Substantial and Widespread Adverse Social and Economic Impacts of Wisconsin's Phosphorus Regulations

A Preliminary Determination

Wisconsin Department of Administration
Wisconsin Department of Natural Resources

04/29/2015

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Abbreviations & Definitions

Note: Some abbreviations and definitions may be report-specific, given the scope and intent of the Act 378 analysis.

µg/L	Microgram per liter
7Q2	Seven-day, two-year low-flow
AM	Adaptive Management
Anthropogenic	Environmental pollution originating from human activity
ARCADIS	Environmental engineering consultants
BOD	Biochemical oxygen demand
cfs	Cubic feet per second
Cost curve	A graph of the costs of compliance with phosphorus limits as a function of effluent flow
COW	Condensate of whey
C_s	Upstream phosphorus concentration
CWA	Clean Water Act
DNR	Wisconsin Department of Natural Resources
DOA	Wisconsin Department of Administration
EBPR	enhanced biological phosphorus removal
EPA	United States Environmental Protection Agency
f	Fraction of the effluent flow that is withdrawn from the receiving water
GDP	Gross domestic product
General Permit	A permit applicable to a class or category of surface water dischargers
GLI	Great Lakes Water Quality Initiative
GSP	Gross state product
Individual Permit	A permit applicable to an individual surface water discharger
Lagoon	An excavated basin or natural depression that contains water, wastewater, or solids
LAL	Limited aquatic life waterbody defined in ch. NR 104, Wis. Adm. Code
Multi-discharger Variance (MDV)	Multi-discharger variance (MDV) means that the variance may apply to multiple WPDES permit holders; it does not imply that one discharger has multiple discharge sites covered by a single variance.
mg/L	Milligram per liter
MGD	Million gallons per day
MHI	Median household income
NCCW	Non-contact cooling water; cooling water effluent that does not come into direct contact with raw material, product, byproduct, or waste
Nonpoint Source (NPS)	Phosphorus runoff that occurs after heavy rains or melting snow wash over farm fields, feedlots, or urban areas and carry fertilizer, manure soil, and other phosphorus-containing contaminants
Point Source (PS)	Point sources are defined as municipal or industrial facilities that have been authorized to discharge to a surface water of the state under a individual WPDES permits.
PRESTO	Pollution Reduction Estimation Tool
Q_e	Effluent flow

Q_s	Receiving water design flow
Recalcitrant phosphorus	The portion of dissolved acid-hydrolizable and/or dissolved organic phosphorus fractions that cannot be effectively removed by tertiary processes and are considered non-reactive.
REMI	Regional Economic Modeling, Inc.
Same Waterbody	Two hydrologically connected points with similar water quality characteristics in which a pollutant can travel between in a reasonable period of time without significantly changing chemically or physically. Hydrological connections can include surface and groundwater connections.
SWAMP	System for Wastewater Applications, Monitoring and Permits
SWIMS	Surface Water Integrated Monitoring System
TBEL	Technology-based effluent limitation
TMDL	Total maximum daily load
TP	Total Phosphorus, a measure of the orthophosphate, polyphosphate and organic phosphate concentration in a sampled stream
UMass	University of Massachusetts, Donahue Institute
WATERS	Water Assessment, Tracking & Electronic Reporting System
WPDES	Wisconsin Pollution Discharge Elimination System
WQBEL	Water quality-based effluent limitation
WQC	Phosphorus water quality criterion from s. NR 102.06, Wis. Adm. Code
WQS	Water quality standard; Regulatory limits for pollutant discharges that are established based on the receiving waterbody's designated uses, the criteria set to protect such uses, and other provisions established to avoid backsliding. These standards typically are addressed in a wastewater treatment plant's NPDES permit.
WQT	Water Quality Trading
WW	Wastewater
WWTF	Wastewater treatment facility

Section 1. Introduction

The Wisconsin Department of Natural Resources (DNR) promulgated phosphorus standards intended to control excess phosphorus pollution in Wisconsin's streams, rivers, lakes and reservoirs on December 1, 2010. These standards include numeric phosphorus criteria to assure a level of water quality that will protect human health from harmful and nuisance algal blooms as well as the beneficial uses of these waterbodies (additional background of TP rule is available in Appendix A, p. 70). Since the phosphorus standards have been promulgated, Wisconsin Pollution Discharge Elimination System (WPDES) permits must be re-evaluated to determine if phosphorus water quality based effluent limitations (WQBELs) are required. These WQBELs range in stringency, depending on the in-stream phosphorus concentration in the receiving and downstream water and the phosphorus loading from the WPDES permit holder (i.e. "point source") in question. However, many point sources face phosphorus limitations so restrictive that a significant financial investment to install necessary treatment will be required.

It is well documented that treatment technology necessary to comply with stringent, low-level phosphorus limitations may be costly. This has spurred many states including Montana, Washington, and Utah, to consider the economic constraints of low-level phosphorus treatment while developing their own nutrient regulations. In Wisconsin, regulatory flexibilities were built into the phosphorus rule to account for this financial burden including water quality trading (WQT), adaptive management (AM), and extended phosphorus compliance schedules. Although these compliance options may be effective for some point sources, barriers prohibit implementation of one or more of these compliance options to be effective for all point sources especially when they rely on involvement and interaction with nonpoint sources. Some point sources have limited areas in which to trade with other point or nonpoint sources or they are not eligible for adaptive management given their location in the watershed. Other point sources are limited by the uncertainty associated with the technical and economic analyses of compliance measures that may be required and/or lack of willing partners to help implement compliance projects.

For these reasons, additional regulatory flexibility was sought to help implement the phosphorus rule in the most economically efficient manner possible. The federal water quality standards regulations at 40 CFR 131 and the federal permitting regulations at 40 CFR 122 provide a number of tools for states and tribes to use that offer regulatory flexibility when implementing water quality management programs, including water quality standards variances. A water quality standards variance is a time limited designated use and criterion (i.e., interim requirements) that is targeted to a specific pollutant(s), source(s), and/or waterbody segment(s) that reflects the highest attainable condition during the specified time period. As such, a variance requires a public process and EPA review and approval under section 303(c) of the Clean Water Act (CWA). Typically, variances are implemented on an individual, permit-by-permit basis. Currently, any point source can request an individual phosphorus variance pursuant to s. 283.15, Wis. Statues. Additional information regarding Wisconsin's individual variance program is available at http://dnr.wi.gov/topic/wastewater/variances.html.

There are several factors that can be used to demonstrate the need for an individual variance (s. 283.15, Wis. Stat.; 40 CFR 131), but an economic determination is the most commonly used. The economic

determination requires that a point source demonstrate that compliance with a water quality standard would result in "…*substantial* and *widespread* adverse social and economic impacts" (s. 283.16(2)(a), Wis. Stats.). Although this option is available, individual variances can be a time consuming process for point sources, DNR, and EPA staff, and can lead to delays in the permit reissuance process. For these reasons, Wisconsin is interested in streamlining this process through the implementation of a multi-discharger variance (MDV). Act 378 was enacted by the Wisconsin Legislature and became effective on April 25, 2014. This law requires that the Wisconsin Department of Administration (DOA), in consultation with DNR, determine "…whether attaining the water quality standard for phosphorus is not feasible because it would cause substantial and widespread social and economic impacts" (s. 283.16(2)(a), Wis. Stats.). Such a determination is to be made on a statewide basis or, optionally, for statewide categories of point sources. A summary of Act 378's requirements is available in Appendix B, p. 75.

EPA has acknowledged that MDVs may be established, and has authorized them for toxic substances, mainly mercury and chloride, in several states. Additionally, EPA has recognized that MDVs are distinctive from an individual discharger WQS variance in the "Water Quality Guidance for the Great Lakes System: Supplementary Information Document" (EPA–820–B–95–001; March 1995). Currently, EPA does not have guidance specific for MDVs, but has provided a few general factors for consideration when making a determination of substantial and widespread adverse social and economic impacts for multiple point sources (EPA-820-F-13-012, March 2013):

- MDVs should only apply to permittees experiencing the same challenges in meeting WQBELs for the same pollutant(s), criteria and designated uses;
- Permittees should be grouped based on specific characteristics or technical and economic scenarios that the permittees share and conduct a separate analysis for each group;
- Sufficient information should be collected for each individual permittee, including engineering analyses and financial information, to adequately support the specification of permittee groups for each individual permittee to be covered by the variance;

The purpose of this report is to describe the methods used to make a substantial and widespread determination in support of a MDV for phosphorus, and to share the preliminary results from these methods for public comment pursuant to Act 378.

Note: This report frequently refers to supplemental reports developed by ARCADIS, Sycamore Advisors, and University of Massachusetts Donahue Institute ("UMass"), entitled "Economic Impact Analysis" and "Addendum to Economic Impact Analysis: Statewide Economic Impacts" (April 24, 2015). These consulting firms were contracted to provide key pieces of information to support this determination. These reports will be referred to in this document as "EIA Report" and "EIA Addendum" for simplicity.

Section 2. Defining Categories

There are over 750 municipal and industrial point sources covered under an individual WPDES permit in Wisconsin, ranging from paper mills to municipal wastewater treatment facilities (WWTFs) to cheese making operations. Pursuant to s. 283.16(2)(a), Wis. Stat., the substantial and widespread adverse impacts determination may be made on either a statewide basis for all point sources, or for statewide categories of point sources. As previously stated, EPA recommends that point sources be grouped by technical and economic scenarios to create as much uniformity within each category as possible. To be consistent with this guidance, DOA and DNR determined categorization was the most appropriate method to analyze costs to make a substantial and widespread adverse impact determination. This method must result in categories of point sources that are socially and economically important on a statewide basis to be consistent with s. 283.16(2)(a), Wis. Stat. Several factors that were utilized to help split point sources into categories, and are described in this section. Figure 1 (p. 11) visually depicts the final categories that were created using these factors.

First, it was important to determine what would constitute a "statewide category". To balance the requirements of s. 283.16(2)(a),Wis. Stat., and EPA's MDV factsheet (EPA-820-F-13-012, March 2013), the following criteria were developed:

1. The final category should have at least 10 individual WPDES permit holders;
2. The final category should have important social and/or economic value to the state of Wisconsin; and
3. Point sources within the final category should have similar technical and economic characteristics.

With the above criteria in mind, EPA's economic guidance[1] was reviewed to help identify categorical distinctions EPA makes for individual variance requests. This guidance separates municipal and industrial permittees and provides distinct "primary" and "secondary" indicators for each group to assess the social and economic impacts of a given regulator policy. For example, the primary indicator for municipal discharges is based on median household income (MHI), while industrial variance requests rely on profitability and other factors. To be consistent with this guidance, municipal and industrial categories were separated for this study. EPA's guidance does not have other clear categorical distinctions that were applicable for this study. Further categorization was, therefore, the result of applying the aforementioned criteria to the municipal and industrial categories.

Municipal WWTFs are very similar from a financial standpoint: EPA applies the same economic primary and secondary indictors to all municipal WWTFs, they all have the same mechanisms for financing facility upgrades, and they all serve a community function rather than being profit seeking. Given these similarities, it did not seem to be necessary to further divide the municipal WWTFs into additional financial categories.

[1] Interim Economic guidance for Water Quality Standards: Workbook. (March 1995), US EPA, Office of Water. http://water.epa.gov/scitech/swguidance/standards/economics/.

However, there is a clear difference in the existing infrastructure of treatment plants within this category. There are more than 500 WWTFs in Wisconsin; it is estimated that almost 75% of these are bio-mechanical facilities, while 25% utilize ponds or lagoons for treatment. Lagoon facilities are much more simplistic in their design and operation compared to their bio-mechanical counterparts which may use a combination of physical, biological and chemical treatment technologies in tanks or other structures. Adding complex phosphorus treatment processes to lagoon facilities is, therefore, generally more costly than it would be for bio-mechanical facilities. Additionally, many of Wisconsin's lagoon facilities have not been required to treat for phosphorus in the past because these technology-based limitations were not established for them. This limited the investment in phosphorus treatment and contributed to the wide technology gap between lagoon and mechanical plants[2]. In order to quantify compliance costs more accurately, lagoon and mechanical WWTFs were separated into two distinctive categories. The financial indicators used to determine whether these costs constitute a substantial and widespread adverse impact are the same between these categories, however.

Several distinctive categories were generated among industries, both for technical and economic reasons. A clear technical difference among industries is whether they produce process wastewater (WW) or non-contact cooling water (NCCW) and/or other low-strength effluents. Industries that generate process wastewater include paper mills, aquaculture, cheese/dairy manufacturers, and food processors, among others. Dischargers that produce low-strength waste or NCCW include power plants and segregated outfalls from some cheese and canning/food processing facilities, and other industries. The low-strength waste group was further separated into two categories: power plants and NCCW discharges. Because the Public Service Commission of Wisconsin regulates power plants, such plants are fundamentally different from a financial perspective from other discharges of low strength wastewater.

The industries within the process wastewater group were separated into several categories. From a technical wastewater perspective, pulp and paper mills have a much higher concentration of recalcitrant phosphorus requiring additional processes for treatment (see p. 22 of the Economic Analysis). Therefore, paper mills were separated into their own category in order to more accurately estimate compliance costs.

Economic factors drove aquaculture, cheese/dairy manufacturing, and other food processing plants to be divided each into their own category. For example, aquaculture was placed into a separate category because this industry's economic characteristics are more similar to agricultural production. Cheese manufacturing in Wisconsin is an important cultural industry and the state has become a worldwide leader in artisanal and specialty cheeses. Wisconsin's cheese industry has been less successful to compete in gross cheese production compared to California, and faces competition in the specialty cheese markets from Vermont, California, and other states. Additionally, this industry relies heavily on local dairy production and local milk prices, which makes this a unique category from a financial standpoint. There are a number of vegetable processing and animal slaughtering/meat processing facilities, which also warranted their own category called "food processing". Many of these facilities

[2] Pursuant to NR 217 Subchapter II, Wis. Adm. Code, municipal discharges require TBELs if they discharge more than 150 lb/mo of total phosphorus.

tend to be canning or freezing operations and are more active during the harvest season. These facilities also tend to rely heavily on local agriculture for its raw materials. Of the remaining process wastewater industrial dischargers, almost 40 facilities are covered under a WPDES permit, but do not meet the criteria to warrant a separate statewide category. Therefore, an 'other' category was created for these rather unique operations. Facilities in the 'other' category include metal finishing, airports, fire products manufacturing, greenhouses, and quarries, among others.

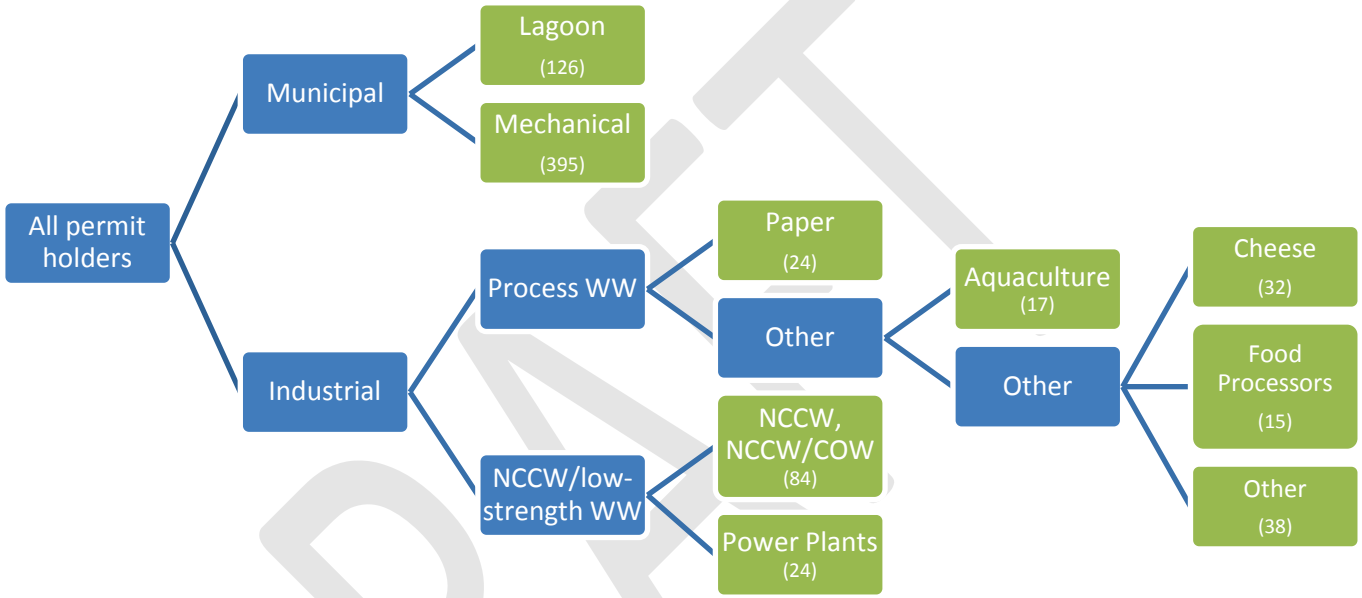


Figure 1. Logic matrix utilized to categorically separate WPDES permit holders.
Green indicates final category. Number in parentheses indicated the number of individual WPDES permit holders within each category.

Section 3. Calculating and Determining the Need for TP WQBELs

Phosphorus limitations were calculated for all individual WPDES permit holders to prepare for the permit reissuance process, and were utilized in this study. Procedures specified in ch. NR 217 Subchapter III, Wis. Adm. Code as well as the Phosphorus Implementation Guidance were used to calculate these limitations. This guidance is available for download at: http://dnr.wi.gov/topic/surfacewater/phosphorus.html. The purpose of this section is to highlight the key methods used to calculate and determine the need for phosphorus WQBELs for the purposes of this study. There are three steps to this process: calculate phosphorus limits, determine the appropriate averaging periods to express the phosphorus limits, and determine the need for these limits. This section highlights the methods used for each of these steps. A gap of this analysis is that TP WQBELs were only available for existing individual WPDES permit holders at this time. This data gap precluded a cost analysis for general WPDES permit holders and new discharges, and is briefly described in this section. It is not practical to replicate all permitting scenarios in this section, so the "Phosphorus Implementation Guidance" on the above website should be referred to for additional details.

A. Calculation of Phosphorus Limits

There are three types of phosphorus WQBELs that can be included in a WPDES permit: WQBELs based on the direct receiving water, WQBELs based on downstream water quality, and TMDL-derived limitations. Each of these limitations requires site-specific data inputs and analyses by DNR staff. Phosphorus WQBELs derived from the direct receiving water and/or downstream water tend to be concentration-based limits, in mg/L units, and vary based on the phosphorus concentration in the receiving water as well as stream and effluent flows. TMDL-derived limitations tend to be mass limitations, in lbs/day units, and vary based on the individual wasteload allocation specified in the approved TMDL. *Note: the allocation methodology also factors in effluent and stream quality in the derivation process.*

Most point sources in Wisconsin discharge to a stream or river. If the applicable phosphorus water quality standards criterion is being met in these waters upstream of the discharge location, a mass-balance approach is used to calculate the applicable phosphorus WQBEL (s. NR 217.13, Wis. Adm. Code):

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

Where:

Limitation = Phosphorus water quality based effluent limitation

WQC = Phosphorus criterion from s. NR 102.06, Wis. Adm. Code

Q_s = Receiving water design flow

Q_e = Effluent flow

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

C_s = Upstream phosphorus concentration

If the applicable criterion is not met, the phosphorus WQBEL is set equal to the phosphorus criterion pursuant to s. NR 217.13(5), Wis. Adm. Code[3]. For example, an industry discharges to a river with an upstream phosphorus concentration of 0.216 mg/L, a value greater than the 0.1 mg/L water quality standard criterion. Because the applicable river criterion is exceeded, the phosphorus WQBEL for the industry is automatically set equal to 0.1 mg/L.

In either case, the first step to calculate phosphorus WQBELs is to determine the applicable phosphorus criteria of the receiving water based on the outfall location. The phosphorus criteria specified in s. NR 102.06, Wis. Adm. Code, vary by waterbody type depending on its sensitivity and response to excess phosphorus (see Appendix A, p. 70, for a description of the applicable phosphorus criteria). During the permit issuance process, DNR staff are responsible for determining which phosphorus criteria apply to the direct receiving water, and if a more sensitive waterbody is downstream of the outfall location. This could happen if a point source discharges to a river or stream that flows into a lake, reservoir, or impoundment that is more sensitive to excess phosphorus due to a reduction in water velocity and increased residence time in such waterbodies. This could also happen if the point source discharges upstream of a phosphorus impaired water, or to a receiving water that does not yet have applicable phosphorus criteria[4]. Several factors are applied to determine if limitations are needed to protect downstream water quality, such as:

- Does the downstream water meet its applicable phosphorus criteria?
- How far downstream is the more sensitive surface water?
- Does the phosphorus contribution from the point source actually make it to the downstream water?

The need for downstream protection limitations is discussed in detail in Section 2.04 of the Phosphorus Implementation Guidance (http://dnr.wi.gov/topic/surfacewater/phosphorus.html).

Once DNR staff determine the most sensitive surface water that needs protection, phosphorus limits are calculated. The applicable phosphorus criteria for streams and rivers are 0.075 mg/L and 0.1 mg/L, respectively. Assuming that assimilative capacity is available for the receiving water, the next step is to determine the existing in-stream phosphorus concentration (C_s). In-stream phosphorus data is available to DNR staff as well as external partners through DNR's Surface Water Integrated Monitoring System (SWIMS)- http://prodoasint.dnr.wi.gov/swims/login.jsp. When sufficient in-stream data is available, DNR staff calculate the median phosphorus concentration according to the procedures defined in s. NR 217.13(2)(d), Wis. Adm. Code[5]. In cases where stream phosphorus data is not available, phosphorus data from a comparable stream is used based on size, drainage basin, topography and land use. Other data inputs that are needed to calculate phosphorus WQBELs using the equation above include: stream flow (Q_s), effluent flow (Q_e), and the fraction of water withdrawal from the receiving water in question.

[3] Phosphorus limitations are also set equal the applicable phosphorus criteria for discharges to inland lakes and reservoirs pursuant to s. NR 217.13(3), Wis. Adm. Code.

[4] Several waterbody types do not have applicable phosphorus criteria including limited aquatic life (LAL) waters. See Appendix A, p. 61 for details.

[5] Median values are publicly available on DNR's surface water data viewer (http://dnr.wi.gov/topic/surfacewater/swdv/) in the "Calculated TP Data" layer.

These variables are typically available from previous permitting decisions as they are used in many permitting decisions and are not unique to phosphorus. Once all data inputs are in-hand, the equation above can be utilized to calculate site-specific WQBELs. For example, a municipal WWTF with a 0.18 million gallons per day (MGD) design flow discharges to a stream with a median phosphorus concentration of 0.019 mg/L and a stream flow (7Q2) of 26 cfs, or 14 MGD. This point source does not have an intake structure, so there is no water withdrawal from the receiving water. The calculated phosphorus WQBEL for this point source is 5.3 mg/L[6].

As previously mentioned, phosphorus WQBELs calculated using the procedures summarized above are concentration limits, in mg/L. In some cases, mass limits accompany these concentration limits to help control phosphorus loadings to surface waters and to comply with s. NR 217.14, Wis. Adm. Code, and 40 CFR 122.45(f). Currently, concentration-based phosphorus WQBELs are typically more restrictive than the mass-based limitations. These mass limitations may become the more restrictive limit as point sources continue to increase capacity and require larger effluent flows. For the purposes of this study, concentration-based limitations were assumed the most restrictive limitation, and were used for estimating compliance costs (Section 4, p. 24), except in the case of TMDLs. Section NR 217.14, Wis. Adm. Code. Mass limitations that have not been established in a TMDL, but derived under s. NR 217.14 procedures were not calculated as part of this study.

Pursuant to s. NR 217.16, Wis. Adm. Code, TMDL-derived WQBELs may be included in WPDES permit in addition to or in lieu of other phosphorus WQBELs. Only point sources in EPA-approved TMDL watershed are subject to these types of limits. At the time this study was completed, several EPA approved TMDLs existed in Wisconsin including the those for Rock River, Lower Fox, and St. Croix Basins, among others (Figure 2). TMDL-derived limits stem from the individual wasteload allocations (WLAs) specified in the TMDL, and are typically mass limitations, in lbs/day. These limits are included in a WPDES permit whenever a facility is given a wasteload allocation in an EPA approved TMDL in order to be consistent with the goals of that TMDL as well as state and federal law. Because TMDLs use a range of methods to develop and express WLAs, there is no one-size-fits-all method to calculate TMDL-derived limitations. Rather, DNR has developed TMDL Implementation Guidance to recommend procedures for each TMDL based on the site-specific methods used to calculate the WLAs in question. This guidance is available at http://dnr.wi.gov/topic/tmdls/implementation.html. For the purposes of this study, phosphorus compliance costs were based on TMDL-derived WQBELs unless more restrictive concentration-based WQBELs were also included in WPDES permits in which case these more restrictive WQBELs were used to derive costs. Section NR 217.16, Wis. Adm. Code, specifies three factors that must be considered when determining if more restrictive WQBELs are needed in addition to TMDL-derived WQBELs:

- The degree to which nonpoint sources contribute to the impaired water;
- Whether waterbodies upstream of the impaired waters are meeting the phosphorus criteria;
- Whether waterbodies downstream of the impairment are meeting the phosphorus criteria;

[6] ([0.075 mg/L)*(16.8 MGD+(1-0)*.18 MGD)-(16.8 MGD-0*0.18 MGD)*(0.019 mg/L)]/ 0.18 MGD); Note: cfs converted to MGD through a conversion factor of 0.646.

Section 4.7 of the TMDL Implementation Guidance describes each of these factors in detail to provide DNR staff with guidance to make these site-specific determinations.

As shown in Figure 2, several TMDLs are in development throughout Wisconsin, including the Wisconsin River, Milwaukee River, and Upper Fox-Wolf River. Consistent with state and federal law, DNR cannot begin implementing TMDL-derived limits in WPDES permits until DNR and EPA approve these TMDLs. Therefore, compliance costs estimated in this study were based solely on the concentration-based WQBELs calculated using the methods in s. NR 217.13, Wis. Adm. Code. Once these TMDLs have been approved, DNR staff can determine if more or less restrictive TMDL-derived limits are needed in WPDES permits, and adjustments can be made to the compliance costs analysis pursuant to s. 283.16(2m), Wis. Stat[7].

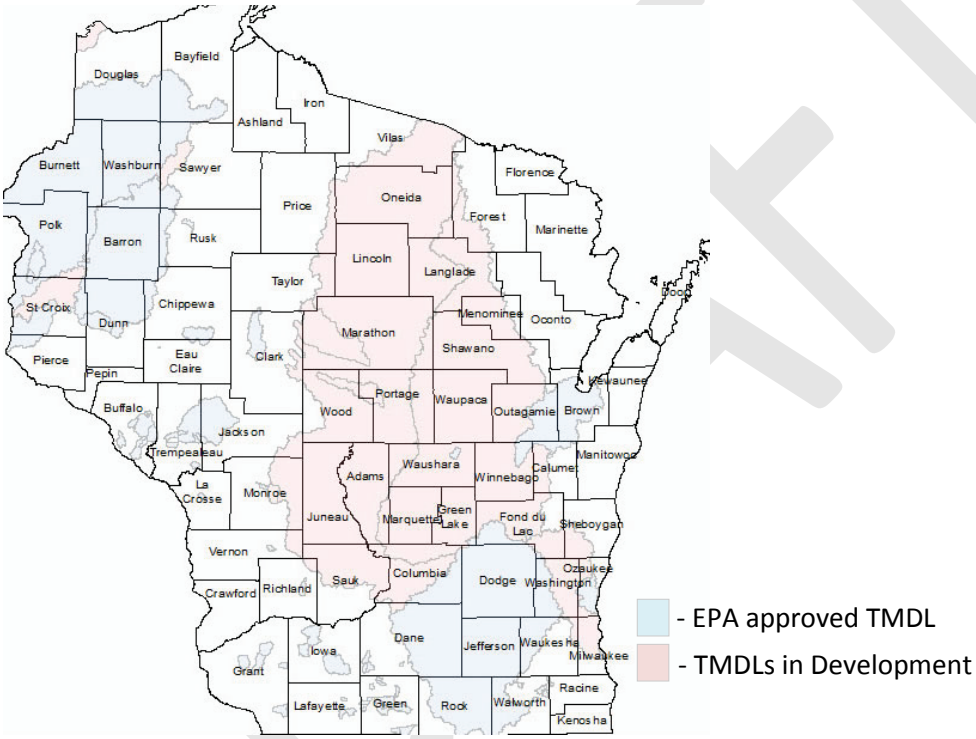


Figure 2. TMDL status map at the time this study was conducted (as of April 2015).

In summary, this study relied on site-specific phosphorus WQBELs to derive phosphorus compliance costs. Within TMDL areas, TMDL-derived limits were used to estimate compliance costs unless more restrictive phosphorus WQBELs were needed to protect local and downstream water quality. In non-TMDL areas, concentration-based WQBELs were used based on local and/or downstream water quality.

[7] Appendix B summarizes the requirements of the phosphorus MDV pursuant to 283.16, Wis. Stat., including the requirement to revisit the variance determination.

B. Expression of Phosphorus Limits

The appropriate averaging periods to express phosphorus WQBELs depend of the type of phosphorus WQBEL as well as the restrictiveness of the limit in question. Typically, permit limits are expressed as daily maximum and monthly average limitations for industrial discharges, and weekly and monthly averages for municipal discharges pursuant to 40 CFR 122.45(d). Although this is appropriate for toxic substances, it is not representative of excess phosphorus pollution, which causes long-term, growing-season problems such as excess algal growth. Longer averaging periods are also more reflective of the technical analyses and rationale used to develop the phosphorus standards. For these reasons, providing a longer averaging period for phosphorus is advantageous because it more clearly aligns with the phosphorus standards. A longer averaging period also allows point sources to maintain compliance with effluent limitations when wastewater and effluent quality exhibit variability without resulting in an immediate, direct impact on water quality. For example, effluent phosphorus concentrations and loadings may be very susceptible to precipitation events. If restrictive phosphorus limits were expressed as daily maximums, permit limit exceedances would likely occur during such events, because treatment technology is not currently available to ensure compliance in all such scenarios.

For these reasons, DNR created an Impracticability Demonstration[8] to justify longer averaging periods for phosphorus WQBELs. For the purpose of this study, it is assumed that all permit limitations would be expressed consistent with the Impracticability Demonstration as well as the Phosphorus Implementation Guidance. This means that:

- Phosphorus WQBELs greater than 0.3 mg/L were expressed as a monthly average;
- Phosphorus WQBELs less or equal to 0.3 mg/L were expressed as six-month averages; and
- TMDL-derived WQBELs were expressed in a manner consistent with the WLA and assumptions of the TMDL, typically expressed as a monthly average[9].

Although this is a reasonable assumption for the purpose of this study, DNR staff are responsible for making a case-by-base determination upon permit reissuance.

C. Determining the Need for Phosphorus WQBELs

Phosphorus WQBELs are required if a point source discharge has the potential to cause or contribute to a phosphorus impairment in either the receiving water or downstream waters (s. NR 217.12(1)(a), Wis. Adm. Code). As illustrated in the "calculation of phosphorus WQBELs" step, phosphorus 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. There are two primary methods for determining if a phosphorus WQBEL is needed in a WPDES permit (s. NR 217.15, Wis. Adm. Code):

1. A phosphorus WQBEL is needed whenever it is more restrictive than a phosphorus TBEL that applies and/or that is already included in the WPDES permit[10]; and

[8] The Impracticability Demonstration is available at http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

[9] Many approved TMDLs provide monthly average WLAs for phosphorus for individual WPDES permit holders.

[10] Phosphorus TBELs are typically set equal to 1 mg/L pursuant to NR 217 subchapter II. Phosphorus TBELs are required for municipal WWTFs that discharge more than 150 lbs of TP/mo and industries that discharge more than 60 lbs of TP/mo.

2. A phosphorus WBQEL is needed if the 99th percentile of the 30-day average discharge concentration of phosphorus (30-day P_{99}) exceeds the potential phosphorus limitation.

Most municipal and industrial discharges contain anthropogenic sources of phosphorus and have previously triggered the need for phosphorus TBELs. Phosphorus, as an essential nutrient, is present in organic matter. Therefore, any municipal or industrial system that comes in contact with organic material, whether it be milk, cheese, vegetables, paper pulp, or human waste, contains anthropogenic phosphorus. Additionally, a treatment process that utilizes biological nutrient removal contains anthropogenic phosphorus. For the reasons above, it can be assumed for this determination that phosphorus standards are needed for most categories of discharges whenever the calculated WQBEL is less than 1 mg/L, particularly for the following categories: municipal discharges, cheese, aquaculture, paper mills, and food processors. The inverse of this assumption is that phosphorus WQBELs are not needed for point sources in these categories if the WQBEL exceeds 1 mg/L; the TBEL would be the controlling limit in these cases. Although this is true for many point sources in these categories, some industrial and municipal discharges that were too small to trigger the need for phosphorus TBELs may be subject to phosphorus WQBELs that are greater than 1 mg/L in their reissued WPDES permits. Due to limited staff time and resources, this study did not estimate costs for these small discharges at this time.

Two industrial categories are excluded from this assumption: noncontact cooling water (NCCW) and power plants. The NCCW category was excluded from this assumption because these effluent streams do not contain raw material, products, byproducts, or waste in them. Additionally, most NCCW discharges have not previously triggered the need for phosphorus TBELs in their WPDES permits. For these reasons, NCCW discharges required a more in-depth analysis (see below). Some municipal and industrial facilities discharge from multiple outfalls. These individual outfalls range from NCCW to on-site wastewater treatment to industrial process wastewater. This is especially true for power plants, but also applies to some paper mills, cheese makers, food processors, municipal WWTFs, and other discharges. For facilities with multiple outfall locations, this study performed a reasonable potential demonstration for each individual outfall location (see power analysis on p. 22).

(1) Noncontact Cooling Water (NCCW)

Effluent streams that are typically included in the "NCCW" category are those that are used for cooling purposes only and do not come into direct contact with any raw material, product, byproduct, or waste. Effluent streams from boiler blowdown, bleed-off, and condensates are similar in nature and are typically included in this category. DNR permits these discharges through both individual and general permits. General permits cover the largest number of permittees in this category to maximize staff resources and to streamline the permitting process for these facilities. There are over 500 facilities that are currently covered under the general NCCW permit-
http://dnr.wi.gov/topic/wastewater/generalpermits.html. A little more than 60 facilities are covered under an individual WPDES permit, mainly due to their additives or water conditioner usage.

The need for phosphorus WQBELs must be evaluated regardless of permit type. Given the nature of these discharges, some discharges within this category will not contain anthropogenic sources of phosphorus. Situations where these discharges clearly contain anthropogenic sources of phosphorus

include: a) when phosphorus-containing additives are included in the facility waste stream; and b) when the NCCW facility utilizes a municipal water supply that adds polyphosphates as its water source[11]. In either situation, phosphorus WQBELs may need to be included in WPDES permits if these limitations have the potential to be exceeded by the NCCW discharge. Based on available data from municipal water supplies and NCCW effluent streams, effluent phosphorus concentrations have a reasonable potential to exceed 1.5 mg/L, which means that phosphorus WQBELs will likely need to be included upon reissuance of the general permit. These WQBELs would be the first phosphorus limitations imposed on many of these discharges since TBELs were not previously triggered due to the small phosphorus loadings coming from these operations.

Phosphorus contained in other NCCW discharges is likely coming from ground water or surface water (i.e., the water supply). In a letter from EPA dated April 1, 2015 (Attached in

	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Adams	$ 44.9	26.9%	7	0.7%	41.5%	9.3%	4
Ashland	$ 38.6	26.3%	8	- 5.3%	29.7%	- 5.7%	6
Barron	$ 44.1	23.2%	24	- 1.1%	32.1%	- 1.1%	6
Bayfield	$ 44.9	25.4%	3	- 3.3%	27.5%	- 0.5%	6
Brown	$ 53.1	14.3%	279	6.4%	32.7%	5.6%	1
Buffalo	$ 47.4	18.0%	6	- 3.1%	27.7%	- 10.3%	6
Burnett	$ 39.6	27.5%	6	- 5.7%	26.2%	9.1%	5
Calumet	$ 65.1	10.5%	39	12.1%	61.1%	3.1%	2
Chippewa	$ 50.6	20.0%	23	6.0%	42.7%	14.1%	3
Clark	$ 43.3	20.9%	8	0.9%	39.8%	4.1%	6
Columbia	$ 57.9	15.3%	27	4.0%	37.1%	7.5%	3
Crawford	$ 42.2	23.1%	13	- 5.0%	37.8%	1.3%	6
Dane	$ 61.7	11.0%	258	11.4%	46.3%	12.5%	0
Dodge	$ 53.1	17.0%	39	1.0%	38.5%	4.1%	4
Door	$ 50.4	20.4%	27	- 3.9%	32.8%	0.7%	6
Douglas	$ 45.4	26.6%	12	1.1%	20.7%	- 2.8%	6
Dunn	$ 48.9	19.6%	19	5.2%	46.2%	5.1%	3
Eau Claire	$ 48.1	17.0%	86	4.4%	42.0%	8.4%	2

[11] Polyphosphates are frequently used in wastewater and water supply streams to control pipe corrosion and to sequester heavy metals such as iron (Fe), manganese (Mn), Copper (Cu), and Lead (Pb). At the time this report was written, an estimated 300 municipal water utilities add polyphosphates. It is unlikely that these utilities will lessen or stop these additions because EPA currently considers this a best available technology-type approach to handle these issues.

Florence	$ 48.0	25.6%	2	- 14.7%	18.2%	18.1%	5
Fond du Lac	$ 53.8	17.8%	63	2.8%	27.6%	1.5%	4
Forest	$ 40.0	28.7%	3	- 9.3%	30.2%	- 1.6%	6
Grant	$ 47.0	19.0%	15	4.1%	51.7%	5.4%	4
Green	$ 55.6	15.9%	26	4.7%	46.1%	6.1%	1
Green Lake	$ 47.0	18.9%	18	- 1.2%	33.8%	- 6.2%	6
Iowa	$ 55.7	16.2%	13	0.7%	35.3%	- 3.8%	4
Iron	$ 39.1	27.1%	2	- 14.9%	49.8%	- 12.2%	5
Jackson	$ 44.1	19.6%	8	4.8%	42.5%	1.9%	4
Jefferson	$ 53.5	17.6%	59	7.2%	27.2%	3.2%	3
Juneau	$ 45.3	24.6%	12	5.7%	37.8%	4.0%	5
Kenosha	$ 54.9	18.3%	196	7.2%	26.7%	5.3%	2
Kewaunee	$ 53.6	17.1%	21	- 1.0%	37.5%	2.5%	4
La Crosse	$ 51.3	16.9%	150	6.5%	39.6%	7.9%	2
Lafayette	$ 49.1	16.3%	6	3.7%	75.2%	9.8%	3
Langlade	$ 42.4	25.1%	9	- 6.5%	26.8%	0.4%	6
Lincoln	$ 49.0	24.5%	12	- 4.8%	16.8%	- 7.9%	6
Manitowoc	$ 48.9	19.2%	56	- 3.5%	30.8%	- 0.5%	5
Marathon	$ 53.4	16.5%	43	3.7%	28.6%	1.1%	4
Marinette	$ 40.5	25.3%	14	- 5.9%	28.8%	- 0.1%	6
Marquette	$ 46.1	27.2%	8	2.3%	29.8%	- 2.6%	6
Menominee	$ 33.3	33.3%	6	- 8.2%	43.1%	14.9%	4
Milwaukee	$ 43.2	21.7%	1,967	1.1%	23.0%	- 1.2%	5
Monroe	$ 49.8	19.3%	22	6.4%	48.6%	9.3%	3
Oconto	$ 51.6	19.4%	9	0.9%	40.5%	- 3.1%	5
Oneida	$ 45.8	24.9%	14	- 4.4%	14.4%	- 1.2%	6
Outagamie	$ 58.3	14.2%	160	6.6%	29.3%	6.9%	1
Ozaukee	$ 75.5	9.9%	168	2.3%	31.6%	10.1%	2
Pepin	$ 47.7	23.3%	9	- 1.6%	35.6%	2.6%	6
Pierce	$ 59.2	15.7%	16	6.5%	21.8%	8.0%	2
Polk	$ 48.5	22.4%	17	0.8%	30.4%	6.3%	5
Portage	$ 51.0	17.1%	40	2.8%	33.7%	4.0%	5
Price	$ 42.6	27.2%	4	- 11.3%	11.1%	- 9.6%	6
Racine	$ 54.1	18.7%	218	1.9%	15.9%	- 1.9%	4
Richland	$ 45.3	22.5%	10	- 0.6%	44.4%	5.7%	4

Rock	$ 49.4	20.1%	86	2.9%	25.3%	- 4.6%	5
Rusk	$ 38.7	30.7%	5	- 4.7%	19.9%	- 13.1%	6
St .Croix	$ 68.4	12.4%	43	18.2%	49.4%	21.2%	1
Sauk	$ 52.1	17.1%	44	6.0%	35.9%	3.1%	4
Sawyer	$ 39.9	28.1%	5	- 2.1%	28.3%	1.3%	6
Shawano	$ 46.6	22.2%	14	- 0.2%	33.1%	2.2%	6
Sheboygan	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Taylor	$ 44.9	22.0%	8	4.3%	23.3%	- 4.2%	6
Trempealeau	$ 49.1	19.9%	19	5.1%	47.9%	11.7%	3
Vernon	$ 45.5	22.1%	11	3.6%	50.0%	7.9%	4
Vilas	$ 40.8	28.0%	9	- 2.0%	16.4%	- 8.9%	6
Walworth	$ 54.0	17.3%	70	6.0%	27.1%	4.2%	3
Washburn	$ 41.9	30.3%	7	- 4.9%	35.9%	1.1%	6
Washington	$ 66.2	15.3%	121	7.7%	38.1%	8.4%	1
Waukesha	$ 75.9	10.9%	417	5.2%	37.2%	5.4%	1
Waupaca	$ 50.8	22.3%	27	- 1.3%	32.5%	- 2.8%	6
Waushara	$ 43.1	23.6%	10	- 1.2%	39.5%	6.5%	5
Winnebago	$ 51.0	15.7%	206	3.9%	31.6%	4.4%	4
Wood	$ 47.7	19.6%	53	- 1.7%	23.9%	- 3.9%	5
Benchmark	U.S. = $53.0	U.S. = 17.1%	WI = 50	~1/2 U.S = 4.4%	U.S = 39.9%	~1/2 U.S = 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Appendix D. EPA Letter Regarding Intake Credits for Phosphorus p. 78), it is acknowledged that intake credits may be factored into the reasonable potential determination for these situations so long as the conditions of Paragraph D.3 in Procedure 5 in Appendix F to 40 C.F.R. Part 132 are met. These conditions are:

1. The facility withdraws 100 percent of the intake water containing the pollutant from the same body of water[12] into which the discharge is made;
2. The facility does not contribute any additional mass of the identified intake pollutant to its wastewater;
3. The facility does not alter the identified intake pollutant chemically or physically in a manner that would cause adverse water quality impacts to occur that would not occur if the pollutants were left in-stream;
4. The facility does not increase the identified intake pollutant concentration, as defined by the permitting authority, at the edge of the mixing zone, or at the point of discharge if a mixing zone is not allowed, as compared to the pollutant concentration in the intake water, unless the increased concentration does not cause or contribute to an excursion above an applicable water quality standard; and
5. The timing and location of the discharge would not cause adverse water quality impacts to occur that would not occur if the identified intake pollutant were left in-stream.

DNR believes that some NCCW discharges would be able to meet these conditions, thereby, eliminating their need to have phosphorus WQBELs in WPDES permits. Only once-through cooling operations could meet these conditions, however, since these process-types do not increase the concentration of phosphorus within the operation.

In summary, phosphorus WQBELs for NCCW facilities will likely be needed whenever:

- A polyphosphate-adding municipal water supply provides the source water;
- Phosphorus-containing additives are utilized in the operation;
- The operation is a closed-cycle recirculating system;
- A cooling tower is present; or
- The operation cannot satisfy other requirements of Paragraph D.3.

Due to data limitations, it is not possible to determine with a sufficient degree of certainty which point sources covered under the NCCW general permit would need phosphorus WQBELs at the time this study was completed. DNR is currently in the process of gathering additional information and moving to an electronic data system to help streamline these permitting decisions. To begin this effort, DNR conducted a survey of its NCCW general permit holders, which estimated that almost 250 of the 500 NCCW general permit holders would require phosphorus WQBELs (Figure 3). Again, further investigation

[12] For the purpose of this study, "same waterbody" means two hydrologically connected points with similar water quality characteristics in which a pollutant can travel between in a reasonable period of time without significantly changing chemically or physically. Hydrological connections can include surface and groundwater connections.

is needed to confirm this number. Additionally, effluent flow data is not electronically available at this time, which prevents the calculation of phosphorus compliance costs (Section 3, p. 24). Once these data gaps are resolved these costs can be factored into this analysis pursuant to s. 283.16(2m), Wis. Stat. For the purpose of this study, all individual NCCW permit holders are assumed to have reasonable potential to exceed their calculated phosphorus WQBEL. This assumption may not necessarily be appropriate for each individual WPDES permit holder, but still significantly underestimates the compliance costs for this category. This decision can also be re-evaluated once additional information regarding NCCW general permit holders is available.

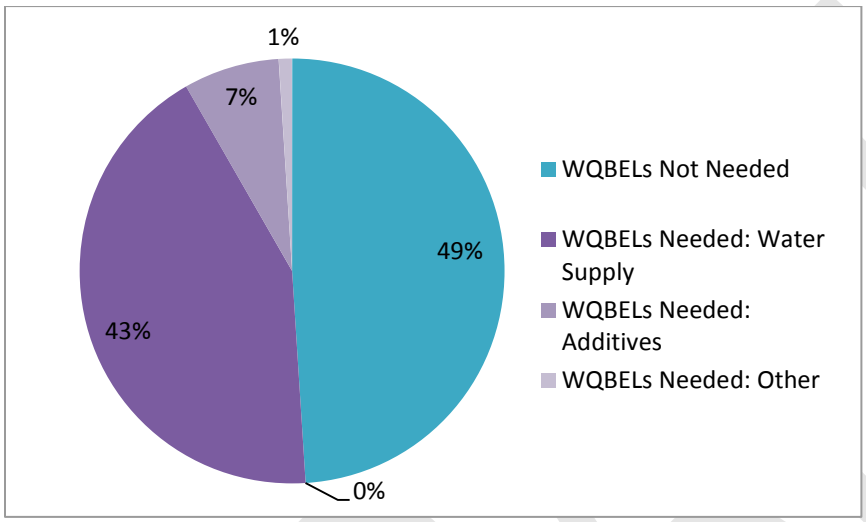


Figure 3. TP WQBEL reasonable potential approximation for NCCW general permit holders based on survey responses. Teal represents percentage of NCCW discharges that do not need phosphorus WQBELs and shades of purple represent percentage of NCCW discharges that do need phosphorus WQBELs.

(2) Power plants and other discharges with multiple outfalls

As previously mentioned, most power plants and some other municipal and industrial permittees discharge from multiple outfall locations, each of which need to be evaluated for phosphorus limits (Figure 4).

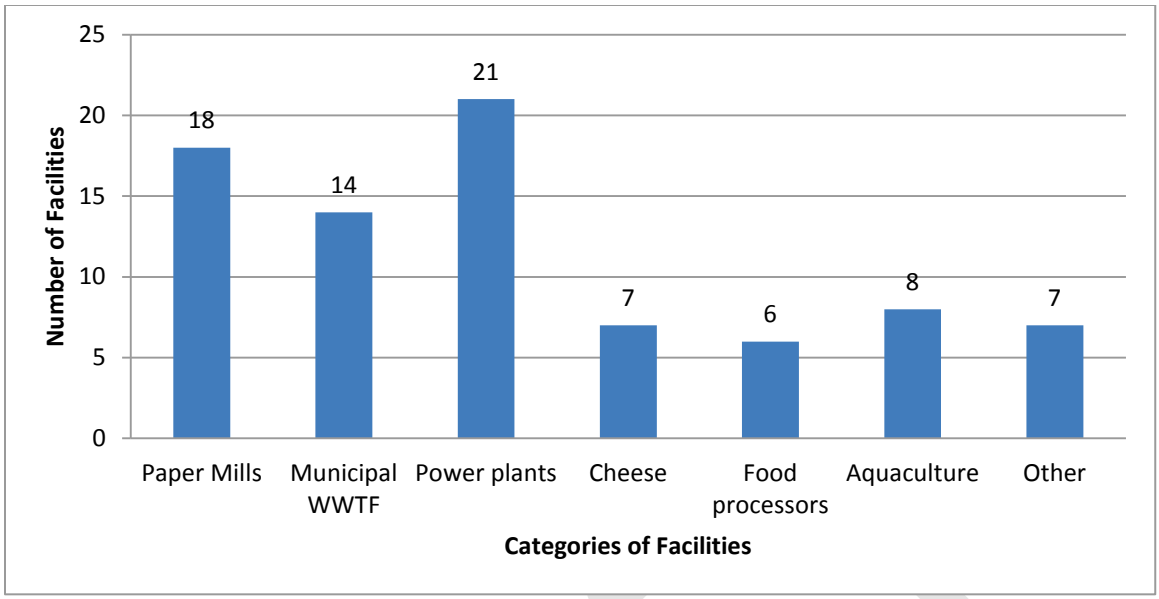


Figure 4. Number of facilities in each category with multiple outfall locations.

The first step to conduct a reasonable potential analysis for these outfall locations is to determine the type of effluent being discharged at each outfall location. These data are typically available in the SWAMP database, but in some cases required DNR staff to review individual permit files to make a determination. Some power plants, for example, operate more than 20 outfall locations, with effluent streams ranging from on-site municipal wastewater treatment facilities to effluent containing polyphosphate additives or coal combustion byproducts to NCCW discharges. Generally, outfalls fall into one of three categories: process wastewater, NCCW, and emergency/intermittent outfalls. Outfalls containing process wastewater clearly contained anthropogenic phosphorus, many of which even trigger the need for phosphorus TBELs in previous WPDES permits. For these reasons, the same assumption used for municipal WWTFs and industrial discharges of process wastewater was also used for these outfalls, i.e., phosphorus WQBELs were assumed to be needed, if the limits were less than 1 mg/L.

As previously mentioned, phosphorus WQBELs are expressed as long-term average limitations (expression of limits step, p. 16). By definition, emergency/intermittent outfalls are short-term discharges. In situations where assimilative capacity is available in the receiving water, it is unlikely that phosphorus WQBELs are needed for these outfall locations. A site-specific determination needs to be made by DNR staff for other situations. For the purpose of this study, however, it was assumed that TP WQBELs are not needed for these discharges, but this may not be the case for all situations.

Outfalls that consisted solely of NCCW are subject to the same principles described for that category (p. 17). Each of these outfalls was evaluated to determine: a) if they had the potential to contain anthropogenic sources of phosphorus through additives or the water supply, b) if a cooling tower was present, and c) if intake credits could be given. This analysis relied on data from SWAMP and Wisconsin's intake database, as well as data from individual permit files, if necessary. For the purpose of this study, phosphorus WQBELs were assumed to be needed unless clear evidence was available to

demonstrate that these WQBELs were not necessary. Again, DNR staff are responsible for making a final determination for individual WPDES permit holders upon permit reissuance.

Using the assumptions and procedures above, a determination was made for each outfall location. If a facility had multiple outfalls that triggered phosphorus limits, the flows from these outfalls were added together to come up with an estimated effluent flow that would need additional phosphorus treatment. This composite flow was used to estimate compliance costs (Section 4, p. 24). The results of this analysis for the power industry are shown in Figure 5.

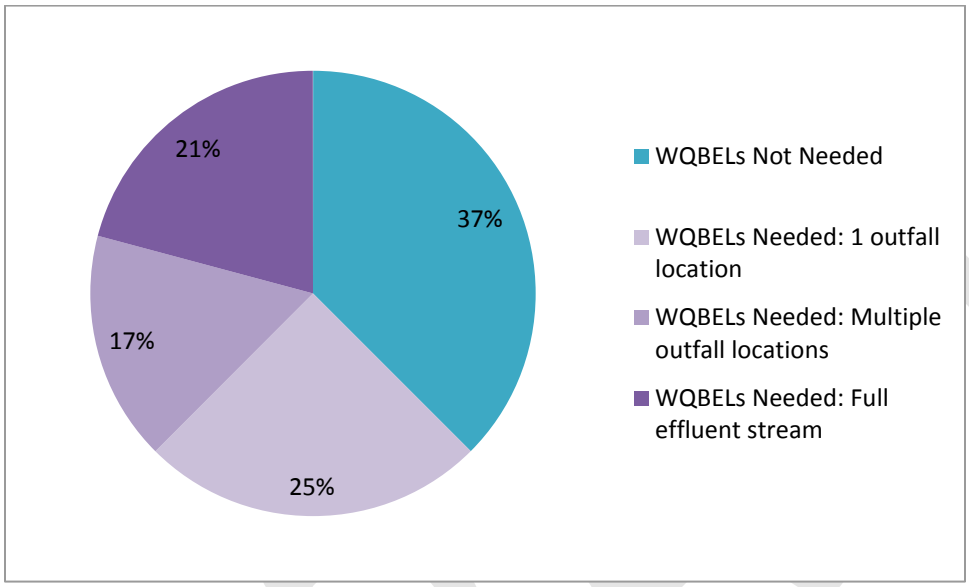


Figure 5. TP WQBEL reasonable potential results for power plants.
Teal represents percentage of power plants that do not need phosphorus WQBELs and shades of purple represent percentage of power plants that do.

Section 4. Determining Compliance Costs

Given the number of point sources in Wisconsin, it was not possible to estimate compliance costs on a facility-by-facility basis, and still receive the benefit of the MDV. Rather, cost curves were developed by ARCADIS to estimate compliance costs based on the restrictiveness of the phosphorus WQBEL, and the permitted flow of the facility. A cost curve, for the purpose of this study, is a graph of the costs of compliance with phosphorus limits as a function of effluent flow. Utilizing cost curves is a straightforward way of estimating the compliance costs for various facilities when site-specific analyses are unavailable or infeasible, and has been used by several similar analyses[13]. The purpose of this section is to highlight the key data inputs used to generate cost curves and the results from this analysis. A more comprehensive description of the methods and assumptions used to generate the cost curve and a comparison of these curves to other studies is provided in the *"Economic Impact Analysis"* (see Section 2 and Appendix E of that report).

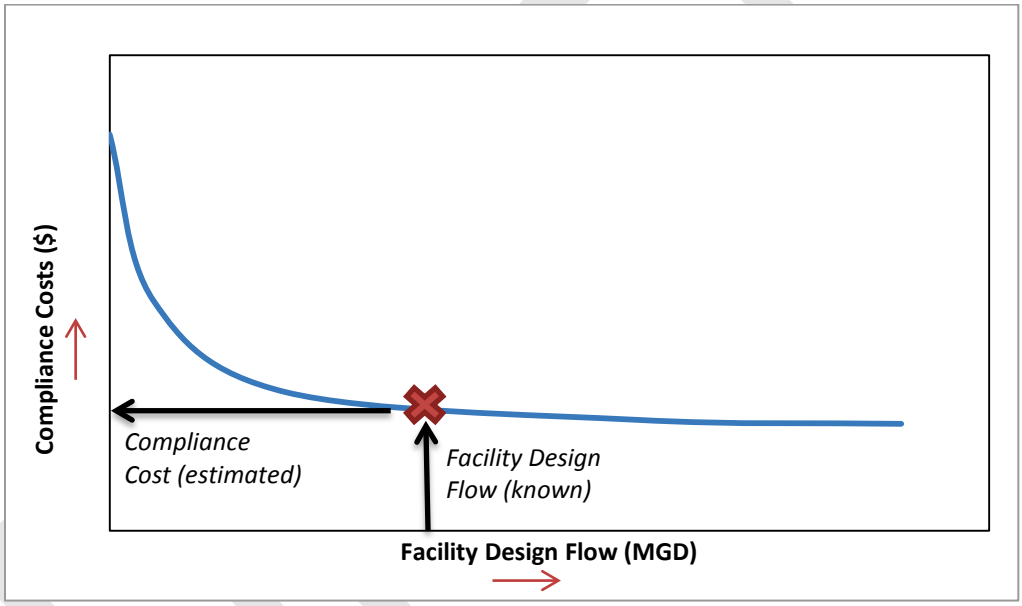


Figure 6. Graphical representation to depict how compliance costs are estimated using cost curve approach.

Compliance costs are driven by the capital costs of treatment equipment necessary to comply with phosphorus WQBELs as well as the operation and maintenance costs for this technology. Therefore, an important step in this process was to create reasonable estimates of existing phosphorus treatment technology at these facilities as well as the additional treatment technology to comply with the phosphorus WQBELs (Section 3, p. 11). As mentioned in Section 2 (p. 9), sewage treatment lagoon systems are significantly different from bio-mechanical plants and likely require additional capital investment to comply with phosphorus WQBELs. Different baseline assumptions were, therefore, made for bio-mechanical WWTFs, lagoons, and industrial discharges (Sections 2.4.1, 2.4.2, and 2.4.3 of the EIA

[13] Examples include: "Technical and Economic Evaluation of Nitrogen and Phosphorus Removal and Municipal Wastewater Treatment Facilities (2011)" by Tetra Tech; "Cost of Phosphorus Removal at Wisconsin Publically Owned Treatment Works (2012)" by Mark Williams; and "Opinions of Probable Cost for Achieving Lower Effluent Phosphorus Concentrations at Wastewater Treatment Plants in Wisconsin (2008)" Strand Associates.

Report, respectively). These baseline assumptions were based on site-specific facility diagrams throughout Wisconsin as well as the expertise of ARCADIS. For example, clarifiers were assumed to be in place for all mechanical municipal and industrial treatment plants, but not for lagoons. Appendix C of the EIA Report provides assumed treatment diagrams used in this analysis. Next, three classes of treatment technology were selected to capture the range of site-specific WQBELs calculated in section 3 (Figure 7). These ranges were chosen based on experience of ARCADIS and other consulting firms as to the range of TP concentration that could be reliably achieved at conventional wastewater treatment plants.

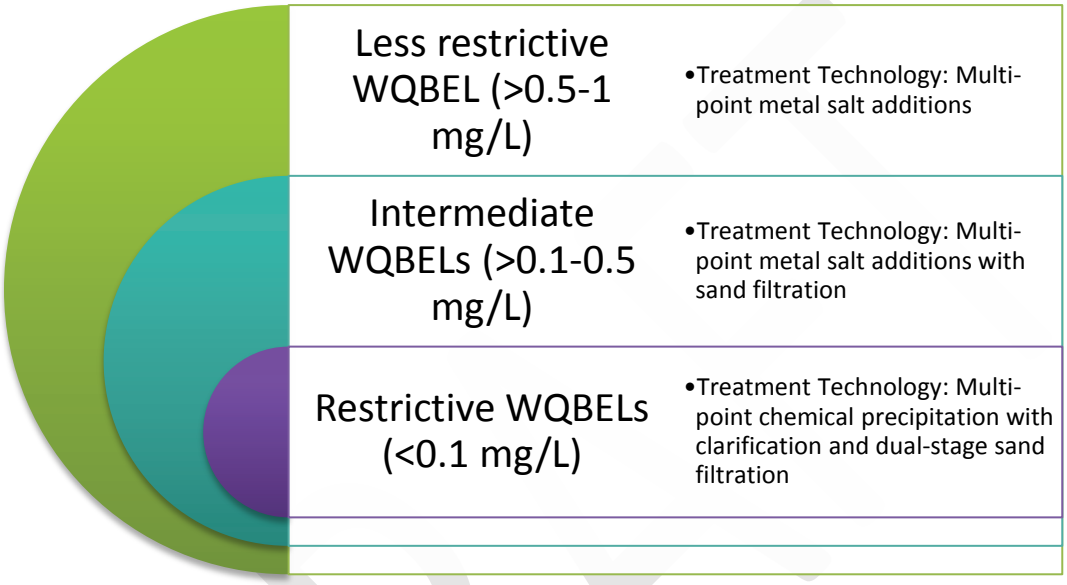


Figure 7. Treatment technology assumed to achieve compliance with ranges of phosphorus WBQELs.

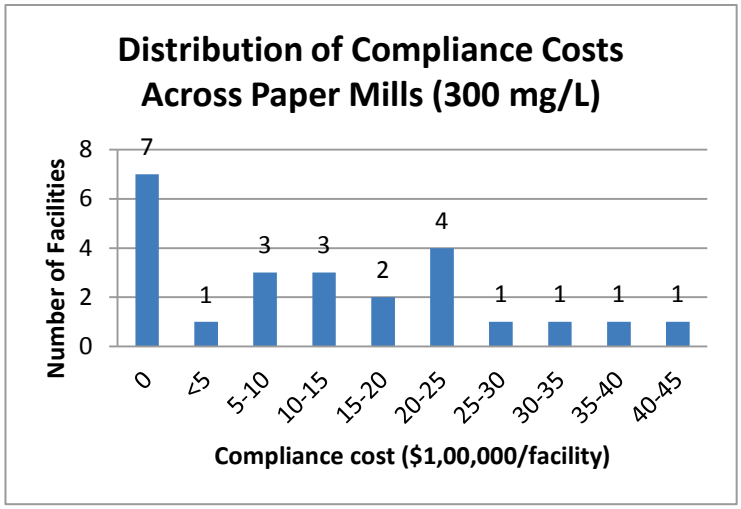
This study acknowledges that on a case-by-case basis other less costly treatment alternatives may be preferable to the technologies described in Figure 7 . For example, some facilities may wish to explore enhanced biological phosphorus removal (EBPR) in lieu of chemical filtration. Other facilities may be interested in installing "package plants", i.e., pre-manufactured treatment facilities used to treat water/wastewater. These alternatives vary widely in effectiveness as well as cost, making it inappropriate to assume that these treatment alternatives will work for statewide categories of point sources in Wisconsin. For example, the effectiveness of EBPR systems is dependent on the presence of nitrate or dissolved oxygen in the anaerobic zone, the carryover of dissolved oxygen in the raw wastewater and primary effluent, nitrification requirements, and the amount of readily biodegradable BOD (rbBOD) available in the anaerobic zone[14]. For this reason, EBPR treatment is not appropriate for many wastewater treatment plants. In other cases, EBPR or package plants may be effective treatment processes, but do not appear to be a lower cost option. For example, pilot testing at the City of Fond du Lac has suggested that "package plants" can achieve compliance with restrictive phosphorus limitations,

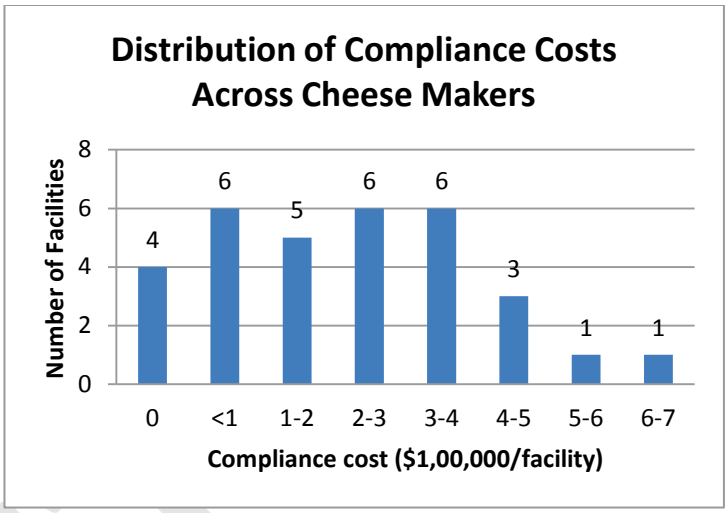
[14] WEF Manual of Practice No. 34 "Nutrient Removal" Prepared by the Nutrient Removal Task Force of the Water Environment Federation®.

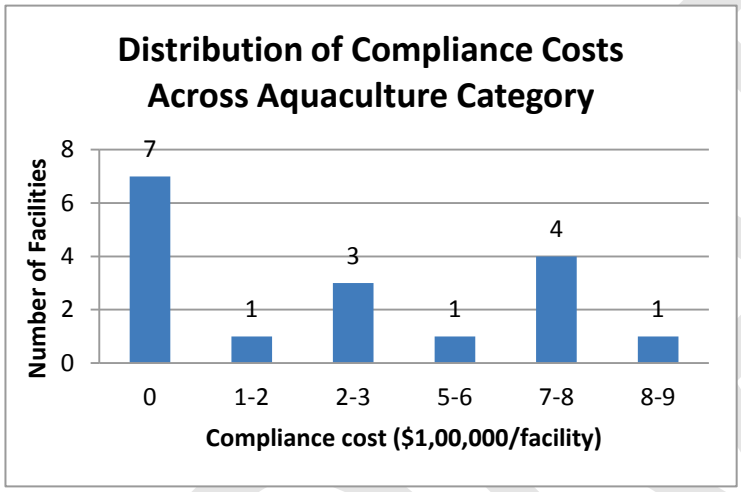
but costs of these package systems may be almost two times larger than the cursory cost estimates derived from the cost curve method[15]. Utilizing the treatment technologies specified in Figure 7 provides a practical approach to estimate costs for the purposes of this study, and ensures that the majority of point sources in each category are adequately represented. If facility-specific data becomes available at a later time, adjustments can be made to the compliance costs analysis pursuant to 283.16(2m), Wis. Stat.

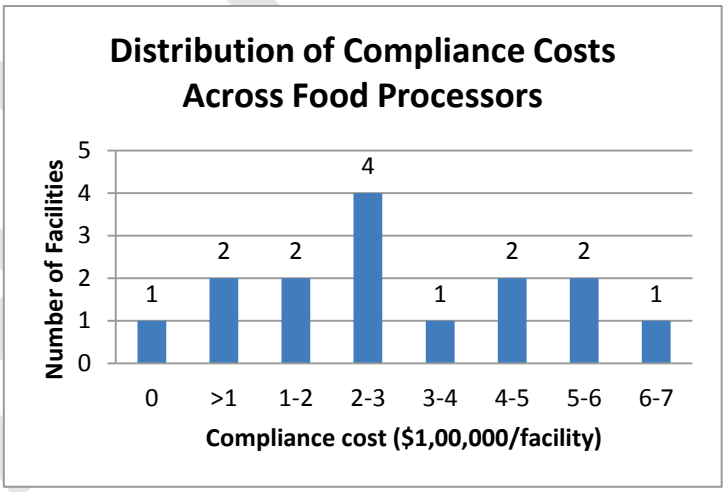
Once the treatment technology was determined, assumed design criteria were used to size various components of the treatment train. Engineering, equipment and construction costs could then be estimated for each treatment scenario. To estimate the costs, ARCADIS relied on budgetary costs for major equipment multiplied by factors to account for ancillary equipment, construction, engineering, and contingency. Factors were determined from engineering guidelines and the results verified against actual design estimates and other published studies. These cost estimate assumptions are provided in detail in Section 2.6 of the EIA Report. The final result was the development of capital and operation and maintenance cost curves, presented in Appendix E of the EIA Report. Using site-specific permitted actual and design flows, cost estimates can be made for each individual WPDES permit holder that had site-specific phosphorus WQBELs calculated. The following sets of figures represent the cost distribution projected for individual facilities using the cost curve approach for each statewide category of discharge.

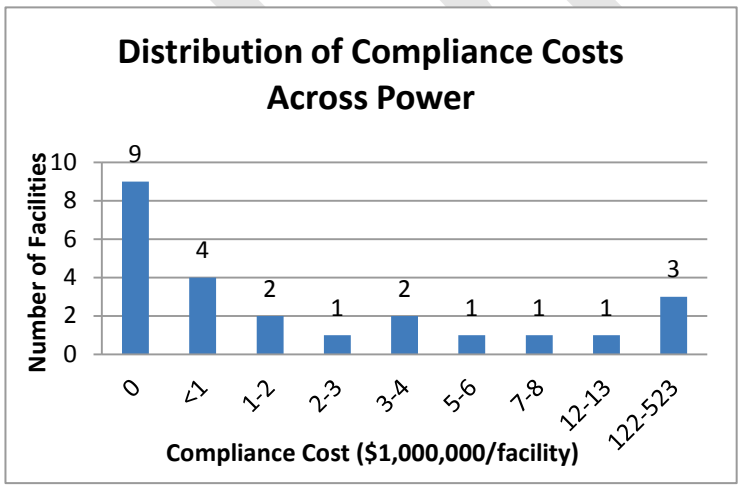
[15] Unpublished data from a pilot test conducted by STRAND Associates.

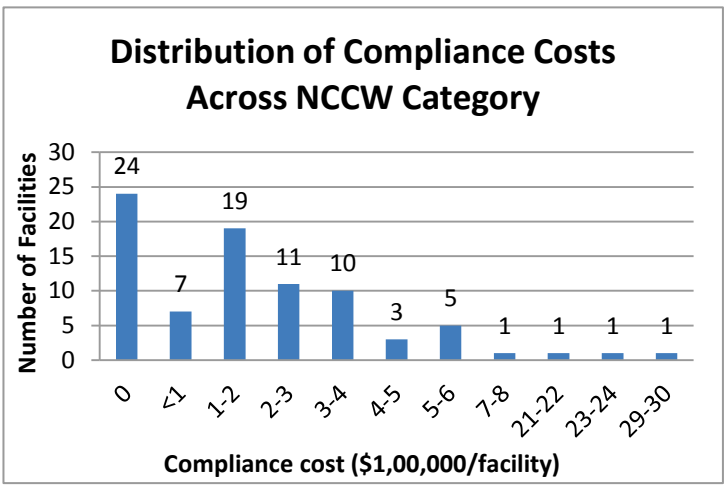

Distribution of Compliance Costs Across Paper Mills (300 mg/L)
Number of Facilities
0
2
4
6
8
7
1
3
3
2
4
1
1
1
1
0
<5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
Compliance cost ($1,00,000/facility)

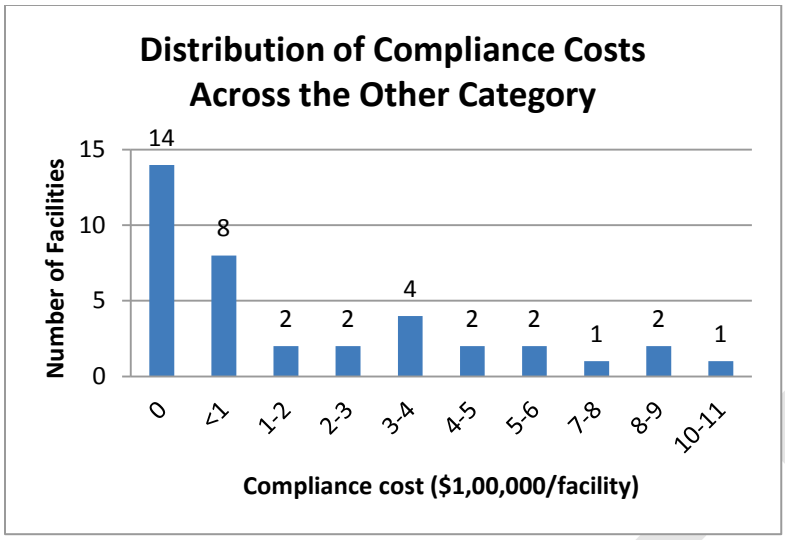

Distribution of Compliance Costs Across Cheese Makers
Number of Facilities
0
2
4
6
8
4
6
5
6
6
3
1
1
0
<1
1-2
2-3
3-4
4-5
5-6
6-7
Compliance cost ($1,00,000/facility)

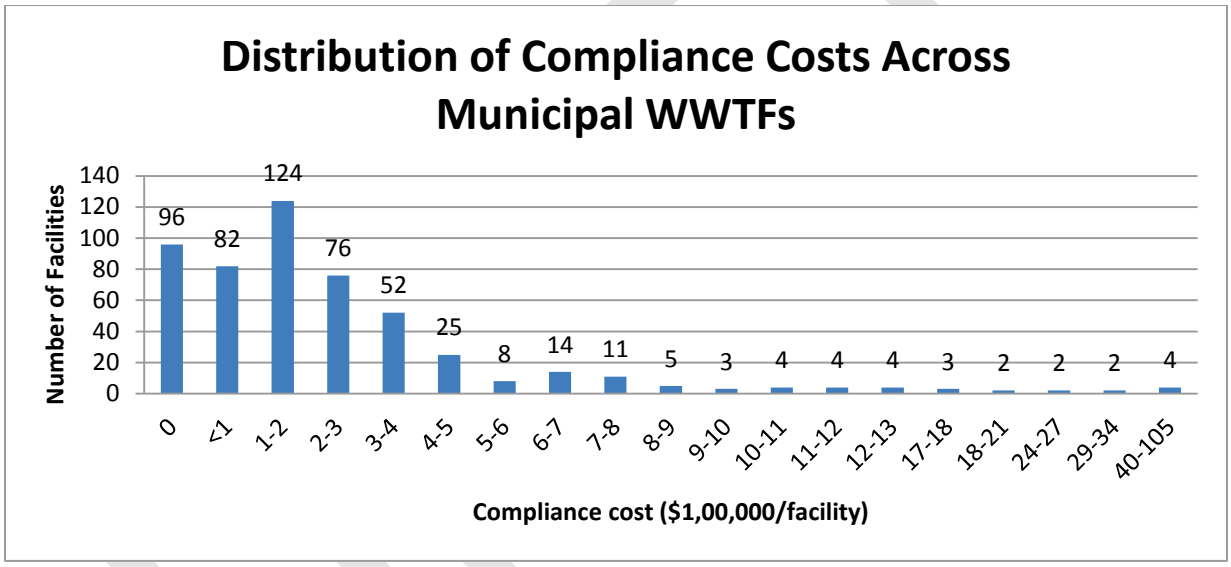

Distribution of Compliance Costs Across Aquaculture Category
Number of Facilities
0
2
4
6
8
7
1
3
1
4
1
0
1-2
2-3
5-6
7-8
8-9
Compliance cost ($1,00,000/facility)


Distribution of Compliance Costs Across Food Processors
Number of Facilities
0
1
2
3
4
5
1
2
2
4
1
2
2
1
0
>1
1-2
2-3
3-4
4-5
5-6
6-7
Compliance cost ($1,00,000/facility)


Distribution of Compliance Costs Across Power
Number of Facilities
0
2
4
6
8
10
9
4
2
1
2
1
1
1
3
0
<1
1-2
2-3
3-4
5-6
7-8
12-13
122-523
Compliance Cost ($1,000,000/facility)


Distribution of Compliance Costs Across NCCW Category
Number of Facilities
0
5
10
15
20
25
30
24
7
19
11
10
3
5
1
1
1
1
0
<1
1-2
2-3
3-4
4-5
5-6
7-8
21-22
23-24
29-30
Compliance cost ($1,00,000/facility)


Distribution of Compliance Costs Across the Other Category
Number of Facilities
15
10
5
0
14
8
2
2
4
2
2
1
2
1
0
<1
1-2
2-3
3-4
4-5
5-6
7-8
8-9
10-11
Compliance cost ($1,00,000/facility)


Distribution of Compliance Costs Across Municipal WWTFs
Number of Facilities
140
120
100
80
60
40
20
0
96
82
124
76
52
25
8
14
11
5
3
4
4
4
3
2
2
2
4
0
<1
1-2
2-3
3-4
4-5
5-6
6-7
7-8
8-9
9-10
10-11
11-12
12-13
17-18
18-21
24-27
29-34
40-105
Compliance cost ($1,00,000/facility)

Section 5. Substantial Impact Analysis

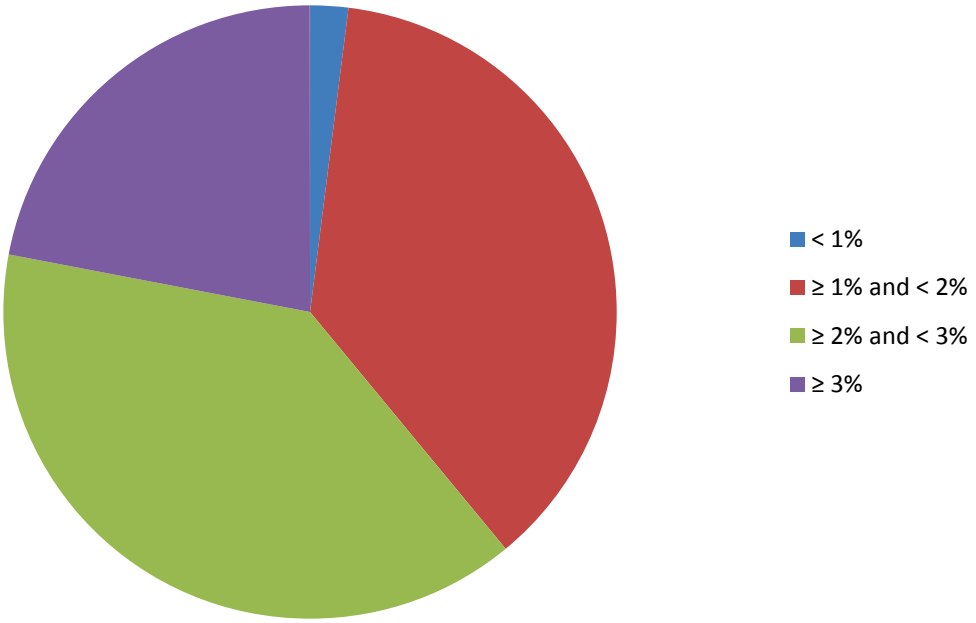
Like requesting an individual variance (EPA–823–B–95–002), a two-step process was used to determine if phosphorus standards compliance has a substantial impact. The purpose of the first step in this process, commonly referred to as the "primary screener", is to determine the phosphorus standards' economic impact on dischargers in each category. The second step, referred to as the "secondary screener", gauges the wider community's socioeconomic well-being and ability to adapt to changes that accompany implementation of phosphorus standards. In order to meet the "substantial determination" test, a facility must meet a primary screener and meet a secondary screener. Unlike individual variances, MDVs can apply to multiple facilities, thereby allowing multiple WPDES permit holders to potentially qualify for a variance under the MDV platform. The purpose of this section is to describe the primary and secondary screeners selected for the phosphorus MDV process.

A. Primary Screeners

(1) Primary Screener for Municipal WWTFs

In the municipal WWTF category, the primary indicator compares phosphorus compliance cost per customer to MHI. Municipal WWTFs' phosphorus compliance costs were estimated with ARCADIS cost curves, and municipal WWTFs reported customer numbers. Considerable work went into determining MHI for the specific communities affected by each municipal WWTF's compliance costs (these MHI figures will not be identical to MHI figures used elsewhere because they are specific to the WWTFs' service areas). The methods used to generate the MHI values are provided in Section 4 of the EIA Report and the "Consideration of Residential Share Data" Section of the EIA Addendum. The results of this analysis are presented in Appendix F of the EIA Addendum, and are summarized in in this determination's Figure 8 on page 31.

Figure 8. Distribution of projected MHI values among municipalities that are incurring phosphorus compliance costs



When estimated per-customer cost is at least 2% of MHI, then phosphorus compliance costs are deemed to have a substantial impact on municipal WWTFs. The municipality should meet at least one secondary indicator as well in order to confirm this determination, thereby meeting the substantial test. (Secondary indicators are discussed in depth in part B of this section, "Secondary Indicators", p. 33). When estimated per-customer cost is at least 1% of MHI but less than 2% of MHI, then the municipal WWTFs must meet at least two secondary indicators in order to meet the substantial test. The substantial impact is less obvious for municipal WWTFs with service areas in this MHI range, so these municipal WWTFs face a higher threshold of two secondary indicators. When the estimated per-customer costs are less than 1% of MHI, the WWTFs' phosphorus compliance costs are not deemed substantial by this primary screener.

(2) Primary Indicators for Industrial Dischargers

Two primary indicators were used to determine if industrial dischargers face substantial impacts from phosphorus compliance costs. The first primary indicator compared the phosphorus compliance costs of individual WPDES permit holders to the compliance costs of other discharges within the same category. As previously stated, applicable industrial categories are aquaculture, cheesemakers, food processors, non-contact cooling water (NCCW), paper, power generators, and other (Section 2, p. 9). Within each category, the first primary indicator ranks permitted dischargers by estimated phosphorus compliance costs. If an individual permit holder bears a significant compliance cost compared to other members of the category, the phosphorus rule likely causes a substantial impact such as competitive disadvantage or impaired profitability. Therefore, the first indicator allows the top 75% of dischargers with nonzero compliance costs to be considered for MDVs and move to the secondary indicator test.

During the course of this preliminary determination, DOA and DNR considered the possibility that dischargers with larger estimated compliance costs may sometimes have larger revenues to shoulder this burden. While this possibility cannot be ruled out definitively, it cannot play a prominent part in this determination for at least four reasons:

1. Analyzing data for individual dischargers quickly descends into individual point source applications, an outcome that runs contrary the very essence of multi-discharger variances;
2. Neither DOA nor DNR has revenue or profit data for individual dischargers;
3. Analyzing the financial position of each individual discharger would require resources that are not available from DOA or from DNR or from EPA; and
4. Dischargers with greater revenues or greater profits may be more likely to forego Wisconsin expansion or shift production to other states or shift production to other countries.

A converse argument could also be made that although an individual permittee does not have high compliance costs relative to other permittees in its category, an individual community may have multiple permittees in the same category and the cumulative compliance costs may have a substantial impact on the individual community. Since Wisconsin is home to may small to medium-sized businesses, this situation will arise across the state. In Wisconsin, small to medium-sized business often cluster near each other. Whether they rely on the same raw materials, the same skilled workers, or the same infrastructure, the result is similar. For example, Green County, Wisconsin is renowned for its large number of small artisanal cheesemakers due to local infrastructure and milk supply. In these situations, the community may face substantial impact due to cumulative compliance costs to multiple permittees in the same category. For these reasons, the second primary indicator for industrial dischargers ranks total compliance costs by county for each category. Each permittee with positive compliance costs belongs to a county. Each county has total (cross-permittee) compliance costs for the category. All counties with positive compliance costs are ranked and assigned to a group (bottom 25% or top 75% of counties for that category). If a permittee with positive estimated compliance costs is in a county in the second group (top 75% of counties in the category), the permittee meets the second primary screener.

In summary, industrial dischargers may be considered for MDVs if they meet two conditions: 1) they are. within the top 75% of permittees incurring costs); and 2) the discharge is located in a county that is within the top 75% of counties incurring costs. Permittees that meet both tests are believed to have a substantial impact, but must meet at least one secondary indicator in order to confirm this determination (see part B of this section, p. 33). Permittees that meet only one primary indicator must meet at least two secondary indicators in order to qualify for MDVs. Permittees do not meet the substantial test if they meet neither primary indicator.[16]

[16] If a permittee fails to meet the substantial test or otherwise fails to qualify for an MDV, the permittee is not necessarily disqualified from seeking an individual variance.

B. Secondary Indicators

Taken together, the secondary indicators should identify those counties that have particular susceptibility to the costs of phosphorus standards, either because local economic conditions limit the capacity to adapt productively to increased costs, or because affected industries' costs are particularly large in relation to a local economy. When selecting indicators, DOA consulted with economists at the Wisconsin Department of Workforce Development and the Wisconsin Department of Revenue. This analysis utilized seven secondary indicators that emerged from the consensus: median household income (MHI), personal current transfer receipts as a share of total income, jobs per square mile, population change, change in net earnings by place of residence, job growth, and capital costs as a share of total wages. These secondary indicators apply to each category, excluding MHI for municipal WWTFs (this indicator was used as a primary screener for that category, see p. 30). The most recent data available at the time of this report was written were used to evaluate the secondary indicators: population data is available for 2014; other data sets are available for 2013. These datasets are the same for all categories of dischargers, excluding capital costs as a share of total wages, which uses category-specific data and category-specific analyses. This section identifies and explains the importance of each of these secondary indictors, and provides a sector-by-sector analysis to illustrate how the secondary indictors apply to each category.

(1) A Note Regarding Color-Coding and Total Scoring:

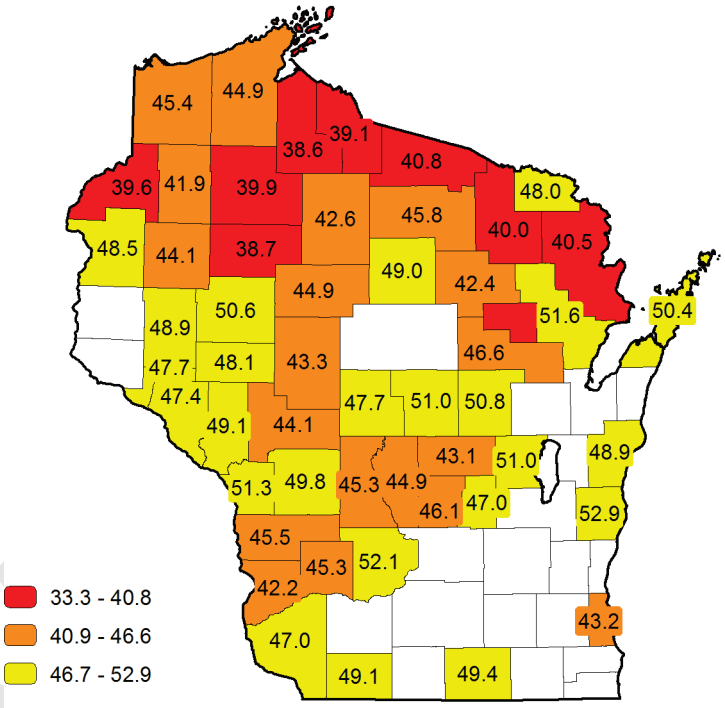
In this section, counties without color in maps and tables post scores causing no concern. The yellow coloring in maps and tables indicates that the counties met the indicator's specified threshold. The orange coloring indicates significantly more concern than the base threshold. The red coloring indicates the highest level of concern.

(2) Identifying the indicators and explaining their importance

(a) Median Household Income

Median household income is an indicator of how easily consumers can cope with increased electricity bills and how easily workers can cope with slower job growth, reduced hours and/or job losses caused by regulatory change. In any community, half the households have income below the median household income and half the households have income above that level.

Figure 9. Median Household Income ($thousands) (U.S. = $53.0)



Source: U.S. Census Bureau 2009-2013 American Community Survey
Table B19013 Median Household Income

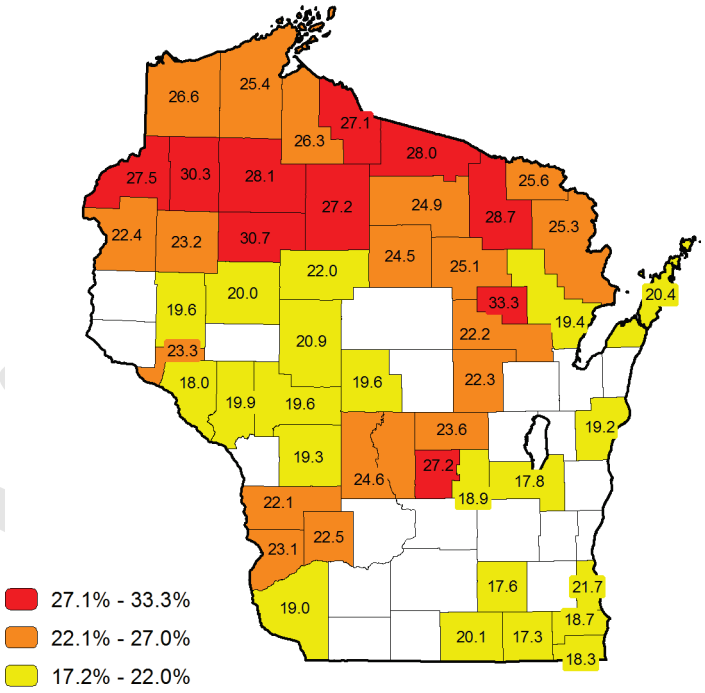
Median Household Income figures came from the Census Bureau's American Community Survey, which indicated that U.S. median household income was $53,046 in 2013. Figure 9 shows only counties with median household income below the U.S. MHI. The darker the shading, the further the county's MHI is below U.S. MHI. This indicator adds to the odds of qualifying for a multi discharger variance if the county MHI is below U.S. MHI of $53,046.

Two notes relating to the use of MHI as a primary indicator for WWTFs: (1) Because MHI is the primary indicator for WWTFs, MHI is the only secondary indicator that is not used as a secondary indicator for WWTFs. (2) Because MHI in the WWTF primary indicator was MHI *for affected communities*, it may differ slightly from MHI *for the county* used in this secondary indicator.

(b) Personal Current Transfer Receipts as a Share of Total Personal Income

While median household income gauges current income levels, it tells little about future trajectory. For insight into future income trends, it is useful to delve into source of income. The U.S. Commerce Department's Bureau of Economic Analysis divides income into three categories. The "earnings" category is generally money earned from work. The "dividends interest and rent" category is investment income. The "personal current transfer receipts" category reflects transfers (mostly from governments to individuals). Nationally, transfer receipts constitute 17.1 percent of total income. Figure 10 highlights counties that derived more than 17.1 of their incomes from transfer receipts. This indicator adds to the odds of qualifying for MDVs if the county derives more than 17.1 percent of its total income from personal current transfer receipts.

Figure 10. Personal Current Transfer Receipts as a Share of Total Personal Income (U.S = 17.1%)



Source: U.S Bureau of Economic Analysis, Personal Income Summary http://www.bea.gov/ Table CA04

Transfer receipts achieve important goals for small amounts of money, but transfer receipts are not regarded as engines of economic activity to the same extent as earnings and investment. Over the next decade or so, many baby boomers will stop paying into Social Security and Medicare (which constitute 61.8 percent of Wisconsin's transfer receipts). Baby boomers will become beneficiaries of those programs. Younger people entering the labor force are less numerous than the baby boomers who are leaving; all else equal, a numerically smaller group will contribute less revenue to fund transfer payments. Younger workers earn lower real wages than baby boomers did at the same ages, which also erodes their contributions to transfer payments. Lastly, younger workers face slower wage growth than baby boomers did, so they're not likely to make up the difference over time. For these reasons, personal

current transfer receipts are unlikely to grow as fast as the broader economy for the next decade. Communities relying heavily on transfer receipts are likely to face slower income growth. Slower income growth would make it more difficult to adjust to the cost of phosphorus standards.

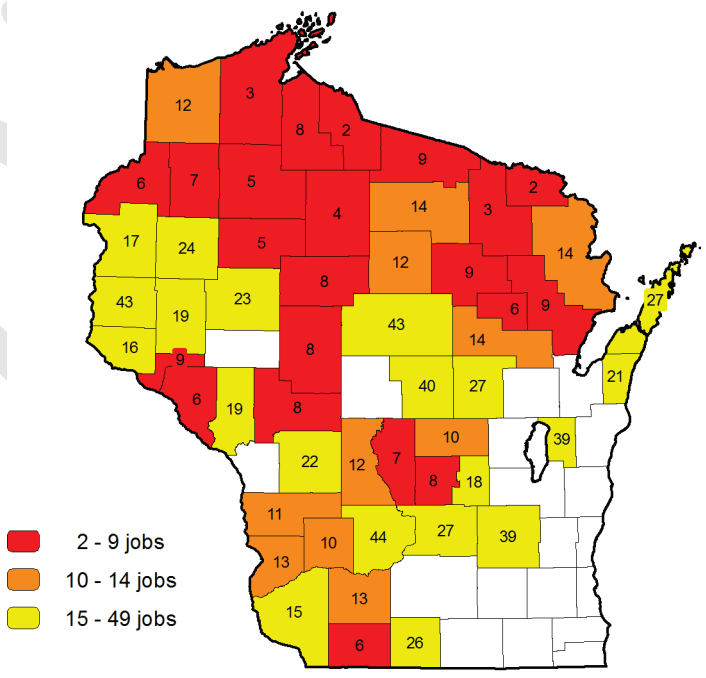
(c) Jobs per Square Mile

When asking how easily a community can adjust to phosphorus standards, it may be useful to consider how many jobs there are per square mile. Particularly in central Wisconsin and in northern Wisconsin, there are many communities with few jobs per square mile surrounded by many other communities with few jobs per square mile. Workers looking for jobs and utilities looking for ratepayers may have to look farther and wider in those cases.

The Wisconsin Department of Workforce Development's Quarterly Census of Employment and Wages supplies the numerator (jobs). The most recent annual figures available at this writing are from 2013. The U.S. Census Bureau's Quick Facts supplies the denominator (land area in square miles). Statewide, the average is 50 jobs per square mile. This indicator adds to the odds of qualifying for MDVs if the county has fewer than 50 jobs per square mile.

If phosphorus standards caused Wisconsin employers to restrict investment, restrain expansion, or reduce current employment, the number of jobs per square mile can affect how easily and how productively workers can resettle. As seen in Figure 11, much of the northern tier of the state and much of the southwest corner of the state has very low job density.

Figure 11. Jobs per Square Mile (WI = 50)



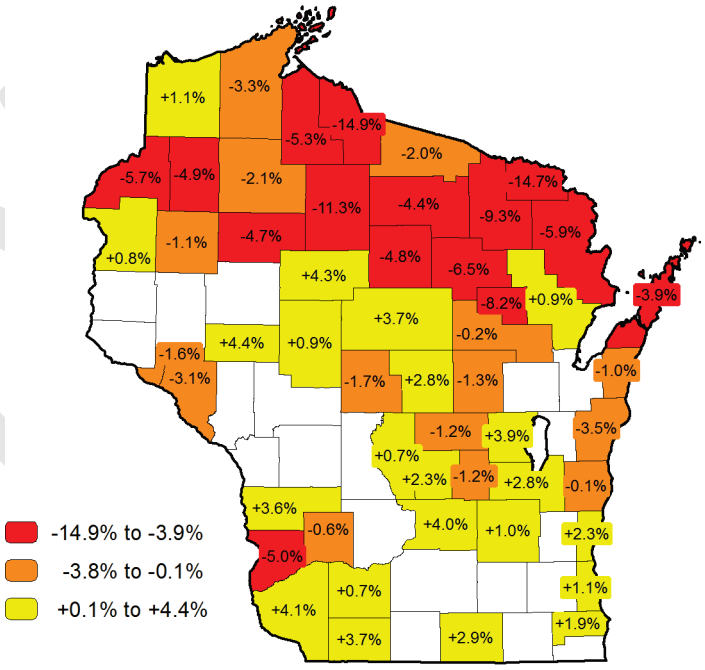
Source: WI DWD Quarterly Census of Employment and Wages
http://worknet.wisconsin.gov/worknet/

(d) Population Change

Compared to the faster-growing communities, communities with slower-than-national population change will spread their electricity and water costs across fewer rate payers, and they will have fewer consumers and workers to kick-start economic activity. Cultural trends and technological trends may be making people and jobs more mobile with each passing year. This would cause communities to compete more intensely to attract investment, jobs, wealth, and development. It may also suggest that below-par population growth could compound over time to widen the gap.

The U.S. Census Bureau estimates that between July 1, 2004 and July 1, 2014, the nation's population grew 8.9 percent. The Wisconsin Department of Administration's Demographic Services Center publishes January 1 population estimates for each county each year. This preliminary determination elected to use DOA population estimates for at least two reasons. (1) When the data gathering began, the Census Bureau had not yet released its county-level population estimates for 2014. (2) The DOA estimates incorporate more local expertise and experience. Figure 12 below shows that only three Wisconsin counties experienced 10-year population change at or above the national rate of change. This indicator increases the odds of qualifying for MDVs if the county's population change was 4.4 or less (less than half the nation's rate)[17].

Figure 12. Population Change January 2004 - January 2014 Less than ½ U.S. Rate



Source: WI DOA Demographic Services Center
www.doa.state.wi.us/demographics

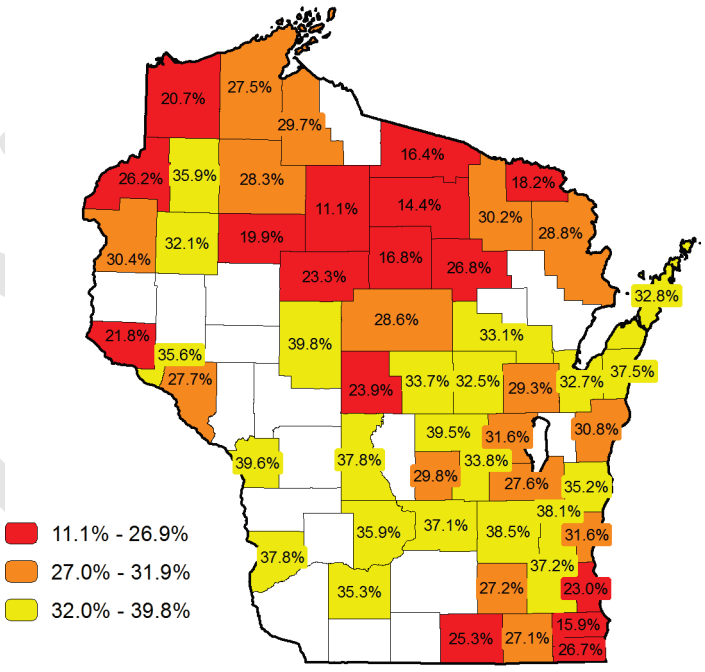
[17] Other indicators are more directly linked to economic impact. While population change is a significant demographic indicator, the indirect linkage between below-national rates of population change and economic impact encouraged the use of the (approximately) half-national-rate threshold.

(e) Net Earnings by Place of Residence Change

When reporting total personal income, the U.S. Department of Commerce's Bureau of Economic Analysis divides income into three categories. The "dividends interest and rent" category is typically associated with investment returns. The "personal current transfer receipts" category is discussed above. The "net earnings by place of residence" category is generally money earned from work. It is often considered a core driver of economic activity. Communities with slower growth in net earnings will have fewer resources to draw upon when paying for the cost of phosphorus compliance.

Between 2003 and 2013, U.S. nominal net earnings by place of residence increased by 39.9 percent. In other contexts, it may be advisable to inflation-adjust the 2003 nominal base to 2013 dollars. Because this indicator compares county changes to national change, the inflation-adjustment would alter all the change figures by the same factor and the proportional gaps between them would remain the same. Inflation-adjustment would change the scale without changing the picture or the results. Figure 13 highlights those counties with net earnings change slower than the national rate (39.9%). This indicator adds to the odds of qualifying for MDVs when the county's net earnings by place of residence increased by less than 39.9% between 2003 and 2013.

Figure 13 Net Earnings by Place of Residence 2003-2013 Change (U.S. = 39.9%)



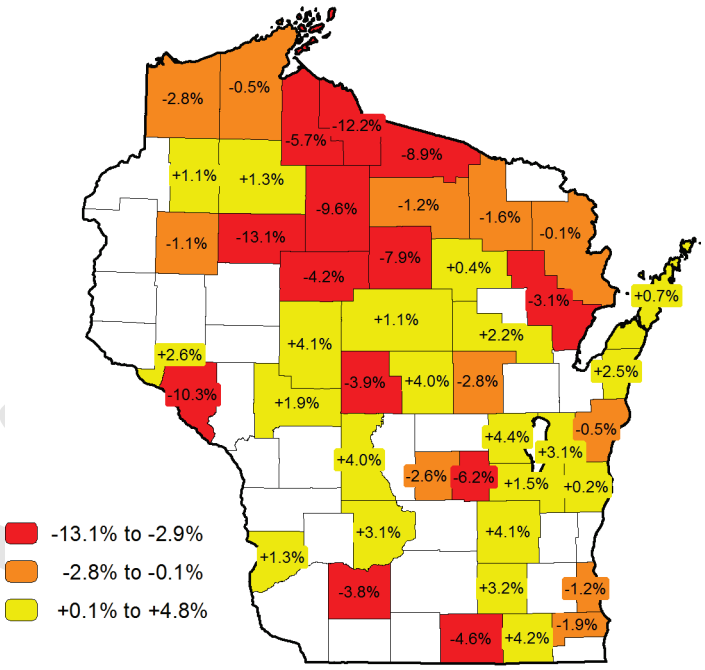
Source: U.S Bureau of Economic Analysis, Personal Income Summary
http://www.bea.gov/ Table CA04

(f) Job Growth

The pace at which a community adds (or loses) jobs may affect its ability to attract and retain workers, its ability to attract and retain businesses requiring local consumers, and its ability to pay higher electricity and water rates to comply with phosphorus standards.

The U.S. Department of Commerce's Bureau of Economic Analysis publishes annual employment figures.[18] These figures indicate that U.S. job growth was 9.8 percent from 2003 and 2013. This indicator increases the odds of qualifying for MDVs if the county's employment declined or grew at or below 4.8 percent (less than half the U.S. rate of growth)[19]. Figure 14 shows counties where employment change between 2003 and 2013 was 4.8% or less..

Figure 14. Job Growth 2003-2013 (U.S = 9.8%)



Source: U.S Bureau of Economic Analysis, Personal Income Summary
http://www.bea.gov/ Table CA04

[18] BEA job figures were used for the job change analysis because the DWD Quarterly Census of Employment and Wages do no publish national figures for comparison.

[19] When selecting a threshold for the job growth indicator, it appeared that the national rate of job change over the time period would "screen in" too many counties. For this reason, the threshold was lowered to approximately half the national rate of job change.

(g) Capital Costs as a Share of Total Wages

The methods for estimating compliance costs are detailed in Section 4, which begins on page 25. Total wages for each county came from the Census Bureau's County Business Patterns. Each category has specific benchmarks for this indicator, so this analysis will be undertaken in the following section Sector-by-Sector Analysis of Secondary Indicators, beginning on page 41.

(3) Sector-by-Sector Analysis of Secondary Indicators

(a) Municipal WWTFs

The purpose of the secondary indicators for municipal WWTFs is to indicate the community's ability to obtain financing and describes the socioeconomic health of the community. As previously mentioned, municipal WWTFs finance phosphorus compliance costs by increasing user fees/revenues from the communities they serve. If the community faces socioeconomic decline and/or hardship, increased sewerage payments likely have a substantial negative impact on the community. The secondary indicators that help demonstrate the socioeconomic status of the community are: personal current transfer receipts as a share of total income, jobs per square mile, population change, net earnings by place of residence change, job growth, and capital costs as a share of total wages.

For a review of secondary indicators applied to counties where municipal treatment plants incur phosphorus compliance costs, see Appendix C, p. 78.

(b) Food Industry

As food industry businesses spend more to comply with Wisconsin's phosphorus standards, they may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If Wisconsin's food industry businesses delay or cancel Wisconsin investments (say equipment purchases), they may lag behind their competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's future food industry employment. Wisconsin's phosphorus standards may also cause food industry businesses to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.) If Wisconsin's food industry businesses resort to wage cuts, hours reductions, or layoffs, their workers will have less money to spend. This could affect spending on retail, real estate, restaurants, and other goods and services.

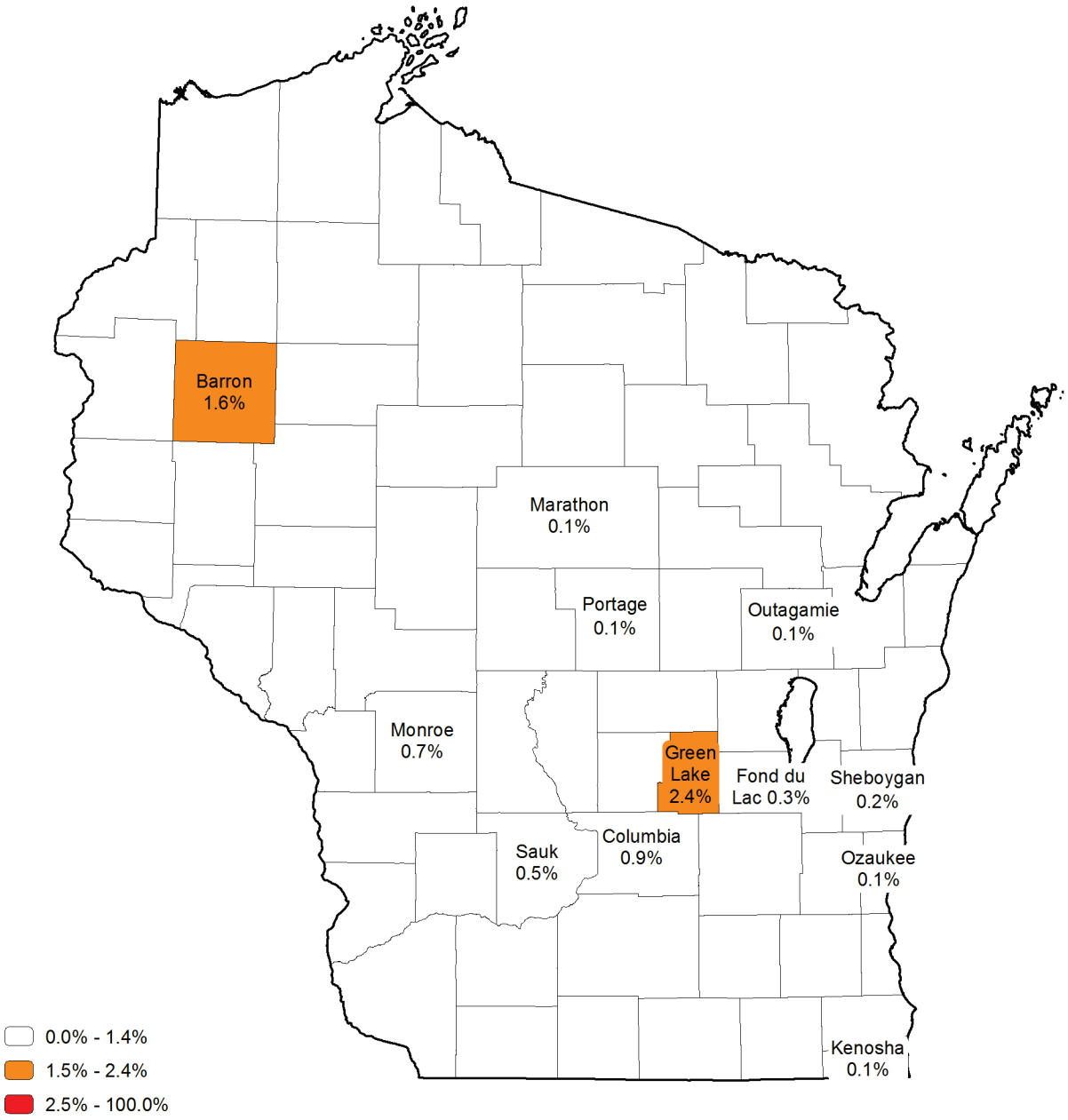
For a review of secondary indicators applied to counties where the food industry's estimated phosphorus compliance costs are greater than zero, see Table 1. For a map showing where those counties are located geographically (including county names), see Figure 15.

Table 1. Food Industry Secondary Indicators

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Barron	1.6%	$ 44.1	23.2%	24	- 1.1%	32.1%	- 1.1%	7
Columbia	0.9%	$ 57.9	15.3%	27	4.0%	37.1%	7.5%	3
Fond du Lac	0.3%	$ 53.8	17.8%	63	2.8%	27.6%	1.5%	4
Green Lake	2.4%	$ 47.0	18.9%	18	- 1.2%	33.8%	- 6.2%	7
Kenosha	0.1%	$ 54.9	18.3%	196	7.2%	26.7%	5.3%	2
Marathon	0.1%	$ 53.4	16.5%	43	3.7%	28.6%	1.1%	4
Monroe	0.7%	$ 49.8	19.3%	22	6.4%	48.6%	9.3%	3
Outagamie	0.1%	$ 58.3	14.2%	160	6.6%	29.3%	6.9%	1
Ozaukee	0.1%	$ 75.5	9.9%	168	2.3%	31.6%	10.1%	2
Portage	0.1%	$ 51.0	17.1%	40	2.8%	33.7%	4.0%	5
Sauk	0.5%	$ 52.1	17.1%	44	6.0%	35.9%	3.1%	4
Sheboygan	0.2%	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	U.S = 39.9%	½ U.S ≅ 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median
[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics;
[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/
[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau,
[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics
[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/
[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 15. Food Industry Capital Costs as a Share of Total County Payroll



Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

(c) Cheesemakers

As cheesemakers spend more to comply with Wisconsin's phosphorus standards, they may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If Wisconsin's cheesemakers delay or cancel Wisconsin investments (say equipment purchases), they may lag behind their competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's future cheese-making employment. Wisconsin's phosphorus standards may also cause cheesemakers to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.) If Wisconsin's cheesemakers resort to wage cuts, hours reductions, or layoffs, their workers will have less money to spend. This could affect spending on retail, real estate, restaurants, and other goods and services.

For a review of secondary indicators applied to counties where cheesemakers' estimated phosphorus compliance costs are greater than zero, see Table 2 p. 46. For a map showing where those counties are located geographically (including county names), see Figure 16, p. 47.

Table 2. Cheesemakers' Secondary Indicators

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Buffalo	2.6%	$ 47.4	18.0%	6	- 3.1%	27.7%	- 10.3%	7
Burnett	0.8%	$ 39.6	27.5%	6	- 5.7%	26.2%	9.1%	5
Calumet	0.8%	$ 65.1	10.5%	39	12.1%	61.1%	3.1%	2
Clark	2.7%	$ 43.3	20.9%	8	0.9%	39.8%	4.1%	7
Dodge	0.0%	$ 53.1	17.0%	39	1.0%	38.5%	4.1%	4
Fond du Lac	0.0%	$ 53.8	17.8%	63	2.8%	27.6%	1.5%	4
Grant	1.6%	$ 47.0	19.0%	15	4.1%	51.7%	5.4%	5
Green	2.2%	$ 55.6	15.9%	26	4.7%	46.1%	6.1%	2
Kewaunee	0.7%	$ 53.6	17.1%	21	- 1.0%	37.5%	2.5%	4
Lafayette	4.5%	$ 49.1	16.3%	6	3.7%	75.2%	9.8%	4
Marathon	0.3%	$ 53.4	16.5%	43	3.7%	28.6%	1.1%	4
Oconto	1.5%	$ 51.6	19.4%	9	0.9%	40.5%	- 3.1%	6
Pierce	1.3%	$ 59.2	15.7%	16	6.5%	21.8%	8.0%	2
Portage	0.0%	$ 51.0	17.1%	40	2.8%	33.7%	4.0%	5
Richland	3.8%	$ 45.3	22.5%	10	- 0.6%	44.4%	5.7%	5
St. Croix	0.3%	$ 68.4	12.4%	43	18.2%	49.4%	21.2%	1
Sheboygan	0.3%	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Taylor	1.5%	$ 44.9	22.0%	8	4.3%	23.3%	- 4.2%	7
Washington	0.2%	$ 66.2	15.3%	121	7.7%	38.1%	8.4%	1
Wood	0.2%	$ 47.7	19.6%	53	- 1.7%	23.9%	- 3.9%	5
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	U.S = 39.9%	½ U.S ≅ 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics; http://worknet.wisconsin.gov/worknet/

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

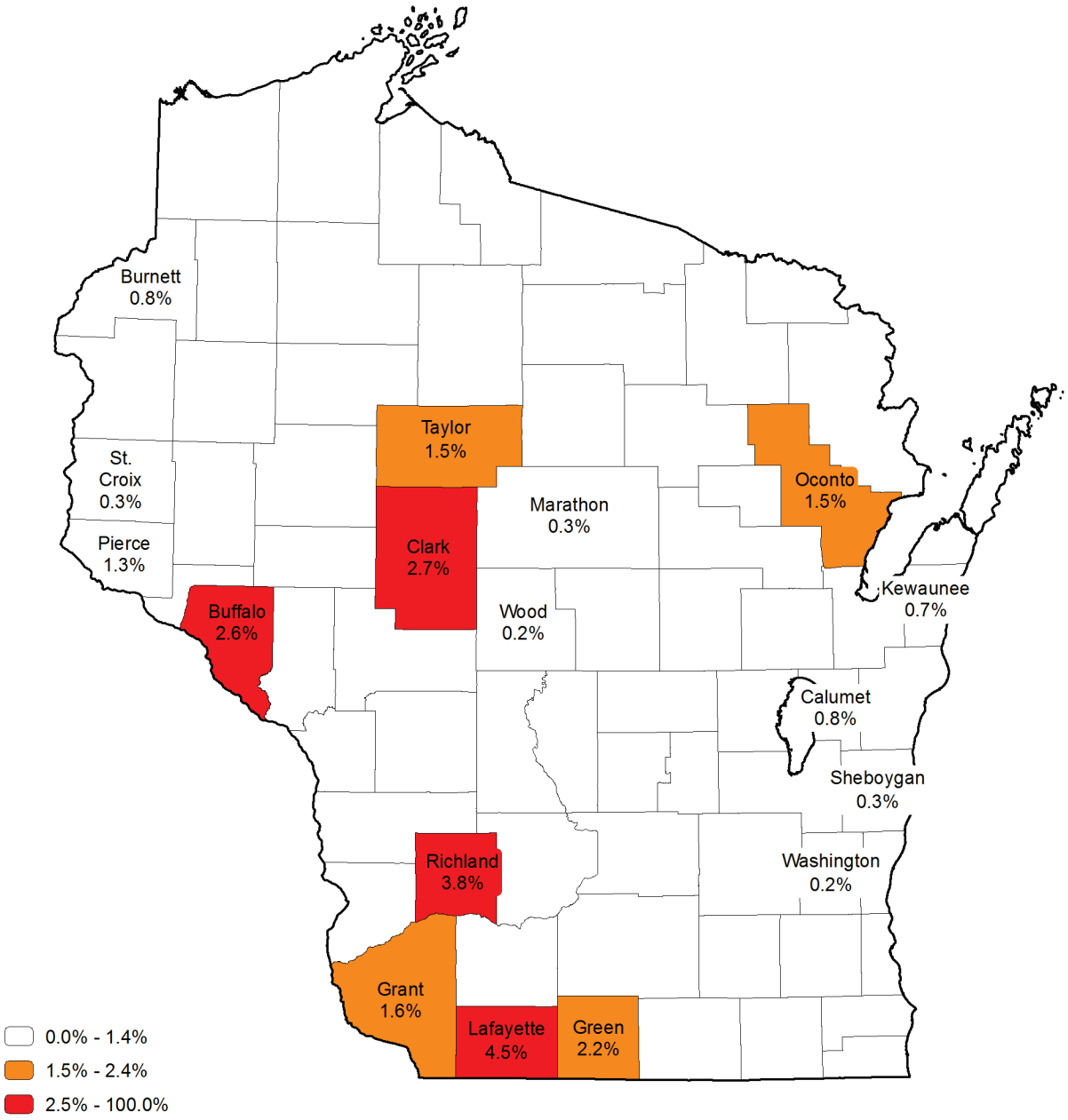
[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 16. Cheesemakers' Capital Costs as a Share of Total County Payroll



Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

(d) Non-Contact Cooling Water

As NCCW businesses spend more to comply with Wisconsin's phosphorus standards, they may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If Wisconsin's NCCW businesses delay or cancel Wisconsin investments (say equipment purchases), they may lag behind their competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's employment in NCCW businesses. Wisconsin's phosphorus standards may also cause NCCW businesses to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.) If Wisconsin's NCCW businesses resort to wage cuts, hours reductions, or layoffs, their workers will have less money to spend on local purchases. This could affect spending on retail, real estate, restaurants, and other goods and services.

For a review of secondary indicators applied to counties where NCCW permittees' estimated phosphorus compliance costs are greater than zero, see Table 3, p 49. For a map showing where those counties are located geographically (including county names), see Figure 17, p. 50.

Table 3. Non-Contact Cooling Water Secondary Indicators

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Brown	0.2%	$ 53.1	14.3%	279	6.4%	32.7%	5.6%	1
Buffalo	1.1%	$ 47.4	18.0%	6	- 3.1%	27.7%	- 10.3%	6
Chippewa	0.9%	$ 50.6	20.0%	23	6.0%	42.7%	14.1%	3
Clark	0.5%	$ 43.3	20.9%	8	0.9%	39.8%	4.1%	6
Columbia	1.8%	$ 57.9	15.3%	27	4.0%	37.1%	7.5%	4
Dane	0.2%	$ 42.2	23.1%	13	- 5.0%	37.8%	1.3%	6
Fond du Lac	0.2%	$ 53.8	17.8%	63	2.8%	27.6%	1.5%	4
Grant	5.6%	$ 47.0	19.0%	15	4.1%	51.7%	5.4%	5
Green	1.6%	$ 55.6	15.9%	26	4.7%	46.1%	6.1%	2
Jefferson	0.4%	$ 53.5	17.6%	59	7.2%	27.2%	3.2%	3
La Crosse	1.0%	$ 51.3	16.9%	150	6.5%	39.6%	7.9%	2
Langlade	0.9%	$ 42.4	25.1%	9	- 6.5%	26.8%	0.4%	6
Manitowoc	0.0%	$ 48.9	19.2%	56	- 3.5%	30.8%	- 0.5%	5
Milwaukee	0.1%	$ 43.2	21.7%	1,967	1.1%	23.0%	- 1.2%	5
Monroe	0.3%	$ 49.8	19.3%	22	6.4%	48.6%	9.3%	3
Oconto	1.8%	$ 51.6	19.4%	9	0.9%	40.5%	- 3.1%	6
Outagamie	0.2%	$ 58.3	14.2%	160	6.6%	29.3%	6.9%	1
Ozaukee	0.3%	$ 75.5	9.9%	168	2.3%	31.6%	10.1%	2
Polk	1.3%	$ 48.5	22.4%	17	0.8%	30.4%	6.3%	5
Richland	3.4%	$ 45.3	22.5%	10	- 0.6%	44.4%	5.7%	5
St. Croix	0.4%	$ 68.4	12.4%	43	18.2%	49.4%	21.2%	1
Sauk	0.7%	$ 52.1	17.1%	44	6.0%	35.9%	3.1%	4
Sheboygan	0.8%	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Trempealeau	0.7%	$ 49.1	19.9%	19	5.1%	47.9%	11.7%	3
Washington	0.0%	$ 66.2	15.3%	121	7.7%	38.1%	8.4%	1
Waupaca	0.9%	$ 50.8	22.3%	27	- 1.3%	32.5%	- 2.8%	6
Waushara	1.0%	$ 43.1	23.6%	10	- 1.2%	39.5%	6.5%	5
Winnebago	0.0%	$ 51.0	15.7%	206	3.9%	31.6%	4.4%	4
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	U.S = 39.9%	½ U.S ≅ 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics; http://worknet.wisconsin.gov/worknet/

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

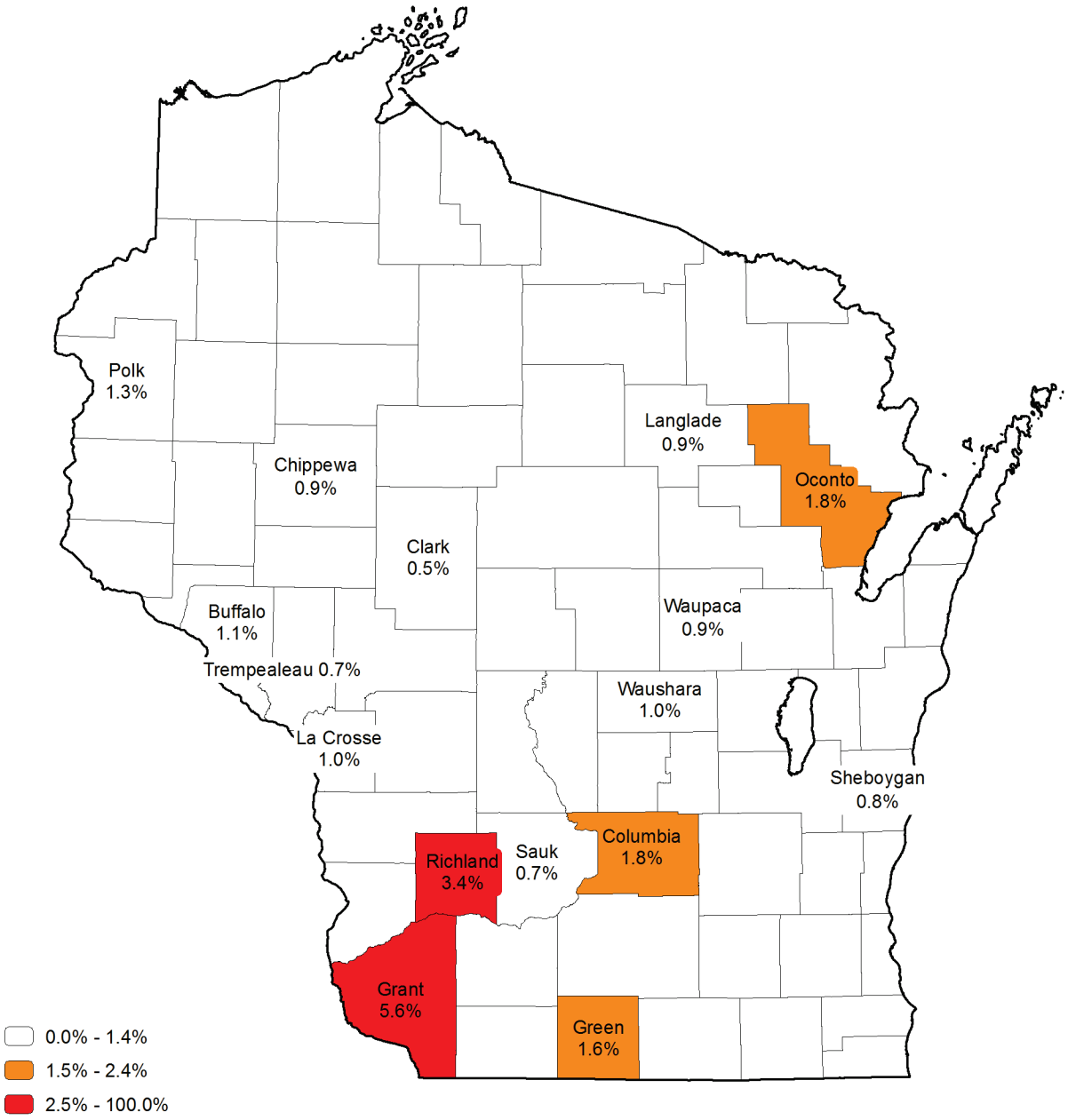
[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 17. Non-Contact Cooling Water Businesses' Capital Costs as a Share of Total County Payroll



Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

(e) Aquaculture

As aquaculture businesses spend more to comply with Wisconsin's phosphorus standards, they may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If Wisconsin's aquaculture businesses delay or cancel Wisconsin investments (say equipment purchases), they may lag behind their competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's employment in aquaculture businesses. Wisconsin's phosphorus standards may also cause aquaculture businesses to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.) If Wisconsin's aquaculture businesses resort to wage cuts, hours reductions, or layoffs, their workers will have less money to spend on local purchases. This could affect spending on retail, real estate, restaurants, and other goods and services.

For a review of secondary indicators applied to counties where aquaculture's estimated phosphorus compliance costs are greater than zero, see Table 4. For a map showing where those counties are located geographically (including county names), see Figure 18.

Table 4. Aquaculture Secondary Indicators

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Dane	0.1%	$ 61.7	11.0%	258	11.4%	46.3%	12.5%	
Douglas	1.6%	$ 45.4	26.6%	12	1.1%	20.7%	- 2.8%	7
Jefferson	0.8%	$ 53.5	17.6%	59	7.2%	27.2%	3.2%	3
Marinette	1.2%	$ 40.5	25.3%	14	- 5.9%	28.8%	- 0.1%	6
Oneida	0.6%	$ 45.8	24.9%	14	- 4.4%	14.4%	- 1.2%	6
Polk	0.7%	$ 48.5	22.4%	17	0.8%	30.4%	6.3%	5
Sheboygan	0.3%	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Waushara	6.3%	$ 43.1	23.6%	10	- 1.2%	39.5%	6.5%	6
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	U.S = 39.9%	½ U.S ≅ 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics; http://worknet.wisconsin.gov/worknet/

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 18. Aquaculture Capital Costs as a Share of Total County Payroll

Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

(f) Paper Industry

As the paper industry spends more to comply with Wisconsin's phosphorus standards, it may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If Wisconsin's paper industry delays or cancels Wisconsin investments (say equipment purchases), it may lag behind its competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's future paper industry employment. Wisconsin's phosphorus standards may also cause the paper industry to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.) If Wisconsin's paper industry resorts to wage cuts, hours reductions, or layoffs, its workers will have less money to spend. This could affect spending on retail, real estate, restaurants, and other goods and services.

For a review of secondary indicators applied to counties where the paper industry's estimated phosphorus compliance costs are greater than zero, see Table 5. For a map showing where those counties are located geographically (including county names), see Figure 19.

Table 5. Secondary Indicators for Paper Industry.

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Brown	1.2%	$ 53.1	14.3%	279	6.4%	32.7%	5.6%	1
Eau Claire	0.6%	$ 48.1	17.0%	86	4.4%	42.0%	8.4%	2
Marathon	1.2%	$ 53.4	16.5%	43	3.7%	28.6%	1.1%	4
Oneida	5.2%	$ 45.8	24.9%	14	- 4.4%	14.4%	- 1.2%	7
Outagamie	1.6%	$ 58.3	14.2%	160	6.6%	29.3%	6.9%	2
Portage	1.8%	$ 51.0	17.1%	40	2.8%	33.7%	4.0%	6
Shawano	3.7%	$ 46.6	22.2%	14	- 0.2%	33.1%	2.2%	7
Winnebago	1.0%	$ 51.0	15.7%	206	3.9%	31.6%	4.4%	4
Wood	4.7%	$ 47.7	19.6%	53	- 1.7%	23.9%	- 3.9%	6
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	½ U.S ≅ 4.8%	U.S = 39.9%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics; http://worknet.wisconsin.gov/worknet/

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

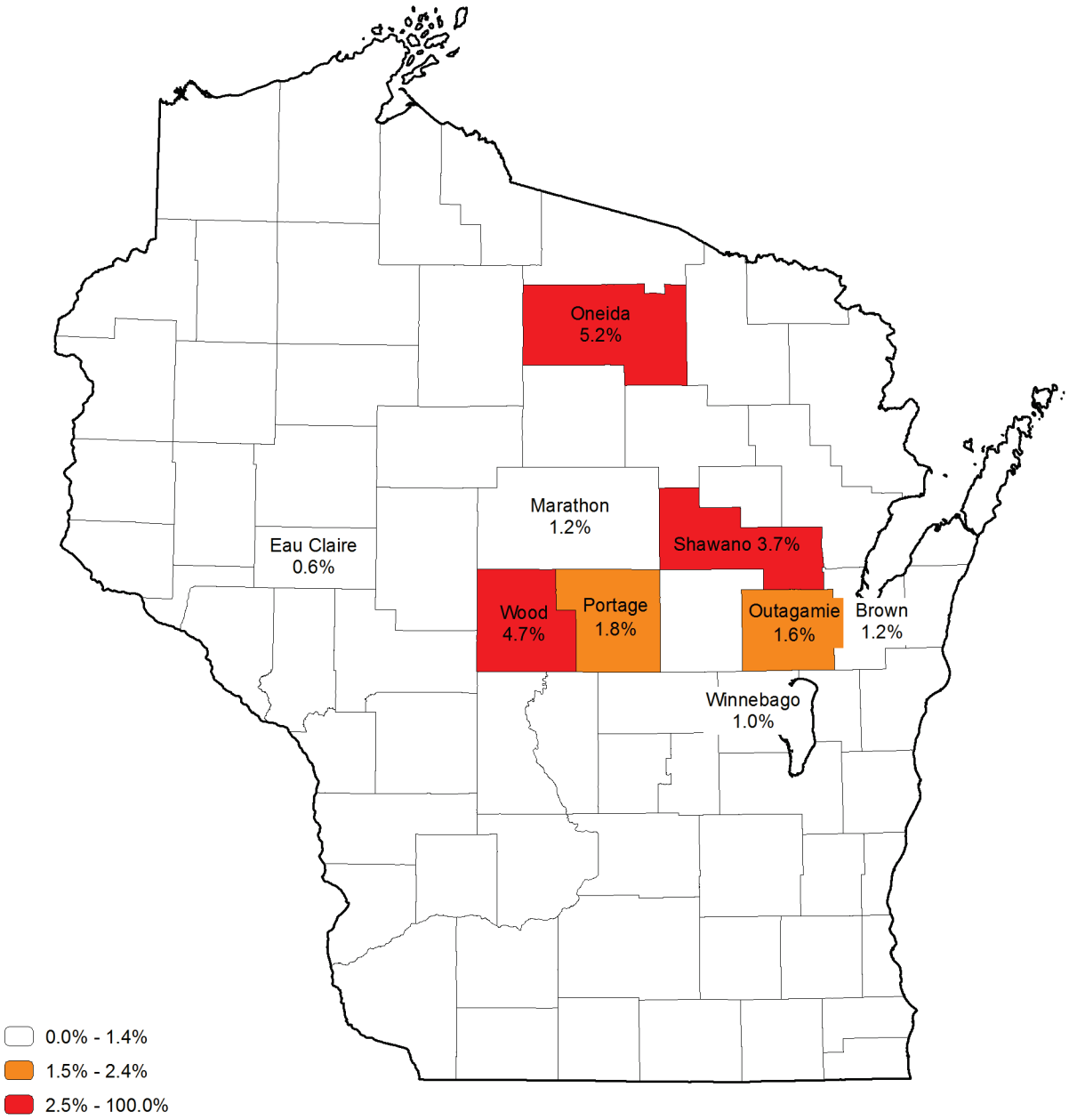
[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 19. Paper Industry Capital Costs as a Share of Total County Payroll



Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

(g) Other

As the businesses in the "other" category spend more money complying with Wisconsin's phosphorus standards, they may lower wages, reduce hours, lay off workers, and/or delay or cancel investment and expansion. Customers often have options from other parts of the country and other parts of the world, so it is not clear that phosphorus compliance costs can be recouped through price increases. If businesses in the "other" category delay or cancel Wisconsin investments (say equipment purchases), they may lag behind their competitors' efficiency gains and product innovations, thereby forfeiting market share, and putting at risk Wisconsin's future employment in the "other" category. Wisconsin's phosphorus standards may also cause businesses in the "other" category to shift production, shift investment plans, and/or shift expansion plans to locations outside Wisconsin (and perhaps outside the U.S.). If businesses in the "other" category resort to wage cuts, hours reductions, or layoffs, their workers will have less money to spend. This could affect spending on retail, real estate, restaurants, and other goods and services.

For a review of secondary indicators applied to counties where businesses in the "other" category have estimated phosphorus compliance costs greater than zero, see Table 6. For a map showing where those counties are located geographically (including county names), see Figure 20.

Table 6. Secondary Indicators for the "Other" Category

	County Capital Costs as a Share of Total Wages	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Calumet	0.8%	$ 65.1	10.5%	39	12.1%	61.1%	3.1%	2
Chippewa	0.2%	$ 50.6	20.0%	23	6.0%	42.7%	14.1%	3
Clark	0.3%	$ 43.3	20.9%	8	0.9%	39.8%	4.1%	6
Douglas	1.3%	$ 45.4	26.6%	12	1.1%	20.7%	- 2.8%	6
Iowa	0.3%	$ 55.7	16.2%	13	0.7%	35.3%	- 3.8%	4
Jefferson	0.3%	$ 53.5	17.6%	59	7.2%	27.2%	3.2%	3
La Crosse	0.3%	$ 51.3	16.9%	150	6.5%	39.6%	7.9%	2
Marinette	0.8%	$ 40.5	25.3%	14	- 5.9%	28.8%	- 0.1%	6
Price	0.6%	$ 42.6	27.2%	4	- 11.3%	11.1%	- 9.6%	6
Sauk	1.6%	$ 52.1	17.1%	44	6.0%	35.9%	3.1%	5
Sheboygan	0.1%	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Washington	0.1%	$ 66.2	15.3%	121	7.7%	38.1%	8.4%	1
Benchmark	≥ 1.5%	U.S. = $53.0	U.S. = 17.1%	WI = 50	½ U.S ≅ 4.4%	U.S = 39.9%	½ U.S ≅ 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] Wisconsin Department of Workforce Development, Local Area Unemployment Statistics; http://worknet.wisconsin.gov/worknet/

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

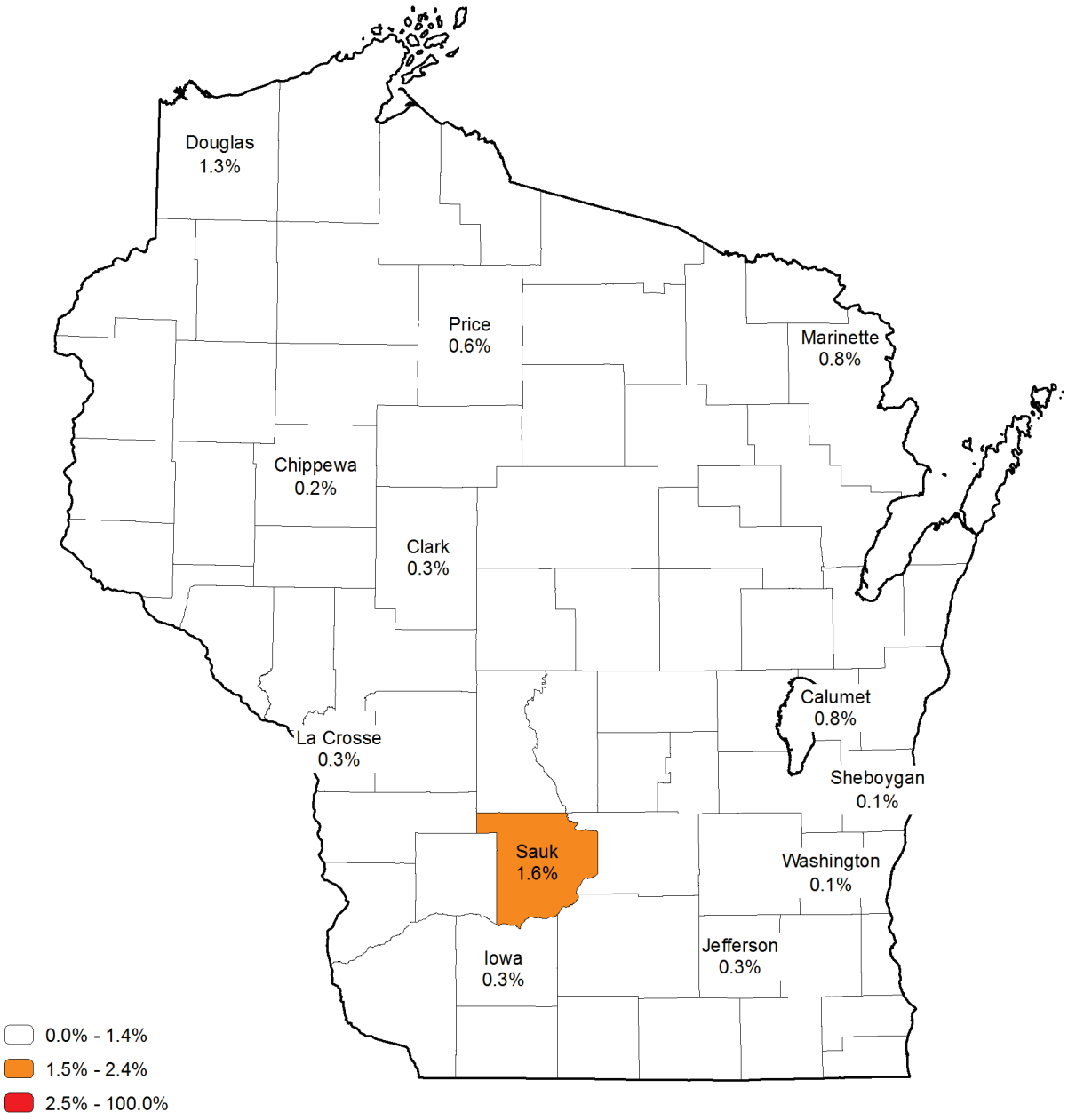
[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Figure 20. "Other" Category Capital Costs as a Share of Total County Payroll



Sources: WI DNR using ARCADIS cost curves
and U.S. Census Bureau County Business Patterns 2012
http://www.census.gov/econ/cbp/

Section 6. Widespread Impact Analysis

Pursuant to s. 283.16(2)(a), Wis. Stat., a determination must be made if complying with phosphorus WQBELs causes a "widespread adverse social and economic impact", sometimes referred to as the "widespread test". The "widespread test" is also presented in EPA guidance as an important determination to justify the need for MDVs as well as individual variances. The purpose of this section is to compile the information in the "EIA Report" as well as the "EIA Addendum" to make a widespread impact determination. Specifically, Section 3.0 of the EIA Report and the "Economic Impacts with Upstream Offsets" Section of the Addendum are the key sources of information for the widespread test. To make a widespread social and economic impact determination, this analysis focused on quantifying the effects of phosphorus compliance on Wisconsin's economy.

This analysis did not consider longer-term benefits to Wisconsin's economy through increases in tourism and recreation due to improved water quality. The reason for this is two-fold. First, implementing phosphorus MDVs promotes water quality improvements through the step-wise reduction in point sources loads as well as the phosphorus reductions from nonpoint sources through the implementation of watershed projects (Appendix B, p. 75). Nonpoint source loads now represent the substantial majority (approximately 80%) of the total phosphorus load to surface water in the state. Because the majority of Wisconsin's watersheds are blended point and nonpoint source watersheds, it is critical that both sources be reduced in order to meet water quality goals. For these reasons, phosphorus MDVs support improvements to water quality, but try to achieve this goal at a lower cost burden. Secondly, the implementation timeframe for the MDV is no more than 20-years, so it seemed appropriate to conduct the widespread test consistent with the implementation timeframe. It is also noted that this decision seems consistent with EPA's individual variance guidance and MDV factsheet, which do not require the completion of environmental benefits in order to justify an individual variance or MDV. (EPA–823–B–95–002; EPA-820-F-13-012).

This analysis utilized the Regional Economic Models, Inc. (REMI) model of the Wisconsin economy to demonstrate the economic impacts of phosphorus compliance costs. The REMI model is a dynamic economic forecasting software application that is used by many consulting firms, educational institutes, and government agencies (local, state, and federal) for a number of applications from determining the economic impacts of highway projects to projecting the economic impacts of environmental policies. Although several economic modelling options were available, the REMI model was selected for its quality and accuracy. The key data input needed for the REMI model was the phosphorus compliance costs by facility. For industrial categories, the compliance costs were assigned to each applicable category of discharge in the REMI model (Section 2, p. 9) to define the incremental cost increases of doing business in the state of Wisconsin as a result of the phosphorus rule. Compliance costs incurred by municipal WWTFs were distributed among five categories in the REMI model, since the mechanism to finance these costs is through user rate increases; these categories were residential, commercial, industrial, public, and other[20]. The model ran these cost simulations over a 10-year period (2015-2025) to determine the long-term impacts of these costs on the Wisconsin economy. It is acknowledged that

[20] 'Other' revenues primarily consist of special assessments on tax revenues, such as property taxes, as well as connection and hookup fees and impact fees.

compliance costs may go beyond the 10-year period. This 10-year timeframe was chosen because it reflects the implementation timeframe of the proposed MDV, and limits modeling errors and data unknowns as project costs move further in the future.

Using the general methods above (see supplemental reports for more details), the total economic impacts of Wisconsin's phosphorus compliance costs were estimated. Total economic impacts are the best estimates of how compliance costs will affect gross state product (state GDP), jobs, wages and population change. These indicators were deemed the most defensible metrics for assessing the widespread impacts of the phosphorus rule and were analyzed on a statewide basis as well as for categories of discharges. Statewide results help demonstrate the total adverse economic impacts of implementing the phosphorus rule in Wisconsin, and are shown in Table 7. The purpose of the sector-by-sector analysis was to determine if implementing the phosphorus rule on any particular category caused widespread impacts to the state, and to conform to EPA's recommendation to conduct a separate analysis for each category (p. 7). This sector-by-sector analysis is presented in Section 3.3 of the EIA Report. For example purposes, the widespread impacts of phosphorus compliance within the paper industry are illustrated in Table 8.

Table 7. Adverse statewide impacts on Wisconsin's economy due to phosphorus compliance.

Economic Impacts	2017	2025
Total Employment (# of Jobs)	-1,548	-4,442
Gross State Product (Millions of Fixed 2014 Dollars)	-$169.4	-$604.2
Total Wages (Millions of Fixed 2014 Dollars)	-$65.7	-$234.8
Population (Individuals)	-1,954	-10,711

Table 8. Adverse statewide impacts on Wisconsin's economy due to phosphorus compliance within the Paper Industry (300 mg/L dosage).

Economic Impacts	2017	2025
Total Employment (# of Jobs)	-92	-702
Gross State Product (Millions of Fixed 2014 Dollars)	-$10.8	-$101.6
Total Wages (Millions of Fixed 2014 Dollars)	-$4.9	-$48.0
Population (Individuals)	-50	-873

It is recognized that while many facilities face considerable phosphorus compliance costs, which will have a negative impact on these entities (Table 7 and Table 8), some economic sectors may receive marginal economic benefits through the implementation of this rule. In-state construction employment, equipment purchases, and higher energy demands may benefit the Wisconsin's economy. These are

short-term benefits, however, and do not provide long-term, sustainable job growth to Wisconsin. Additionally, these temporary employment opportunities frequently pay less than permanent positions that may be lost because of the phosphorus rule. The temporary boosting effect of the construction-related economic growth is considerable in the first two years of phosphorus implementation, which is estimated to increase Wisconsin's employment by 13,315 and the Wisconsin GDP by over $1 billion during this timeframe. As the phosphorus rule continues to be implemented, the long-term effects of companies investing less, moving out of the state, and/or having to terminate employment opportunities due to the phosphorus rules becomes clear on the Wisconsin economy[21]. Even when factoring in the potential offsetting the potential benefits, Wisconsin's economy still faces widespread adverse impacts (Table 9).

Table 9. Statewide Economic Impacts with Upstream Offsets in 2025.

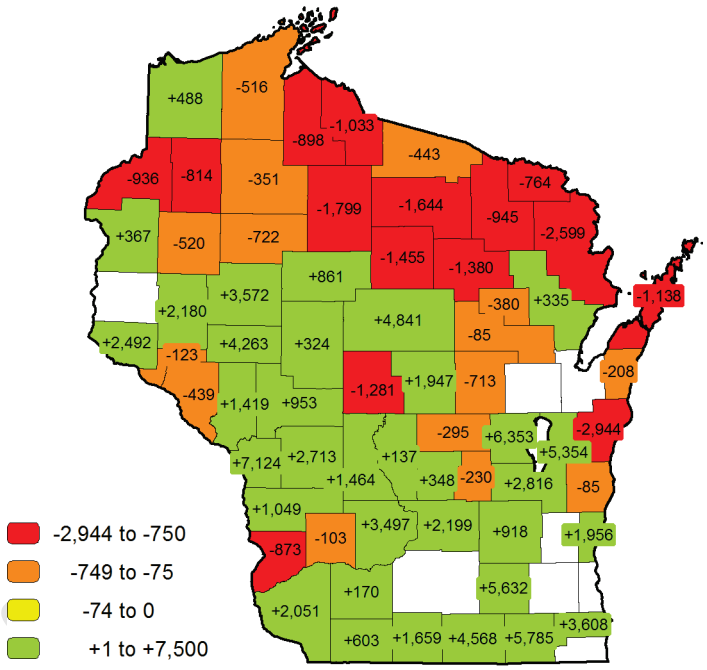
Economic Impacts	Forgone in 2025
Total Employment (# of Jobs)	-3,361
Gross State Product (Millions of Fixed 2014 Dollars)	-$478.9
Total Wages (Millions of Fixed 2014 Dollars)	-$184.1
Population (Individuals)	-7,545

[21] This study conducted a business survey, which supported these REMI conclusions, finding that job creators in Wisconsin are more likely to employ fewer staff, decrease investment, postpone expansion, and shift production elsewhere due to the phosphorus rule. See Section 3.5 of the EIA Report for details.

A. Context of the Widespread Determination

To help put these numbers in context, Wisconsin is currently home to approximately 5.7 million residents in 72 counties. Current population trends indicate that 30 of the 72 counties are already experiencing population declines, and the population growth of many other counties is slow. (Figure 21.)

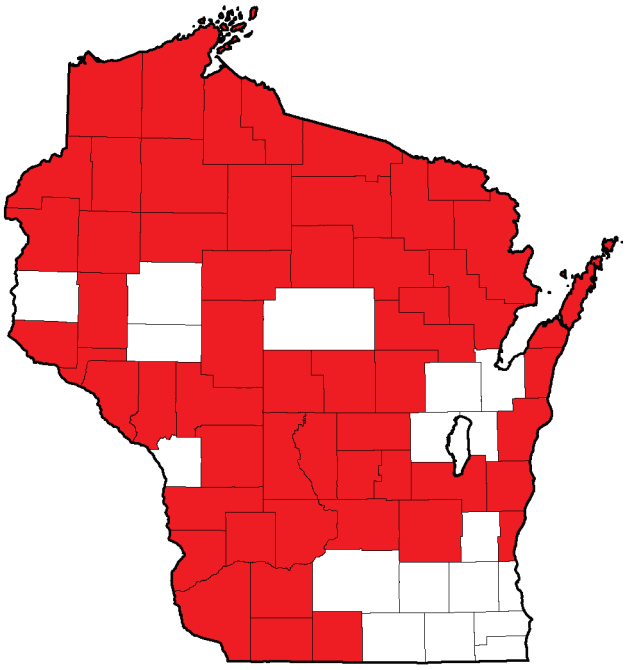
Figure 21. Population changes from 2004-2014 below +7,500.



Source: WI DOA Demographic Services Center
www.doa.state.wi.us/demographics

In fact, if you add the population change of 54 counties from 2004-2014, this net change is less than 7,500 residents (Figure 22. Counties with combined 2004-2014 population change of less than +7,500). The 18 counties with population increase greater than 7,500 residents tend to be associated with metropolitan areas- Madison, Milwaukee, Green Bay, and Minneapolis. These metropolitan areas are sometimes less impacted by the phosphorus compliance costs (Figures-15-20), indicating that the phosphorus rule is disproportionately impacting areas in Wisconsin already experiencing economic hardship.

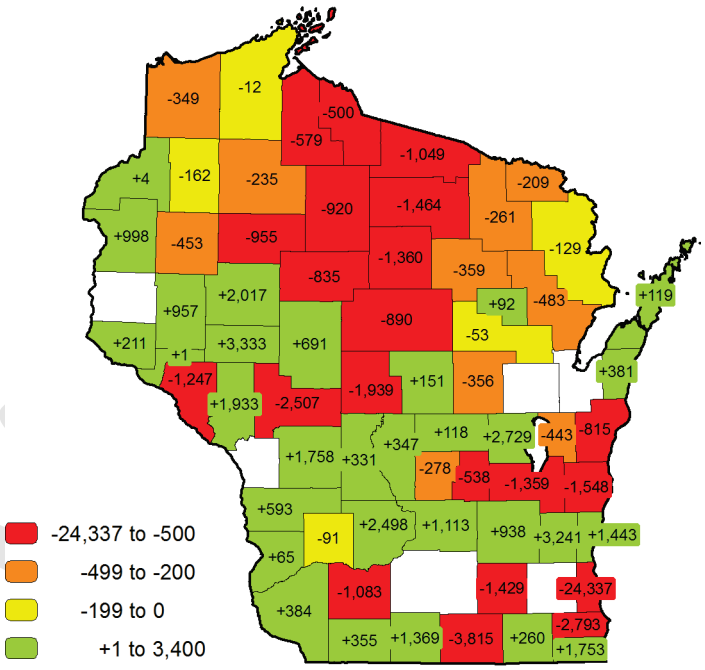
Figure 22. Counties with combined 2004-2014 population change of less than +7,500



Source: WI DOA Demographic Services Center
www.doa.state.wi.us/demographics

The REMI model output also indicates that Wisconsin's 2025 employment will be over 3,300 jobs lower than it would be without phosphorus standards. In a state with 2.7 million jobs, the significance of 3,300 jobs may not be obvious. For clearer, more meaningful context, it is useful to review the geographic distribution of 10-year employment change. Each county displayed in Figure 23 experienced 10-year employment change of less than +3,300 jobs between 2003 and 2013. Thirty-six of Wisconsin's 72 counties experienced absolute declines in total employment during that 10-year period. When considering counties with numerically small employment gain or employment decline, there is considerable overlap between these areas and areas that will acutely feel the impact of phosphorus standards.

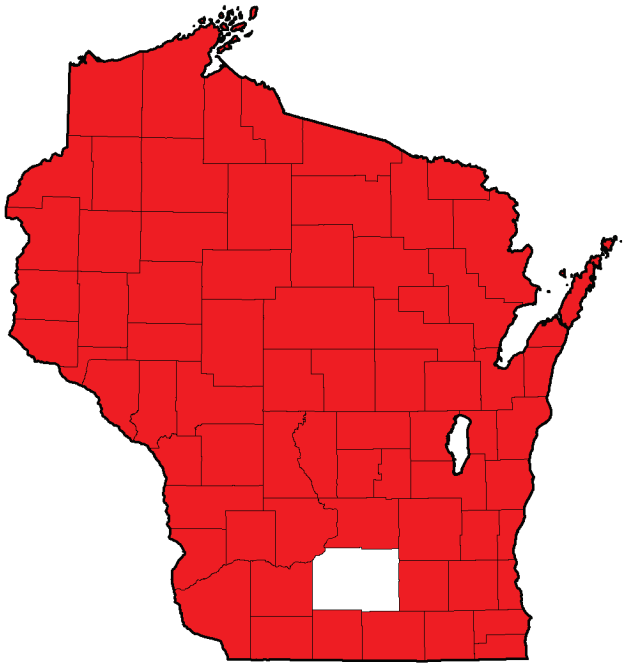
Figure 23. Job growth from 2003-2013



Source: WI DWD Quarterly Census of Employment and Wages
http://worknet.wisconsin.gov/worknet/

Figure 24 shows the counties that can be added in a running total before breaching +3,400 net job change 2003-2013. Starkly, 71 of Wisconsin's 72 counties can be **c**ombined without hitting that threshold.

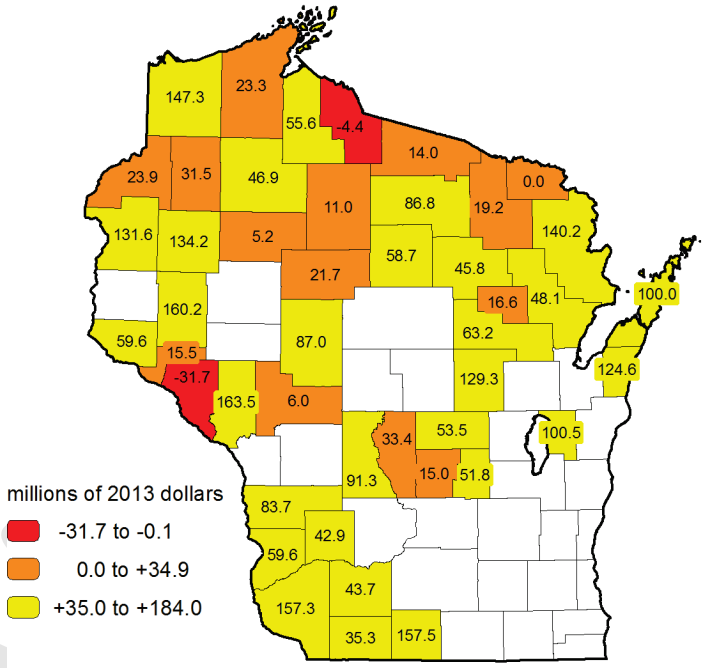
Figure 24. Combined 10-year employment changes <3,400



Source: WI DWD Quarterly Census of Employment and Wages
http://worknet.wisconsin.gov/worknet/

Wage change was another important metric that indicated widespread impact to Wisconsin's economy. The REMI model projected that Wisconsin wages would be $184.1 million lower by 2025 than they would be without the phosphorus rule. Some might argue that this is a small amount in a state with annual wages around $116.4 billion (per the Quarterly Census of Employment and Wages). Figure 25 shows counties with 10-year total wage changes of less than $184.1 million. (For calculations, 2003 wages were adjusted to 2013 dollars using the Consumer Price Index[22]).

Figure 25. Wage Changes 2003-2013 (fixed 2013 $ million)

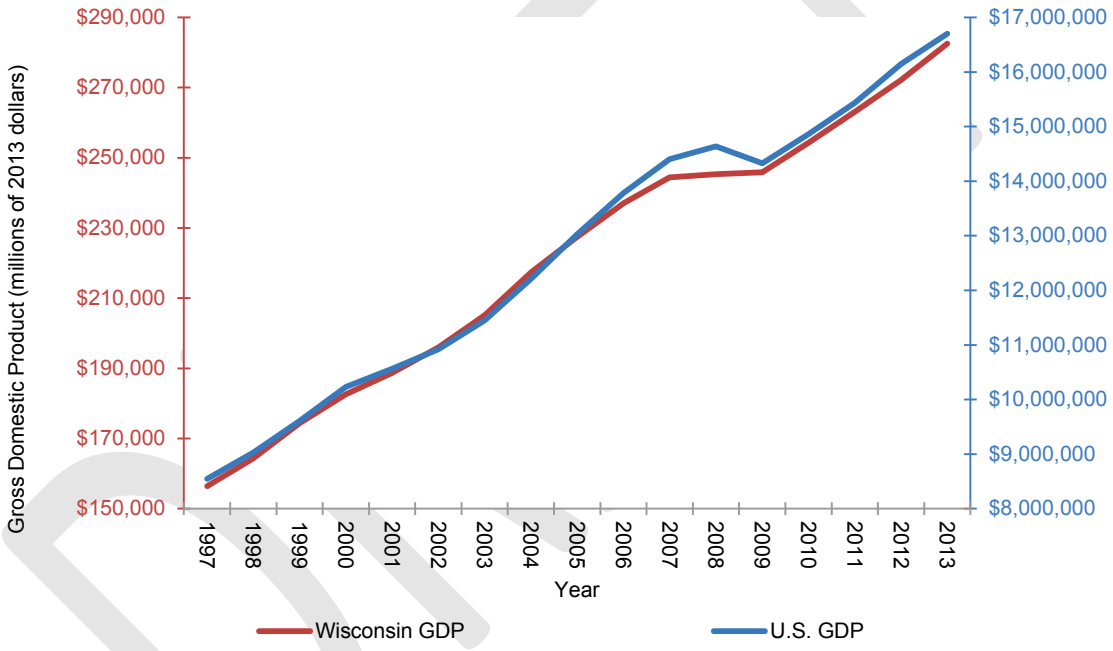


Source: WI DWD Quarterly Census of Employment and Wages
http://worknet.wisconsin.gov/worknet/

[22] This section compares actual 10-year changes in total wages and comparing these changes to the REMI 10-year forecast of wages foregone as a result of phosphorus standards implementation. This comparison requires inflation-adjusted wages (also called real wages). In the prior section Net Earnings by Place of Residence Change on 35, the comparison was not to the REMI forecast, but to U.S. change over the same time period, so inflation-adjustment in the prior section would have changed the scale without changing the picture or changing the results.

Of the 72 counties, 45 experienced a 10-year change in total real wages of less than $184 million dollars and 2 counties experienced a negative 10-year change in real total wages. Some may argue that time periods for employment and wage change should not include the recent economic turmoil. Figure 26 compares Wisconsin GDP[23] to U.S. GDP and shows 1) that the state tracked the nation fairly closely from 1997 to 2005 or 2006, and 2) that the state has not closed the gap that opened up around 2006 or 2007. The persistence of this gap suggests that the employment changes and wage changes noted above are at least partially attributable to factors that set Wisconsin apart from the nation. Also, the persistence of this gap adds to the evidence that the REMI model's prediction that compliance with phosphorus standards would lead to $714 million of forgone Wisconsin GDP represents a significant impact. Because both the Bureau of Economic Analysis GDP data and REMI data is statewide, it is not possible to show more localized output impacts.

Figure 26. Gross Domestic Product and Gross State Product



Source: U.S. Bureau of Economic Analysis, GDP by state, http://www.bea.gov/regional/index.htm.

[23] National Gross Domestic Product is simply referred to as GDP. Wisconsin GDP is called Gross State Product in some accompanying materials. The terms are interchangeable.

B. Sensitivity Analysis of Widespread Determination

It is acknowledged that, like any statewide or cursory analysis, site-specific compliance costs may be higher or lower than those projected using the cost curve method. Although this was a balanced approach, and made reasonable and defensible assumptions, a sensitivity analysis was conducted to determine the potential economic impacts of over or under-estimations in compliance costs. Specifically, this sensitivity analysis raised and lowered compliance costs by +/-25% and re-ran the REMI model to determine changes in the economic impacts. This REMI analysis also accounted for potential upstream offsets (p. 60) to generate a conservative sensitivity analysis. Increased/decreased compliance costs were the basis for this sensitivity analysis as these costs were the primary data input for the REMI model, and are most likely to cause variability to the final result. It is noted that revised interest rates were used in the EIA Addendum compared to the EIA Report, but these changes did not have a significant impact on costs or results. The results of the sensitivity analysis are depicted in Table 10. See EIA Addendum and EIA Report for additional details.

Table 10. Sensitivity analysis results.

Scenario	Jobs		Gross State Product ($ millions)	
	2017	2025	2017	2025
Low (-25%)	9,986	-2,529	$758.4	-$360.5
Original	13,315	-3,361	$1,011.2	-$478.9
High (+25%)	16,645	-4,185	$1,264.3	-$596.2

Section 7. Conclusions

In reviewing the categories, analysis of data and the primary and secondary economic indicators presented throughout this report, the Department of Administration finds that implementation of the Wisconsin water quality standards for phosphorus will cause substantial and widespread adverse social and economic impacts to the state. Therefore it recommends the Department of Natural Resources request approval of a multi-discharger variance (MDV) from the United States Environmental Protection Agency for the purposes of phosphorus reduction.

This conclusion is based on the multifaceted data provided by ARCADIS, The University of Massachusetts, Sycamore, DOA and the DNR in researching, analyzing and quantifying the results provided through the Regional Economic Models, Inc. (REMI) by the University of Massachusetts Donahue Institute.

Without a variance to effectively comply with the existing phosphorus regulations almost 600 Wisconsin businesses will be impacted as they continue to work their way out of the recession. The overall cost to Wisconsin communities will be a minimum of $3.4 billion in capital expenditures which will rise to over $6 billion when accounting for interest paid on borrowing needed to meet increased capital costs. In addition, an O&M cost of $405 million annually combined with debt service will equate to $708 million annually, placing an additional economic burden upon business already affected by a slowly recovering economy and additional regulations beyond phosphorus.

When looking at all the sectors impacted it is not just their individual costs and their ability to absorb them, but how they will likely implement that absorption through rate/cost increases affecting all other sectors that rely on output to run their operations. In turn, businesses may potentially take one of four avenues if denied a variance - decrease investment, postpone expansion in Wisconsin, shift production to another state or cease operations all together.

Wisconsin understands both the need to significantly reduce non-naturally occurring phosphorus in the state's waterways. Based on the methodology and quantitative analysis produced by this study, a multi-discharger variance is critical that will achieve reduction in phosphorus amounts without placing additional undue burdens on existing utilities and business. Without the multi-discharger variance, affected businesses will realize the full impact of the regulatory costs in 2025, when total statewide economic impacts result in 4,517 fewer jobs, $238.3 million in wages forgone, and a $616.6 million reduction in gross state product resulting in 11,000 fewer Wisconsin residents (Source: Regional Economic Models, Inc., as calculated by the University of Massachusetts Donahue Institute). In addition, of the 72 counties in Wisconsin, 42 have an Affordability Indicator in excess of 2.0% while another 28 counties measured a "mid-range" burden of between 1.0% and 2.0%

Due to the current information presented in this report, especially the combination of primary and secondary indicators affecting communities throughout Wisconsin, it is the recommendation of the Wisconsin Department of Administration that the Wisconsin Department of Natural Resources seek additional regulatory flexibility in implementing the phosphorus rule. This implementation should be accomplished in the most economically efficient manner possible to lessen the substantial and

widespread adverse social and economic impacts the current phosphorus standards would impose on Wisconsin citizens and businesses, while continuing to comply with local, state and federal laws in order to improve water quality.

Appendix A. Background of Phosphorus Regulations in Wisconsin

Phosphorus is an essential nutrient necessary for plant growth, and has been recognized as the controlling factor in plant and algae growth in Wisconsin lakes and streams. For this reason, small increases in phosphorus can fuel substantial increases in aquatic plant and algae growth, which can reduce recreational opportunities, property values, and can even impact public health. Phosphorus entering our lakes and streams comes from "point sources" - piped wastes such as municipal and industrial wastewater treatment plants that release liquid effluent to lakes and rivers or spread sludge on fields; and from natural sources, including past phosphorus loads that build up in lake bottom sediments. Phosphorus also comes from "nonpoint" or "runoff" pollution. Such pollution occurs when heavy rains and melting snow wash over farm fields and feedlots and carry fertilizer, manure and soil into lakes and streams, or carry phosphorus-containing contaminants from urban streets and parking lots.

Wisconsin has had a long history of protecting Wisconsin's surface water from excess phosphorus pollution. For example, Wisconsin promulgated technology-based effluent limitations (TBELs) in 1993 to set a minimum level of phosphorus treatment for point source discharges based on available treatment technologies. Additionally, Wisconsin has implemented priority watershed projects throughout the state to help reduce nonpoint source pollution to meet water quality goals. A full description about these and other historic phosphorus procedures is available at http://dnr.wi.gov/news/mediakits/mk_phosphorus.asp.

To further protect human health and welfare from excess phosphorus pollution, revisions to Wisconsin's Phosphorus Water Quality Standards for surface waters were adopted on December 1, 2010. These revisions:

1. Established the maximum allowable phosphorus concentration in Wisconsin's waters, also known as phosphorus criteria (see s. NR 102.06, Wis. Adm. Code);
2. Created phosphorus standard implementation procedures for Wisconsin Pollutant Discharge Elimination System (WPDES) permits (see ch. NR 217, Subchapter III); and,
3. Strengthened agricultural performance standards to help curb nonpoint source phosphorus pollution (see ch. NR 151, Wis. Adm. Code)[24].

Not all surface waters respond to phosphorus pollution in the same way. Some receiving waters are more tolerant to excess phosphorus, or have naturally higher occurring levels of phosphorus within them. For these reasons, the phosphorus criteria vary depending on waterbody type (

Table 11). The scientific justification for these differences is summarized below, and fully described in the technical support document for this rule package, which is available for download at http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

[24] Changes to NR 151, Wis. Adm. Code were formally promulgated January 2011.

Table 11. 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

Rivers vs. Streams: In comparing Wisconsin's rivers and streams, rivers are typically slower moving and have a higher concentration of suspended materials, which decreases light penetration throughout the water column. For these reasons, algal growth between rivers and streams differs. Faster moving streams are typically dominated by benthic algae, whereas rivers are dominated by suspended algae growth. This leads to changes in the expression of phosphorus pollution within these waterbodies. For these reasons, 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 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 27 illustrates those waterbodies that are defined in s. NR 102.06(3)(a), Wis. Adm. Code, as rivers.

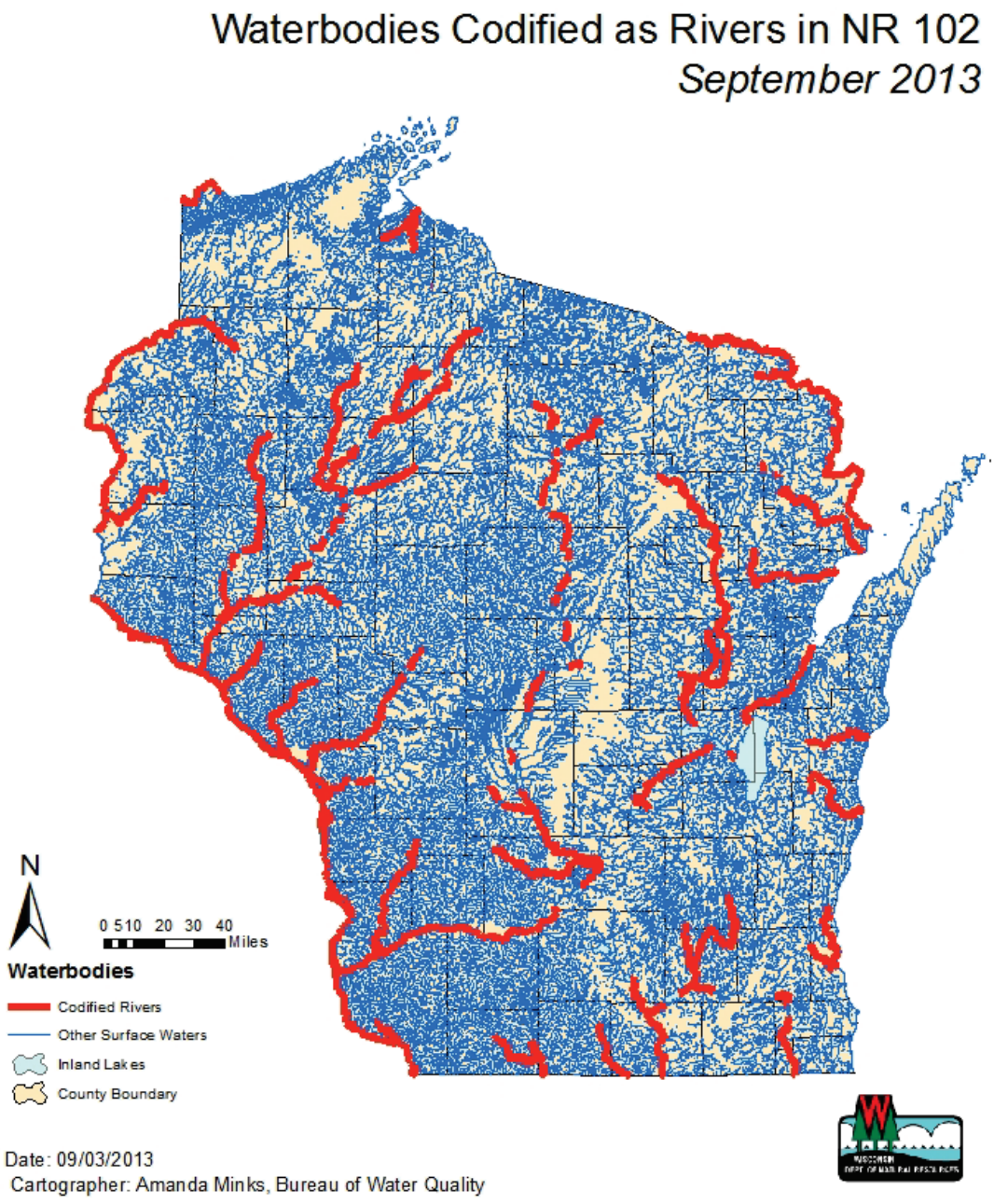


Figure 27. Visual of rivers that receive a phosphorus water quality criterion of 100 µg/L pursuant to s. NR 102.06(3)(a), Wis. Adm. Code.

Lakes and Reservoirs: Most of Wisconsin's lakes and reservoirs are already classified using the Natural Community classification system, and are available for look up in the WATERS database: http://prodoasint.dnr.wi.gov/wadrs/login.jsp. 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 12. It is the responsibility of DNR staff to determine the appropriate lake/reservoir classification prior to permit reissuance and/or TMDL development.

Table 12. 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 (µg/L)
Non-stratified drainage	Shallow Headwater Drainage	40
	Shallow Lowland Drainage	
Non-stratified seepage	Shallow Seepage	40
Stratified drainage	Deep Headwater Drainage	30
	Deep Lowland Drainage	
Stratified seepage	Deep Seepage	20
Stratified two-story fishery	Deep Two-story Fishery	15

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 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. 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.

Limited Aquatic Life (LAL), Wetlands, and Ephemeral Systems: At the time of this analysis, LAL, wetland, and ephemeral systems do not have applicable phosphorus criteria. 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. Likewise, if a point source was previously considered a wetland discharge, it can continue to be treated as a wetland discharge for the purposes of implementing the phosphorus rule.

Additional information regarding receiving water types, applicable TP criteria, and guidance to make these determinations is available in Chapter 1 of the Phosphorus Implementation Guidance, which is available at http://dnr.wi.gov/topic/surfacewater/phosphorus.html.

Appendix B. Summary of Multi-discharger Variance (MDV) Procedures Pursuant to Act 378

The purpose of this appendix is to highlight key concepts within Act 378. For full details regarding this law visit https://docs.legis.wisconsin.gov/2013/related/acts/378.

Wisconsin Act 378 establishes a process to potentially allow WPDES permittees to apply for and implement variances for phosphorus water quality based effluent limitations using a statewide analysis for determining whether compliance with water quality based effluent limitations for phosphorus is not feasible, because it will cause substantial and widespread adverse social and economic impacts. As previously stated, the purpose of this report is to articulate DOA/DNR findings regarding the cost implications of phosphorus regulations on Wisconsin's economy. Once a final determination is made, DNR must seek approval for a MDV from the U.S. EPA. Both DOA and DNR recognize that economic conditions are not static which is why this determination will be reviewed throughout implementation. Specifically, Act 378 requires that DNR, as part of the triennial standard review, evaluate new information to determine, if a review of this final determination is necessary and appropriate. If so, DOA and DNR must relook at the determination in light of a number of factors including the availability and cost-effectiveness of new technology. In any case, a review of the determination must be made in 2024 and a report issued as to whether the determination remains accurate.

If a MDV is granted for phosphorus in Wisconsin, it does not necessarily mean that all point sources in the state or all point sources in specific categories, will qualify for the MDV. Like all variances, only existing sources can apply for the MDV. Additionally, the point source must certify that a major facility upgrade would be needed to comply with their applicable TP WQBELs thereby creating a financial burden on the discharge and community. Lastly, the point source must agree to comply with interim phosphorus effluent limits and an implementation requirement. Interim limitations are numeric limitations designed to make incremental progress towards compliance with the final WQBEL, and to prohibit backsliding during the permit term. A compliance schedule may be included in the WPDES permit should some time need to be provided to comply with the interim limitation. However, this compliance schedule is not to exceed the permit term (5 years). The default interim limitations are provided in Figure 28; however, categorical interim limitations may be calculated, if necessary.

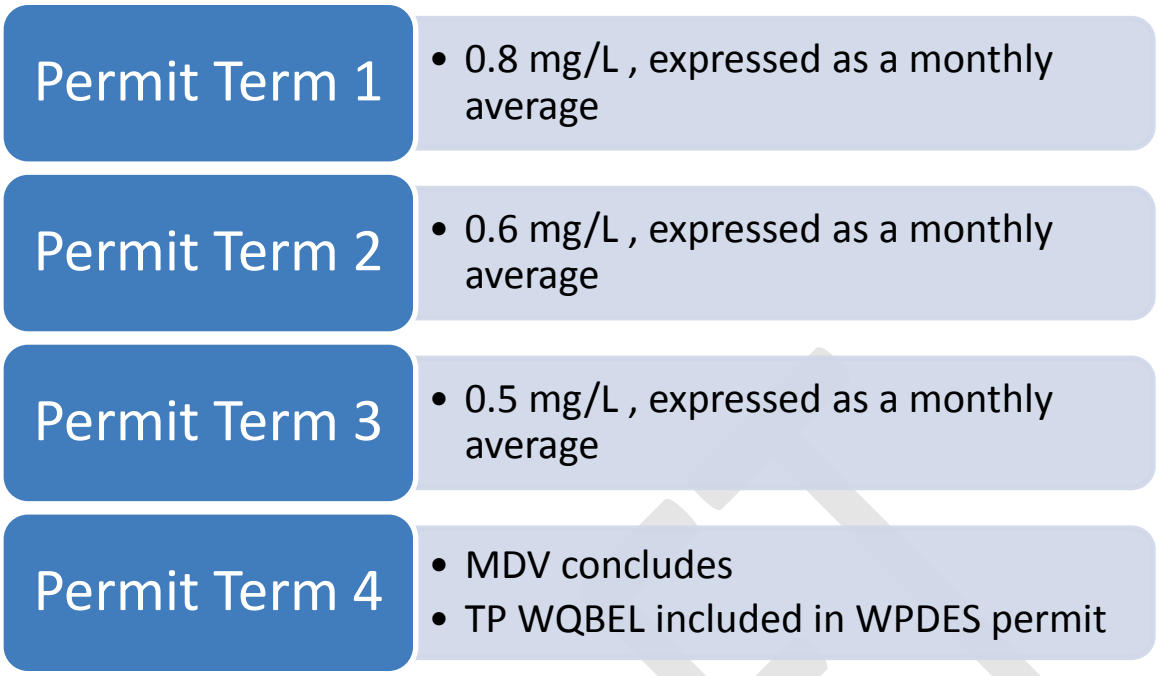


Figure 28. Default interim limitations by permit term specified in Act 378.

Similar to "pollution minimization plans" for other variances, the watershed plan is designed to make economically feasible reductions in phosphorus entering to receiving water to help work towards compliance with the WQBEL. Through modelling, by the Pollution Reduction Estimation Tool (PRESTO) model, DNR has also demonstrated that although most point sources discharge phosphorus continually to surface waters, the majority of the phosphorus loading to Wisconsin's streams and rivers comes from nonpoint sources. For more information, see http://dnr.wi.gov/topic/SurfaceWater/PRESTO.html. For these reasons, watershed plans are a key piece needed to address excess phosphorus pollution in Wisconsin's surface waters. There are three types of watershed projects that could be utilized:

- Enter into an agreement with DNR to implement a plan or project designed to result in an annual reduction of phosphorus from other sources in the HUC 8 basin in an amount equal to the difference between what they discharge and a target value.
- Enter into an agreement with a third party and approved by DNR to implement a plan or project designed to result in an annual reduction of phosphorus from other sources in the HUC 8 basin in an amount equal to the difference between what they discharge and a target value.
- Make payments to counties in the same HUC 8 basin of $50 per pound times the number of pounds of phosphorus their discharge exceeds the target value. Payments are capped for any one point source at $640,000 per year.

For each of the three implementation options, the target value will be the wasteload allocation for point sources in an EPA-approved TMDL area, or a 0.2 mg/L target value for point sources outside of a TMDL

area. Annual reporting is required to verify the watershed plan was implemented in accordance with the specific plan.

Appendix C. Secondary Indicators Analysis by County

The following graph represents the secondary indicator analysis for all counties. For Details, see Section 5, part B Secondary Indicators, p. 33.

Table 13. Secondary analysis by county.

	Median Household Income in Thousands of Dollars [1]	Personal Current Transfer Receipts Share of Total Income 2013 [2]	Jobs per Square Mile [3]	Population Change 2004 - 2014 [4]	Change in Net Earnings 2003-2013 [5]	Employment Change 2003 -2013 [6]	Secondary Screening Criteria Met
Adams	$ 44.9	26.9%	7	0.7%	41.5%	9.3%	4
Ashland	$ 38.6	26.3%	8	- 5.3%	29.7%	- 5.7%	6
Barron	$ 44.1	23.2%	24	- 1.1%	32.1%	- 1.1%	6
Bayfield	$ 44.9	25.4%	3	- 3.3%	27.5%	- 0.5%	6
Brown	$ 53.1	14.3%	279	6.4%	32.7%	5.6%	1
Buffalo	$ 47.4	18.0%	6	- 3.1%	27.7%	- 10.3%	6
Burnett	$ 39.6	27.5%	6	- 5.7%	26.2%	9.1%	5
Calumet	$ 65.1	10.5%	39	12.1%	61.1%	3.1%	2
Chippewa	$ 50.6	20.0%	23	6.0%	42.7%	14.1%	3
Clark	$ 43.3	20.9%	8	0.9%	39.8%	4.1%	6
Columbia	$ 57.9	15.3%	27	4.0%	37.1%	7.5%	3
Crawford	$ 42.2	23.1%	13	- 5.0%	37.8%	1.3%	6
Dane	$ 61.7	11.0%	258	11.4%	46.3%	12.5%	0
Dodge	$ 53.1	17.0%	39	1.0%	38.5%	4.1%	4
Door	$ 50.4	20.4%	27	- 3.9%	32.8%	0.7%	6
Douglas	$ 45.4	26.6%	12	1.1%	20.7%	- 2.8%	6
Dunn	$ 48.9	19.6%	19	5.2%	46.2%	5.1%	3
Eau Claire	$ 48.1	17.0%	86	4.4%	42.0%	8.4%	2
Florence	$ 48.0	25.6%	2	- 14.7%	18.2%	18.1%	5
Fond du Lac	$ 53.8	17.8%	63	2.8%	27.6%	1.5%	4
Forest	$ 40.0	28.7%	3	- 9.3%	30.2%	- 1.6%	6
Grant	$ 47.0	19.0%	15	4.1%	51.7%	5.4%	4
Green	$ 55.6	15.9%	26	4.7%	46.1%	6.1%	1
Green Lake	$ 47.0	18.9%	18	- 1.2%	33.8%	- 6.2%	6
Iowa	$ 55.7	16.2%	13	0.7%	35.3%	- 3.8%	4
Iron	$ 39.1	27.1%	2	- 14.9%	49.8%	- 12.2%	5
Jackson	$ 44.1	19.6%	8	4.8%	42.5%	1.9%	4

Jefferson	$ 53.5	17.6%	59	7.2%	27.2%	3.2%	3
Juneau	$ 45.3	24.6%	12	5.7%	37.8%	4.0%	5
Kenosha	$ 54.9	18.3%	196	7.2%	26.7%	5.3%	2
Kewaunee	$ 53.6	17.1%	21	- 1.0%	37.5%	2.5%	4
La Crosse	$ 51.3	16.9%	150	6.5%	39.6%	7.9%	2
Lafayette	$ 49.1	16.3%	6	3.7%	75.2%	9.8%	3
Langlade	$ 42.4	25.1%	9	- 6.5%	26.8%	0.4%	6
Lincoln	$ 49.0	24.5%	12	- 4.8%	16.8%	- 7.9%	6
Manitowoc	$ 48.9	19.2%	56	- 3.5%	30.8%	- 0.5%	5
Marathon	$ 53.4	16.5%	43	3.7%	28.6%	1.1%	4
Marinette	$ 40.5	25.3%	14	- 5.9%	28.8%	- 0.1%	6
Marquette	$ 46.1	27.2%	8	2.3%	29.8%	- 2.6%	6
Menominee	$ 33.3	33.3%	6	- 8.2%	43.1%	14.9%	4
Milwaukee	$ 43.2	21.7%	1,967	1.1%	23.0%	- 1.2%	5
Monroe	$ 49.8	19.3%	22	6.4%	48.6%	9.3%	3
Oconto	$ 51.6	19.4%	9	0.9%	40.5%	- 3.1%	5
Oneida	$ 45.8	24.9%	14	- 4.4%	14.4%	- 1.2%	6
Outagamie	$ 58.3	14.2%	160	6.6%	29.3%	6.9%	1
Ozaukee	$ 75.5	9.9%	168	2.3%	31.6%	10.1%	2
Pepin	$ 47.7	23.3%	9	- 1.6%	35.6%	2.6%	6
Pierce	$ 59.2	15.7%	16	6.5%	21.8%	8.0%	2
Polk	$ 48.5	22.4%	17	0.8%	30.4%	6.3%	5
Portage	$ 51.0	17.1%	40	2.8%	33.7%	4.0%	5
Price	$ 42.6	27.2%	4	- 11.3%	11.1%	- 9.6%	6
Racine	$ 54.1	18.7%	218	1.9%	15.9%	- 1.9%	4
Richland	$ 45.3	22.5%	10	- 0.6%	44.4%	5.7%	4
Rock	$ 49.4	20.1%	86	2.9%	25.3%	- 4.6%	5
Rusk	$ 38.7	30.7%	5	- 4.7%	19.9%	- 13.1%	6
St .Croix	$ 68.4	12.4%	43	18.2%	49.4%	21.2%	1
Sauk	$ 52.1	17.1%	44	6.0%	35.9%	3.1%	4
Sawyer	$ 39.9	28.1%	5	- 2.1%	28.3%	1.3%	6
Shawano	$ 46.6	22.2%	14	- 0.2%	33.1%	2.2%	6
Sheboygan	$ 52.9	14.7%	113	- 0.1%	35.2%	0.2%	4
Taylor	$ 44.9	22.0%	8	4.3%	23.3%	- 4.2%	6
Trempealeau	$ 49.1	19.9%	19	5.1%	47.9%	11.7%	3

Vernon	$ 45.5	22.1%	11	3.6%	50.0%	7.9%	4
Vilas	$ 40.8	28.0%	9	- 2.0%	16.4%	- 8.9%	6
Walworth	$ 54.0	17.3%	70	6.0%	27.1%	4.2%	3
Washburn	$ 41.9	30.3%	7	- 4.9%	35.9%	1.1%	6
Washington	$ 66.2	15.3%	121	7.7%	38.1%	8.4%	1
Waukesha	$ 75.9	10.9%	417	5.2%	37.2%	5.4%	1
Waupaca	$ 50.8	22.3%	27	- 1.3%	32.5%	- 2.8%	6
Waushara	$ 43.1	23.6%	10	- 1.2%	39.5%	6.5%	5
Winnebago	$ 51.0	15.7%	206	3.9%	31.6%	4.4%	4
Wood	$ 47.7	19.6%	53	- 1.7%	23.9%	- 3.9%	5
Benchmark	U.S. = $53.0	U.S. = 17.1%	WI = 50	~1/2 U.S = 4.4%	U.S = 39.9%	~1/2 U.S = 4.8%	

[1] U.S Census Bureau, American Community Survey 2009-2013; Table B19013 Inflation-Adjusted Median Household Income

[2] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[3] Jobs from WI DWD Quarterly Census of Employment and Wages; land area from U.S. Census Bureau, County Quick Facts

[4] WI DOA Demographic Services Center; www.doa.state.wi.us/demographics

[5] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

[6] U.S Bureau of Economic Analysis, Personal Income Summary Table CA04; http://www.bea.gov/

Appendix D. EPA Letter Regarding Intake Credits for Phosphorus

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

APR 0 1 2015

REPLY TO THE ATTENTION OF:

Russell Rasmussen, Administrator
Division of Water
Wisconsin Department of Natural Resources
P.O. Box 7921
Madison, Wisconsin 53707-7921

Dear Mr. Rasmussen:

Recently, questions have arisen in discussions between our agencies as to whether water quality based effluent limitations for phosphorus would be required in National Pollutant Discharge Elimination System permits for discharges of once-through non-contact cooling water from power plants, where the power plant is not adding phosphorus to the cooling water.

While resolution of these questions would depend upon the unique factual circumstances involved with any specific permittee at issue, U.S. Environmental Protection Agency regulations recognize that a permitting authority could determine that there is no reasonable potential for a discharge to cause or contribute to an exceedance of water quality criteria in these situations – and so a limit would not be required for the specific pollutant at issue – if the conditions in Paragraph D.3 in Procedure 5 in Appendix F to 40 C.F.R. Part 132 are met. Although those regulations pertain to discharges of certain pollutants into the Great Lakes System, EPA believes that a permitting authority could similarly determine that, when those conditions are met, there is not reasonable potential with respect to discharges of other pollutants within the Great Lakes System or discharges of any pollutant outside of the Great Lakes System.

Paragraph D.3.b.iv in Procedure 5 provides that one of the conditions to support a no reasonable potential determination is that:

> The facility does not increase the identified intake pollutant concentration, as defined by the permitting authority, at the edge of the mixing zone, or at the point of discharge if a mixing zone is not allowed, as compared to the pollutant concentration in the intake water, unless the increased concentration does not cause or contribute to an excursion above any applicable water quality standard.

With regard to this condition, EPA explained on page 378 of the Supplemental Information Document that was prepared in support of EPA's adoption of the Water Quality Guidance for the Great Lakes System (Guidance) at 40 C.F.R. Part 132 that:

> As with the other conditions, the final Guidance does not establish how "no increased concentration" should be determined and leaves this to the discretion of the permitting authority. Language has been added to the final Guidance to clarify that the permitting authority has this discretion. As a general rule, increases in concentration can be determined easily by comparing measurements of intake levels of the pollutants with those in the effluent to determine whether there is any statistically significant difference. This approach can incorporate principles of averaging (provided, of course that the averaging period is appropriate for the circumstances) and also can have the end result of accounting for relatively insignificant mass increases or "slight" increases due to evaporation where such differences are not statistically significant. In addition, increases due to evaporation that cannot be measured or are not statistically significant, as discussed below, adequately account for "insignificant" increases due to evaporation.

Consequently, we believe that the Wisconsin Department of Natural Resources could appropriately determine for some discharges of once-through non-contact cooling water from power plants that water quality based effluent limitations are not necessary for phosphorus; particularly where the facility utilizes a completely "piped" cooling system.

If you have any questions about this letter, please contact Sean Ramach, of my staff, at (312) 886-5284 or ramach.sean@epa.gov.

Sincerely,

Tinka G. Hyde
Director, Water Division

cc: Susan Sylvester, WDNR