WQBEL assigned is equal to the criterion. The discharge was monitored on a monthly basis with the following results:

Date	Concentration (µg/L)
1/11/2010	50
2/4/2010	50
3/7/2010	90
4/5/2010	70
5/2/2010	50
6/7/2010	80
7/13/2010	110
8/9/2010	80
9/7/2010	150
10/5/2010	80
11/7/2010	100
12/5/2010	90

The 30-day P_{99} result is 96 µg/L. This is less than the 100 µg/L (0.1 mg/L) WQBEL. Therefore, it is deemed that the discharge does not have the reasonable potential to cause an exceedance of the criterion. No phosphorus WQBEL is required.

Example 2:

> This example is the same at Example 1, except the discharge is to a stream with a phosphorus criterion of 75 µg/L, and the stream exceeds the criteria. As such, there is no assimilative capacity and the WQBEL is set equal to the criterion. The discharge was monitored on a monthly basis using the same data as in Example 1. Again, the 30-day P_{99} result is 96 µg/L. In this case, however, the 30-day P_{99} exceeds the applicable criteria of 75 µg/L (0.075 mg/L). Therefore, it is deemed that the discharge does have the potential to cause an exceedance of the criterion and a WQBEL should be included in the WPDES permit.

Reasonable Potential for Limited Aquatic Life (LAL) Systems

As described in Section 1.01, p. 5, LAL systems, ephemeral streams, and wetlands do not have applicable criteria. Discharges to these waters may be subject to phosphorus WQBELs if they can cause or contribute to an exceedance of the downstream criteria. If a discharge to a LAL, ephemeral stream, or wetland system has no potential to cause or contribute to an exceedance of the applicable water quality criteria in the downstream segment, phosphorus limits may not be required at this time.

Note: At some point in the future criteria may be derived for these waterbody types and a reasonable potential analysis would need to be performed based on the new criteria.

A discharger may submit in-stream phosphorus monitoring data and/or data analyses to the Department to illustrate that the effluent does not cause an exceedance in the downstream water. If insufficient data has been submitted to the Department, or the data suggests that the discharge has an impact to the downstream water, limits will be included in the WPDES permit based on the criteria and flow conditions for the next downstream segment. All monitoring must be conducted consistent with the Department guidance on stream monitoring (see Section 4.01, p. 95, for details).

There are several monitoring and data analyses strategies that can be used to make this determination. The Department and regulated community have flexibility in selecting any of the following options or developing new strategies to best represent specific site conditions. Strategies for assessing the potential to impact downstream waters are discussed in Section 2.04, p. 48 of this guidance. Alternative strategies may be approved on a case-by-case basis.

Note: Ambient and downstream monitoring for all in-stream monitoring scenarios should only be conducted during periods of active discharge.

Chapter 2

Section 2.03: Expression of Phosphorus Limits

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There are several types of phosphorus limitations that may be included in WPDES permits. These limitations include:

- Technology-based phosphorus limitations (ch. NR 217 Subchapter II, Wis. Adm. Code)
- Section NR 217.13, Wis. Adm. Code, water quality-based effluent limitations
- Section NR 217.14, Wis. Adm. Code, Mass Limitations
- TMDL-derived phosphorus limitations
- Interim phosphorus limitations
- Section NR 217.18, Wis. Adm. Code, adaptive management interim limitations

The expression of each of these limitations is discussed this section of guidance, and is summarized in Table 5 below. As stated in Section 2.02, only representative data should be used for permitting decisions (p. 35).

Table 5. Phosphorus Limits- what are they, and how are they expressed?

P Limit Name	Limit Type	Limit Expression	Description	Reference
NR 217.13 WQBEL	Concentration -based limits	Monthly average or six-month average, depending on limit stringency	• If the WQBEL is ≤0.3 mg/L, express limit as a 6-month average[1]. Also include a monthly average limit equal to 3x the six-month average[1] • If the WQBEL is >0.3 mg/L, express limit as a monthly average	• Impracticability determination • s. NR 217.14(2), Wis. Adm. Code
NR 217.14 mass limits	Mass limits	Either monthly average or six-month average[1], depending on limit stringency	• Only necessary if discharged to a lake/reservoir, O/ERW, or P impaired water not covered under a TMDL • If the WQBEL is ≤0.3 mg/L, express limit as a 6-month average[1]. Otherwise express limit as a monthly average	• s. NR 217.14, Wis. Adm. Code • s. NR 217.14(3), Wis. Adm. Code
TMDL-derived limits	Mass limits	Varies by TMDL	• Monthly average limits (Ex. Rock) • Limits consistent with NR 217.13 WQBEL (Ex. Lower Fox, St. Croix- individual) • 12-Month rolling average limits (Ex. St. Croix- aggregate)	TMDL Implementation Guidance *(Note: NR 217.13 limits may also be included in addition to TMDL-derived limits- see TMDL implementation guidance for details)*
Technology-based limit	Concentration -based limits	• Municipal discharges expressed as a monthly average • Industrial discharges expressed as a 12-Month rolling average	Typically, the TBEL is set equal to 1 mg/L. However, an APL can also be set. APLs are expressed the same as regular TBELs	s. NR 217.04, Wis. Adm. Code
Interim P limit	Concentration -based limits	• If the interim limit equals the TBEL, express the interim limit consistent with the TBEL limit, or • Express interim limit in a manner consistent with how the limit was derived (ex: monthly average limit based on 30 day P_{99})	Interim P limits are required if a P compliance schedule of any duration is granted. In other words, necessary for traditional and extended compliance schedules	• s. NR 217.17(3)(c), Wis. Adm. Code • Section 2.03, p. 38, of P Implementation Guidance
Adaptive Management Interim Limits	Concentration -based limits	• 0.6 mg/L six-month avg.[1] (permit term 1) • 0.5 mg/L six-month avg.[1] (permit term 2) • To be determined (permit term 3) • 1.0 mg/L monthly avg. (all permit terms)	Only necessary if adaptive management compliance option is specified in the WPDES permit.	s. NR 217.18, Wis. Adm. Code; 283.16, Wis. Stat.

1- The averaging period for six-month average limits is May-October and November-April.

Technology Based Limits

Technology based limits for phosphorus limits are expressed in WPDES permits as monthly average concentrations [ss. NR 217.04 (1)(a) 1 and 2]. For permittees other than publicly owned treatment works and privately owned domestic sewage works (i.e., industrial permittees), compliance must be determined on the basis of a 12-month rolling average [s. NR 217.04 (1)(a) 2]. Permit drafters should continue to specify "Rolling 12-Month Average" as the limit type in SWAMP for industrial permittees.

Note: Technology-based effluent limitations for phosphorus must also be included in the WPDES permit when phosphorus is addressed by EPA effluent limitation guidelines and new source performance standards.

Water Quality Based Effluent Limits

Water quality based effluent limits (WQBELs) for phosphorus derived and determined necessary pursuant to ss. NR 217.13 and NR 217.15, Wis. Adm. Code, shall be expressed in WPDES permits as a concentration. A mass limit shall also be included in the permit for a discharge directly to, or upstream from, a lake or reservoir, outstanding or exceptional resource water, 303(d) listed phosphorus-impaired water, surface water with an approved TMDL for phosphorus [s. NR 217.14 (1), Wis. Adm. Code], or exceptional or outstanding resource water as designated in EPA approved tribal water quality standards[4]. For receiving or downstream waters other than those just listed, a mass limit may be included in the permit in addition to the concentration limit when an increase in the phosphorus load is likely to result in adverse effects on water quality in the receiving or downstream water [s. NR 217.14 (1)(b), Wis. Adm. Code].

Mass limits shall be calculated from the concentration limit and the effluent flow (Q_e) used to derive the concentration limit [s. NR 217.14 (3), Wis. Adm. Code]. For example, if the conservation of mass equation from s. NR 217.13 (2), Wis. Adm. Code, is used to calculate a monthly average limit of 0.45 mg/L, the effluent flow used in the equation equals 1.5 MGD, and the downstream receiving water is impaired for phosphorus and lacks a TMDL, a monthly average mass limit of 5.6 lbs/day (i.e., 0.45 mg/L x 1.5 MGD x 8.34, a conversion factor) would be included in the permit along with the concentration limit of 0.45 mg/L.

Water quality based effluent limits derived pursuant to s. NR 217.13, Wis. Adm. Code, both concentration and mass, shall be expressed in permits as monthly average limits with the following exceptions [ss. NR 217.14 (2) and (3), Wis. Adm. Codes]. If the concentration limit is less than or equal to 0.3 mg/L, the concentration and mass limits should be expressed as six-month average limits and an additional limit equal to three times the concentration limit should also be included in the permit as a monthly average concentration limit, but not a monthly average mass limit. Six-month average concentration and mass limits are applicable to the periods of May 1st through October 31st and

[4] DNR staff can access EPA approved Tribal O/ERW waters on the "Tribal OERW" layer on the internal SWDV.

November 1st through April 30th each year[5]. Alternative averaging periods may be considered for non-continuous discharges, seasonal discharges, or other unique situations.

For example, if the WQBEL derived pursuant to s. NR 217.13, Wis. Adm. Code, equals 0.075 mg/L, Q_e equals 1 MGD, and the receiving water is upstream of a reservoir, the following effluent limits would be included in the permit: a monthly average concentration limit of 0.225 mg/L, and six-month average limits of 0.075 mg/L, and 0.63 lbs/day (i.e., 0.075 mg/L x 1 MGD x 8.34).

For discharges to lakes, a six-month mass limit is always required [s. NR 217.14 (1)(c), Wis. Adm. Code]. If the concentration limit derived pursuant to s. NR 217.13, Wis. Adm. Code, is less than or equal to 0.3 mg/L, the method specified in the previous paragraphs may be used to establish the mass limit. If the concentration limit is greater than 0.3 mg/L, the six-month mass limit should be calculated from the monthly average concentration limit.

Technology based limit (TBEL) versus water quality based effluent limit (WQBEL)

When the technology based limit for phosphorus is more restrictive than the WQBEL, s. NR 217.12 (2), Wis. Adm. Code, requires the technology based limit be included in the permit in lieu of the WQBEL. In addition, any water quality based mass limits specified by ss. NR 217.14 (1) and (3), Wis. Adm. Code, as explained above, must also be included in the permit.

For example, if technology and water quality based phosphorus limits equal 1 mg/L and 2.2 mg/L, respectively, and the effluent flow rate (Q_e) equals 0.75 MGD, permit phosphorus limits would equal 1 mg/L and 14 lbs/day (i.e., 2.2 mg/L x 0.75 MGD x 8.34) both expressed as monthly average limits. An industrial permittee would still be able to demonstrate compliance with the concentration limit using a 12-month rolling average concentration, but the average mass of phosphorus discharged each month must be less than or equal to the monthly average mass limit.

TMDL/WLA Limits

When a TMDL has been approved by EPA for the receiving water and a limit based on the TMDL wasteload allocation is included in the permit pursuant to s. NR 217.16, Wis. Adm. Code, the limit shall be expressed in a manner consistent with the wasteload allocation and assumptions of the TMDL. This limit may be used in place of or along with the WQBEL. See Section 2.05, p. 55, and "*TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs, Edition No. 2 (2013)"* available at http://dnr.wi.gov/topic/tmdls/implementation.html for details.

Expression of Interim Phosphorus Limits

[5] Limits calculated using monthly stream flow values should continue to be expressed as monthly average limitations regardless of stringency as these limits vary by month.

Adaptive Management Limits

Adaptive management requires interim limits of 0.6 mg/L for the first permit term and 0.5 mg/L for the second permit term. These limits shall be expressed as six-month averages as specified by ss. NR 217.18(3)(e) 2 and 3, Wis. Adm. Code. Accompanying monthly average limitations set equal to 1.0 mg/L are also required in addition to the six-month average limitations [ss. NR 217.18(3)(e) 2 and 3].

NOTE: Recent changes have also authorized adaptive management to be carried into the third permit term; however, adaptive management interim limits have yet to be specified for this permit term (283.16, Wis. Stat.).

Since the rule does not specify the use of a rolling average to demonstrate compliance, as it does in Subchapter II for industrial point source technology based limits, the interim limit should not be expressed as a rolling average limit. Further, since the rule fails to specify which six-month periods should be used to demonstrate compliance, as it does for upstream phosphorus concentrations (C_s), the most common interpretation of a six-month average should be used. That is, the average of effluent samples collected during the periods of January through June and July through December should be used to demonstrate compliance with the six-month average interim limits. Permit drafters should code the six-month average limits in SWAMP just for the months of June and December. Section NR 217.18(3)(e), Wis. Adm. Code, states that compliance schedules of up to 5 years may be allowed for permittees to meet adaptive management interim limits. The determination of compliance schedules, if any, to meet interim limits shall be made on a case-by-case basis. See the Adaptive Management Technical Handbook for more information about adaptive management, available at http://dnr.wi.gov/topic/SurfaceWater/AdaptiveManagement.html.

Interim limits required when a compliance schedule for phosphorus WQBELs is included in the permit [s. NR 217.17 (3)(c), Wis. Adm. Code]

Section NR 217.17(3)(c), Wis. Adm. Code, requires that, when granting a schedule of compliance, the department shall include in permit interim effluent limitations representing good management and operation for similar treatment processes based on performance of other wastewater treatment facilities that will lead to compliance with WQBELs. Interim effluent limitations are required whenever a compliance schedule is granted, regardless of the duration of that schedule. The department should use sound reasoning to set limits that are achievable and that make progress toward phosphorus reductions. However, the need to meet interim limits should not require permittees to invest in "temporary" treatment that will eventually need replacement to achieve stricter effluent quality at a later date, unless there is the reasonable expectation that temporary treatment will be cost-effective in the long run. If the department sets interim limits based on existing capabilities, there is no need to allow compliance schedules to meet interim limits.

Permits with a compliance schedule to meet a WQBEL should commonly have language something to the effect: *Starting on the effective date of this permit, the permittee shall develop and implement a*

phosphorus discharge optimization plan. The purpose of the optimization plan is to reduce as much of the discharged phosphorus as possible through slight operational changes to the facility. For example, more chemical addition could be used to capture additional phosphorus. See Section 4.03, p. 106, for additional information on optimization plans.

Note: The purpose of the Operation and Needs Review (ONR) is to find out if final limits can be met by simply making operational or other minor facility changes; whereas the optimization is just to reduce as much as possible the levels going out.

Limit calculator staff should use best professional judgment when selecting a method, and when calculating interim limits**. Not all statistical methods of evaluation are appropriate for all data sets of phosphorus**. If available, limit calculator staff should consider similar facility types when determining appropriate interim limits. These data may be available in the phosphorus tracking spreadsheet, if needed- \\central\Water\WQWT_PROJECTS\WY_CW_WQBEL\Phosphorus. Table 6 below provides options to calculate interim limits. Interim limitations are only necessary for those months that phosphorus compliance is not achieved at the time of permit reissuance.

Table 6. Interim Limits Options Table for Facilities with Compliance Schedules to Meet WQBELs.

Fac. Type	Existing Limit Basis	Current Limit	Proposed Interim Limit	Reasoning
Muni mechanical > 150 lbs	1.0	1.0 mg/L	1.0 mg/L or current EQ (4-day p99)	Optimization plan required will push plants to perform
	BioP APL w/polishing	1 + mg/L	1.0 mg/L	Bio P plants with chemical polishing can meet 1.0 mg/L
	BioP APL w/o polishing	1 + mg/L	Retain current limit	Optimization plan required will push plants to perform
Muni mechanical > 150 lbs; lagoon	APL w/chem addition	1 – 2 mg/L	Retain current limit	Optimization plan required will push plants to perform
	APL w/o chem addition	Existing EQ	Develop APL based on chem. addtn. to pond	We are currently requiring this regularly to achieve TBELs
Muni < 150 lbs	None	None	Existing effluent quality	Cannot justify "temporary" upgrade to add chem. trmt. for these small facilities
Industrial > 60 lbs	1.0	1.0	1.0	Optimization plan required will push plants to perform
	APL	1.0 +	Retain current limit	Optimization plan required will push plants to perform
Industrial <60 lbs but with Reas. potential	None	None	Existing effluent quality	Cannot justify "temporary" upgrade to add chem. trmt. for these small facilities

The following is a list of options on how to determine existing effluent quality, as used in the table above. The procedures below can be modified as appropriate to better reflect the site-specific conditions of the facility in question. Each of these options may be considered and a case-by-case determination should be made:

- **TBEL or APL including in previous WPDES permit**
  - Whenever there is a TBEL or an APL included in a WPDES permit, If a facility's effluent quality is consistently significantly below the TBEL/APL, an interim limitation equal to a calculated P_{99} may be more appropriate to better reflect current effluent conditions. Otherwise it is recommended that this limitation be retained the WDPES as the interim phosphorus limitation. If a technology based limit is retained in the permit as an interim limit, the averaging period of the limit should not be changed. That is, monthly average limits should continue to be expressed as monthly averages, and 12-month rolling average limits should continue to be expressed as 12-month rolling averages.

- **P_{99} where sufficient historical data is available**

- If sufficient data are available, and a TBEL/APL is not applicable, it is recommended that an interim limitation be calculated based on current effluent quality using a P_{99} approach. Limit calculators should use professional judgment when selecting an appropriate averaging period for the P_{99} calculation. In cases of high effluent variability, it is recommended that the interim limit be set equal to the 1-day P_{99}, expressed as a monthly average. If effluent variability is not a concern, a 4-day or 30-day P_{99} may be more appropriate, expressed as a monthly average. Limit calculators should consider both historic effluent variability and possible increases in effluent variability as part of the optimization and planning processes when determining an appropriate averaging period.

- **Non-numeric (BMP) limit based on phosphorus discharge optimization plan**
  - Occasionally the only phosphorus data available from these facilities are the 4 sample results collected through the permit application process or limited sampling during the permit. If little or no data are available at the time of permit reissuance, a narrative interim limitation may be appropriate. As previously mentioned, an optimization plan should be required for facilities with a compliance schedule. The optimization plan will require a discharge to attain the highest amount of phosphorus removal achievable given the current operational situation. A narrative interim limitation may be used in lieu of a numeric interim limitation in recognition of these activities, absent historic effluent phosphorus data. For example, *"The plant shall be operated such that the amount of phosphorus being discharged on an annual basis does not increase over the permit term, and that the phosphorus reductions will occur during the permit term through optimization."*

- **Numeric result of P_{99} calculation done after first 12 months following reissuance**
  - If insufficient data is available to calculate an interim limitation at the time of permit reissuance, and a numeric limitation is preferred to a narrative limitation (as described above), generic language may be included in the permit to set the interim limit equal to the P_{99} once calculated after year 1 of the permit. If this approach is chosen, the preferred method is to base the interim limitation on the 99th percentile of the monthly averages. With this approach, the monthly averages are used in the equations NR 106.05(5)(a), Wis. Adm. Code, rather than the individual effluent results. Due to this significant change from the methodology included in the rule, it recommended that rather than incorporating the equations by rule reference, the equations be directly incorporated into the permit as a footnote to the Monitoring Requirements and Effluent Limitations table.

    The s. NR 106.05(5)(a), Wis. Adm. Code, requirements can be significantly simplified, due to a few factors:

- In the equations "n" would always equal one, therefore "Z_p" is a constant at 2.327
- As the monthly mean effluent concentration will not be below the limit of detection, "d' is a constant at 0.
- "mu_{dn}" equals "mu_d" since "n" equals one.
- "$(sigma_{dn})^2$" equals "$(sigma_d)^2$" since "n" equals one.

Using these simplifications the equations in s. NR 106.05(5)(a) can be simplified to:

P_{99} = exp (a + 2.327*b)

Where:

P_{99}	= Upper 99th percentile of monthly averages (mg/L)
exp	= Base e (or ~2.718) raised to the power shown between the parentheses
a	= ln (m) - $0.5b^2$ [equivalent to "mu_d" in s. NR 106.05(5)(a)]
b^2	= 1n [1 + $(s/m)^2$] [equivalent to "$(sigma_d)^2$" in s. NR 106.05(5)(a)]
ln	= Natural logarithm
m	= Mean of monthly average discharge concentrations (mg/L)
s	= Standard deviation of monthly average discharge concentrations (mg/L)

This methodology will most often result in a higher value than the reported maximum monthly average, and represents a value that could be met immediately. Therefore use of this methodology requires only minimal time to implement after the data has been collected and analyzed.

- **Maximum value of small data set**
  - If considerable data are available, but not sufficient to calculate a P_{99}, the maximum value of the dataset can be used to set the interim limit. In this case the interim limit should be expressed as a monthly average. This approach may also be useful in cases where highly variable effluent TP concentrations result in a large P_{99} value, making the calculated P_{99} value extraneous. It is important to only use representative data (p. 35) when determining an appropriate maximum value to ensure that the interim limitation

is sufficiently restrictive to meet the goals of the interim limitation as described in Section 1.02, p. 12.

- **Using historical data and best professional judgment (BPJ)**
    - Historical data can be used in conjunction with knowledge of the discharge and similar discharge types in the State to make a BPJ determination to set the interim limit. Permit drafters and limit calculators should work collaboratively to set the appropriate interim limit using BPJ. This approach may be useful, if historical data are no longer representative of current effluent quality, among other cases.
- **Adaptive Management-based interim limit**
    - If a facility is eligible for adaptive management and can easily meet a 0.6 mg/L six month average limit, this limit could be included as the interim limit in the first permit term. This approach may be useful if the current effluent quality is significantly lower than the applicable TBEL/APL.
- **Interim limits based on similar facilities**
    - If no data are available but data from similar discharges are, the maximum value from these similar datasets may be used as the interim limit. In this case the interim limit should be expressed as an annual average.

Chapter 2

Section 2.04: Consideration of Downstream Waters

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Consideration of the water quality in downstream waters is mentioned in a number of places in Subchapter III of NR 217, Wis. Adm. Code, including:

- "Water quality based effluent limitations for phosphorus shall be included in a permit whenever the department determines":
    - "The discharge from a point source contains phosphorus at concentrations or loadings which will cause, has 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." [ss. NR 217.12 (1) intro and (1) (a)] (emphasis added)
- "Water quality based effluent limitations for phosphorus shall be calculated based on the applicable phosphorus criteria in s. NR 102.06 at the point of discharge, except the department may calculate the limitation to protect downstream waters." (s. NR 217.13) (emphasis added)
- "A mass limit shall also be included in a permit for discharges of phosphorus to any of the following receiving or downstream waters:
    1. A lake or reservoir;
    2. An outstanding or exceptional resource water, as designated in ss. NR 102.10 and 102.11;
    3. A phosphorus impaired water: or
    4. A surface water that has an approved TMDL for phosphorus." [s. NR 217.14 (1) (a)] (emphasis added)

  Note: Mass limits shall be included in a permit if any of the above conditions are met regardless of reasonable potential.
- "The department may establish mass limitations in permits for any other discharges of phosphorus if a concentration limit for phosphorus is included in the permit, and where an increase in phosphorus load is likely to result in adverse effects on water quality in the receiving water or downstream water." [s. NR 217.14 (1) (b)] (emphasis added)
- The department shall include a water quality based effluent limitation for phosphorus in a permit whenever the discharge or discharges from a point source or point sources contain phosphorus at concentrations or loadings which will cause, has the reasonable potential to

cause or contribute to an exceedance of the water quality standards in s. NR 102.06 in either the receiving water or downstream waters. [First sentence of s. NR 217.15 (1) (a)] (emphasis added)

Documentation

A checklist has been created to help WDNR staff consider the needs for downstream protection limitations. This checklist is based on the general and specific guidance below and is available at \\central\Water\WQWT_PROJECTS\WY_CW_WQBEL\Phosphorus. It is recommended that this checklist be completed whenever WDNR staff consider the need for downstream protection limitations. A copy of the completed checklist should be attachment to the limit memo and saved in SWAMP.

General Guidance

Typically, phosphorus limits are based on the needed water quality protection of the local receiving water. Phosphorus limits based on downstream water quality may be included in the WPDES permit where point sources cause or contribute to an exceedance of phosphorus standards in downstream waterbodies (s. NR 217.13(1)(b), Wis. Adm. Code). Best professional judgment should be used when determining if phosphorus limits should be calculated based on local and/or downstream water quality. In all cases, streams with a criterion of 75 µg/l flow into another stream with a criterion of 75 µg/l or a river with a criterion of 100 µg/l. In no case does a river flow into a stream. The only situations where a stream or river flows into a water body with a lower phosphorus water quality standards concentration are those where the downstream water is a lake, reservoir or Great Lake.

To determine whether a discharge will affect a downstream water, consideration should be given to all relevant information available, including the following general factors:

1. Distance of the outfall to the downstream water.

   The longer the flow distance of a river or stream from the outfall to the downstream water, the greater the opportunity for phosphorus to be retained.

2. Amount of phosphorus discharged compared to the flow of the receiving water.

   The relative contribution of phosphorus from the discharger to the downstream water should be considered.

3. Presence of an impoundment or other natural or artificial feature which would impede the movement of phosphorus downstream.

   Many impoundments, reservoirs or lakes will retain a portion of the phosphorus entering the water body.

4. Presence of floodplains, wetlands and similar physical features where phosphorus may be retained.

   Phosphorus attached to sediment may be deposited on floodplains and not subject to downstream transport.

The presence of these factors increases the difficulty of determining downstream impacts and decreases the applicability of simple static models, such as the conservation of mass equation in s. NR 217.13, Wis. Adm. Code. Use of a conservation of mass equation in the presence of these factors will likely overestimate the impact of the discharges for downstream waters. In many cases, presence of these factors will require use of more "sophisticated" models that take into account transport of phosphorus.

Specific Guidance

In addition to the general guidance above, this section provides additional specificity for frequent scenarios where it is necessary to consider downstream protection limitations. This section provides additional guidance to aid in the decision making process for these situations. The factors described in this portion of guidance are designed to ensure that downstream waters are adequately protected.

- **Criteria of the downstream water is attained**
  Phosphorus limits should be based solely on local water quality protection in these instances. These limits should be sufficiently protective of both local and downstream water quality.

- **A TMDL is developed to address a downstream impairment**
  In general, WQBEL development based on an EPA approved TMDL for the downstream water should always be considered, where a TMDL has been developed for that water that includes a wasteload allocation for the specific point source. There may be situations where the WQBEL calculated for the immediate receiving water is more stringent than the TMDL-derived WQBEL. In this situation, the more stringent limitation that is based on the point of discharge should be included (See logic diagram 2, p. 17). "TMDL Development and Implementation Guidance" is available, which discusses evaluation and inclusion of TMDL-derived limitations in more detail- http://dnr.wi.gov/topic/tmdls/implementation.html.

- **The point source discharges to a receiving water that flows into a stream/river that exceeds its applicable criteria upstream of the confluence.**
  If the ambient phosphorus concentration of the direct receiving water is below the phosphorus criteria of the downstream water, phosphorus limitations should be based on local water quality concerns unless more restrictive limitations are specified in an EPA approved TMDL, as previously mentioned. The exceedance in the downstream water is likely coming from other phosphorus loadings in the watershed in these instances.

Example: A stream has an ambient phosphorus concentration of 50 µg/L and flows into a river that is exceeding its phosphorus criteria. It is recommended that phosphorus limits be calculated to address local water quality concerns, as the stream is not causing the impairment to the downstream water.

- **The point source discharges to a receiving water that flows into a lake or reservoir that is exceeding its applicable criteria but a TMDL has not yet been developed and approved.**
  In this situation, the direct receiving water may be adding significant phosphorus loads to the downstream water causing or significantly contributing to the exceedance. Therefore, the need for limitations to protect the downstream waters should be carefully evaluated. Factors to consider include when making this determination include:

  1. *What portion of the phosphorus being discharged is delivered to the downstream water?*
     In some larger stream and river systems, significant phosphorus losses can occur from sedimentation, uptake, and other removal mechanisms such that the phosphorus discharged upstream does not significantly contribute to the downstream impairment. If the downstream water is within the same HUC 12 watershed, these losses are likely minimum. However, if the downstream water is outside the HUC 12, these losses may be important to quantify. Several models are available that can help quantify loss and removal of phosphorus in watersheds such as SPARROW. The USGS SPARROW Online Decision Support System as well as a tutorial for using this model is available at http://water.usgs.gov/nawqa/sparrow/. Appendix B, p. 113, provides additional guidance for WDNR staff to utilize the SPARROW tool.

  2. *What is the phosphorus load of the point source(s) and direct receiving water compared to the phosphorus load of the downstream water?*
     In situations where the direct receiving water and point source(s) represent a small portion of the total phosphorus load to the downstream water, downstream protection limitations may not be appropriate because the phosphorus contribution of the point source(s) is negligible to the downstream water. WDNR should consider the cumulative point source load to the downstream water in these situations, not just the individual load from the specific point source in question. A change in concentration analysis may be useful to help make this determination, as discussed later in this guidance.

  3. *Is the downstream water on the impaired water list?*
     In some situations, the downstream water may exceed the phosphorus criteria, but may not be on the impaired waters list because the biology of the downstream water has not been adversely affected by the exceedance. If the biological condition of the downstream water is good or excellent, a downstream protection limitation may not be appropriate because the designated uses of the downstream water are being met. These waters may be flagged for a site-specific phosphorus criteria as discussed in Section 1.01, p. 5, in these instances.

If the downstream water is on the approved impaired waters list, is proposed to be listed on a future impaired waters list, or has demonstrated signs of poor biological health due to eutrophication, a limitation to protect downstream waters may be appropriate. It may be appropriate to consider the factors described in the "general guidance" section above (p. 50) when determining whether or not to include these limitations.

4. *What is the stringency of the phosphorus limitation based on local water quality?*
   Department staff should compare the stringency of phosphorus limitations calculated for the direct receiving water compared to limitations based on downstream protection. If the direct receiving water is exceeding its applicable phosphorus limitation, stringent phosphorus limitations may already be included in the WPDES permit. Compliance with these limitations would demonstrate substantial progress towards achieving the water quality goals of local and downstream water quality. Therefore, it may not be necessary to include even more stringent phosphorus limitations based on downstream protection in these instances.

5. *Is a TMDL being developed for the downstream water?*
   TMDLs take a balanced approach to address excess phosphorus pollution, rather than solely relying on point source reductions to meet water quality goals. If a TMDL is in development to protect a downstream impaired water, it may be appropriate to estimate the stringency of the future TMDL-derived limitation to determine if downstream protection limitations are warranted in advance of the TMDL. If the projected TMDL-derived limitation is likely to be stringent (i.e., equivalent to 0.3 mg/l or less), it may be appropriate to include a downstream protection limitation in advance of the TMDL. The stringency of the limitation will depend on a number of factors including the contribution of point and nonpoint sources to the impaired water. In watersheds significantly dominated by nonpoint phosphorus pollution, TMDL-derived limitations for point sources will likely be less stringent. In blended watersheds, or watersheds that are dominated by point source phosphorus pollution, TMDL-derived limitations will likely continue to be stringent, and a downstream protection limitation may be appropriate in advance of the TMDL. The Pollutant Load Ratio Estimation Tool (PRESTO) model can be used for determining the contributions of phosphorus in the watershed- http://dnr.wi.gov/topic/surfacewater/presto.html. Questions on the PRESTO model may be submitted to:

   Theresa Nelson
   TMDL Modeler
   608-266-7037
   dnrwaterqualitymodeling@wisconsin.gov

   Timing is also an important factor when considering the need for downstream protection limitations in future TMDL watersheds. If the TMDL will be completed within the permit term, it may be appropriate to include limits based on local water quality until the TMDL is completed. If

the TMDL will not be completed for several permit terms, it may be appropriate to include downstream protection limitations in advance of the TMDL. Staff should use best professional judgment when making these decisions, factoring in the timing of the TMDL development strategy, the nonpoint source contributions to the impairment, and other site-specific factors.

If a TMDL is not being developed, modeling may also be appropriate to evaluate the need for downstream protection limitations outside of a TMDL watershed. It is not recommended to engage in modeling efforts in watersheds with TMDL in development to avoid duplicating work. There are several tools available to perform a lake modeling mass balance analysis. The BATHTUB model is one option that is recommended. BATHTUB is a steady-state water quality model that simulates eutrophication-related water quality conditions in lakes and reservoirs, and accounts for advective and diffusive transport as well as nutrient sedimentation. Required data types for the BATHRUB model include watershed characteristics, water and nutrient loads, lake/reservoir morphology, and observed water quality data. Model outputs include tabular and/or graphic displays of segment hydraulics, water and nutrient balances, and predictions of nutrient concentrations, transparency, and chlorophyll-a concentrations.

These analyses, as necessitated by limited staff time, must be done on a priority basis and done in accordance with work planning. High priority areas may include areas where WPDES permits are up for reissuance, areas where a number of WPDES permits would benefit from this evaluation, or areas that are close to or exceed applicable phosphorus water quality criteria. Dischargers or other third parties can also perform a lake modeling mass balance analysis and submit applicable results to the Department for consideration. In the absence of models, staff should use best professional judgment when making these decisions.

Example: A stream has an ambient phosphorus concentration of 60 µg/L and flows into a reservoir that is exceeding its phosphorus criteria of 40 µg/L. A TMDL is not scheduled to be completed within the next permit term, and the stream represents the majority of the phosphorus load to the reservoir. It is recommended that downstream protection limitations be included in the WDPES permit in this instance.

- **For discharges in the Great Lakes Basin**

  Presently, the open and nearshore waters of both Lake Michigan and Lake Superior are believed to be meeting their applicable TP criteria. Additionally, dilution modeling completed by Tetra Tech, in consultation with EPA and WDNR, indicate that phosphorus limitations for discharges to receiving waters upstream of Lake Michigan or Lake Superior should be based on local water quality concerns. These limitations are believed to be sufficiently protective of the Lake Michigan and Lake Superior at this time. If there is no applicable phosphorus criterion for the upstream water, downstream protection limitations may be appropriate. Best professional judgment should be used when making these decisions in consultation with the guidance below. Additional guidance to calculate limitations for Great Lakes discharges is also available in Section 2.01, p. 27.

- **The point source discharges to a limited aquatic life stream or wetland.**
  Presently, the criteria in s. NR 102.06, Wis. Adm. Code, do not apply to limited aquatic life (LAL) systems or wetlands [s. NR 102.06 (6) (d)]. These waters were not included in the USGS/WDNR stream and river studies and, therefore, the Department lacked the technical basis to determine and propose applicable criteria. At some time in the future, the Department may adopt phosphorus criteria based on new studies focusing on limited aquatic life waters and/or wetlands. During the interim, WQBELs should be based on the criteria and flow conditions for the next stream segment downstream (or downstream lake or reservoir, if appropriate).

  If a discharge to a LAL or wetland system has no potential to cause or contribute to an exceedance of the applicable water quality criteria in the downstream segment, phosphorus limits may not be required until phosphorus criteria for LAL and wetland systems has been promulgated. A discharger may submit in-stream phosphorus monitoring data and/or data analyses to the Department to support this conclusion. If insufficient data has been submitted to the Department or the data suggests that the discharge has an impact to the downstream water, limits will be included in the WPDES permit based on the criteria and flow conditions for the next stream segment downstream. All monitoring must be conducted consistent with the Department guidance on stream monitoring (see Section 4.01, p. 95, for details).

  There are several monitoring and data analyses strategies that can be used to make this determination. The Department and regulated community have flexibility in selecting any of the following options or developing new strategies to best represent specific site conditions. The Department and regulated community should consider the factors previously described in this Section when making this determination.

Chapter 2

Section 2.05: Relationship between WQBELs and TMDL-derived Limits

Author: Amanda Minks
Last Revised: October 8, 2013

There are two general methods expressed in Subchapter III of ch. NR 217, Wis. Adm. Code, to determine WQBELs for phosphorus. The first is through the methods described in s. NR 217.13, Wis. Adm. Code (see Section 2.01, p. 27). The second method is to derive a WQBEL based on the wasteload allocation for the facility identified in an EPA approved total maximum daily load (TMDL) analysis.

Section NR 217.16, Wis. Adm. Code, describes the relationship between an EPA approved TMDL for phosphorus and WQBELs for point source permits. It does not describe or direct how the wasteload allocation of the approved TMDL is developed or how it is expressed. Limit calculator staff should consult the individual TMDLs and "*TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs, Edition No. 2 (2013)"* to calculate and express TMDL-derived limits. TMDL implementation Guidance is available at http://dnr.wi.gov/topic/tmdls/implementation.html.

The TMDL Implementation Guidance also describes when to include s. NR 217.13 WQBELs in addition to or in lieu of TMDL-derived phosphorus limitations. As a general rule of thumb, discharges to impaired waters covered under the TMDL do not require s. NR 217.13 WQBELs. Again, refer to the TMDL Implementation Guidance for further detail.

Questions regarding TMDL implementation may be submitted to the TMDL Implementation Coordinator:

> Kari Fleming
> Kari.Fleming@Wisconsin.gov
> 608-267-7663

For a list of EPA approved TMDLs or TMDLs in development in Wisconsin, visit http://dnr.wi.gov/org/water/wm/wqs/303d/TMDL.html. Figure 2, p. 12, provides a visual of approved TMDLs and TMDLs in development at the time this Guidance was written.

Chapter 2

Section 2.06: Multiple Discharges

Author: Jim Baumann

Last Revised: November 23, 2011

Section NR 217.13 (6), Wis. Adm. Code, requires that when more than one discharge may be affecting the water quality of the same receiving water, the WQBELs are to be based on allocating the allowable discharge among the various dischargers based on site-specific considerations. Although the rule mentions the same receiving water, it is most important to use this option when the multiple discharges are impacting the same segment or reach of a river or stream. **The same rule requires the Department to notify all permittees and provide an opportunity for comment**. This section is not used when a TMDL is developed.

The intent of this section is to avoid to the extent practicable allocating the same assimilative capacity to multiple dischargers and to avoid allocating all or most of the assimilative capacity to an upstream discharger; leaving little or no assimilative capacity to a nearby downstream discharger. These situations are likely to occur when there are both industrial discharges of phosphorus and municipal wastewater discharges in the same community. These situations may also occur where neighboring communities all have their own wastewater treatment facilities.

An analysis of multiple dischargers is useful under any, some or all of the following conditions:

1. Phosphorus discharge mixing zones overlap or are likely to overlap.
2. The phosphorus concentration upstream of the first discharge is less than applicable criterion, indicating that there is an amount of assimilative capacity available. If the concentration upstream of the first discharge exceeds the criterion, no assimilative capacity is available, all of the discharges will have the WQBEL set equal to the criterion and a multiple discharge analysis is not useful.
3. Similar to number 1 above, the phosphorus concentration upstream of the first discharge is less than applicable criterion and the concentration upstream of the second discharge exceeds the criterion. This indicates that the upstream discharge may be using all of the assimilative capacity and there is no assimilative capacity for the downstream discharge.
4. Where it is not practicable to collect stream data between the outfalls or where there is incomplete mixing between the outfalls.
5. Where the downstream discharger requests the multiple discharge analysis and offers adequate justification for the analysis.

The conservation of mass equation in s. NR 217.13 (2), Wis. Adm. Code, should be used when the river or stream segment between the dischargers does not include significant impoundments/reservoirs or other features that reduce the transport of phosphorus. Situations with impoundments or reservoirs will require adjustments to the equation for the amount of phosphorus retained.

The multiple discharge analysis can be conducted where all of the discharges are initially grouped or as a series of calculations. Under the grouped analysis the effluent flow, Qe, used in the equation is the combined effluent flows from all of the dischargers. The 7-day Q_2 stream will not vary for those discharges in the group. The resulting WQBEL would then be a concentration that would be applicable for all of the discharges.

If the analysis is conducted as a series of calculations, a conservation of mass equation must be used to predict the in-stream concentration upstream from the second discharge and so on for all the discharges. The analysis may need to be repeated varying the upstream WQBEL. The steps in the analysis are as follows:

1. Calculate the WQBEL for the upstream discharge using the equation in s. NR 217.13, Wis. Adm. Code.

2. Use the WQBEL calculated in step one to predict a concentration upstream of the second discharge as follows:

$$C_{predicted} = (C_{upstream} * Q_{upstream} + WQBEL * Q_{effluent}) / (Q_{upstream} + Q_{effluent})$$

3. Calculate the WQBEL for the second discharge using $C_{predicted}$ and the equation in s. NR 217.13, Wis. Adm. Code.

Chapter 2

Section 2.07: New Discharges

Author: Amanda Minks

Last Revised: September 24, 2014

The term "New Discharger" is used in several subsections of chs. NR 217 and NR 207, Wis. Adm. Code, including:

- "New discharger means a point source which was not authorized by a WPDES permit as of December 1, 2010. A new discharger includes a relocation of an outfall to a different receiving water." [s. NR 217.11(3)] (emphasis added)

- "If a new discharger is proposing a discharge of phosphorus to a receiving or downstream water that is a phosphorus impaired water, the new discharger may not discharge phosphorus except as follows:
    - The new discharger of phosphorus is allocated part of the reserve capacity or part of the wasteload allocation in an EPA approved TMDL;
    - The new discharger can demonstrate the new discharge of phosphorus will improve water quality in the phosphorus impaired segment; or
    - The new discharger can demonstrate that the new phosphorus load will be offset through a phosphorus trade or other means with another discharge of phosphorus to the 303 (d) listed water. The offset must be approved by the Department and must be implemented prior to discharge. [s. NR 217.13(8)] (emphasis added)

- "The department shall include a water quality based phosphorus limitation in a permit for a new discharger if the department determines the new discharger will discharge phosphorus at concentrations or loadings which may cause or contribute to exceedances of the water quality criteria in s. NR 102.06 in either the receiving water or downstream waters. To estimate the amount of phosphorus discharged by a new discharger, the department may consider projected discharge information from the permit applicant and phosphorus discharge information from similar sources." [s. NR 217.15(1)(e)] (emphasis added)

- "Any new discharger may not receive a compliance schedule to achieve compliance with a phosphorus water quality based effluent limitation." [s. NR 217.17(4)] (emphasis added)

- "A new discharger may not receive approval for a variance under [NR 217.19] or pursuant to any other variance procedure." [s. NR 217.15(1)(e)] (emphasis added)

General Guidance

A discharge to any surface water that was not authorized in a WPDES permit prior to December 1, 2010, is considered a new discharger. This includes an existing discharge that is moved to a new receiving water. For purposes of implementing s. NR 217.15(1)(e), Wis. Adm. Code, moving a discharge downstream on the same water body is not considered a new discharger unless data shows this change could cause or contribute to an impairment downstream. Process changes that would impact effluent characteristics in addition to relocation of an outfall would constitute a new discharge, however.

New dischargers of phosphorus may be permitted to discharge to surface waters of the state that are not listed on the EPA approved 303(d) list for a phosphorus impairment if they do not have the potential to cause or contribute to phosphorus impairments. Department staff should consider the guidance in Section 2.04, p. 48, when determining if a new discharger has the potential to cause or contribute to a downstream phosphorus impaired water. Phosphorus limitations should be included in WPDES permits for the new discharger, if these limitations have the potential to be exceeded pursuant to Section 2.02, p. 32. These limitations shall be calculated using the procedures in Section 2.01, p. 27, unless the new discharger is to an exceptional resource water. In this case water quality based effluent limitations shall be set equal to the existing levels of these substances upstream of, or adjacent to, the discharge site. An alternative methodology for calculating phosphorus limitations to exceptional resource waters is authorized in s. NR 207.03(4)(a), Wis. Adm. Code, if the new discharger is needed to prevent or correct either an existing surface or groundwater contamination situation, or a public health problem. New dischargers are not authorized to receive compliance schedules to provide them time to meet these limitations, nor are they able to request a variance to these limits pursuant to ss. NR 217.17(4) and NR 217.19, Wis. Adm. Code, and s. 283.15 (4) (a) 1. f., Wis. Stats. In some cases it may be appropriate to provide a couple of months in the permit after start up to work out operational issues, before the final limit applies.

A new discharger of phosphorus to a phosphorus impaired water may not be permitted unless: 1) it is allocated in the reserve capacity of an EPA approved TMDL; 2) the discharger will improve the phosphorus water quality; or 3) a trade or other means of offsetting the phosphorus contained in the discharge has been implemented prior to initiating the discharge. An online impaired waters database is available at http://dnr.wi.gov/water/impairedSearch.aspx to search for phosphorus impaired waters. Guidance for each of these options is described below:

1. **The new discharger is allocated part of the reserve capacity or part of the wasteload allocation of an EPA approved TMDL [(NR 217.13(8)(a), Wis. Adm. Code)];**

Guidance: DNR or a third party can develop a TMDL. TMDLs must be reviewed and approved by DNR and EPA before the new discharger can utilize either the reserve capacity or wasteload allocation to initiate the discharge. Additionally, a WPDES permit must be issued to the new discharger before the discharge can be initiated. This permit must include TMDL-derived limitations consistent with the use of the reserve capacity. If reserve capacity is used to authorize the new discharger, the TMDL project

manager should be notified and the use should be tracked to avoid possible over-allocation of the reserve capacity in the future. Visit http://dnr.wi.gov/topic/tmdls/ for the list of approved TMDLs.

2. **The discharger will improve the phosphorus water quality [(NR 217.13(8)(b), Wis. Adm. Code)]; or**

Guidance: To show an improvement in water quality DNR and EPA expect that the new discharger will demonstrate that its discharge will result in a decrease in the phosphorus concentration or loading in the receiving water. Two methodologies are recommended for making this type of demonstration: (a) perform an analysis showing that water quality criteria is being improved or attained, or (b) discharge at an effluent concentration well below the criteria. The new discharger has discretion in selecting a method. If the permittee chooses to perform an analysis, the permittee is responsible for submitting sufficient analysis through modeling and monitoring demonstrating that the discharge will reduce in-stream phosphorus concentrations with a goal of attaining water quality criteria. The modeling analysis should quantify sources of phosphorus on a mass basis similar to a TMDL analysis. The permittee should contact the DNR Statewide TMDL Development Coordinator prior to initiating the analysis to discuss requirements.

In lieu of an analysis, the facility may choose to discharge phosphorus well below the criteria. The intent is not that the new discharge will cause or contribute to an existing impairment, rather, that the discharge will actually improve water quality. The policy of established effluent limitations well below the applicable phosphorus criteria for new dischargers is supported in EPA's approval letter of NR 217 (dated 7/25/2012).

It is recommended that effluent phoits be established at concentrations approaching reference conditions to ensure that the new discharger is well below the criteria. EPA typically defines reference conditions for nutrients as the best 25th percentile of all data or the upper 75th percentile for a subset of sites thought to be minimally impacted by anthropogenic activities (U.S. Environmental Protection Agency, 2000). These sites were identified and used to establish Wisconsin's phosphorus water quality standards, and are described at Robertson and others (2006), Robertson and others (2008), and the *Technical Support Document* (2010). The analyses used to quantify phosphorus concentrations from these reference sites is briefly summarized below.

Two regionalized schemes are laid out in Roberston and others (2006) to quantify phosphorus concentrations in reference conditions: 1) level III ecoregions, and 2) environmental phosphorus zones (EPZ), which are largely driven by inherent soil types (see Figure 3 below). These approaches divide Wisconsin into groups based on either the ecological characteristic of Wisconsin (i.e., ecoregion approach) or by the soil types and land uses of Wisconsin (EPZ approach). Within each group, biological, and phosphorus reference conditions were quantified by collecting in-stream data at reference sites pursuant to EPA's definition. These in-stream phosphorus data were then analyzed using a multiple linear-regression approach with upper 95% confidence limits. The results from these analyses are summarized below for guidance purposes.

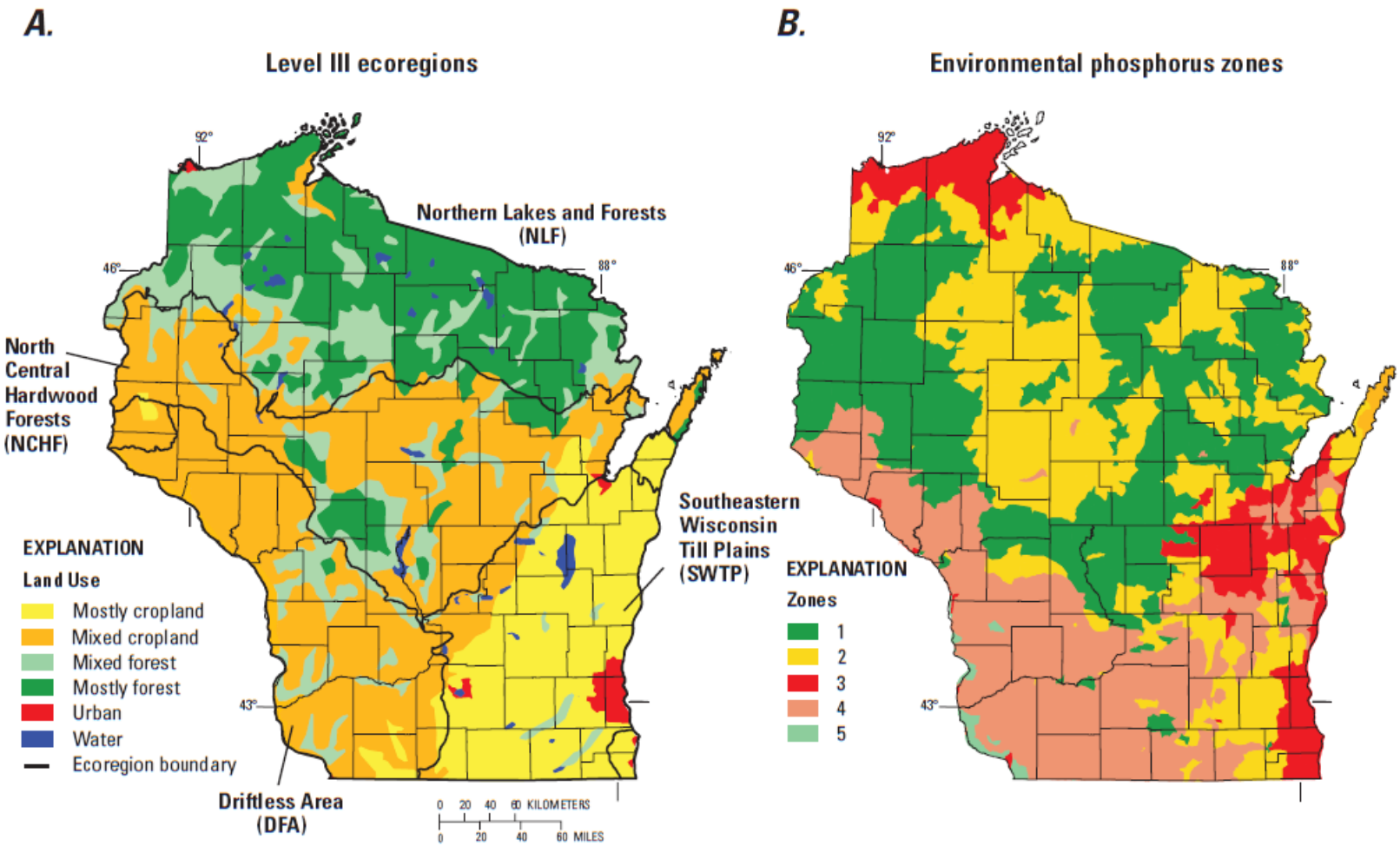

Figure 3. Two regionalization schemes for consideration: A., level III ecogions (Omernik and other, 2000) with major land-use/land-cover categories (Lillesand and others, 1998) and B, environmental phosphorus zones (Robertson et. al., 2006).

Table 7. Estimated phosphorus concentrations in level III ecoregions using a multiple linear-regression approach with upper 95% confidence limits, as illustrated in Figure 1A.

Region	U.S. EPA Recommendation (mg/L)
North Central Hardwood Forests	0.060
Driftless Area	0.057
Southeastern Wisconsin Till Plains	0.044
Northern Lakes and Forests	0.036

Table 8. Estimated phosphorus concentrations in environmental phosphorus zones (EPZ) using a multiple linear-regression approach with upper 95% confidence limits, as illustrated in Figure 1B.

EPZ	Reference TP Concentration (mg/L)
EPZ 1	0.039
EPZ 2	0.054
EPZ 3	0.043
EPZ 4	0.055

By comparing Table 1 and 2, phosphorus targets can be inferred for the purposes of establishing phosphorus limitations near background concentrations and well below the criteria. Another piece of evidence to consider when calculating these limits is the impacts of excess phosphorus on benthic chlorophyll *a* in streams, and suspended chlorophyll *a* in rivers and other waterbody types. EPA has consistently promoted the use of primary producers to set numeric nutrient targets for surface waters, and benthic chlorophyll *a* and suspended chlorophyll *a* are key parameters Wisconsin used to derive our phosphorus criteria and achieve this recommendation. As illustrated in Robertson et. al. (2006) and Robertson et. al. (2008), the response of benthic chlorophyll *a* to phosphorus in streams is at 39 µg/L, and the response of suspended chlorophyll *a* to phosphorus in rivers is at 64 µg/L. To promote consistency with EPA guidance and Wisconsin's phosphorus criteria, it is recommended that suspended/benthic chlorophyll *a* break points be considered in addition to the ecoregion and EPZ data when establishing effluent limitations for new dischargers well below the applicable phosphorus criteria.

There are several options for interpreting the above data. The recommended approach is to set the applicable phosphorus limitation equal to highest reported value from the U.S. EPA recommendation, EPZ, and breakpoint approach for the receiving water in question. For example, Black Creek in Marathon County is a phosphorus impaired water, with a watershed largely falling within the North Central Hardwood Forests (NCHF) ecoregion, and EPZ2. Black Creek is defined as a stream pursuant to s. NR 102.06, Wis. Adm. Code, making benthic chlorophyll *a* the appropriate primary production parameter. Given the information above, the phosphorus targets for this waterbody are: NCHF = 60 µg/L , EPZ2 = 54 µg/L, and benthic chlorophyll *a*=39 µg/L. It is therefore recommended that the phosphorus concentration limitation be set equal to 60 µg/L for new discharges to Black Creek. It is noted that the actual median reference P concentrations pose substantially lower targets (25 and 29 µg/L) when compared to the data above, which was derived using the 95th percentile approach.

Once a concentration limitation has been calculated for the new discharger, mass limitations also need to be calculated pursuant to s. NR 217.14(1)(a)(3), Wis. Adm. Code. To calculate mass limitations, the projected effluent flow as defined in s. NR 217.13(2)(c), Wis. Adm. Code should be used. See Section 2.03, p. 38, for additional guidance on calculating mass limits.

3. **A trade or other means of offsetting the phosphorus contained in the discharge has been implemented prior to initiating the discharge [(NR 217.13(8)(c), Wis. Adm. Code)].**

Guidance: A new discharger can demonstrate that the new phosphorus load will be offset through a phosphorus trade with another discharge(s) of phosphorus. This offset could be the difference between the mass of the proposed phosphorus discharge and a zero mass discharge. Trading may also be used to comply with s. NR 215.13(8)(a) or (b), Wis. Adm. Code. In these trading situations, the mass of the proposed discharge and the applicable effluent limit derived under s. NR 217.13(8)(a) or (b), Wis. Adm. Code. Department staff should use best professional judgment when calculating the amount of offset necessary to demonstrate an improvement in water quality for the specific situation. All trades must be consistent with DNR water quality trading guidance, available at http://dnr.wi.gov/topic/SurfaceWater/WaterQualityTrading.html. Additionally, the new discharger must be issued a WPDES permit with an approved water quality trading plan, and trading requirement incorporated in the permit, prior to discharge initiation.

Reference:

Robertson, D. M., Graczyk, D. J., Garrison, P. J., Wang, L., LaLiberte, G., and Bannerman, R., "Nutrient Concentrations and Their Relations to the Biotic Integrity of Wadeable Streams in Wisconsin", USGS Professional Paper 1722, 2006.

Robertson, D. M., Weigel, B. M., Graczyk, D. J., "Nutrient Concentrations and Their Relations to the Biotic Integrity of Nonwadeable Rivers in Wisconsin", USGS Professional Paper 1754, 2008.

U.S. Environmental Protection Agency, 2000a, Nutrient criteria technical guidance manual—lakes and reservoirs: Office of Water, EPA–822–B–00–001, 238 p.

Chapter 3- Implementation Procedures

The purpose of this Chapter is to provide Department staff with general guidance on implementing phosphorus limitations in WPDES permits. Chapter 3 is meant to describe implementation options specified in ch. NR 217, Subchapter III, and provide guidance on issuing permits with phosphorus WQBELs. Site-specific evaluations must be made when implementing these procedures in WPDES permits.

Additionally, some facilities may have distinctive features that are not easily accounted for in this general Guidance. In these situations it may be prudent to work with the facility and other staff to identify reasonable implementation procedures.

Chapter 3

Section 3.01: Compliance Schedules

Author: Tom Mugan and Mary Ryan
Last Revised: December 1, 2013

First Permit Term Following Rule Promulgation

At the time of permit application, many permittees will not know the best alternative for achieving compliance with a phosphorus WQBEL until the permittee has gone through facility planning. Even those for whom TMDL limits have been set will have had little time to determine their best alternative for meeting those limits. Additionally, phosphorus has many novel implementation options such as adaptive management and water quality trading, that facilities have not had time to consider. Therefore, selection of options to most cost-effectively meet water quality standards may, in many cases, be done during the term (or terms) of the permit. We may reissue permits with the WQBELs as calculated under s. 217.13, Wis. Adm. Code, or as set by a TMDL and include compliance schedules that require permittees to either: a) meet those limits during the term of the permit, or b) require permittees to implement source reduction measures and evaluate compliance alternatives for meeting the final phosphorus WQBEL, if the WQBEL or a recalculated WQBEL, is not scheduled to become effective until future permit terms. These compliance alternatives include:

- Operational changes to meet a WQBEL
- Construction to meet a WQBEL
- Adaptive management as specified in s. NR 217.18, Wis. Adm. Code
- Water quality trading

The flexibility of this process will help provide the Department with time to process permits without the need to delay permit reissuance or modify permits to react to new information received during the permit term.

As we get several years into rule implementation, we will likely need to revise this guidance to reflect what we have learned. The need for a compliance schedule and the length of time allowed in a schedule will depend on individual circumstances. Section NR 217.17, Wis. Adm. Code, provides criteria for compliance schedules, factors that will help determine the length of compliance schedules, and requirements on the content of compliance schedules.

The compliance schedule must lead to compliance as soon as possible. The rules allow compliance schedules of up to 7 or 9 years in cases where a significant upgrade is needed to meet a restrictive limit (must be determined necessary and appropriate by the permit drafter or basin staff person consistent with s. NR 217.17, Wis. Adm. Code). The permit fact sheet should contain a statement concerning the capability of the current plant to meet the WQBEL and a brief discussion that the compliance schedule proposed in the permit is the appropriate length, considering the individual circumstances.

If a significant treatment system upgrade will likely be needed to meet a stringent phosphorus WQBEL and accordingly, the permit drafter or basin staff person determines an extended compliance schedule is necessary and appropriate (a schedule that goes beyond 5 years), the permittee may be interested in pursuing either the adaptive management approach or water quality trading. See Appendix A, p. 110, for additional information about these compliance options. In cases where an upgrade is needed to meet the limit, the permittee will need to develop an engineering design report (and a facility plan if required pursuant to ch. NR 110, Wis. Adm. Code) during the term of the first permit and determine whether one of the implementation options mentioned above will be explored. If these options are not selected, the facility will be responsible to achieve the final WQBEL by the end of the compliance schedule.

The facility planning/engineering design process below draws upon experiences of WDNR's municipal and industrial plan review staff on actions and time frames needed to evaluate alternatives in planning cost-effective solutions for plant construction or other alternatives to meet water quality. Initial steps are fairly standard for an engineering evaluation of current facility capabilities and the start of upgrade planning, and usually do not require that the permittee obtain the services of an engineering consultant. Subsequent steps draw upon the results of initial steps in the process and the guidance branches to several general tracks. The specific tracks may dictate actions that will be difficult for some permittees to perform without outside expertise. In setting compliance schedules, permits staff should do their best to predict outcomes that will affect future requirements so as to minimize the need for future permit modifications. We anticipate our experience will help future work in this area.

The terminology used below is generic so it applies to both municipal and industrial systems, although some of the standard facility planning terms used for municipal systems are primarily used. The Department recognizes that industrial systems have mechanisms, such as manufacturing process changes, to control discharge levels besides what happens at the wastewater treatment plant. Staff should consider specific situations when interpreting how to apply this guidance when setting permit conditions.

Permit Reissuance Process (first reissuance following rule promulgation):

1. The permittee completes and submits the permit application

   - Some amount of effluent phosphorus data will be available for purposes of determining the need for limits
   - The permittee will likely not know which solution or option it will pursue to meet water quality. However, in unusual circumstances, the permittee may already know if it wishes to pursue alternatives such as adaptive management (AM), a variance or water quality trading (WQT). The permit reissuance application may include an application for AM, an application for a variance or a WQT agreement.

2. The Department Limits Calculator determines applicable final phosphorus limits (TBEL or WQBEL, and accounting for TMDLs). See Chapter 2, p. 26, for details on calculating phosphorus limits.

3. The Limits Calculator or other permits staff person determines if the existing facility, as currently operated, can already meet final limits.

Note: It is not necessary that a study of possible operational improvements be conducted as part of the application process. This can be included as a first step of the compliance schedule.

- If the permittee can already meet the limit – No compliance schedule is allowed
- If the permittee can't consistently meet the limit – A compliance schedule is allowed

4. If the Department is approving an AM plan or WQT agreement at this time (see separate guidance on adaptive management and water quality trading or Appendix A, p. 110, of this Guidance), but plans haven't yet been implemented, reissue the permit with appropriate implementation requirements and appropriate numeric effluent limitation (see s. NR 217.18 (3)(e), Wis. Adm. Code).

5. If the Department is not approving an AM plan or WQT agreement at this time, include final limits, and if allowed and necessary, a compliance schedule and interim limits. If final limits are to become effective beyond the term of the permit, the limits must still be stated in the permit [s. NR 217.17 (3) (e), Wis. Adm. Code], even though they have a delayed effective date.

6. Interim effluent limits must be required in the permit [s. NR 217.17(3)(c), Wis. Adm. Code] whenever a compliance schedule is granted. See Section 2.03, p. 38, for details on calculating and expressing interim limits.

General Guidelines on Determining Appropriate Length of Compliance Schedule

Prior to issuing a compliance schedule, the Department must use the available information to determine if the schedule of compliance 1) will lead to compliance with the phosphorus WQBEL as soon as possible, and 2) is appropriate and necessary because the permittee cannot immediately achieve compliance with the WQBEL based on existing operation of its treatment facility. Statements of the factual information used and the determinations should appear in the permit fact sheet.

When determining whether the compliance schedule will bring the permittee into compliance "as soon as possible", the Department must consider the steps needed and time necessary for each step to achieve compliance. As previously stated, many permittees will not have had time to review compliance options and will determine the best compliance option during facility planning. Therefore, the Department feels that, in many cases, it will be appropriate to grant time in the compliance schedule to review compliance options and alternatives. As phosphorus implementation continues, the Department will expect facilities to begin this evaluation prior to permit reissuance, assuming that the discharger has already had time to evaluate applicable compliance options.

The number of steps in a compliance schedule and the amount of time required to achieve these steps will likely be proportional to the stringency of the final WQBEL. In reviewing current effluent data and available technology, the Department considers limits less than 0.6 mg/L for mechanical plants or less than 1.5 mg/L for ponds and lagoons to be stringent limits, as a rule of thumb. Department staff must review this "rule" and make a case-by-case determination, if the final WQBEL is indeed "stringent". In most cases the facility upgrades required to meet these limits will be extensive, and extended compliance schedules are warranted to give facilities time to consider their options and obtain the financial resources required for the plant upgrade. On the other spectrum, some facilities will only require slight operational changes to achieve compliance. In these cases, the compliance schedules will be brief in order to allow time for these slight operational adjustments to be made.

The following are examples compliance schedules that represent the maximum time available to achieve compliance. The Department sets and reviews compliance schedules on a case-by-case basis. Facilities may or may not be granted the maximum compliance schedule. Permit staff may use these as compliance schedule templates with sample steps and suggested time intervals. Individual circumstances should be considered in deciding to use these as is, or to tailor or mix-and-match them for use in permit drafting. As of December 2012, the compliance schedule template for stringent phosphorus limits was updated per EPA's recommended language. Their recommendations are incorporated into the following information.

Setting Permit Compliance Schedules for Stringent Limits and How We Expect Facility Planning to Proceed

As a rule of thumb, limits less than 0.6 mg/L for mechanical plants or less than 1.5 mg/L for ponds and lagoons are considered to be stringent limits.

1. **Time = 0 ← Permit Reissued**

   During the first year, allow for preparation of an Operational Evaluation Report (also known as an **Operation and Needs Review (ONR) study** for municipal entities**)**. This includes evaluation of collected data and identification of source reduction measures and operational changes or minor miscellaneous facility enhancements, as well as an implementation plan and schedule. If a previously conducted facility planning study, or municipal Operation and Needs Review (ONR)study has recently been completed there may be no need to allow time for another study. This means the time schedule for the following items would move ahead 1 year.

   Note: The goal of the Operational Evaluation is to find out if final limits can be met by simply making operational or other minor facility changes. If the permittee cannot meet the final phosphorus limits, the permittee shall initiate a study of feasible alternatives for meeting the

final limits.

2. **12th month ← Obtain Department Acceptance of a submitted Operational Evaluation**

If a Department accepted Operational Evaluation Report concludes only operational improvements are necessary to meet final limits, then the permittee is not required to conduct an evaluation of compliance alternatives, and the operational improvements must be implemented according to a schedule to be contained in the accepted operational evaluation report. In accordance with s. NR 217.17 (1) (a) 1, Wis. Adm. Code, the schedule should ensure the operational improvements are implemented "as soon as possible". Permit staff will send a letter to the permittee stating that limits will become effective on the date called for in the Department- accepted Operational Evaluation Report. If the Department accepted Operational Evaluation Report concludes the permittee cannot achieve final phosphorus limits, the permittee shall initiate a study of feasible alternatives for meeting the final phosphorus limits.

Initiate a Study of Feasible Compliance Alternatives-(if determined necessary by the Operational Evaluation Report). The permittee may consider options such as industrial process changes, facility upgrading, consolidation with other sewerage systems, and alternative discharge locations. If a permittee is interested in pursuing an AM or WQT, the permittee should study these options as part of the engineering design process and/or facility planning process as applicable, or if the permittee is not pursuing these options, the permittee should provide a brief explanation as to why these options aren't feasible. If an AM plan is to be evaluated, the information required by ss. NR 217.18(2) (a), (b) and (c), Wis. Adm. Code, should be submitted with the planning limits request to make a preliminary determination if the applicant qualifies for an AM plan

Note: The Department guidance for planning limit requests will be revised to address this option.

Note: Early on (within 1st year) of the study on feasible compliance alternatives the permittee might need to request planning effluent limits, if they may differ from final effluent limits calculated prior to permit reissuance, in accordance with current Department guidance and procedures. The Department might prepare a Planning Limits Memo that would include revised limits for newly proposed design flows or discharge locations and attempts to explain any possible future permit limit changes expected for the appropriate planning period.

Note: For municipal facilities, a two year time period from the start of facility planning to the submittal of the facility plan should be used as the normal time period for a typical facility upgrade but the total time allowed for facility planning can be adjusted based on consideration of factors as listed in s. NR 217.17(1), Wis. Adm. Code. For example, if the phosphorus limit will be less than 0.6 mg/L, this might require a more extensive engineering study and in accordance with the factor described in s. NR 217 (1)(b)4, Wis. Adm. Code, the compliance schedule may be extended. It is recommended this extension be no more than 6 additional months in order to allow the approved facility plans to be considered as part of the next permit reissuance. If the schedule is extended the associated following action dates could be set back accordingly.

Note: The purpose of the ONR is to determine if final limits can be met by simply making operational or other minor facility changes

3. **24th month ←** Permittee submits Status Report on evaluation of compliance alternatives and on progress implementing source reduction measures, operational improvements and minor facility modifications to optimize phosphorus reductions, and to the extent that such measures will not enable compliance with the final phosphorus limit.

4. **36th month ← Permittee submits a preliminary compliance alternatives plan**

   If the Preliminary Compliance Alternatives plan concludes upgrading of the permittee's wastewater treatment facility is necessary to achieve the final phosphorus limits, the submittal shall include a preliminary engineering design report. Communication between the facility and/or its consultant continues during this period.

   If the plan concludes Adaptive Management will be used, the submittal shall include a completed Watershed Adaptive Management Request Form 3200-139 without the Adaptive Management Plan.

   If water quality trading will be undertaken, the plan must state that trading will be pursued.

5. **48th month ← Permittee submits Final Compliance Alternatives Plan for Department Approval**

   The approval may be for a facility upgrading and/or a tentative approval for an AM plan [approval as referenced in s. NR 217.18(2), Wis. Adm. Code], or a WQT plan. Any AM plan would include an engineering assessment of whether existing facilities can meet an interim limit of 0.6 mg/L P. If WQ Trading will be used, the submittal shall identify potential trading partners.

   If proposed upgrading, the submittal shall include a final engineering design report and a facility plan if required pursuant to ch. NR 110, Wis. Adm. Code.

   If the final Compliance Alternatives Plan concludes that a variance will be pursued, the Plan shall provide information regarding the basis for the variance.

   Start WPDES Permit Reissuance Application Process for next permit term: Based on results of the Final Compliance Alternatives Plan, the permittee might request a s. NR 217.19, Wis. Adm. Code, lagoon variance (or a s.283.15, Stats. variance) or the AM option with the next permit reissuance. At this time, the Department might be deciding to propose to implement an AM or WQT agreement into the next permit term.
   Submit the Permit Application (6 Months Prior to Permit Expiration): The permittee must submit the permit application at least 6 months prior to permit expiration. If the permittee intends to pursue adaptive management, a completed Watershed Adaptive Management Request Form 3200-139 is required along with a completed Adaptive Management Plan. If the permittee intends to

pursue pollutant trading, an application for water quality trading is required. If the permittee intends to seek a variance, the permittee shall submit an application for a variance.

6. **60th month ← Submit Progress Report on Construction Plans and Specifications (if the approved plan includes any facility upgrading)**

7. **60th month ← Finalize Permit Reissuance Process (reply to public comments and complete the 'Notice of Final Determination')**

8. **60th month ← Reissue Permit (Second term following rule promulgation)** with appropriate phosphorus limits and a compliance schedule(s).

   Note: Refer to AM Technical Handbook for additional terms and conditions.

   Compliance Schedule – If upgrading is proposed, include the **established dates for the "Final Plans and Specifications" (72 months), "Treatment Plant Upgrade to Meet WQBELs" (75 months), Progress Reports (as needed) and facility construction completion and startup**.

   If an AM or WQT plan is proposed the permit should include an implementation schedule for specific plan elements or actions. If an AM plan is being implemented, then the interim limit of no greater than 0.6 mg/L (six month average) is applicable. An interim limit may also be applicable for this permit term [a short-as-possible compliance schedule(s) to meet the limits may be allowed]. Per s. NR 217.18 (3) (e) 2, Wis. Adm. Code, the schedule to meet the interim, 0.6 mg/L limit may not exceed 5 years.

   If a facility upgrading is proposed that doesn't include construction of filtration or a similar upgrade, the proposed effective date for meeting the P limit should be no more than 2 years into the new permit term (84th month). This complies with the maximum schedule of 7 years as allowed by s. NR 217.17(2), Wis. Adm. Code. If the upgrade includes filtration or similar extensive upgrading, the schedule may be extended to up to two more years [up to 9 years as allowed by s. NR 217.17(2), Wis. Adm. Code].

9. **84th to 108th month (24th to 48th of new term) ← Meet new P limit (if facility upgrading is needed)**

10. **108th month ← Permit Application Process**

    If AM plan is being implemented, the limits would be re-calculated with new receiving water data. If water quality standards are not being achieved [s. NR 217.18 (3)(e)3, Wis. Adm. Code], the permit may be reissued provided a revised AM plan is submitted and accepted by the Department prior to the permit reissuance.

Note: See AM Technical Handbook for further details.

11. 120th month ← Reissue Permit (3rd permit term following rule promulgation)

If an updated AM is proposed the permit should include an implementation schedule for specific plan elements or actions. The interim limit of 0.5 mg/L (six-month average). A 1 mg/L monthly average would also be applicable for this permit term. Per s. NR 217.18(3)(e)3, Wis. Adm. Code, a compliance schedule to meet the 0.5 mg/L limit may not exceed 5 years.

Note: See AM Technical Handbook for further details.

12. 180th month ← Reissue Permit (3nd term after AM plan approval)

If an updated AM is proposed the permit should include an implementation schedule for specific plan elements or actions. Interim limits will also be included in the reissued WPDES permit. A compliance schedule to meet these limits may also be included in the permit if necessary, not exceed 5 years.

Note: See AM Technical Handbook for further details.

13. 240th month ← Reissue Permit (4th term after AM plan approval)

If water quality standards are still not being attained as a result of AM plan measures, the permit would be issued with a requirement and schedule to meet the final limit. A compliance schedule for measures other than an AM plan would be required. The compliance schedule for the water quality based effluent limit may not exceed five years [s. NR 217.18(3)(e)4, Wis. Adm. Code].

Note: See AM Technical Handbook for further details.

<u>Example 1</u>: Phosphorus Compliance Schedule (stringent limits)

Water Quality Based Effluent Limits (WQBELs) for Total Phosphorus

The permittee shall comply with the WQBELs for Phosphorus as specified. No later than 30 days following each compliance date, the permittee shall notify the Department in writing of its compliance or noncompliance. If a submittal is required, a timely submittal fulfills the notification requirement.

Steps/Actions	Due Date (after reissuance)
Operational Evaluation Report: The permittee shall prepare and submit to the Department for approval an operational evaluation report. The report shall include an evaluation of collected effluent data, possible source reduction measures, operational improvements or other minor facility modifications that will optimize reductions in phosphorus discharges from the treatment plant during the period prior to complying with final phosphorus WQBELs and, where possible, enable compliance with final phosphorus WQBELs by [ENTER DATE (36 MONTHS FROM REISSUANCE)]. The report shall provide a plan and schedule for implementation of the measures, improvements, and modifications as soon as possible, but not later than [ENTER DATE (36 MONTHS FROM REISSUANCE)] and state whether the measures, improvements, and modifications will enable compliance with final phosphorus WQBELs. Regardless of whether they are expected to result in compliance, the permittee shall implement the measures, improvements, and modifications in accordance with the plan and schedule specified in the operational evaluation report. If the operational evaluation report concludes that the facility can achieve final phosphorus WQBELs using the existing treatment system with only source reduction measures, operational improvements, and minor facility modifications, the permittee shall comply with the final phosphorus WQBEL by [ENTER DATE (36 MONTHS FROM REISSUANCE)] and is not required to comply with the milestones identified below for years 3 through 9 of this compliance schedule ('Preliminary Compliance Alternatives Plan', 'Final Compliance Alternatives Plan', 'Final Plans and Specifications', 'Treatment Plant Upgrade to Meet WQBELs', 'Complete Construction', 'Achieve Compliance'). STUDY OF FEASIBLE ALTERNATIVES - If the Operational Evaluation Report concludes that the permittee cannot achieve final phosphorus WQBELs with source reduction measures, operational improvements and other minor facility modifications, the permittee shall initiate a study of feasible alternatives for meeting final phosphorus WQBELs and comply with the remaining required actions of this schedule of compliance. If the Department disagrees with the conclusion of the report, and determines that the permittee can achieve final phosphorus WQBELs using the existing treatment system with only source reduction measures, operational improvements, and minor facility modifications, the Department may reopen and modify the permit to include an implementation schedule for achieving the final phosphorus WQBELs	12 months

sooner than [ENTER DATE (108 MONTHS FROM REISSUANCE).	
Compliance Alternatives, Source Reduction, Improvements and Modifications Status: The permittee shall submit a 'Compliance Alternatives, Source Reduction, Operational Improvements and Minor Facility Modification' status report to the Department. The report shall provide an update on the permittee's: (1) progress implementing source reduction measures, operational improvements, and minor facility modifications to optimize reductions in phosphorus discharges and, to the extent that such measures, improvements, and modifications will not enable compliance with the WQBELs, (2) status evaluating feasible alternatives for meeting phosphorus WQBELs.	24 months
Preliminary Compliance Alternatives Plan: The permittee shall submit a preliminary compliance alternatives plan to the Department. If the plan concludes upgrading of the permittee's wastewater treatment facility is necessary to achieve final phosphorus WQBELs, the submittal shall include a preliminary engineering design report. If the plan concludes Adaptive Management will be used, the submittal shall include a completed Watershed Adaptive Management Request Form 3200-139 without the Adaptive Management Plan.	36 months
Final Compliance Alternatives Plan: The permittee shall submit a final compliance alternatives plan to the Department. If the plan concludes upgrading of the permittee's wastewater treatment is necessary to meet final phosphorus WQBELs, the submittal shall include a final engineering design report addressing the treatment plant upgrades, and a facility plan if required pursuant to ch. NR 110, Wis. Adm. Code. If the plan concludes Adaptive Management will be implemented, the submittal shall include a completed Watershed Adaptive Management Request Form 3200-139 and an engineering report addressing any treatment system upgrades necessary to meet interim limits pursuant to s. NR 217.18, Wis. Adm. Code. If the plan concludes water quality trading will be used, the submittal shall identify potential trading partners. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	48 months
Progress Report on Plans & Specifications: Submit progress report regarding the progress of preparing final plans and specifications. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	60 months
Final Plans and Specifications: Unless the permit has been modified, revoked and reissued, or reissued to include Adaptive Management or Water Quality Trading measures or to include a revised schedule based on factors in s. NR	72 months

217.17, Wis. Adm. Code, the permittee shall submit final construction plans to the Department for approval pursuant to s. 281.41, Stats., specifying treatment plant upgrades that must be constructed to achieve compliance with final phosphorus WQBELs, and a schedule for completing construction of the upgrades by the complete construction date specified below. (Note: Permit modification, revocation and reissuance, and reissuance are subject to s. 283.53(2), Stats.) Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	
Treatment Plant Upgrade to Meet WQBELs: The permittee shall initiate construction of the upgrades. The permittee shall obtain approval of the final construction plans and schedule from the Department pursuant to s. 281.41. Stats. Upon approval of the final construction plans and schedule by the Department pursuant to s. 281.41, Stats., the permittee shall construct the treatment plant upgrades in accordance with the approved plans and specifications. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	75 months
Construction Upgrade Progress Report #1: The permittee shall submit a progress report on construction upgrades. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	
Construction Upgrade Progress Report #2: The permittee shall submit a progress report on construction upgrades. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	
Complete Construction: The permittee shall complete construction of wastewater treatment system upgrades. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit.	84 to 108 months
Achieve Compliance: The permittee shall achieve compliance with final phosphorus WQBELs. Note: See 'Alternative Approaches to Phosphorus WQBEL Compliance' in the Surface Water section of this permit	84 to 108 months (Should be one month after construction completion)

For any compliance schedule date in the above (or below) schedule that does not include a submittal to the Department, or any date that is missed by 30 days or more, the permittee shall notify the Department in writing within 30 days of the scheduled date of its compliance or non-compliance with the scheduled requirement. If any interim requirement will take more than one year to complete, the permittee shall also include a projected completion date for the interim requirement.

Note: The purpose of the Operational Evaluation is to determine if final limits can be met by simply making operational or other minor facility changes. The purpose of the optimization plan is to reduce as much as possible the levels going out.

Setting Permit Compliance Schedules for Less Stringent Limits and How We Expect Facility Planning to Proceed

As a rule of thumb, limits equal to or greater than 0.6 mg/L for mechanical plants or greater than about 1.5 mg/L for ponds and lagoons are considered to be less stringent limits.

1. **Time = 0 ← Permit Reissued**

   During the first year, allow for an Operational Evaluation (also known as an **Operation and Needs Review (ONR) study** for municipal entities**)**. This includes evaluation of collected data, identification of source reduction measures, and operational changes or minor miscellaneous facility enhancements, as well as an implementation plan and schedule for optimizing removal of phosphorus. If a previously conducted facility planning study, or ONR study, has recently been completed there may be no need to allow time for another study. This means the time schedule for the following items would move ahead 1 year.

   Note: The goal of the ONR (or Operational Evaluation) is to find out if simply making operational or other minor facility changes can meet final limits.

2. **12th month ← Obtain Department Acceptance of a submitted Operational Evaluation or ONR Study**

   If a Department accepted study concludes only operational improvements are necessary to meet final limits, then no subsequent facility planning is required, and the operational improvements must be implemented according to a schedule to be contained in the accepted operational study report. In accordance with s. NR 217.17 (1) (a) 1, Wis. Adm. Code, the schedule should ensure the operational improvements are implemented "as soon as possible". Permits staff will send a letter to the permittee stating that limits will become effective on the date called for in the Department-accepted Operational Study Report or ONR.

   Start Facility Planning Study (if determined necessary by the Operational Evaluation or ONR). The planning process may consider options such as process changes, facility upgrading, consolidation with other sewerage systems, and alternative discharge locations. If a permittee is interested in pursuing AM (unlikely with limits above 0.6 mg/L) or WQT, the permittee should study these alternatives as part of facility planning. If an AM plan is to be evaluated, the information required by ss. NR 217.18(2) (a), (b) and (c), Wis. Adm. Code, should be submitted with the planning limits request to make a preliminary determination if the applicant qualifies for an AM plan.

   Note: the Department guidance for planning limit requests will be revised to address this option). Because one of the adaptive management eligibility requirements is "filtration or equivalent technology to meet the WQBEL", many facilities with less stringent limits will not be eligible for adaptive management (s. NR 217.18(c), Wis. Ad. Code).

   Note: Early on (within 1st year) of the planning study the permittee might need to request planning effluent limits, if they may differ from final effluent limits calculated prior to permit reissuance, in accordance with current Department guidance and procedures. The Department might prepare a

Planning Limits Memo that would include revised limits for newly proposed design flows or discharge locations and attempts to explain any possible future permit limit changes expected for the appropriate planning period.

Note: For municipal facilities, a one year time period from the start of this type of targeted facility planning to the submittal of the facility plan should be used as the normal time period for a typical facility upgrade but the total time allowed for facility planning can be adjusted based on consideration of factors as listed in s. NR 217.17(1), Wis. Adm. Code. For example, if other issues are being considered as part of a more comprehensive upgrade, this might require a more extensive engineering study and in accordance with the factor described in s. NR 217 (1)(b)4, Wis. Adm. Code, the compliance schedule may be extended. It is recommended this extension be no more than 6 additional months in order to allow completion of construction within the term of the permit. If the schedule is extended the associated following action dates could be set back accordingly.

Note: The purpose of the ONR or Operational Evaluation is to determine if simply making operational or other minor facility changes can meet final limits

3. **24th month ← Permittee submits a Facility Plan or Engineering Report for Department Approval**

   The Department begins review of the facility plan and communication between the facility or its consultant continues during this period.

4. **27th month ← Department Approval of Facility Plan, Engineering Report, and/or Tentative Approval of an AM/WQT Plan**

   The approval will likely be for facility upgrading since adaptive management will not likely be a reasonable option and water quality trading will not likely be cost-effective for mechanical treatment plants.

   Note: If Water Quality Trading or Adaptive Management is the selected alternative, a permit modification will be required prior to the effective date of the new phosphorus effluent limit(s) to conform to the requirements of these programs.

5. If proposed upgrading, prepare construction plans and specifications (allowing 9 months).

   36th month ← Submit Construction Plans and Specifications (if the approved plan includes any facility upgrading)

   Department review of construction plans and specifications (allow 3 months)

6. **42nd month ← Department approval of Construction Plans and Specifications**

   48 month ← **Start WPDES Permit Reissuance Application Process for next permit term**

7. 54th month ← ← Meet new P limit (if facility upgrading is needed)

<u>Example 2 (Municipal Example):</u> Phosphorus Compliance Schedule (less-stringent limits)

No later than 30 days following each compliance date, the permittee shall notify the Department in writing of its compliance or noncompliance with the required action. If a submittal is part of the required action then a timely submittal fulfills the written notification requirement.

Steps/Actions	Due Date (after reissuance)
Operation and Needs Review (ONR): The permittee shall prepare an Operation and Needs Review (ONR) study report and submit it for Department approval. The report shall evaluate collected effluent data, possible source reduction measures, operational improvements or other minor facility modifications that would enable compliance with the final phosphorus WQBEL (water quality based effluent limit) or some improved level of effluent quality using the existing treatment system. Also, the ONR shall include a phosphorus discharge optimization plan for the current operation to optimize reductions in phosphorus. If the report concludes that the facility can achieve the final phosphorus WQBEL, the study shall contain a schedule for implementation of any improvements or other study recommendations. The implementation schedule shall be based on providing compliance with the final phosphorus WQBEL as soon as possible. Once the ONR is approved by the Department the schedule, the permittee shall take the steps called for in the ONR and optimization plan and follow the implementation schedule as approved. If the Department approved ONR report concludes that the facility cannot achieve the phosphorus limit, the permittee shall initiate a Facilities Planning Study and implementation of the phosphorus discharge optimization plan for the current operation.	12 months
Facility Plan: Submit a Facility Plan that evaluates feasible alternatives for meeting the final phosphorus WQBEL which may include: facility upgrading, consolidation with other sewerage systems, alternative effluent discharge locations, an Adaptive Management Plan, Water Quality Trading plan or a water quality standards variance. If Water Quality Trading or Adaptive Management is the selected alternative, a permit modification will be required prior to the effective date of the new phosphorus effluent limit to conform to the requirements of these programs.	24 months
Construction Plans and Specifications: Submit construction plans and	36 months

specifications for approval if the approved Facility Plan calls for upgrading the treatment facility.	
Progress Report: Submit a progress report on meeting the final WQBEL for phosphorus.	42 months
Complete Actions: Complete actions to meet the final WQBEL for phosphorus. Comply with the new phosphorus final limits.	54 months

Example 3 (Industrial): Phosphorus Compliance Schedule (less-stringent limits – Industrial Facility)

No later than 30 days following each compliance date, the permittee shall notify the Department in writing of its compliance or noncompliance with the required action. If a submittal is part of the required action then a timely submittal fulfills the written notification requirement.

Required Action	Due Date
Operational Evaluation Report: The permittee shall prepare an operational evaluation report and submit it for Department approval. The report shall include an evaluation of collected effluent data, possible source reduction measures, operational improvements or other minor modifications that would enable compliance with the final phosphorus WQBEL (water quality based effluent limit) or some improved level of effluent quality using the existing wastewater treatment system. If the operational evaluation report concludes that the facility can achieve the final phosphorus WQBELs using the existing treatment system with only source reduction measures, operational improvements or minor facility modifications, the report shall contain a schedule for implementation of the improvements or other report recommendations necessary to meet final phosphorus WQBELs. The implementation schedule shall be based on providing compliance with the final phosphorus WQBEL as soon as reasonably possible. Once the report is approved by the Department,-the permittee shall take the steps called for in the operational evaluation report and follow the schedule of implementation as approved. If the Department approved report concludes that the facility cannot achieve the phosphorus limit with source reduction measures, operational improvements or other minor facility modifications, the permittee shall initiate a Facility Planning Study and comply with the remaining schedule of compliance. Regardless of the conclusion of the operational evaluation report, the report shall also include a plan and implementation schedule for optimizing the treatment plant's removal of phosphorus during the period prior to complying with the WQBELs. Once the operational evaluation report is approved by the Department, the permittee shall proceed with implementation of the optimization plan and follow the schedule of implementation as approved.	12 months

Facility Plan: The permittee shall submit a Facility Plan that evaluates feasible alternatives for meeting the phosphorus WQBELs. Alternatives may include: upgrading wastewater treatment facilities, selecting the Watershed Adaptive Management Option pursuant to s. NR 217.18, Wis. Adm. Code, using Water Quality Trading in conjunction with or in place of facility upgrading, site-specific water quality criteria development, or a variance from water quality standards pursuant to s. 283.15, Stats. If Water Quality Trading or Adaptive Management is the selected alternative, a permit modification will be required prior to the effective date of the new phosphorus effluent limit to conform to the requirements of these programs.	24 months
Final Plans and Specifications: If the facility plan concluded that upgrading of the permittee's wastewater treatment system is necessary to meet final water quality based effluent limits, submit construction plans and specifications for Department approval.	36 months
Construction Progress Report: Submit a progress report on meeting the final WQBEL for phosphorus.	42 months
Complete Construction: Complete construction of wastewater treatment system upgrades. Comply with the final phosphorus limits.	54 months

Chapter 3

Section 3.02: SWAMP Tools for Phosphorus

Author: Mary Ryan

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Introduction

The new phosphorus rules encompassed in chs. NR 102 and NR 217, Wis. Adm. Code, became effective on December 1, 2010. The System for Wastewater Applications, Monitoring and Permits (SWAMP) has been updated to include phosphorus requirements related to the new phosphorus rules as described below.

Permit Application

- Monitoring: The permit application has been updated to increase monitoring for Phosphorus from 4 samples (collected at least 1 month apart) to 12 samples (collected weekly for 3 months) and a recommended analytical method is specified (EPA 365.1, 'Automated Ascorbic Acid Reduction'). The required sample type is a 24-hr flow proportional composite. Wastewater treatment lagoons may be allowed to collect grab samples if a composite sampler is unavailable.

Note: For fill and draw facilities, the permit application should be sent at a timescale appropriate for the facility to collect sufficient phosphorus data.

- Variance Application for Stabilization Ponds & Lagoons: The permit application will be updated to include an option for owners of a stabilization pond or lagoon system to apply for a variance to the phosphorus WQBEL per s. NR 217.19, Wis. Adm. Code.

- Adaptive Management Request: The permit application will be updated to include a request form for the Adaptive Management Approach per s. NR 217.18, Wis. Adm. Code.

Permit Reissuance Process

The permit reissuance process is described in Section 3.01, p. 65, of this Guidance (titled "Compliance Schedules" - by Tom Mugan and Mary Ryan) and summarized below.

Review the Permit Application Data

Initially, the permit application data (and any existing representative phosphorus data in SWAMP) will be reviewed to determine the need for limits. If additional phosphorus data is needed for this determination the permittee should be contacted and asked to submit the additional data.

Calculate Phosphorus Limits and Determine Compliance

Phosphorus limits are calculated by the Limits Calculator (Technology Based Limits or Water Quality Based Effluent Limits and an accounting of any Total Maximum Daily Loads) and then WDNR staff must determine if it is possible for the facility, as currently operated, to comply with the phosphorus limits. Interim phosphorus limits are also calculated as applicable per s. NR 217.17(3)(c), Wis. Adm. Code.

Permit Drafting

If the permittee can meet the final phosphorus limits then no compliance schedule is allowed. If the permittee cannot consistently meet the limits then a compliance schedule is allowed and interim limits are to be included in the permit per s. NR 217.17(3)(c), Wis. Adm. Code. In both cases monitoring must be required at an appropriate frequency (typically 3 times per week for majors and weekly for minors).

*Surface Water Section: Include the final phosphorus WQBEL (monthly average) in the monitoring table if the permittee can meet the limit.

Note: An NR 217 WQBEL limit is not required if the 30 day average P_{99} calculation does not exceed the calculated WQBEL and the facility did not previously have a technology based limit.

However if phosphorus is present in the effluent at a level that warrants monitoring based on professional judgment then weekly or monthly monitoring should be included in the permit.) If the permittee cannot meet the final phosphorus WQBEL, include the interim phosphorus limit in the monitoring table and note in the Table Notes that it is an interim limit (also specify the final phosphorus limit in the Table Notes) then use the checkbox for 'Phosphorus Limitations' at the Input & Footnotes tab to insert the standard footnote (designed for stringent phosphorus limits). This standard footnote specifies the final phosphorus limit and includes options for recalculation of the final limit based on submittal of a Watershed Adaptive Management (AM) Plan or an application for Water Quality Trading (WQT) or a variance application or new information that supports recalculation of the limit(s) and the Department modifies or reissues the permit to incorporate the revised limit(s). Two additional footnotes are also included that provide information on 'Alternatives Approaches to Phosphorus WQBEL Compliance' and 'Submittal of the Permit Application and AM or WQT or Variance Application':

Phosphorus Water Quality Based Effluent Limitation(s)

The final water quality based effluent limit for phosphorus is **Enter applicable units & averaging period** unless:

(A) As part of the application for the next reissuance, or prior to filing the application, the permittee submits either: 1.) a watershed adaptive management plan and a completed Watershed Adaptive Management Request Form 3200-139; or 2.) an application for water quality trading; or 3.) an application for a variance; or 4.) new information or additional data that supports a recalculation of the numeric limitation; and

(B) The Department modifies, revokes and reissues, or reissues the permit to incorporate a revised limitation before the expiration of the compliance schedule*.

If Adaptive Management or Water Quality Trading is approved as part of the permit application for the next reissuance or as part of an application for a modification or revocation and reissuance, the plan and specifications submittal, construction, and final effective dates for compliance with the total phosphorus

WQBEL may change in the reissued or modified permit. In addition, the numeric value of the water quality based effluent limit may change based on new information (e.g. a TMDL) or additional data. If a variance is approved for the next reissuance, interim limits and conditions will be imposed in the reissued permit in accordance with s. 283.15, Stats., and applicable regulations. A permittee may apply for a variance to the phosphorus WQBEL at the next reissuance even if the permittee did not apply for a phosphorus variance as part of this permit reissuance.

Additional Requirements: If a water quality based effluent limit has taken effect in a permit, any increase in the limit is subject to s. NR 102.05(1) and ch. NR 207, Wis. Adm. Code. When a six-month average effluent limit is specified for Total Phosphorus the applicable averaging periods are May through October and November through April.

Note: The Department will prioritize reissuances and revocations, modifications, and reissuances of permits to allow permittees the opportunity to implement adaptive management or nutrient trading in a timely and effective manner.

Alternative Approaches to Phosphorus WQBEL Compliance

Rather than upgrading its wastewater treatment facility to comply with WQBELs for total phosphorus, the permittee may use Water Quality Trading or the Watershed Adaptive Management Option, to achieve compliance under ch. NR 217, Wis. Adm. Code, provided that the permit is modified, revoked and reissued, or reissued to incorporate any such alternative approach. The permittee may also implement an upgrade to its wastewater treatment facility in combination with Water Quality Trading or the Watershed Adaptive Management Option to achieve compliance, provided that the permit is modified, revoked and reissued, or reissued to incorporate any such alternative approach. If the Final Compliance Alternatives Plan concludes that a variance will be pursued, the Plan shall provide information regarding the basis for the variance.

Submittal of Permit Application for Next Reissuance and Adaptive Management or Pollutant Trading Plan or Variance Application

The permittee shall submit the permit application for the next reissuance at least 6 months prior to expiration of this permit. If the permittee intends to pursue adaptive management to achieve compliance with the phosphorus water quality based effluent limitation, the permittee shall submit with the application for the next reissuance: a completed Watershed Adaptive Management Request Form 3200-139, the completed Adaptive Management Plan and final plans for any system upgrades necessary to meet interim limits pursuant to s. NR 217.18, Wis. Adm. Code. If the permittee intends to pursue water quality trading to achieve compliance, the permittee shall submit an application for water quality trading with the application for the next reissuance. If system upgrades will be used in combination with pollutant trading to achieve compliance with the final water quality-based limit, the reissued permit will specify a schedule for the necessary upgrades. If the permittee intends to seek a variance, the permittee shall submit an application for a variance with the application for the next reissuance.

The recommended monitoring requirements for phosphorus WQBELs are shown below:

- Parameter: Phosphorus, Total
- Units: µg/L (*or* mg/L if the WQBEL is expressed in mg/L); mass limits may also be included per s. NR 217.14, Wis. Adm. Code

- Sample Frequency: 3/Week for majors and Weekly for minors (*or* a frequency that is equal to the monitoring for BOD/TSS)
- Sample Type: 24-Hr Flow Prop Comp (lagoon systems may be allowed to collect grab samples)

Note: If a TBEL (Technology-Based Effluent Limit) is included in the permit, in most cases the existing monitoring requirements for phosphorus can be continued in the reissued permit.

*Compliance Schedules: There are 3 compliance schedules available in SWAMP at the Picklist button for phosphorus. Select the compliance schedule based on whether the new phosphorus limit is considered stringent or not stringent. Generally, if the new phosphorus limit is <0.6 mg/L for mechanical plants or <1.5 mg/L for lagoon systems then select the 'Phosphorus – WQBELs for Total Phosphorus'. If the new phosphorus limit is ≥0.6 mg/L for mechanical plants or greater than about 1.5 mg/L for lagoons systems then select either the 'Phosphorus – (Less Stringent WQBEL – Ind Fac)' or 'Phosphorus – (Less Stringent WQBEL – Muni Fac)'.

Note: The standard compliance schedules in the Picklist are meant to provide representative examples that should cover the majority of cases. The compliance schedule language may be modified as necessary and appropriate to represent case-by-case determinations and BPJ.

*Standard Requirements: The Standard Requirements section now includes an updated section on 'Appropriate Formulas for Effluent Calculations' to include calculations to determine compliance with six-month and annual concentration limits and total load limits.

Chapter 3

Section 3.03: Variance and Variance Applications

Author: Tom Gilbert, Rick Reichardt and Lynn Singletary
Last Revised: October 12, 2016

The following Guidance only addresses the implementation of s. 283.15, Stat. and ch. NR 217.19, Wis. Adm. Code, phosphorus variances. Other variance types such as the multi-discharger phosphorus variance, will be addressed in other guidance documents. Visit http://dnr.wi.gov/topic/surfacewater/phosphorus/statewidevariance.html for more information about the multi-discharger phosphorus variance.

Requests for water quality standards variances are generally addressed in s. 283.15, Stats., and Subchapter III in ch. NR 200, Wis. Adm. Code. Variances for stabilization pond or lagoon systems, specifically, are also covered under section ch. NR 217.19, Wis. Adm. Code, based on the criteria of s. 283.15 (4) (a) 1 f, Wis. Adm. Code, which states, "The standard, as applied to the permittee, will cause substantial and widespread adverse social and economic impacts in the area where the permittee is located". Phosphorus variances for all non-lagoon systems are addressed in s. 283.15 and Subchapter III in ch. NR 200, Wis. Adm. Code. A variance cannot be applied to a "new discharger" [see definition under s. NR 217.13 (8), Wis. Adm. Code].

Section NR 217.19, Wis. Adm. Code, Variance Process

- The review of s. NR 217.19, Wis. Adm. Code, variance requests will be coordinated by the Wastewater Section in the Bureau of Water Quality. Approval letters on variances are signed by the Water Division Administrator and the Department's Chief Legal Counsel prior to being sent to EPA Region 5 Standards Section for final approval.

  Variance Request Coordinator:
  Brenna Stow
  Brenna.Stow@Wisconsin.gov
  608-267-7640

- The Department must provide written notification of the expected phosphorus WQBEL to the permittee. This written notification will likely occur either as part of the permit application process, or as part of a facility planning limits determination memo. Determining the need for a variance is based on knowing what the phosphorus WQBEL will be and what treatment alternatives are available. Adaptive management or water quality trading may be pursued within the term of the variance.
- The application for s. NR 217.19, Wis. Adm. Code, variances must be made on Department forms (see documentation section below). One form is applicable to industrial wastewater lagoon systems and a second form is applicable to non-industrial wastewater lagoon systems (both municipal and private). The forms cover the information as required by s. NR 217.19 (2) (b), Wis. Adm. Code.

- The s. NR 217.19, Wis. Adm. Code, variance request shall be made in the permit application for reissuance no later than 180 days prior to expiration of the current permit. If written notification of the phosphorus limits is received after the time of permit application for reissuance, the variance application is due no later than 30 days following notification if the permittee would like a variance decision made at the time of permit reissuance.
- Because for some facilities, the 2010 phosphorus rule may require compliance with a stringent phosphorus limit, compliance schedules are often extended into the next permit issuance. For permittees that do not believe they will be able to meet their final proposed WQBEL, applying for a variance may be a good option. The application for the variance can occur during either the first or the second permit term.
    - Application during the first permit term following the 2010 phosphorus rule: Permittees that choose to apply for a phosphorus variance at the time of permit application for their first permit since the phosphorus rule was implemented in 2010 can expect to see similar compliance items to the regular, non-variance compliance schedule in their permit. For example, the variance would require operational evaluation and optimization, consideration for compliance alternatives and source reduction, and a plan for phosphorus source reduction which could ultimately lead to compliance with the WQBEL.
    - Application during the second permit term following the 2010 phosphorus rule: Because the final WQBELs do not become effective until the second permit term following the 2010 phosphorus rule, permittees considering the variance option may choose to wait to apply for a phosphorus variance until their second permit term after the 2010 phosphorus rule. Those permittees are still expected to complete all compliance schedule items listed in their permit for the first permit term. For example, the permittee would be required to submit the Operational Evaluation Report; Status Update on Compliance Alternatives, Source Reduction, Improvements and Modifications; Preliminary Compliance Alternatives Plan; Final Compliance Alternatives Plan.
        - If a permittee decides to pursue a variance following the conclusion of the facility planning process as specified in the permit compliance schedule, the Department's tentative decision will be incorporated into the public notice for the next permit reissuance or modification for the permit. If such a decision is made and the variance application is submitted to the Department with the permit application for reissuance, the progress report on plans and specifications will not be due during the first permit term.
- The Department's tentative decision on the variance request is made at the time of the public notice for the proposed permit reissuance.
- Prior to reissuing a permit with a variance, the Department must obtain EPA approval of the variance. This EPA approval step may add up to 60 days to the total time required to process a permit reissuance.
- If the variance request is denied, the Department will notify the permittee in writing.

Department Decisions on s. NR 217.19, Wis. Adm. Code, Variance Requests

In accordance with EPA Economic Guidance for Water Quality Standards (http://water.epa.gov/scitech/swguidance/standards/economics/index.cfm), if the resulting cost of implementing the phosphorus WQBEL for municipal systems is greater than 2% of the median household income (MHI), the facility is likely to receive approval for a variance. However, the incremental cost increase should also be considered. For example, one community might need a cost increase of 1% to reach the 2% of MHI, whereas another community might need a 50% increase to reach the 2% of MHI.

For industrial systems, EPA guidance does not have a specific threshold like municipal variance, but guidance is available to assist in making a substantial and widespread determination (http://water.epa.gov/scitech/swguidance/standards/economics/index.cfm).

Variance Conditions

- The permit will identify conditions of the variance in accordance with s. NR 217.19(4), Wis. Adm. Code, and the Department will determine whether a phosphorus technology-based limit would apply. As a minimum, phosphorus monitoring would be required and an interim phosphorus limit based on the upper 99th percentile of representative daily discharge concentrations (one-day P_{99}) as calculated in s. NR 106.05(5)(a), Wis. Adm. Code, would be included.
- In accordance with s. 217.19 (4) (d), Wis. Adm. Code, the Department shall require, as an approval condition, an evaluation of possible means to achieve compliance with the applicable phosphorus WQBEL. The evaluation should consider operational changes, source reduction measures, capital improvements, and pollutant trading or adaptive management options. The results of this evaluation would provide information for determining continued compliance options at the time of the next permit reissuance.
- A variance granted in accordance with s. NR 217.19, Wis. Adm. Code, is only effective for the term of the permit, but the permittee may re-apply for the variance for future permit reissuances. To be approved for a second variance, the facility must show that steps are being taken to approach the final WQBEL. There is no guarantee that a variance would be approved for an additional permit term. EPA must approve all variance requests. If a variance is denied, after the permit is issued the permittee may not apply for a variance based on the factors in s. 283.15(4)(a)1.f., Wis. Stats, for the same permit term.

Relationship to Technology Based Alternative Phosphorus Limit (APL)

Facilities that exceed the mass threshold value contained in ch. NR 217, Wis. Adm. Code, are still required to achieve a limit of 1.0 mg/L or an approved APL. For lagoon and pond systems, the Department will continue to require evaluations to reduce the amount of P discharged which will provide information to establish an APL. Permits for these facilities could, if appropriate, include a requirement to initiate chemical addition. Chemical addition may be done either by directly applying it to the cells or by using temporary chemical feed equipment to a manhole or other appropriate mixing

location. The chemical addition should be required for the term of the permit. A report summarizing the results of the chemical addition should be submitted. Sample compliance schedule language will be included in the Department's permit database, SWAMP.

If a facility does not exceed a mass threshold, the variance will require treatment optimization, but will not require the facility to achieve compliance with a 1.0 mg/L if that limitation is infeasible.

Section 283.15, Stats. Variance request

The Department may grant variances for facilities that use treatment systems other than ponds and lagoons (mechanical plants). The approval criteria and application and review processes for this type of variance is documented in s. 283.15, Wis. Stats. and ch. NR 200, Wis. Adm. Code. The processing for this type of variance is similar to the expedited lagoon and pond system variances covered under s. NR 217.19, Wis. Adm. Code. Applications for this type of variance may be made within 60 days of permit reissuance, but would preferably occur at the time of permit application. The Department's tentative decision is issued at the time of public notice and the variance may not be included in a final WPDES permit without approval from EPA.

Documentation

WDNR forms have been created to help streamline the submittal and review process for s. NR 217.19, Wis. Adm. Code, and 283.15 variance requests, the following forms have been drafted. Externals should consider completing these forms and submitting them to WDNR staff whenever these variances are requested. Fillable pdf versions of these forms will be made available on the Watershed drive at \\central\Water\WQWT_PROJECTS\WY_CW_Phosphorus\Forms, and online at http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

- Form 3200-137- Phosphorus Variance Application for Industrial Discharges- s. NR 217.19
- Form 3200-138- Phosphorus Variance Application for Municipal Discharges- s. NR 217.19
- Form 3200-144- Phosphorus Variance Application for Industrial Discharges- s. 283.15, Stat.
- Form 3200-143- Phosphorus Variance Application for Municipal Discharges- s. 283.15, Stat.

DNR staff should also review variance submittal documents in the phosphorus variance folder (\\central\water\WQWT_PROJECTS\WY_CW_Variances\Phosphorus). This folder includes the phosphorus variance data sheet and other documents that DNR staff are responsible for completing prior to public comment and EPA submittal.

Chapter 3

Section 3.04: Phosphorus Third Year Compliance Action Worksheet

Author: Lonn Franson, Amy Garbe, and Amanda Minks
Last Revised: October 5, 2015

Background: For facilities where the WPDES permit necessitates report submittal of a Study of Feasible Alternatives for meeting the final phosphorus limit, the following is provided to aid in preparation and Department review of these reports.

Permit language in the majority of re-issued permits contains the following language to initiate this report if necessary, at the end of the first year of the permit (12th month).

- *"If the Operational Evaluation Report concludes that the permittee cannot achieve final phosphorus WQBELs with source reduction measures, operational improvements and other minor facility modifications, the permittee shall **initiate a study of feasible alternatives** for meeting final phosphorus WQBELs and comply with the remaining required actions of this schedule of compliance."*

Permit language at the end of the second year (24th month) requires the permittee to submit a status report on the progress of actions of "Optimization" and of the status of evaluation of "Feasible Alternatives".

Permit language at the end of the third year (36th month) requires submittal of a "Preliminary Compliance Alternatives Plan", aka the Study of Feasible Alternatives. The content and review of this preliminary report is a **critical permit decision point going forward** for both the permittee and the Department. The action steps for achieving compliance with the final phosphorus limit need to have been generally decided upon at this time by the facility as details for completion of those steps need to occur during the upcoming 4th year of the permit term.

Permit language at the end of the fourth year (48th month) requires submittal of the "Final Compliance Alternatives Plan". The contents of this final report will require Department review and approval, as the chosen alternative to achieve compliance with the final phosphorus limit will be incorporated into appropriate compliance schedule language and conditions of the next generation WPDES permit.

Because of the importance and significance of financial decisions and the need for review of tertiary treatment technologies, the preliminary and final reports are expected to be prepared by consultants capable of providing engineering design requirements of NR 110 (municipal) and NR 108 (industrial). Each facility is unique, but provided is a list of items that needs to be considered and addressed. The level of detail of review and explanation will vary based on the practicability of each as well as restrictiveness of the final phosphorus WQBEL.

Items to Evaluate in the Study of Feasible Alternatives

1. Background Information
    a. Existing Treatment Facility Considerations
    b. Existing Collection System Considerations
    c. Influent Flows & Loads
    d. Existing Performance
    e. Proposed Effluent Limits
    f. Current Effluent Total Phosphorus Annual Mass Discharge

2. Summary and Conclusions from completion of implementation of your **Optimization Action Plan** (First year compliance report)
    a. If the plant is now able to meet final limitations, nothing further is required
    b. If not able to meet final limits, are there problem months?
    c. What is the annual offset needed based on data collected since optimization (most current conditions)?

3. Build Treatment Alternative:
    a. Is Comprehensive Facility Planning effort needed to address multiple issues of:
        i. Facility age and infra-structure deficiencies
        ii. New treatment type
        iii. Other pollutants requiring upgrade
        iv. Other needs
    b. Engineering Report – an abbreviated facilities plan for addition of P treatment.
    c. Alternate discharge locations: other surface water or groundwater
    d. Regionalization should be considered

4. Would additional in-stream monitoring be helpful to determine receiving water quality, especially in situations where there is limited surface water quality data available upon review of your Water Quality Based Effluent Limit (WQBEL) memo?
    a. If data has already been collected, please include
    b. If not, please visit section 7 of the Adaptive Management Handbook for monitoring requirements
    c. New low flow from USGS

5. Do you meet the criteria to use Adaptive Management (AM) an option? IF AM is an option, further evaluation, investigation, and documentation is needed. Is this a practical alternative with watershed location, water quality issues, potential partnerships, geography, local support, land use issues, etc.? What is an estimated cost per pound for comparison with other alternatives?
    a. Include Needed Reductions Calculation (page 35 of AM Handbook)
    b. Consider and initiate discussions with other partners (point sources or MS4s) in watershed
    c. Is this a practical alternative considering the watershed location, water quality issues, local leadership, potential partnerships, geography, local support and land use issues?

6. Is Water Quality Trading (WQT) an economic and viable alternative? Documentation to provided why or why not with justification and estimated cost per pound estimate for comparison to other options.
    a. Consider both stormwater and non-point practices

7. Individual Variance
    a. s. 283.15 – has the information needed to request one been provided within the context of the report.
    b. All other options have been considered and all are greater than 2%

8. Multi-discharger Phosphorus Variance per 283.16 – pending future determination
    a. Note that is not a viable compliance option as of this draft (5/11/15) and therefore cannot be a chosen alternative. See MDV implementation guidance for eligibility requirements.

9. Combination of Alternatives
    a. There is a possibility that a combination of the above compliance options will be the most economically feasible. Such as, minor facility upgrade with Adaptive Management or Water Quality Trading.

10. Financial Information to be Considered
    a. What is the current WW utility budget?
    b. User rates as a % of MHI
    c. Status and strategy of future debt retirement and new capital expenditures

Additional Paperwork to Include:

1. If AM is chosen option, include Adaptive Management Request Form: http://dnr.wi.gov/topic/surfacewater/documents/AM_Request_Form.pdf

2. If WQT is chosen option, include NOI for WQT: http://dnr.wi.gov/topic/surfacewater/documents/NOI_WQT.pdf

3. If Construction is chosen option, include preliminary facility plan if applicable

Helpful Links:

AM Handbook -
http://dnr.wi.gov/topic/SurfaceWater/documents/AdaptiveManagementHandbooksigned.pdf

WQT How to Manual -
http://dnr.wi.gov/topic/surfacewater/documents/WQT_howto_9_9_2013signed.pdf

PRESTO - http://dnr.wi.gov/topic/surfacewater/PRESTO.html

EVAAL - http://dnr.wi.gov/topic/nonpoint/evaal.html

Computer Models – Links located in WQT How to Manual

Surface Water Data Viewer - http://dnrmaps.wi.gov/SL/Viewer.html?Viewer=SWDV

Chapter 4- Tools for the Regulated Community

This Chapter is meant to provide valuable information to the regulated community and other interested groups. When making decisions about a facility, it is important to work closely with appropriate Department staff. Many facilities are unique and must be handled on a case-by-case basis. However, this Chapter should help to explain the responsibilities and options that exist for the regulated community. Chapter 1, p. 5, and the Frequently Asked Questions page may also provide useful information that can help answer phosphorus-related questions:
http://dnr.wi.gov/org/water/wm/wqs/phosphorus/index.htm.

If you have phosphorus related question, please email us at DNRPhosphorus@wisconsin.gov.

Chapter 4

Section 4.01: Monitoring Guidance

Author: Jim Baumann and Mary Ryan

Last Revised: December 1, 2013

Introduction

Effluent monitoring and ambient stream monitoring for phosphorus to be conducted by the permittee is specified in Subchapter III of Chapter 217, WQBELs for Phosphorus. There are several circumstances that may require effluent and stream monitoring:

1. Monitoring to provide data for calculation of water quality based effluent limitations using the conservation of mass equation in s. NR 217.13, Wis. Adm. Code.

   Explanation: Section NR 217.13(2)(d), Wis. Adm. Code, specifies that upstream phosphorus concentrations must be known or calculated in order to derive a WQBEL. The Department will use historical data from the specific stream or similar location to fulfill this need. However, a discharge may wish to monitor the ambient phosphorus concentration to provide site-specific information. Pursuant to s. NR 217.15(1), Wis. Adm. Code, permittees may also need to collect effluent samples of phosphorus to be evaluated for WQBELs, if data is not available. This data collection will be specified in the permit application for reissuance s. NR 217.13(1)(d), Wis. Adm. Code.

2. Monitoring to fulfill the requirements of Adaptive Management in s. NR 217.18, Wis. Adm. Code. See the Adaptive Management Technical Handbook for details on Adaptive Management Monitoring, available for download at http://dnr.wi.gov/topic/SurfaceWater/AdaptiveManagement.html.

   Explanation: In order to request adaptive management, WQBELs must be calculated for phosphorus. Therefore, sufficient data must be collected to calculate and determine the necessity for these WQBELs (as described above). Furthermore, s. NR 217.18(3)(a), Wis. Adm. Code, specifies that monitoring in the receiving water and effluent monitoring must be performed to document the effectiveness of the adaptive management plan. The frequency of this monitoring will depend on the adaptive management plan and will be specified in the permit. This monitoring can also be used to re-calculate a water quality based effluent limit to reflect the improved water quality.

3. Monitoring to fulfill the requirements of a wastewater permit.

   Explanation: Permits with WQBELs for phosphorus will require effluent monitoring. This includes permits with approved phosphorus variances. Pursuant to s. NR 217.15(2), Wis. Adm. Code, the Department may also require monitoring of phosphorus discharges in a permit, even if WQBELs for phosphorus were not required. The frequency of this monitoring will be specified in the permit.

Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code and shall be performed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Table 9 below provides a list of these protocols at the time this guidance was developed. See NR 218 and NR 219, Wis. Adm. Codes, for up-to-date analytical methods.

Table 9. Approved NR 219 analytical methods (at the time this guidance was written).

Approved Methods for Analysis of Total Phosphorus in Wastewater **Based on ch. NR 219, Wis. Adm. Code, Rev 2009**					
Analytical Technology	**EPA Method**	**Standard Methods**	**ASTM Method**	**USGS Method**	**Other[1]**
Persulfate digestion		4500 - P B.5 18, 19, 20 or 21 edition			973.55
Followed by one of the following :					
Manual Ascorbic acid reduction	365.3 (1978)	4500 - P E[2] 18, 19, 20 or 21 edition	D515-88 (A)	I-4600-85	973.56
Automated Ascorbic acid reduction	365.1 rev 2.0 (1993)	4500 - P F[2] 18, 19, 20 or 21 edition			
Semi-automated block digestor	365.4 (1974)		D515-88 (B)	I-4610-91	
1 "Official Methods of Analysis of the Association of Official Analytical Chemists" 16th Edition 1998					
2 The letters E and F were switched in ch. NR 219, Wis. Adm. Code - this is the correct reference					

Limit of Detection

The analytical methodologies used must enable the laboratory to quantitate all substances for which monitoring is required. For effluent monitoring this means the limit of detection (LOD) must be below the effluent limitation. For in-stream monitoring this means the LOD must be below the applicable in-stream phosphorus criteria (Section 1.01, p. 5). Again, the Department recommends a level of detection at 30 µg/L and a level of quantitation at 90 µg/L for most monitoring situations.

If the required level cannot be met by any of the methods available in ch. NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

Effluent Phosphorus Monitoring

Monitoring for the Permit Application

The permit application will require 12 samples for phosphorus collected weekly for 3 months. The recommended analytical method is EPA 365.1 (Automated Ascorbic Acid Reduction) and the required sample type is a 24-hr flow proportional composite. Wastewater treatment lagoons may be allowed to collect grab samples if a composite sampler is unavailable.

Effluent Phosphorus Monitoring for the WPDES Permit

Surface Water Section - WQBELs: All electronic discharge monitoring reports (eDMRs) as of April 2011 require LOD, LOQ and Lab ID to be reported for phosphorus. The Department encourages monitoring that will achieve a level of detection at 30 µg/L and a level of quantitation at 90 µg/L thereby enabling an understanding of the impacts of Phosphorus.

When a Water Quality Based Effluent Limit (WQBEL) applies to the permittee's discharge the following monitoring requirements are recommended in the Surface Water section of the permit.

Parameter:	Phosphorus, Total
Units:	µg/L (*or* mg/L if the WQBEL is expressed in mg/L)
	Note: mass limits may also be included per s. NR 217.14, Wis. Adm. Code.
Sample Frequency:	3x/week for major wastewater treatment facilities; 1x/week for minor wastewater treatment facilities (or a frequency that is equal to the monitoring for BOD/TSS)
Sample Type:	24-Hr Flow Prop Comp (lagoon systems may be allowed to collect grab samples)

Note: If the P_{99} of the 30 day average discharge does not exceed the calculated WQBEL and the facility did not previously have a technology based limit then the WQBEL does not need to be included in the permit. However if phosphorus is present in the effluent at a level that warrants monitoring based on professional judgment then weekly or monthly monitoring should be included in the permit.

Surface Water Section - TBELs: If a Technology-Based Effluent Limit is included in the permit, in most cases the existing requirements for phosphorus can be continued in the reissued permit.

Standard Requirements Section: The Standard Requirements section for all WPDES permits includes the 'Sampling and Testing Procedures' as shown below.

Ambient Phosphorus Monitoring

Consistent with the approach used to study more than 240 Wisconsin streams and 42 rivers for the purpose of developing phosphorus criteria, the objective of the monitoring is to characterize the phosphorus concentrations most commonly occurring in the stream during the primary algae and aquatic plant "growing season" of May through October. To avoid entering bias into the monitoring by purposefully monitoring high or low flow conditions, the monitoring should be conducted as follows:

- *Samples should be collected using adequate methods during pre-selected days or dates (e.g. second Tuesday of the month) once per month (about 30 days apart) each month from May through October. If samples cannot be collected each of the six months, at a minimum four months should be sampled. Any applicable data collected should be submitted to the Department for review. To determine adequate methods for data collection see s. NR 205.07, Wis. Ad. Code.*

The use of a median value of the sample results will discount the influence of short during high flow events or low flow periods.

Sample Location

The stream should be monitored based on the best location consistent with the following, recognizing that there may be a need to balance the desired objectives:

- ***In close proximity and upstream of the outfall***
  This is to avoid factors, such as additional drainage area adding flow and phosphorus to the stream that could change the results.

- ***Representative of the upstream conditions***
  Stream reaches with major springs or major sediment deposits, such as former millpond beds, may create much localized conditions that aren't reflective of the upstream conditions and should be avoided. As a rule of thumb the location selected should be representative of a quarter to half mile stretch upstream. Also avoid reaches downstream of where cattle are in the stream.

- ***Has thorough mixing of the stream water***
  Stream reaches immediately downstream from tributaries or major springs may not have complete mixing and should be avoided.

Sample Collection at Stream Location

At the stream location, the samples should be collected as follows:

- ***In portion of stream with greatest or strongest flow***
  This may or may not be in the middle of the stream. In general, relatively straight reaches of the stream are preferred. However, if a meander section of the stream is selected for sampling, the sample should be collected in the portion with greatest flow at the outside of

the meander. Slow flow areas along the banks, in eddies or immediately downstream of islands should be avoided.

- ***3 to 6 inches below surface using thrice rinsed sample bottles, completely filling the sample bottle***
  Surface samples tend to have debris and other things floating on the surface and should be avoided. Whether a sample is collected by hand directly in a sample bottle or with a sampling device, such as a Van Dorn sampling bottle, the collection vessel needs to be rinsed three times with water from the same location as the sample. Care should be made to avoid touching the inside cap of sample bottles.

- ***Avoid disturbing the sample site***
  If the sample is collected by wading in the stream, walk upstream to the sample location and take the sample facing upstream.

- ***Don't trespass on private lands to collect sample***
  Use a public access point, such as a road right of way, or seek permission from the landowner or operator to cross land for the purpose of collecting the samples.

<u>Sample Handling</u>

The collected sample should be handled as follows:

- *Add the prescribed amount of H_2SO_4 (generally 2.0 ml), cap and invert several times to mix.*

- *Uncap and check pH by touching pH paper to residual water on the inside of cap. Add additional acid if a pH of 4 or less is not achieved.*

- *Follow directions from laboratory for labeling bottle, including date, time and location.*

- *Store bottle on ice or refrigerate to transport to laboratory for analysis.*

- *Have sample analyzed by a WDNR certified or registered laboratory (s. NR 149.03(19); s. NR 149.03(66), Wis. Adm. Code).*

Chapter 4

Section 4.02: Comparison of Compliance Options

Author: Jim Baumann

Last Revised: January 28, 2010

Subchapter III of ch. NR 217, Wis. Adm. Code, contains or references a number of options for water quality based effluent limit calculation and implementation of those limits. The opportunity to "mix and match" these options not only provides flexibility, it potentially creates a picture of complexity. The purpose of this paper, and especially the table below, is to try to simplify the options in order to help the permit writer and the permittee select and use options.

For this simplified discussion, the options are broken into two groups, as follows:

- Methods for deriving water quality based effluent limits
    - Procedures in s. NR 217.13, Wis. Adm. Code (use as the base approach)
    - Total Maximum Daily Load wasteload allocations
- Options for implementation
    - Extended compliance schedules
- Water quality trading
- Watershed adaptive management option (or simply adaptive management)

Although water quality trading and adaptive management are listed as options for implementation, they may, if fully implemented, result in a less stringent water quality based effluent limit due to improved water quality upstream from the point source discharge location or the point on a downstream water where the phosphorus criteria first apply. For this discussion, however, they are considered primarily as implementation options.

The options may be used together. For example, a TMDL could be developed during the period of a compliance schedule, potentially changing both the effluent limit and the compliance date. Some of the options are already combined or built in. For example, adaptive management has a built in compliance schedule.

Before shifting to the table below which compares and contrasts the three implementation options, it is appropriate to briefly describe and discuss each of the options and provide a few additional notes.

<u>Water Quality Based Effluent Limits derived under s. NR 217.13, Wis. Adm. Code.</u>

This is the base approach to deriving WQBELs. The approach is based on the Clean Water Act obligation that the effluent limits must be sufficient to attain and maintain water quality standards. In general, for a given set of flow conditions and assuming the discharges are at the facility's design capacity, the total reduction in phosphorus load needed to attain water quality standards is assigned to the point source.

No other source control, such as upstream nonpoint source control, is assumed. However, in no case is the WQBEL set to less than the receiving water criterion.

Total Maximum Daily Load Derived WQBELs

Under the Clean Water Act, a TMDL analysis is the only means to shift a portion of the responsibility for controlling pollutants from the point source dischargers to other sources, such as nonpoint sources. A TMDL derived WQBEL could result in a less stringent WQBEL, especially in situations where the point source discharge is a relatively small contributor of phosphorus and/or when the upstream conditions are close to the phosphorus criterion – either above or below the criterion.

Extended Compliance Schedules

Compliance schedules are used to provide the time needed to install or otherwise bring about needed changes to the operation of the wastewater treatment facility. In the opinion of EPA, compliance schedules should be of the minimum length of time necessary to comply with the permit requirement. Indirectly, compliance schedules may also allow time for other options to materialize, such as completion of a TMDL.

Water Quality Trading

Water quality trading does not remove, shift or transfer responsibility for pollutant control from the point source discharge. It does, however, provide an alternate means to create and realize an equivalent or greater reduction in phosphorus load from other sources. Generally, the alternate means of control will be at a lower cost.

Watershed Adaptive Management

Under this option, the point source discharger may choose to accept an interim limit (starting at 0.6 mg/L), conduct stream monitoring, develop with partners a watershed management plan and implement portions of that plan. Presumably, if the watershed management plan is fully implemented, the discharger's permit will eventually have a substantially less stringent WQBEL based on improvements in water quality upstream. The expectation for the role for the discharger in implementation of the watershed management plan is that it is proportional to the point source contribution. This may not be the best option for a facility where compliance with a 0.6 mg/L interim effluent limit will require a major capital investment.

Note: All of these options presume that the facility will have a stringent WQBEL for phosphorus that would otherwise require capital or major O&M additions to the facility's phosphorus removal processes. They are not intended to apply to situations where the change from exiting technology based limits to WQBELs is small, such as from 1.0 mg/L to 0.8 mg/L.

Comparing and Contrasting Features of Implementation Options for Subchapter III of ch. NR 217, Wis. Adm. Code.

This table briefly describes the features of three implementation options for complying with phosphorus water quality based effluent limits. Those effluent limits may be derived using the procedures in s. NR 217.13, Wis. Adm. Code, or through a TMDL. Although these options are presented as separate or distinct, to some degree they may be combined. Although variances to water quality standards pursuant to s. 283.15, Stats. are not presented as an option, they may constitute a fourth option. See accompanying discussion for a description of each option.

Feature	Extended Compliance Schedule later coupled with a TMDL	Water Quality Trading	Watershed Adaptive Management
General eligibility and duration	WDNR must determine a need based on factors in rules; seven years maximum, except up to nine years if tertiary treatment, such as filtration, is needed.	No restrictions on eligibility; duration to be determined	Filtration or similar tertiary treatment needed to meet WQBEL Both point sources and nonpoint sources must contribute or cause exceedance of applicable phosphorus criterion Nonpoint source and urban stormwater contribution must be greater than 50% or permittee must demonstrate control of nonpoint sources necessary to meet applicable phosphorus criterion.

Development of watershed plan	Not required	Not required	Plan required; updated with each permit application for reissuance Permittee role in plan implementation proportional to phosphorus contribution Implementation focused to subwatersheds Progress ramped up over two permit terms
Monitoring of stream water quality	Not required	Not required	Required
Discharge monitoring	As specified in permit	As specified in permit	As specified in permit
Subchapter II technology based limits (e.g. 1 mg/L)	Must be met	Must be met	Must be met.
"Final" WQBEL in permit (although compliance may not be in permit term)	Yes, required by = EPA Reviewed at each permit reissuance	Yes, required by EPA Reviewed at each permit reissuance	Yes, required by EPA Reviewed at each permit reissuance

	Monthly or six-month average limits, consistent with the impracticability demonstration or TMDL, where applicable May be revised based on wasteload allocation of approved TMDL	Monthly or six-month average limits, consistent with the impracticability demonstration or TMDL, where applicable	May change if watershed plan implementation is successful Monthly or six-month average limits, consistent with the impracticability demonstration or TMDL, where applicable
Interim effluent limits	Required, but no specific limit specified Must represent good management and operation for similar facilities	Not required	0.6 mg/L limit specified for first permit term, up to 0.5 mg/L for second permit term, additional interim limits applicable for third permit term. Expressed as six-month average. 1.0 mg/L monthly average. Interim limit must be met by end of permit term.
Trade ratio	Not applicable	Required; details to be determined	Not applicable; unless trading is part of watershed adaptive management plan
Other actions	Specified in permit, such as optimization plan	Determination of trade "value" for each trade; details to be determined	As specified in watershed adaptive management plan

Reporting and documentation	Annual reporting as specified in permit; consistent with s. NR 217.17, Wis. Adm. Code	Documentation of agreements with trade partners Annual or more frequent compliance reporting; details to be determined	Annual reporting on progress to meet milestones in watershed adaptive management plan
Public comment/review	As part of permit public notice process; annual reports considered public information	Trading agreements will be public noticed as part of the permit reissuance. Also, annual reports considered public information; other details to be determined	Watershed adaptive management plan subject to public review as part of permit public notice; annual reports considered as public information

Chapter 4

Section 4.03: Operational Evaluation & Optimization Plans

Author: Amanda Minks
Last Revised: January 6, 2014

Optimization is a very important step in achieving the final phosphorus WQBEL and is a requirement of a phosphorus compliance schedule (see Section 3.01, p. 65). A reduction in the discharge levels that can be achieved through minimization and minor additions or optimization of the existing WWTP can greatly reduce the costs of construction or other means of achieving limits. It is up to point sources to identify economically viable optimization opportunities in the optimization plan. A "Operational Evaluation and Optimization Report Worksheet" has been developed to aid point sources in the development of these reports- http://dnr.wi.gov/topic/surfacewater/documents/POptApproval_%2002212014.pdf.

Department staff will review the report to determine whether key elements have been addressed and to ensure that the schedule which you propose conforms to the deadlines established in the permit compliance schedule. If the submittal meets these criteria, the Department reviewer will sign and return a copy of the summary sheet. Once the report is approved, the permittee shall proceed with implementation of the optimization plan in accordance with the approved schedule that is consistent with ch. NR 217, Wis. Adm. Code.

Factors to Consider When Developing/Reviewing Optimization Plans:

- Determine additional data needs.
- Identify monitoring needs of individual sources.
    - Industrial or commercial contribution.
    - Hauled in wastes, such as septage or holding tank wastes.
    - Industrial process lines.
    - WWTP process contribution, such as sludge decant.
    - WWTP unit effluent concentrations.
- Municipalities: work on P minimization with contributing sources; such as
    - Industrial: metal phosphatizing, dairy processing, meat packing, poultry processing, etc.
    - Commercial/institutional: vehicle washing, industrial cleaning & sanitizing, nursing homes, education facilities.
- Industry: explore reducing use of P chemicals, substitution for P chemicals, or alternate means of handling higher P loads.
- Work with water supplier to optimize P addition to the water supply used for corrosion control or iron and manganese sequestration.
- Optimize/increase chemical addition to increase P removal without impacting micro-organisms in WWTP.
- Evaluate multiple points of chemical addition.
- Optimize sludge decant.
    - Low rates

    - During low flow/loading periods.
    - Use side stream chemical addition to remove P from decant.
    - Increase chemical dosage during decant.
- Increase use of chemical polishing at Bio-P systems, particularly during sludge decant.
- Adjust sludge age/wasting at bio-P plants.
- Chemical addition to lagoons.
- For Pulp Mills (and other P deficient WW) optimize P addition thru use of on-line measurement of organic load to trigger nutrient addition.
- Identify minor construction (e.g., piping for additional chemical addition points) that may be necessary to further enhance P removal.
- Identify changes that may be necessary to the solids handling system due to the additional sludge that may be generated.

Chapter 4

Section 4.04: Polyphosphates and their alternatives

Author: Amanda Minks

Last Revised: September 3, 2013

Polyphosphates are frequently used in wastewater and water supply streams to control pipe corrosion and to sequester heavy metals such as iron (Fe) and manganese (Mn). These heavy metals are benign to human health but can cause several nuisances including staining clothing and an unpleasant taste. Despite these benefits, the addition of polyphosphates to water can have unintended consequences included accelerated algal growth in receiving waterways.

Polyphosphates and Water Quality Criteria for Phosphorus:

The use of polyphosphates can cause phosphorus standard exceedances at the point of discharge and can inhibit downstream uses due to elevated phosphorus concentrations. Facilities that use polyphosphates, thereby adding polyphosphates to a discharge stream, must be evaluated for phosphorus limits.

There may also be some situations where a facility does not directly use or add polyphosphates, but uses water from a water supply that has elevated phosphorus concentrations due to the use of polyphosphates. Since the phosphorus concentration in the intake water has been modified from the ambient conditions, these facilities must be evaluated for phosphorus limits, even if they do not directly add or use polyphosphates. If limits are determined to be necessary the point source should work with water supply to find appropriate alternatives to phosphorus use.

To determine if your municipal water supply adds polyphosphates visit: http://prodoasext.dnr.wi.gov/inter1/pws2$.startup and search for your municipal community and the county of the municipality. If polyphosphates are used, they will be listed in the "Treatment Processes" section of this website.

Alternatives:

There are several alternative to using polyphosphates for corrosion control or heavy metal sequestration. Before alternatives are considered, however, the existing physical and chemical condition of the system should be evaluated. It may be that the physical condition of distribution pipes is the primary cause of the problem. Therefore, the ongoing replacement of system piping will resolve the majority of the problem. The acidity/alkalinity of the water could also cause rapid corrosion. In these cases, adding a simple acid or base polymer will help slow the rate of corrosion.

Although these measures will likely help, there may be some situations that will still require the use of chemical additives. Rather than using polyphosphates, bimetallic compounds, like bimetallic

phosphates, may be used. These compounds are less soluble than other forms of phosphates and may perform better at lower concentrations.

Sulfite, particularly sodium sulfite or sodium bisulfite, is an effective replacement for polyphosphate as a corrosion inhibitor. Sulfite prevents corrosion by scavenging residual dissolved oxygen from the water system and controlling the pH level within an acceptable range. Sulfite based corrosion inhibitors have a relatively low environmental impact, marginal environmental toxicity, are easy to test, and are economical alternative to polyphosphates. However, excessive or continuous air ingression into the system will increase the sulfite inhibitor demand and, therefore, the cost. Previous studies have suggested that adding sodium sulfite may increase the abundance of sulfate reducing bacteria in the water system. Sulfite may also be a contributing factor in the stress cracking of stainless steel expansion bellows. Typically, the application rate of sulfite is 50-100 mg/L SO_3 (80-160 ppm Na_2SO_3), depending on site-specific conditions.

An effective alternative for Fe and Mn sequestration is to add silicates, most commonly sodium silicate, to the water system. Studies have found that silicate addition is equally as effective as polyphosphates in metal sequestration. However, silicate efficiency may be reduced in water with high carbonate concentrations. It is recommended that a small amount of a secondary amendment, like hydrogen chloride or other acid, be added in these cases to improve the effectiveness of silicate. Previous studies have found that effective application rates of SiO_2 range from 7 mg/L to 20mg/L, depending on site-specific conditions. Adding silicate can also act as a corrosion inhibitor in water streams. Studies have suggested that silicates form a protective layer against corrosion and elevate the pH of the water to further prevent corrosion. Silica based corrosion inhibitors have a low environmental impact, marginal environmental toxicity, are economical to use, and do not act as a nutrient for bacteria. However, studies have suggested that silicate as a corrosion inhibitor may not be as effective as polyphosphates or other corrosion inhibitors in static flow conditions. In static flow conditions, phosphate-silicate blends may be used to improve sequestration efficiency. Previous studies have found that effective application rates of SiO_2, as a corrosion inhibitor, range from 25 mg/L to 40mg/L, depending on site-specific conditions.

There are several other chemical additives that could be used for corrosion inhibition and for heavy metal sequestration. These include organic inhibitors, molybdate inhibitors, and nitrite inhibitors, among others. Although these compounds may be used, they may have unintended environmental consequences and should be carefully evaluated before use.

Appendix A. Brief Description of Adaptive Management and Water Quality Trading

Municipal and industrial discharges, no matter their size, should review all applicable phosphorus compliance options including adaptive management and water quality trading to determine which compliance option is best for them. Because new water quality-based phosphorus limits are often more stringent than the applicable technology-based phosphorus limits, alternative options for complying with WPDES limits have been considered to ease the financial burden on communities and industry. Adaptive management and water quality trading are innovative approaches to reach water quality goals more efficiently, and for point sources to achieve compliance with phosphorus limits in their WPDES permits in the most cost effective manner possible. Adaptive management and water quality trading allow facilities facing higher phosphorus control costs to meet their regulatory obligations by reducing phosphorus pollution within their watershed to achieve compliance and water quality improvement at a lower overall cost.

Although the goal and overall implementation strategy of these compliance options is similar, they are not the same program (Table 10, p. 111). Understanding these differences can help you determine which of these options is most appropriate for your facility. WDNR recommends that the following factors be considered when comparing adaptive management to water quality trading:

1. **Flexibility**: Adaptive management is a flexible compliance option because field-by-field management practices do not need to be specified in a WPDES permit. This allows management measures and strategies to be adjusted throughout the permit term as more experience is gained. Water quality trading is less flexible because field-by-field trading practices must be specified in the WPDES permit [s. 283.84(4), Wis. Stats.]. Therefore, management measures cannot be adjusted throughout the permit term without a permit modification. Given this, adaptive management may be the preferred compliance option for permittees that have not had experience working with nonpoint sources or best management practices, and/or wish to have implementation flexibility over time. Trading may be the preferred compliance option for dischargers that prefer regulatory stability over time.
2. **Timing**: Water quality trading requires that “credits” be generated before they can be used to offset a phosphorus discharge. This offset must be in place by the effective date of the WQBEL in order to demonstrate compliance. It will take time to establish these practices and begin generating trading credits with them. In contrast to trading, adaptive management allows management practices to be installed throughout the permit term. If preparation and planning time is needed, adaptive management may be the preferred compliance option. For example, if agricultural nutrient management planning is a key practice to reduce nonpoint sources, adaptive management may be the preferred compliance option given that these practices can take time to begin producing phosphorus reductions. If best management practices can be easily installed and can begin generating credits in a short timeframe, water quality trading may be the preferred compliance option.
3. **Calculating offsets**: Calculation of pollutant reduction credits for trading requires trade ratios to account for modeling assumptions used to estimate phosphorus reductions from nonpoint

sources. Adaptive management does not require these margins of safety to be considered. However, in-stream monitoring must be completed to demonstrate water quality improvements over time [s. NR 217.18(3)(a), Wis. Adm. Code]. If in-stream monitoring is not feasible, water quality trading may be the preferred compliance option, since compliance is shown through modeling. Adaptive management may be the preferred compliance option if more flexibility in calculating offsets is desired and in-stream monitoring is feasible.

4. **Reductions needed**: The phosphorus reductions needed for adaptive management and water quality trading should be compared. If the in-stream phosphorus concentration is approaching the applicable phosphorus criterion and stream flow is relatively low, adaptive management is likely the preferred compliance option. However, if a facility only needs to offset a small amount of phosphorus loading to achieve compliance, water quality trading (or a combination of trading and optimization) is likely the preferred compliance option. Because lagoon and other small discharges generally add such a small mass of phosphorus to the receiving water, offsetting this amount through a trade may be cost effective and preferable.
5. **Credits for practices**: With trading, the credit duration and magnitude generated from a given practice depends on the duration and type of practice. For example, a one-year cropping practice typically only provides credit for one year. With adaptive management, the length of a specific practice does not matter as much as the result. As long as in-stream water quality goals are being achieved, the management measures and location of these practices can change.

Note: If a permittee selects adaptive management as the preferred compliance option, that permittee can choose a different compliance option upon permit reissuance. For example, if a facility enters into adaptive management and doesn't observe the anticipated water quality improvements in the receiving water, that facility can choose to achieve compliance with phosphorus limits through water quality trading at the next permit reissuance. Practices installed under adaptive management can be used in a water quality trading framework so long as those practices meet the water quality trading requirements.

Table 10. Comparing adaptive management and water quality trading.

	Adaptive Management	Water Quality Trading
Goal	To improve water quality and achieve P water quality criteria in ambient water	To offset P that is discharged in excess of an effluent limit
Implementation timing	Install practices identified in the plan prior to or during the term of the permit	Install practices and generate pollutant load reductions prior to credit use
Duration	A maximum duration of fifteen years can be granted to achieve compliance with P criteria; PS is in compliance with permit requirements for as long as criteria are attained	May be used to demonstrate compliance indefinitely, as long as credits are generated
Applicable limit	Interim limits applicable throughout the AM project, and may continue if criteria are attained; if unsuccessful,	WQBEL only

	WQBEL applies	
Trade ratios	Not required	Required
Effluent monitoring	Required	Required
In-stream monitoring	Required	Not required
Method of compliance	In-stream and effluent monitoring; P concentration meets WQC	Effluent monitoring, modeling of practices, and trade ratios
Required reductions	Difference between in-stream P concentration and P criterion	Difference between effluent P concentration and effluent P limit
Flexibility to adjust strategy over time	More flexible	Less flexible
Can reductions from other point sources count towards compliance?	Yes	Yes
Can traditional BMPs such as contour strips count towards compliance?	Yes	Yes
Can wetland restoration, bank stabilization and other similar practices count towards compliance?	Yes	Only if reductions are quantifiable
Is inspection of the BMP required?	Some periodic inspections required, but not for every BMP	Yes, every BMP should be periodically inspected
Does modeling need to be performed to quantify expected load reductions?	Yes, some modeling is required	Yes, field-by-field modeling is required
Eligibility requirements	Must be in a nonpoint source dominated watershed, and discharge to a receiving water that exceeds the applicable TP criteria	Must be able to find sufficient credit for needed offset

To learn more about the adaptive management and water quality trading programs, and how to develop and implement successful adaptive management/water quality trading plans, visit http://dnr.wi.gov/topic/SurfaceWater/AdaptiveManagement.html, and http://dnr.wi.gov/topic/surfacewater/waterqualitytrading.html, respectively. Resources available include Adaptive Management Technical Handbook, Water Quality Trading Guidance documents, Adaptive Management-Water Quality Trading Webinar Series, and Factsheets. The Adaptive Management and Water Quality Trading Factsheets may be of particular interest for those looking for basic information about these options, as well as answers some of the frequently asked questions about these programs. Questions may be submitted to your local adaptive management/trading coordinator, or the statewide coordinator:

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608-628-0585

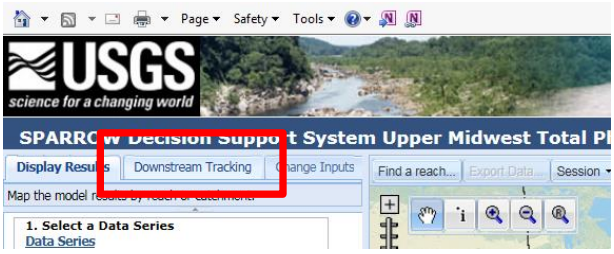
Appendix B. Using the USGS SPARROW Model (Version 1.4.32.20)

The following instructions allow you to determine the delivery factor for the downstream water using the SPARROW model. This document is not intended to provide a full tutorial on SPARROW use or capabilities. Visit http://cida.usgs.gov/sparrow/#region=WI:modelid=42 for more information regarding this tool. A video tutorial is also available at http://cida.usgs.gov/sparrow/. As a reminder, the SPARROW model should only be used to determine the amount of phosphorus delivered from upstream watersheds (HUC-12s+).

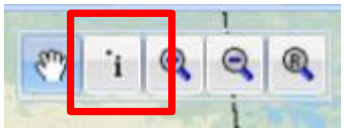
1. Launch Sparrow- http://cida.usgs.gov/sparrow/map.jsp?model=42

2. Zoom to your area of interest-

3. Click on the "Downstream Tracking" tab

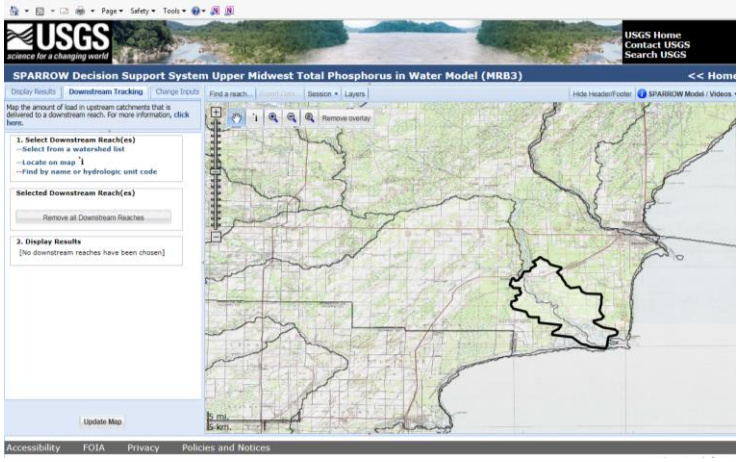


4. Identify your downstream water of interest by using the "Select Downstream Reach(es)" icon on the map-

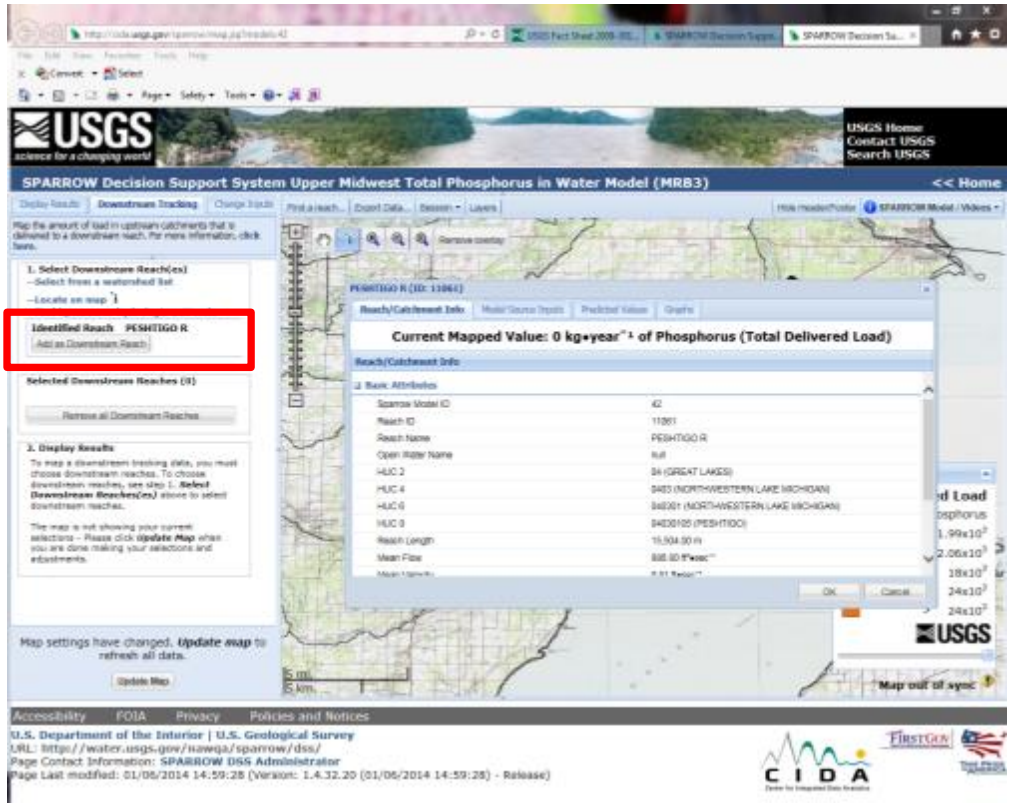


For example purposes, let's try to determine to amount of phosphorus delivered to Lake Michigan from the Peshtigo River. Tip: Select the pour point of the Peshtigo River before it enters the Lake, not the Lake itself.

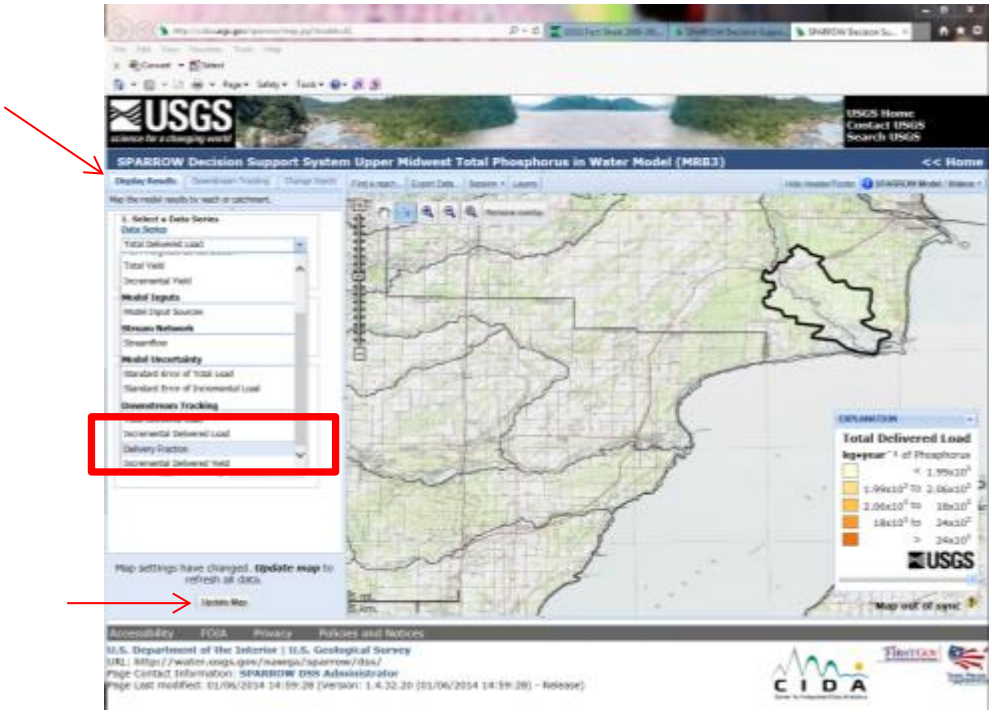
Note: SPARROW automatically delineates a watershed based on the point you select.



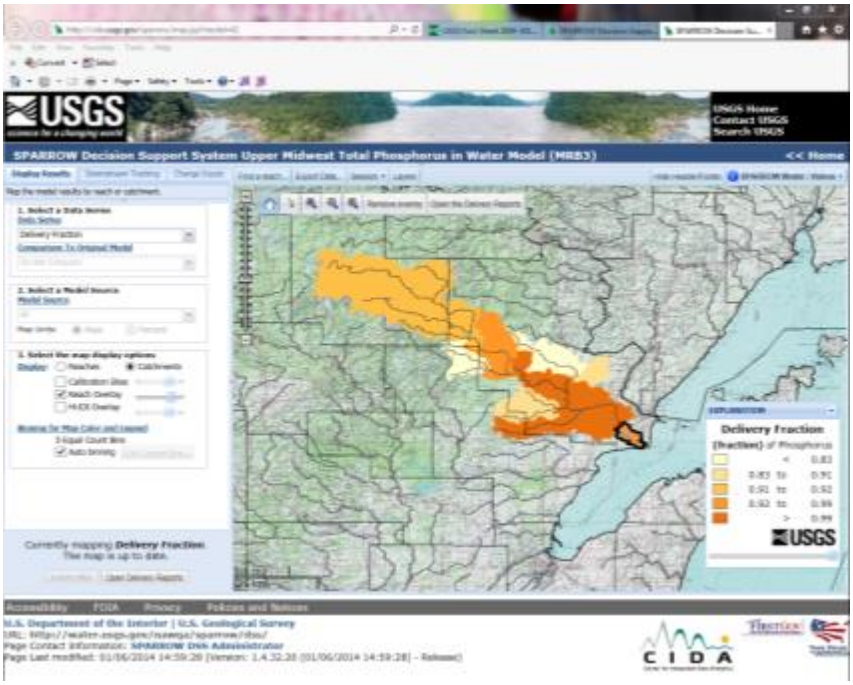
5. Identify the selected point as a downstream reach, by clicking the "add as downstream reach" button.



6. In the “Display Results” tab at the top of the screen, in the “Data Series” area, click “Delivery Fraction”.



7. From here you can identify how much of the phosphorus is projected to be delivered from the Peshtigo River to Lake Michigan.



Note: "Open Delivery Report" & "Export Data" allow you to download results to Excel Spreadsheets, if interested.