Accounting for Future NPDES-Permitted Pollutant Loads in Waste Load Allocations for Municipal Stormwater

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Abstract

In linking National Pollutant Discharge Elimination System Phase II municipal separate storm sewer system (MS4) permits to total maximum daily loads (TMDLs), proper derivation of the waste load allocation (WLA) is critical. A TMDL WLA sets a cap on pollutant loading and may restrict growth and development. To avoid having to reopen a TMDL, the WLA should include pollutant loads from the future urban footprint, as determined using land use or orderly annexation plans. The WLA should also include loads associated with discharges from MS4s that will be designated for permit coverage in the future. One can account for the discharges related to these MS4s using information on population trends and projections. Accounting for discharges resulting from urban growth or future permitted MS4s in the WLA reduces the likelihood that a TMDL will need to be reopened and provides permittees with flexibility in managing their stormwater discharges.

Introduction

A total maximum daily load (TMDL) is the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards. TMDLs include pollutant loads from nonpoint sources (load allocation, or LA) and point sources (waste load allocation, or WLA); they also include a margin of safety that accounts for uncertainty in the estimate of the TMDL. The TMDL may include a separate reserve capacity (RC) that accommodates future loads.

The WLA includes municipal separate storm sewer system (MS4)[i] discharges covered under a National Pollutant Discharge Elimination System (NPDES) permit in addition to other regulated discharges. Stormwater permits must be consistent with TMDL WLAs. 40 CFR §122.44(d)(1)(vii)(B). Stormwater permits typically do not contain numeric effluent limits. A common way for permittees to meet the WLA is to implement best management practices (BMPs) for which they can establish load reduction credits. A WLA is fully achieved when the cumulative reductions associated with BMPs equal the required reduction to meet that WLA. A permittee can maintain compliance with a permit through the successful implementation of a compliance schedule as the permittee makes progress toward ultimately meeting a WLA.

Many urban areas are experiencing growth. In Minnesota, impervious surface increased in area by 145,830 ha, from 1.2% to 1.9% of the total land area, between 1990 and 2000 (Bauer et al. 2005). As MS4s owned by municipalities, townships, or other entities grow, they may be designated for NPDES Phase II permit coverage and therefore represent new regulated discharges. If an MS4 discharges to an impaired water body but has no WLA, its allowable discharge of the pollutant of impairment is zero. Failure to account for urban growth in the TMDL therefore potentially restricts growth and development.

Currently, the stormwater and TMDL communities are engaging in considerable discussion about how to link permits to TMDLs. An often overlooked issue is the need to write TMDLs in such a way that enables clear linkage of waste load allocations to permit limits. Addressing future NPDES-permitted (regulated) pollutant loads from MS4s provides an important example of one method to ensure TMDL WLAs can be addressed by future MS4 permittees without the need to reopen the TMDL.

In this paper, we present several methods for incorporating stormwater discharges from newly regulated MS4s, or from discharges associated with urban growth, into TMDL WLAs. We present preferred methods and provide case studies to illustrate the application of the preferred methods.

Approaches for Addressing Future Regulated Pollutant Loads

Several methods are available for addressing future regulated loads in TMDLs.

1. The WLA can be based on the current footprint of the regulated area for stormwater discharges. In this case, the permittee must offset pollutant loads associated with growth or new dischargers by reducing the load beyond the WLA. For example, if a WLA calls for a 25% reduction in loading, a permittee generates offsets by reducing its load by more than 25%. Many WLAs are very restrictive, making it difficult to generate excess load for offsets.
2. A permittee may achieve its WLA through water quality trading. Trading with nonpoint sources (LA) seems unlikely to be feasible because one must meet specific baseline requirements in the LA to generate tradable pollutant credit. These baseline requirements can often be difficult to achieve. Reductions in the LA are not regulated and are not likely to meet the overall reduction target in the absence of additional incentives. In addition, a tracking system is necessary to determine when tradable pollutant credit exists. Another limitation is that trade ratios may be high. Trading with other permittees (either regulated MS4s or regulated wastewater treatment plants) may not be feasible because it is difficult to generate tradable load. To a certain extent, categorical WLAs establish a trading mechanism, but administration of categorical WLAs through the permit is challenging.
3. Future growth may be linked to performance-based measures. For example, the Potash Brook TMDL identifies channel protection measures that, when implemented, protect against increased loading associated with growth (Vermont Department of Environmental Conservation 2008). This is a viable approach when modeling or

monitoring supports the selection of performance measures. The performance measures are likely to be specific to each TMDL; this is problematic for general permits that cannot easily be reopened.

4. TMDLs can establish a separate RC to accommodate increased pollutant loading. For example, the Lower Cuyahoga River TMDL sets aside an RC of 6% based on predicted population growth in the watershed (Ohio Environmental Protection Agency 2003). A TMDL should describe methods for allocating the RC to the various sources and indicate that the RC can be accessed only by entities identified in the TMDL (US Environmental Protection Agency, Region V, pers. comm., March 2009).
5. By definition, the WLA is the portion of the loading capacity allocated to individual existing and future point source(s). 40 CFR §130.2(h); 40 CFR §130.2(i). Thus, the WLA may include pollutant loads that are currently not regulated but that will be at some point in the future.
6. One may base the WLA on the current footprint but allow growth that meets target reductions in growth areas. This typically requires a transfer from the LA to the WLA. For example, consider a case where an agricultural area adjacent to an urban area requires a 25% reduction in loading. If, during development, the permittee reduces loading from the agricultural land by 25% or more, the target reduction is satisfied. The TMDL should clearly define the requirements of an exchange between the WLA (the permittee) and the LA (the agricultural area), including the entity responsible for completing such exchanges.

Methods 5 and 6 are preferred approaches for addressing future loads in TMDLs, primarily because they introduce flexibility and may encourage low-impact development, which has the potential to recognize greater pollutant reductions than traditional development practices. Below, we discuss these options in greater detail and describe case studies.

Addressing Loads Associated with Urban Growth

Urban growth occurs primarily in municipalities located on urban fringes with significant tracts of land available for development. The goal of incorporating growth into the WLA is not to make room for increased loads in the WLA, as might occur if forested area is converted to urban land use, or to allow for continued high loading rates, as might occur when certain agricultural land uses are converted to urban land use. Instead, TMDL load targets for the land undergoing urban development should be passed on to permittees. This creates an incentive for permittees to implement BMPs, including low-impact development BMPs, that meet TMDL reduction targets. In some cases, permittees may reduce loads beyond reduction targets, thus generating load that is available as an offset. One may apply the offsets to built-out areas that would otherwise require expensive retrofits.

An MS4 permittee is responsible only for discharges associated with its publicly owned conveyance system. Assuming that development will occur on all land within a permittee's jurisdiction results in an overallocation to the permittee. To set the WLA, we suggest using 10- to 20-year projections of land use based on information from comprehensive land use plans, annexation plans, or other reliable sources. The following provides a guide for splitting loads into the WLA or LA.

- Include single- and multifamily residential, commercial, industrial, and public and semipublic land uses as well as roads in the WLA.
- Include agriculture, farmsteads, rural residential, seasonal or vacation, and diversified residential land uses in the LA if they will not discharge to a regulated MS4; include them in the WLA if they will discharge to a regulated MS4.
- Include parks and undeveloped land in the WLA if discharges from these will be to a regulated MS4.

Case Study 1—Reitz Lake

Reitz Lake, located in east-central Minnesota (Figure 1), is impaired for eutrophication. The 1,465-ha watershed is about 54% agriculture, 22% forest and grassland, 16% wetland and water, and 8% developed. Thus, 117 ha in the watershed

are currently developed. The 117 ha occur within the city of Waconia and in Laketown Township, each of which are regulated through a Phase II MS4 general permit. Currently, the majority of the watershed lies within Laketown Township, but the cities of Victoria and Waconia have orderly annexation plans, described in an annexation agreement between the township and the two cities, for much of the area within the township. By 2030, more than 80% of the watershed will lie within the two cities. The City of Victoria is also a regulated MS4. The Minnesota Pollution Control Agency (MPCA) used the Waconia and Victoria comprehensive land use plans (City of Waconia 2010; City of Victoria 2009) to determine the area likely to be developed. This area, which includes portions of annexed areas targeted for residential, commercial, and industrial development, encompasses 317 ha of the watershed and will likely drain to a regulated MS4 by 2030. The WLA in the TMDL (Carver County Land and Water Services 2010) therefore includes the 317 ha of currently regulated and likely to be regulated areas rather than just the 117 ha of currently regulated areas.

To achieve the Reitz Lake water quality standard, a 54% reduction in phosphorus loading is needed. This is a significant reduction. However, 200 of the 317 ha comprising the WLA are not currently urbanized. Much of the area to be developed is row crop agriculture. The average annual phosphorus loading rate given in the Reitz Lake TMDL report is 0.5 kg/ha for agricultural land and 0.4 kg/ha for developed (urban) land (Carver County Land and Water Services 2010). Assuming that the 200 ha to eventually be regulated is row crop agriculture, the estimated annual phosphorus loads are 100 kg for the 200 ha of agricultural land and 47 kg for the 117 ha of urban land, for a total load of 147 kg. Reducing this by 54% to reach the TMDL WLA yields a target load of 68 kg/ha/year.

Dietz and Clausen (2008) show that, compared to traditional urban development, nutrient export from low-impact development remains unchanged from predevelopment levels. The Reitz Lake TMDL report (Carver County Land and Water Services 2010) states that annual phosphorus loading from forested areas is 0.04 kg/ha. Assuming that forested

areas represent predevelopment levels, the implementation of low-impact development practices on the 200 ha of developing land should result in an annual export of 8 kg of phosphorus. Even if no BMPs were implemented on the existing 117 ha of urban land, the final export across the entire 317 ha would be 55 kg/ha/year. Thus, the entire load reduction requirement could be achieved through the implementation of low-impact development practices on newly developed land. While these assumptions may be overly liberal, this example points out the potential importance of allowing regulated MS4s flexibility in meeting TMDL WLAs.

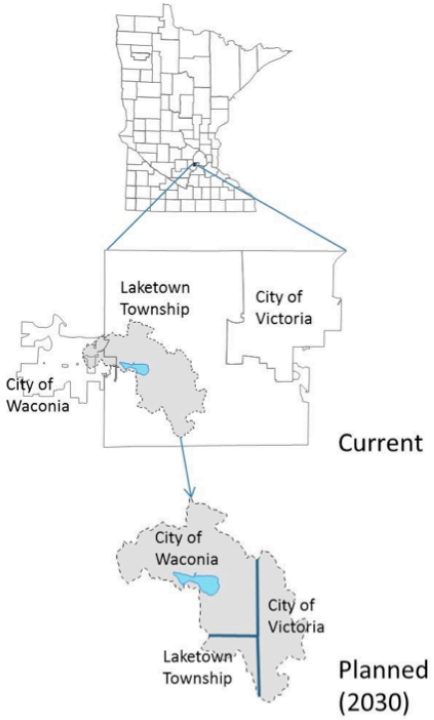

Figure 1. Location of Reitz Lake watershed (shown in gray shading), including existing and future city and township boundaries. By 2030, the cities of Victoria and Waconia will annex most of the watershed.

Addressing Loads Associated with New Discharges

When a US Census Bureau–defined urban area expands or when a permitting authority first designates municipalities for permit coverage, discharges from those new areas are regulated by an NPDES permit. These discharges must be included in a TMDL WLA. If a permitting authority anticipates that it will designate a new MS4 for permit coverage, it can include the pollutant loading from that MS4 in a TMDL as a WLA even if the MS4 is currently not regulated. Once the MS4 becomes regulated, the WLA can be incorporated into the NPDES permit. This process of anticipating regulated discharges obviates the need to reopen a TMDL when an MS4 is designated for permit coverage.

One can predict new discharges based on population growth projections or trends over a reasonable time frame, such as 20 years. Because determining

the exact boundaries of future dischargers is difficult, the TMDL can describe a process of transferring the WLA among permittees or transferring the LA to the WLA. Following, we describe three different approaches for addressing future growth in TMDLs that do not require reopening the TMDLs.

Future regulated dischargers must receive individual WLAs to prevent an overallocation of load in case the discharge is not covered by the NPDES permit. For example, consider a case in which a permitting authority gives three MS4s a categorical WLA of 15 units, but one of those MS4s is not yet regulated. Because the WLA includes a discharge that is not regulated, it represents an overallocation for the two discharges that are regulated. To prevent this situation, the permitting authority would give the two regulated MS4s a categorical WLA, and it would give the future regulated MS4 an individual WLA that would eventually be incorporated into the new permit.

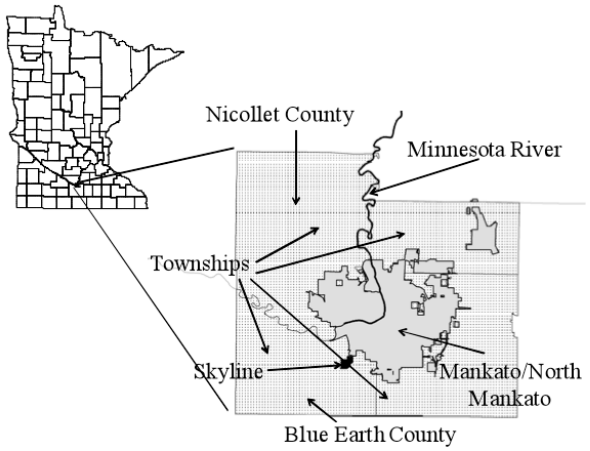

Figure 2. The US Census Bureau classified Mankato as an urban area following the 2010 census. This figure illustrates the locations of townships, a municipality (Skyline), and the counties that will come under permit coverage as a result of this designation. Mankato State University is not shown.

Case Study 2—Mankato, Minnesota

The U.S. Census Bureau classified the Mankato area, located in south-central Minnesota (Figure 2), as a metropolitan statistical area in 2008 and as an urban area following the 2010 census. Currently, only the cities of Mankato and North Mankato have NPDES permits. Based on the 2010 census, Nicollet and Blue Earth counties; the municipality of Skyline; Belgrade, Lime, South Bend, and Mankato Townships; Mankato State University; and the Minnesota

Department of Transportation will be required to obtain permit coverage.

Segments of the Minnesota River located in and downstream of the Mankato area are impaired for turbidity. The draft Minnesota River turbidity TMDL (Minnesota Pollution Control Agency 2012a) provides a categorical WLA for Mankato and North Mankato, the two entities currently regulated, and a separate categorical WLA for the remaining entities. This categorical allocation is similar to an individual allocation since all of the latter entities will come under permit coverage simultaneously. Comprehensive land use plans or annexation plans do not exist, so the WLA equals the load associated with the current footprint plus an additional 5% to account for growth. The TMDL bases the 5% growth figure on the rate of growth in impervious cover between 1990 and 2000; it calculates the current footprint using the National Land Cover Database (NLCD). The TMDL assumes the NLCD land cover classes Developed–Low Intensity, Developed–Medium Intensity, and Developed–High Intensity are land uses served by stormwater conveyances and thus are regulated areas. As such, they require WLAs, while all other NLCD land cover classes are included in the LA. Because of uncertainties in predicting growth in the Mankato urban area, the TMDL (MPCA 2012b, 21) describes a mechanism for transferring load: "If regulated MS4 communities expand beyond this five percent, or expand into areas currently included in the load allocation, mass from the load allocation will be moved to the waste load allocation proportional to the amount of land affected."

Case Study 3—Crow River, Minnesota

The Crow River in east-central Minnesota (Figure 3) is impaired for several pollutants. The MPCA issued a public notice soliciting comments on the draft Crow River TMDL on June 18, 2012, and the TMDL was submitted to EPA Region V for final review on June 4, 2013. One criterion for MS4 permit designation in Minnesota is a municipality with a population of

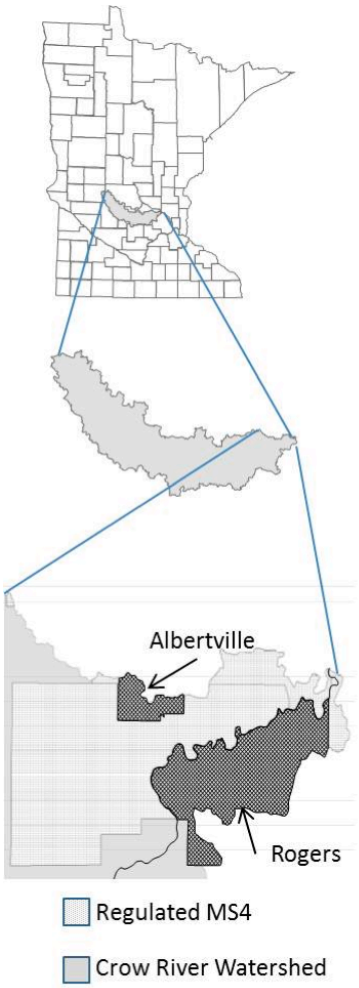

Figure 3. Location of the lower Crow River watershed

5,000 or more that discharges to an impaired water body. The lower portion of the watershed encompasses several cities that are undergoing rapid growth; some of these cities are designated MS4s based on the criterion cited above, but several cities are not.

We examined growth trends and comprehensive land use plans for the cities that are currently not regulated MS4s. The cities of Rogers and Albertville did not exceed a population of 5,000 when the TMDL was written; however; the population of each city was projected to exceed 5,000 by the year 2020. The MPCA established individual WLAs for each of these MS4s based on information from comprehensive land use plans. Several cities adjacent to Rogers and Albertville (Greenfield, Rockford, and Hanover, not shown in Figure 3) were projected to remain below 5,000 in population and did not receive WLAs. Currently regulated entities and those expected to meet criteria for regulation by 2020 were assigned WLAs. The WLAs for Rogers and Albertville will become a permit requirement at the time they are required to obtain coverage under the MS4 permit, and the TMDL will not need to be reopened.

Case Study 4—Elk River Watershed

The Elk River watershed, located within the Mississippi River watershed near St. Cloud, Minnesota, includes 12 regulated MS4s. The TMDL (Minnesota Pollution Control Agency. 2012) addresses four impairments: Elk River bacteria and

turbidity, Mayhew Lake nutrients, and Big Elk Lake nutrients. The MPCA assigned categorical WLAs collectively to the regulated MS4s for each impairment, but it was not necessary to assign WLAs to potential future regulated sources because the TMDL establishes a mechanism for transferring load from LA to WLA.

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The watershed as a whole has experienced rapid growth in the past decade. For example, the city of Becker saw a 54% increase in population in six years, from 2,673 in 2000 to 4,105 in 2006. It is difficult to estimate land areas that will drain to a regulated MS4 in the future, either as a result of expansion of an existing permittee's regulated area or a new regulated discharge. For that reason, transfers of load may be necessary in the future, and the TMDL report (MPCA 2012a, 6-10) establishes the scenarios in which transfers of load between two WLAs or from a LA to a WLA can be accomplished without requiring the TMDL to be reopened.

Future transfer of MS4 loads in this TMDL may be necessary if any of the following scenarios occur:

1. New development occurs within a regulated Municipal Separate Storm Sewer System (MS4). Newly developed areas that are not already included in the WLA must be given additional WLA to accommodate the growth. This will involve transferring LA to the WLA.
2. One regulated MS4 acquires land from another regulated MS4. Examples include annexation or highway expansions. In these cases, the transfer is WLA to WLA.
3. One or more non-regulated MS4s become regulated. If this has not been accounted for in the WLA, then a transfer must occur from the LA.
4. Expansion of an urban area encompasses new regulated areas for existing permittees. An example is existing state highways that were outside an Urban Area at the time the TMDL was completed, but are

now inside a newly expanded Urban Area. This will require either a WLA to WLA transfer or a LA to WLA transfer.

5. A new MS4 or other stormwater-related point source is identified and is covered under a National Pollutant Discharge Elimination System (NPDES) permit. In this situation, a transfer must occur from the LA.

Load transfers will be based on methods consistent with those used in setting allocations in the TMDL. In cases where WLA is transferred from or to a regulated MS4, the permittees will be notified of the transfer.

Summary

We presented two preferred methods of accounting for future loads in TMDLs that have a WLA for regulated MS4s. These include (1) anticipating future regulated MS4s or growth of existing regulated MS4s and incorporating discharges from these into the WLA and (2) creating a mechanism in the TMDL that allows for a transfer of load from the LA to the WLA. As illustrated by the case studies, the application of these methods allows for growth, provides flexibility to permittees, and creates incentives to implement low-impact development BMPs without requiring a TMDL to be reopened. We recommend using these approaches to TMDL development because they establish clear connections between WLAs and permit requirements and save time and money that would be invested should a TMDL need to be reopened.

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[i] *An MS4 (40 CFR §122.26(b)(8)) is a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, constructed channels, or storm drains) that (1) is/are owned or operated by a state, city, town, borough, county, parish, district, association, or other public body (created to or pursuant to state law), including special districts under state law (such as a sewer district, flood control district, drainage district, or similar entity), or an Indian tribe or an authorized Indian tribal organization, or a designated and approved management agency under Section 208 of the Clean Water Act; (2) discharge(s) into waters of the United States; (3) is/are designed or used for collecting or conveying stormwater; (4) is/are not a combined sewer; and (5) is/are not part of a publicly owned treatment works, as defined at 40 CFR §122.2.*