All things TMDL

A place to look for total maximum daily load (TMDL) guidance

All Things TMDL is a resource to be used by total maximum daily load (TMDL) writers and reviewers. It contains brief guidance for topics related to TMDLs in Minnesota and is a supplement to TMDL protocols and the TMDL report template. *All Things TMDL* should not be considered a comprehensive guidance regarding TMDL writing in Minnesota.

Contents

Abbreviations

BC	boundary condition
CAFO	concentrated animal feeding operation
CBOD	carbonaceous biochemical oxygen demand
CSO	combined sewer overflow
CSW	construction stormwater
DEM	digital elevation model
DMR	discharge monitoring records
DO	dissolved oxygen
EAO	Environmental Analysis and Outcomes
EDA	Environmental Data Access
EPA	United States Environmental Protection Agency
EQuIS	Environmental Quality Information System
GIS	geographic information system
HSPF	Hydrologic Simulation Program–Fortran
HUC	hydrologic unit code
ID	identification
ISW	industrial stormwater
ITPHS	imminent threat to public health and safety
LA	load allocation
MnDOT	Minnesota Department of Transportation
MOS	margin of safety
MPCA	Minnesota Pollution Control Agency
MS4	municipal separate storm sewer system
NBOD	nitrogenous biochemical oxygen demand
NPDES/SDS	National Pollutant Discharge Elimination System/State Disposal System
PJG	Professional Judgement Group
PM	project manager
RC	reserve capacity
SAM	Scenario Application Manager
SOD	sediment oxygen demand
SSO	sanitary sewer overflow
SSTS	subsurface sewage treatment system
TMDL	total maximum daily load
TP	total phosphorus

TSS	total suspended solids
UA	urbanized area
USGS	United States Geological Survey
WLA	wasteload allocation
WQBEL	water quality based effluent limit
WQS	water quality standard
WRAPS	watershed restoration and protection strategies
WWTP	wastewater treatment plant

A. Data collection for TMDL studies

A description of data sources that can be used in TMDL (and Watershed Restoration and Protection Strategy [WRAPS]) source assessments. This list is not exhaustive.

The Minnesota Pollution Control Agency (MPCA) Data Desk provides data services assistance from the MPCA's data analysis unit. Data requests can be made through the Minnesota Service Hub (link available to MPCA employees on the Lorax) or through email (DataDesk.MPCA@state.mn.us) for TMDL writers external to the MPCA. The primary data requested for TMDL projects from the Data Desk are permitted sources and feedlots (Section A.5).

A.1. Tableau reports

Much of the information available for TMDL studies is available internally to Minnesota Pollution Control Agency (MPCA) staff through internal Tableau reports. These reports can only be accessed internally at MPCA. The following is a list of Tableau reports that are referenced here in *All Things TMDL*; more information on some of the reports is provided later in *All Things TMDL.* If the TMDL is being developed by consultants or local partners, the MPCA project manager should provide these reports at the beginning of the project to the entity developing the report:

- Impairment information
  - Stressor ID data report
  - Impaired waters TMDL planning summary
- Wastewater
  - DMR—Multiple facility dashboard
  - Reported releases (wastewater)
  - TMDL WLAs (wasteload allocations) for wastewater
- Septic systems
  - SSTS compliance history by LGU
  - SSTS total permits issued history by LGU
- Feedlots
  - Active feedlot sites (reg required) (This report should be secondary to the feedlot information provided by the MPCA Data Desk; see "Permitted sources and feedlots" in Section A.5.)
  - Compliance inspections at funded sites
- Construction stormwater
  - CSW permit coverage by county and watershed
  - CSW sites
- Industrial stormwater
  - ISW permits (includes sectors, EJ areas and county information): ISW Permits - Tableau Server (This report should be secondary to the industrial stormwater information provided by the MPCA Data Desk; see "Permitted sources and feedlots" in Section A.5.)

When using information from these reports in a TMDL report, please reference the name of the Tableau report and the date when the information was downloaded.

A.2. Water quality data

Please request water quality data from EQuIS by first contacting Andrea.Plevan@state.mn.us.

Alternatively, data from individual water bodies can be downloaded from the MPCA's Environmental Data Access (EDA) webpage.

As a third option, EQuIS data can be requested through the MPCA Data Desk. This Data Desk request should be separate from other Data Desk requests (e.g., for permitted sources and feedlots) so that the water quality data request can be tracked separately. Consultants can email the Data Desk at DataDesk.MPCA@state.mn.us; MPCA staff should use the Minnesota Service Hub (link available internally on the Lorax) to submit a ticket to the MPCA Data Desk. Requests for water quality data are typically fulfilled within a week.

For lake TMDLs, EQuIS and EDA data may be supplemented with UMN Remote Sensing data using the Minnesota LakeBrowser. Select the lake of interest and then Click "Full Report" and then "Show/hide daily values" under the "Lake Clarity Tabular View" subsection. This table can be copied directly into Excel.

There may also be data available from other organizations such as United States Geological Survey (USGS), tribes, Metropolitan Council Environmental Services Environmental Information Management System, and local partners such as soil and water conservation districts. Federal data (e.g., USGS and tribes), in addition to data from other states, can be downloaded from the National Water Quality Monitoring Council's Water Quality Portal.

A.3. Watershed boundaries

When delineating watershed boundaries to impaired waters, please start with the watershed boundaries in the appropriate Hydrologic Simulation Program–Fortran (HSPF) model developed by MPCA and consultants (download the Scenario Application Manager [SAM] project from SAM File Sharing or contact Chuck.Regan@state.mn.us for geographic information system [GIS] layers). If there is no HSPF model for the watershed, watershed boundaries from other models may be used. A statewide GIS layer of HSPF model boundaries is available internally at env_watershed_hspfmodel_catchments. When using this layer, please review the metadata and compare the watershed boundaries with those in the SAM project. In the future, this layer may be made available through Minnesota Geospatial Commons. Please contact Ashley.Ignatius@state.mn.us or Chuck.Regan@state.mn.us with questions.

The watershed boundaries in the HSPF model may not take into account stormsewers. Please work with the MPCA Stormwater–TMDL Liaison (Anna.Bosch@state.mn.us) to contact cities in the watershed before finalizing the watershed boundaries to impaired waters.

Where additional watershed breaks are needed to define the impairment watersheds, please use DNR Level 8 and/or 9 watershed boundaries. For impairment watersheds that are on a finer scale than the DNR Level 9 boundaries, watershed breaks can be based on a digital elevation model (DEM), or online tools such as USGS StreamStats can be used.

A.4. Tribal boundaries

A TMDL report must identify tribal lands that are located within the watershed of the impaired water bodies. The most recent "American Indian Area Geography" layer posted on the U.S. Census Bureau's TIGER/Line® Shapefiles can be used. Because this layer may not be the most current, tribes may be contacted directly for updated tribal boundary data.

A.5. Permitted sources and feedlots

At the start of a TMDL project, MPCA staff or the consultant should contact the MPCA Data Desk to request a list of all of the permitted sources (e.g., industrial, wastewater treatment plants (WWTP), concentrated animal feeding operations (CAFO), municipal separate storm sewer systems (MS4), construction and industrial stormwater) and active, registered feedlots (including animal units, animal numbers, and animal types) in the watershed of concern. Part of the Data Desk's process involves checking location data to determine if the source is actually inside or outside of the watershed; this is important because there are errors in location data. The list of permitted sources and feedlots that the Data Desk produces is therefore more accurate than a list that could be derived from viewing individual GIS layers. Consultants can email the Data Desk at DataDesk.MPCA@state.mn.us; MPCA staff should use the Minnesota Service Hub (link available on the Lorax) to submit a ticket to the MPCA Data Desk. A request for permitted sources and feedlots may take a few weeks to be fulfilled, so please request it early in the project.

This information can be requested for the entire hydrologic unit code (HUC) 8, or for a smaller HUC level (e.g., HUC10 or 12). The information will be provided in an Excel spreadsheet with spatial coordinates, so it is often helpful to request the entire HUC8, and then the sites in the project area can be selected in GIS based on the project extent.

Other sources of information on permitted sources and feedlots (e.g., What's In My Neighborhood, GIS layers provided by MPCA or MN Geospatial Commons, and MPCA Tableau reports) should be secondary to the information provided by the Data Desk.

A.6. Permitted municipal separate storm sewer systems

See Total Maximum Daily Loads in the Minnesota Stormwater Manual for information about stormwater and TMDLs. The Data Desk report (see Section A.5) provides the list of permitted MS4s in the requested watershed. The TMDL writer should use the MPCA shapefile (https://gisdata.mn.gov/dataset/util-ms4-boundaries) and then contact the MPCA Stormwater–TMDL Liaison (Anna.Bosch@state.mn.us) to confirm the existing permitted MS4s and identify potential future MS4s that need to be considered. The individual permitted MS4s should be invited to participate as part of the TMDL development process (e.g., as part of the core team or local partner team), and should be contacted directly to inquire if the MS4 has mapped their regulated MS4 area; the permitted MS4 area typically does not coincide with the entity's jurisdictional boundary. Additionally stormsewers may alter an impairment's drainage area, and this should be taken into account in a TMDL study to the extent possible.

The following permitted MS4s are regulated solely within the U.S. Census-defined urbanized area (UA) and other platted areas outside the UA but within the jurisdiction.

Cities:	Eagle Lake	Medina	Rice Lake
Carver	Grant	Newport	Saint Augusta
Dayton	Hanover	North Oaks	Skyline
Dellwood	La Crescent	Nowthen	St. Bonifacius
Dilworth	Long Lake	Proctor	Wayzata
Townships:	Jackson	Marion	South Bend
Brockway	La Crescent	Midway	Spring Lake
Cascade	Laketown	Minden	St. Joseph
Duluth	Le Sauk	Rochester	Watab
Empire	Louisville	Sauk Rapids	West Lakeland
Haverhill	Mankato		

If any part of the regulated area of one of these permitted MS4s is in the TMDL watershed, it would be considered a permitted MS4 subject to the TMDL. See the side bar for data sources for U.S. Census-defined urbanized areas.

GIS data sources for U.S. Census-defined urbanized areas:

- MPCA R drive: census_2010_urban_areas_usboc
- U.S. Census Bureau: TIGER/Line Shapefile 2010 Census Urban Area National (or the most recent layer)

Urbanized areas are defined in the shapefile as UATYP10 = "U" (exclude UATYP10 = "C"—these are the urban "clusters," which are not regulated through MS4 permits).

In addition to municipalities and townships, the above-referenced shapefile contains non-municipal MS4s (often called "non-traditional" MS4s), which include watershed organizations, counties, the Minnesota Department of Transportation (MnDOT), and certain publicly owned entities such as colleges and universities, prisons, and hospitals. Regulated MS4 areas for non-traditional MS4s consist of conveyance systems (which include transportation corridors) that are owned and operated by the entity and are within the U.S. Census-defined urbanized area. To confirm if a non-traditional MS4 has regulated area in the project watershed, overlay the "urbanized areas" from the U.S. Census Urban Areas shapefile with the project area. Regulated MS4 area will only be within UAs.

The area of the transportation corridors (county and MnDOT MS4s) within the urbanized areas can be approximated by an average right-of-way width around the transportation corridors. Roads can be identified, along with MS4 ownership, in the "Primary_Routes_in_Minnesota" feature class from the MnDOT Route Centerlines file geodatabase available through the Minnesota Geospatial Commons (also see MnDOT's Route System Descriptions):

- MnDOT ownership: ROUTE_SYSTEM = 01 (Interstate), 02 (U.S.), or 03 (State).
- County ownership: ROUTE_SYSTEM = 04 (CSAH) or 07 (County).

To estimate MnDOT regulated MS4 area, please first contact MnDOT staff (nick.tiedeken@state.mn.us for all projects; beth.neuendorf@state.mn.us for MnDOT Metro District, and tara.carson@state.mn.us for MnDOT Outstate Districts), who might want to delineate the area or provide other information to inform delineation of the regulated area.

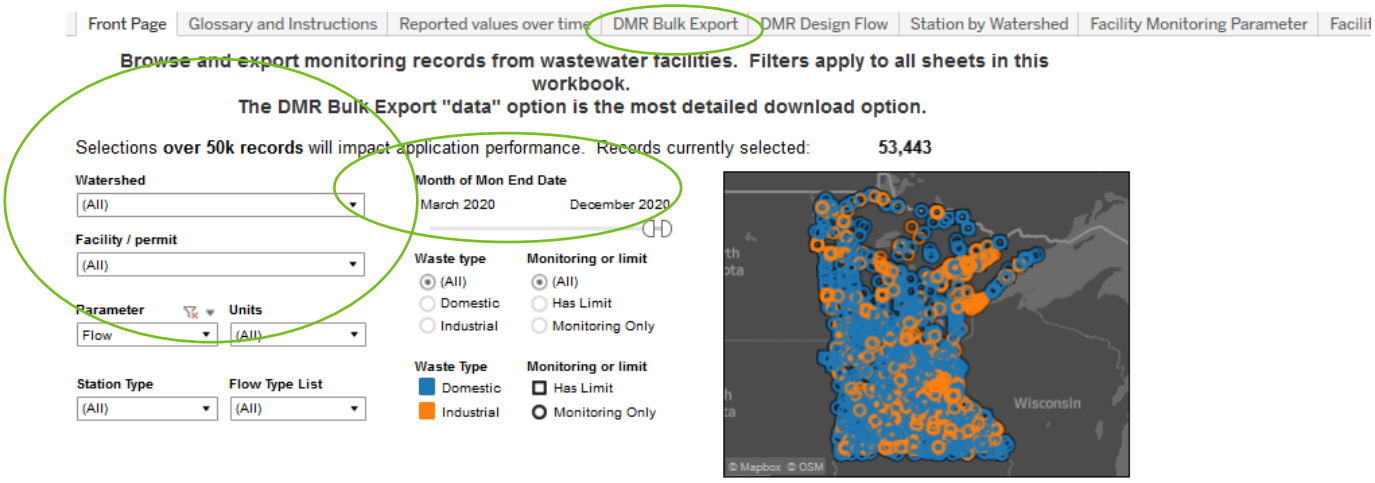
See also Guidance on what discharges should be included in the TMDL wasteload allocation for MS4 stormwater in the Minnesota Stormwater Manual for issues to consider when developing WLAs for permitted MS4 stormwater.

A.7. Permitted wastewater

A list of permitted wastewater sources in the area of interest will be provided by MPCA's Data Desk (see Section A.5). The TMDL writer should review and summarize the permitted wastewater sources and then contact the MPCA Wastewater–TMDL Liaison (Marco.Graziani@state.mn.us) to confirm the permitted wastewater sources that need to be addressed in the TMDL report. This should be done towards the beginning of TMDL development.

Discharge monitoring records

Discharge monitoring records (DMRs), which can be used to evaluate a facility's discharge relative to its permit limits, can be downloaded from the MPCA's external Wastewater data browser (data are updated quarterly):



- Select the HUC8 watershed, facility name and permit number, and parameter (e.g., flow, fecal coliform) from the drop-down fields.
- Select the time period of interest with the sliders under *Month of Mon End Date.*
- Select *DMR Bulk Export* from the tabs across the top.
- Locate the download icon, either at the top or bottom of the window (depending on browser).

- Select the Crosstab option to download the data into a logically ordered .csv file in MS Excel.

Similar information can also be accessed internally through the MPCA's Tableau DMR—Multiple facility dashboard[1]. The look and functionality are similar to the external Wastewater data browser, but the Tableau dashboard has more selection options, the data are refreshed daily, and larger file exports are supported.

Wastewater releases

In their TMDL review, the U.S. Environmental Protection Agency (EPA) asks if there are sanitary sewer overflows (SSOs) or combined sewer overflows (CSOs) in the impairment watersheds. Please use the following to address this in a TMDL report:

- SSOs: MPCA refers to SSOs as "releases." A record of reported releases from WWTPs can be accessed in the Tableau report Reported Releases[1]. The data in this report are somewhat anecdotal and are not standardized; however, the data could be used to identify where wastewater releases might be contributing to impairment. For assistance interpreting information in this report, please contact the MPCA Wastewater–TMDL Liaison (Marco.Graziani@state.mn.us).
- CSOs: MPCA is aware of only one CSO in the state. This CSO is in Minneapolis, and it has not discharged in years.

Wastewater releases are discussed in the Otter Tail River Watershed TMDL report (2021); please see this report as an example.

A.8. Subsurface sewage treatment systems

Estimates of subsurface sewage treatment system (SSTS) compliance, failure, and imminent threat to public health and safety (ITPHS) rates are provided in the Tableau report Compliance history by LGU[1]. If you would like more recent data than that provided in the report, contact Katie.Dowlding@state.mn.us.

Small community wastewater treatment areas of concern are identified by counties as having five or more homes within 0.5-mile of one another. The communities may have been listed because they were known to be noncompliant or due to an unknown status of SSTS compliance. For more information and the list of these areas, please contact Lisa.McCormick@state.mn.us. The data are gathered from LGUs, so specific questions related to communities on the list should be discussed with the LGU. Unless confirmed with the LGU, specific information about the names and locations of the communities should not be included in a TMDL report. A general description of the number of suspected small community wastewater treatment areas of concern may be reported.

B. Impairment lists

As part of watershed charter development and with input from local partners, the MPCA Watershed project manager (PM) will determine which TMDLs should be addressed in a TMDL report (Project charter guidance, available internally at MPCA). Factors that may be considered include the priority of the water body, available information, and resources for TMDL development.

B.1. Accounting of TMDLs in impairment tables

There are two locations in the TMDL report template with information about impairments in the watershed:

- Section 1.2: Identification of water bodies. The purpose of this section is to identify the water bodies for which TMDLs are developed in the report. Include biological impairments (fish and macroinvertebrates) that are addressed by TMDLs in the report. For example, a total suspended solids (TSS) TMDL might apply to a TSS impairment and a fish impairment on the same water body. Because the TSS TMDL addresses both impairments, it must be listed separately in the table so that EPA can acknowledge and approve TMDLs for both impairments. Please use the table provided in the TMDL report template, which

[1] *This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

includes fields from the impaired waters list and fields specific to the TMDL report. Additional information on some of the fields is as follows:

- Affected designated use: From impaired waters list.
- Listing parameter: "Pollutant or stressor" from impaired waters list.
- TMDL pollutant: This is the pollutant on which the TMDL is written. The TMDL pollutant might be the same as the "listing parameter" field (e.g., TSS for TSS impairments or *Escherichia* (*E.) coli* for *E. coli* impairments), or it might differ (e.g., TSS for biological impairment or phosphorus for nutrients impairment).
- Category 4A upon TMDL approval: Impairment will be categorized as 4A (impaired and a TMDL study has been approved by EPA) upon approval of the TMDL and will appear as 4A in the next impaired waters list. For an impairment to be categorized as 4A, the EPA must have approved all TMDLs needed to achieve attainment of applicable water quality standards for the impairment. For biological impairments, if there are remaining conclusive or inconclusive pollutant stressors, the impairment should not be categorized as 4A and will remain in category 5 until all confirmed pollutant stressors have been addressed by a TMDL (i.e., inconclusive stressors are determined to be conclusive stressors or not a stressor, and TMDLs are developed for all conclusive pollutant stressors). If an impairment will not be categorized as 4A upon TMDL approval, an explanation may be added to the table (e.g., inconclusive stressor remains), and the impairment will stay in category 5. Note that a biological impairment with both pollutant and nonpollutant stressors can be categorized as 4a after pollutant stressors have been addressed via a TMDL (e.g., a biota listing with pollutant stressor(s) and habitat stressor).

- Appendix A: Impaired water bodies in the HUC8 watershed. When writing a HUC8 watershed TMDL report, it is preferable to document the status of *all* of the impairments in the watershed, whether or not TMDLs are developed for the impairments in the report. This information will typically be presented in a table and will include impairments for which TMDLs were previously completed, are being completed in the report, and are being deferred. The table will also include impairments for which TMDLs are not needed, such as if the impairment is due to a non-pollutant or to natural conditions.

  Please use the table provided in the TMDL report template, which includes fields from the Tableau report Impaired waters TMDL planning summary[2] and fields specific to the TMDL report. Additional information on some of the fields is as follows:

  - Listing parameter: "Pollutant or stressor" from impaired waters list.
  - Stressors to bioassessment impairments: Many of these will be documented in the Tableau report. If the information is not yet available through Tableau, please discuss with stressor ID staff and/or review the stressor identification report. Differentiate between conclusive stressors and inconclusive stressors. For non-biological impairments, this field should be NA (not applicable). This field can also be adapted to include causes of low dissolved oxygen impairments.
  - EPA category in next impaired waters list: For all impairments that are not addressed in this TMDL report, the EPA category will be listed in the Tableau report Impaired waters TMDL planning summary[2]. For impairments addressed in this TMDL report, the impairments indicated as "eligible for category 4A" in Section 1.2 should be also indicated as 4A here.
  - The impairment categories are the following (please see the impaired waters list for more information on some of these categories):
    - 4A: Impaired and a TMDL study has been approved by USEPA ("done")
    - 4B: Impaired but a TMDL study is not required because water quality standards are expected to be met in the near future

[2] *This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

- 4C: Impaired but a TMDL study is not required because the impairment is not caused by a pollutant ("non-pollutant")
- 4D: Impaired but a TMDL study is not required because the impairment is due to natural conditions with insignificant anthropogenic influence ("natural background")
- 4E: Impaired but existing data strongly suggests a TMDL study is not required because impairment is not caused by a pollutant or is due to natural conditions; a final category determination will be made pending confirmation from additional data collection.
- 5: Impaired status and TMDL has not been approved by USEPA ("not done yet")

- Planned recategorization: Recategorizations from category 5 to anything except for 4A must be requested (see Section B.4: *Recategorizations*). Planned recategorizations are documented in the Tableau report Impaired waters TMDL planning summary. The inclusion of the proposed category in the TMDL report does *not* automatically change the classification. The change in classification is done through the impaired waters list, and any change in classification that is not a simple "TMDL completed" (category 5 → 4A) needs to be submitted to Miranda Nichols in the Environmental Assessment and Outcomes Division for consideration. See also pages 4–7 in Reviewing total maximum daily load reports.
- TMDL developed in this report: Indicate which TMDLs are developed in this report. Consider adding a brief explanation of why TMDLs are not developed in the report (e.g., TMDL previously completed, non-pollutant stressors, numeric water quality criterion not established, not enough information to identify stressors).

B.2. Biological, dissolved oxygen, and pH impairments in TMDL reports

Using the stressor identification report and the Tableau Stressor ID data report[3], the Watershed PM and stressor identification (ID) staff typically decide which biological impairments will be addressed by which pollutants in a TMDL report. The "stressors" or "probable stressors" identified in the stressor ID that are pollutant-based (e.g., TSS, phosphorus) are considered for TMDL development. Inconclusive pollutant stressors need to be further investigated before they should be considered for TMDL development. Other factors that influence the decision are the priority of the water body, available information, and resources for TMDL development. These factors are all taken into account during charter development when the PM works with local partners to determine which TMDLs should be addressed in a TMDL report.

Some PMs prefer to wait until there are no remaining inconclusive stressors before undertaking TMDL development on a biological TMDL. With this approach, all needed TMDLs will be written for a biological impairment in the same TMDL report, and the biological impairment can be categorized as 4A upon EPA-approval. Other PMs prefer to complete TMDLs for probable stressors as they are identified, regardless of whether inconclusive stressors remain. In this case, the biological impairment would remain in category 5 even after TMDL approval because not all TMDLs that are needed to result in attainment of WQS have been developed or approved by EPA.

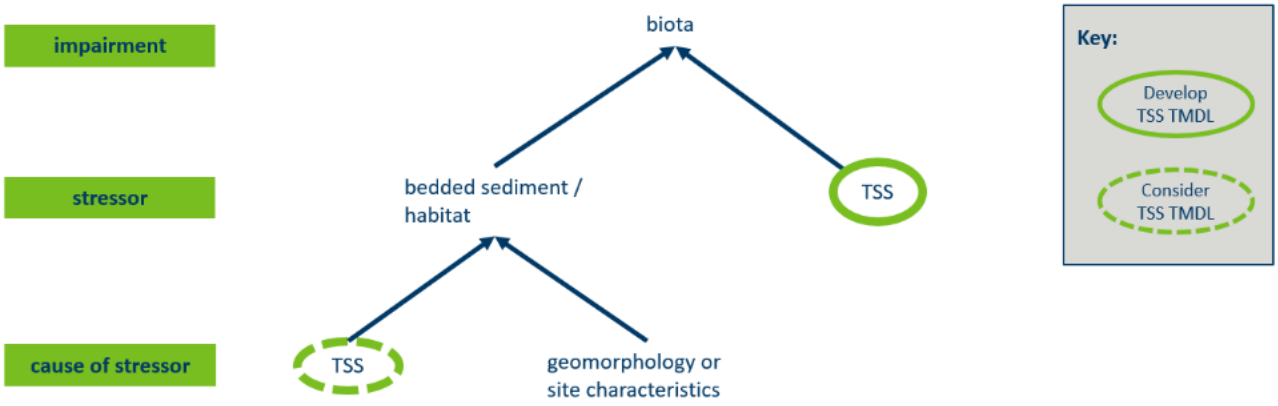
Bedded sediment: When bedded sediment is identified as a stressor to a stream biological impairment, it is often considered a non-pollutant stressor because of the effects of bedded sediment on habitat. In this case, the impairment could be considered for 4C (non-pollutant) recategorization if no pollutants are identified as a stressor or inconclusive stressor. A TSS TMDL should be developed only if TSS is identified as a stressor and/or determined to be a primary cause of the bedded sediment (Figure 1). (Other potential causes of bedded sediment include geomorphology or site characteristics such as flat slopes, over-widened channels, or excess pasturing.)

If TSS is determined to be a cause of the bedded sediment but the TSS WQS is met in the stream, a TSS TMDL *could* be considered (Figure 1). However, the TMDL target would be the TSS WQS even though the standard is

[3] *This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

being met. Therefore, the TMDL would be achieved and TSS reductions would not be called for. Instead of developing a TSS TMDL, consider calling attention to the stream's bedded sediment and TSS issues in the WRAPS, where implementation strategies to address the water quality issues can be recommended.

Figure 1. Bedded sediment, TSS, and biota impairments



Similarly, bedded sediment can also affect dissolved oxygen concentrations in the overlying water through sediment oxygen demand. In this case, bedded sediment would be a source of sediment oxygen demand but not necessarily a direct stressor. A sediment oxygen demand TMDL could be developed to address the impairment, and a sediment TMDL is not needed.

If sediment accumulates naturally in a stream and if there are no other stressors, the impairment could be considered for 4D (natural background) recategorization.

Linkage to pollutants in biological, dissolved oxygen, and pH impairments: For all biological (e.g., fishes bioassessments, aquatic macroinvertebrate bioassessments), dissolved oxygen (DO), or pH impairments that are addressed with TMDLs, the report should show the linkage between the impairment and the pollutant on which the TMDL is based (this can be done in Section 1.2: *Identification of water bodies*, to accompany the impairment table). For example, if a phosphorus TMDL is developed to address a DO impairment, discuss the linkage between phosphorus and DO in the system and show that it is reasonable to expect that if phosphorus loading were reduced to meet the TMDL, then the water body would meet DO water quality standards. For most biological impairments, the stressor identification report shows the link between the pollutant and the impairment. In this case, the stressor ID report should be referenced and only a brief summary needs to be included in the report. In other cases, additional analysis might be needed in the TMDL report to support the selection of the TMDL parameter.

If a biological impairment is not addressed by a TMDL in the TMDL report, then discussion of the impairment and its stressors is not needed in the TMDL report.

B.3. Professional Judgement Group report

The *Professional Judgement Group* (PJG) report available through CARL (Comprehensive Assessment Resource Library) provides notes from the assessment process that are sometimes useful in understanding why a water body was designated as impaired. Access the report from the MPCA through CARL→Reports→PJG Report. CARL is available internally at the MPCA; if a consultant is developing the TMDL report, MPCA staff should consider exporting the PJG report and providing to the consultant at the beginning of a project.

B.4. Recategorizations

Moving an impairment out of EPA Category 5 is called a recategorization. Reasons for recategorizations include non-pollutant stressors, natural background causes of impairment, impairment delisting, impairment correction, and impairments that are being addressed and recategorized to 4A based on a previously approved TMDL.

Relevant guidance documents are available for more information; the majority of these are only available internally at the MPCA. Contact Miranda.Nichols@state.mn.us regarding recategorization forms and process.

- 4A recategorizations[4]
- 4B requirements
- 4C non-pollutant and 4C candidate decision tree[4]
- 4D natural background[4]
- 4E additional monitoring[4]
- Delistings and corrections: biological and chemical impairments[4]
- Impairment recategorization and deferral tracking in Tempo (Tempo wiki)[4]

Some aquatic life listings will require recategorization after stressor identification work is complete. There may also be cases in which data suggest that a listing be removed (i.e., corrected). These recommendations and proposed new categories can be documented in a TMDL report appendix. However, decide in your project context if another document is better (e.g., stressor identification report or the TMDL report body such as Section 1.2 Identification of water bodies).

The most likely recategorizations include Category 4C. Waters should be placed in Category 4C when the state demonstrates that the failure to meet an applicable water quality standard is not caused by a pollutant, but instead is caused by other types of stressors. Segments placed in Category 4C do not require the development of a TMDL. Examples include aquatic life listings for which only habitat and/or flow alteration are conclusive stressors, and no inconclusive stressors remain.

Listings with pollutant stressors that are not addressed should stay in Category 5. For example, in the case of nitrate as a stressor to aquatic life, nitrate TMDLs are deferred until a numeric water quality standard for aquatic life in MN is developed; Category 5 maintains a sort of "holding bin" status for such aquatic life use listings.

a. Delistings

A water body delisting occurs only when new and reliable data or information indicates that the water body is now meeting water quality standards. High-level delisting requirements are found in the MPCA's Assessment Guidance Manual (latest version found on the MPCA's Impaired Waters List webpage). More in-depth guidance exists internally. In this case, the TMDL and allocations remain in effect. Once approved, a TMDL does not expire after a water body meets WQSs. Federal regulations (40 CFR 130.7(c)(1)) state that "TMDLs shall be established at levels necessary to attain and maintain the applicable narrative and numerical WQS."

b. Corrections

A correction is an impairment that is removed from the 303(d) list. There are multiple reason for corrections, including finding that the listing dataset was invalid given the standards or assessment methodology in place at the time.

B.5. Newly identified impairments

If newly identified impairments are discovered during a TMDL study, the MPCA PM should work with MPCA Environmental Analysis and Outcomes (EAO) Division assessment staff to verify the impairment. If it is assessed as impaired, a TMDL should be developed for the pollutant and included in the TMDL report; these new impairments should be explicitly identified in the report as new. The PM should work with Miranda Nichols to fill out the "Off Cycle Waterbody Assessment" form so it can be added to the impaired waters list. In the impaired water bodies table, include all of the typical information for the new impairments except for the listing year. Use the next year that the impaired waters list will be developed for the new impairments. Include the following footnote in the table: Expected to be listed on the [insert year] impaired waters list as impaired.

[4] *These files can only be accessed internally at MPCA. If you would like to view the files, please request them from your MPCA contact or Miranda.Nicols@state.mn.us.*

C. Pollutant sources

A TMDL pollutant source assessment will vary in detail based on the project scope and level of detail requested by the project manager and project partners. A pollutant source assessment in a previous TMDL report can be referenced in a later TMDL report if the sources are similar. For example, for an *E. coli* TMDL in an agricultural watershed with similar sources described in a previously approved TMDL report, the newer TMDL report can summarize the sources and reference the more detailed information in the previous TMDL report.

Much of the source information on permitted sources and feedlots will be provided by the Data Desk (see Section A.5 for instructions on requesting this information).

C.1. *E. coli* source assessments

A common approach to evaluating *E. coli* sources in Minnesota has been to estimate the amount of *E. coli* organisms produced by various source types (e.g., different types of livestock, pets, wildlife, and humans). Although this approach can provide useful information, *E. coli* production rates reported in the literature are highly variable, and other, less quantitative, approaches to source assessment are just as robust and easier to communicate to the TMDL audience. MPCA recommends not quantifying *E. coli* production by source and instead providing source information such as the following (see Section A for data sources):

- Livestock: Animal or animal unit density by subwatershed and by animal type; consider differentiating livestock in CAFOs from non-CAFO feedlots.
- Wildlife: Locations of wildlife management areas or land covers such as large wetland areas that would attract wildlife.
- SSTS: Rates of non-compliant SSTS (available by county), or consider contacting county staff directly for more detailed information on the impairment(s) of interest.
- Small community wastewater treatment areas of concern: Map or description of locations, if applicable
- Municipal wastewater.
    - Review DMRs to evaluate compliance with fecal coliform effluent limits.
    - WWTPs that discharge to a class 7 water are not required to disinfect in April. If these WWTPs are in the watershed of a class 2 impairment, wastewater effluent could contribute to impairment in April (the *E. coli* stream standard applies from April through October in class 2 waters). To determine the likelihood that the effluent contributes to *E. coli* impairment in April, evaluate WWTP design flow relative to stream low flow, April surface water monitoring data, and the location and distance of the effluent discharge point relative to the downstream impairment.
    - Evaluate location and frequency of wastewater releases.
- Stormwater runoff: Map or description of applicable areas. Stormwater runoff is a potential source to streams that flow through developed areas of permitted and non-permitted MS4s.
- Natural background: See TMDL report template.
- Naturalized *E. coli*: See TMDL report template.

C.2. Permitted MS4s: phosphorus load estimates

For phosphorus TMDLs (lake and stream), existing (or baseline) phosphorus loads from permitted MS4s should be quantified to the extent possible. These baseline phosphorus load estimates can be used in MS4 permit applications and annual reporting. Please explain the approach used to derive the load estimates, such as HSPF modeling, unit area loads, P8 modeling, etc.

C.3. Feedlots

a. Template language in source assessment

Please use the language in the source assessment section of the TMDL report template (Section 3.6) to discuss National Pollutant Discharge Elimination System/State Disposal (NPDES/SDS) permitted animal feeding operations. This language can be adapted for use in the watershed of interest.

- Section 3.6.1.1 Permitted sources→NPDES and SDS permitted animal feedlots
- Section 3.6.1.2. Non-permitted sources→Non-NPDES/SDS permitted animal feedlots and manure application

b. Tableau reports

Tableau reports contain information on feedlots that can be used in TMDL and WRAPS reports. The reports in the list below are contained in the Tableau workbook Watershed Report—Active Feedlots/Inspections[5].

- **Feedlot list**. The Active Feedlot sites (Reg Required) report selects active feedlots[6] by HUC8 watershed, HUC12 watershed, and/or county. Includes information on permit status, shoreland location, permit and/or registration number, number of animal units, and other information. (This report should be secondary to the feedlot information provided by the MPCA Data Desk; see "Permitted sources and feedlots" in Section A.5.)
  - Filter by NPDES/SDS/GAP = Y to list just the NPDES/SDS permitted feedlots and CAFOs.
- **Feedlot inspections**. Compliance Inspections at Funded Sites [7]. The summary table at the top of this Tableau report includes the information needed to complete the summary of feedlot inspections required in the reasonable assurances section of the TMDL report template (Section 6.2.2):

  > From [year] through [year—use the most recent 10 year period], there were xx feedlot facilities inspected in the [Name] Watershed, with xx of those inspections occurring at non-CAFO facilities and xx at CAFO facilities. There have been an additional xx facilities with manure application reviews within the watershed; xx of those inspections were conducted at CAFO facilities and xx at non-CAFO facilities.

  If you would like to explore the feedlot inspections data for a watershed, the following can be used as a guide to the "Compliance Type" field:
  - For inspections prior to 2018 ("FE" = feedlot evaluation).
    - FE Compliance Inspection.
      - Compliance status of feedlot: onsite facility inspection (e.g., open lots, process wastewater, barns, manure storage areas).
    - FE Land Application—Level I: basic manure application records review (i.e., did they keep records).
    - FE Land Application—Level II: detailed land application records review (amount of nitrogen and phosphorus applied).
    - FE Land Application—Level III: manure application inspection (how and where manure was applied, were setbacks followed; usually did not include N and P rate review).
  - For inspections in 2018 and later.

---

[5] This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.

[6] Active feedlots are feedlots that have 10+ animal units (AU) located in shoreland or 50+ AU located outside of shoreland that have current (Effective Start Date 1-1-14 or later) authorization (i.e., registration or permit).

[7] This report shows inspections since 2011, which is when the information entered into the state's database changed to what is described here, and state feedlot staff and county feedlot officers started inspecting and entering information as described. There may be some sites in the report for which the most recent compliance inspection was prior to 2011. In these cases, the inspection was performed by MPCA staff and only general comments and notes on the inspection were entered in the database. The general comments are not part of the Tableau report, but are available in Tempo if you would like to review the notes.

- Level I, II, and III inspections discontinued.
- FE Compliance Inspection.
  - Compliance status of feedlot: onsite facility inspection (e.g., open lots, process wastewater, barns, manure storage areas).
  - Manure application records: are they keeping the required records; if they do have records, determine if a compliant rate of nitrogen is being applied.
- Desktop N and P Inspection: is a compliant rate of nitrogen and phosphorus applied.
- In-field land application: in-field inspection to determine if manure application is compliant with setback requirements.

- "Overall Compliance Rating," for facilities that have been inspected since 2016

C.4. SSTS—Tableau reports

Tableau reports contain information on SSTS that can be used in TMDL and WRAPS reports[8].

- To approximate the noncompliant SSTS in a county that were replaced (can be used in TMDL reasonable assurance; see Section 6.2.1 of TMDL report template), use Total permits issued history by LGU:
  - Select "New Replacement Repair" = Replacement
  - Download the data as an Excel file, and plot the totals as a chart
- Use same report to show new systems, which are generally associated with new construction
  - Select "New Replacement Repair" = New
- Can show SSTS compliance by LGU
- Contact Katie.Dowlding@state.mn.us for more recent data (as of fall 2021, the Tableau reports provide information through 2016)

C.5. HSPF models and SAM

MPCA and their consultants develop HSPF models for watersheds throughout Minnesota. These models simulate flow and water quality, and they can support pollutant source assessment for many TMDL studies. Model results can be generated from either the HSPF model itself or through SAM, which is a tool that provides a more user-friendly approach to analyze HSPF results. Download SAM and watershed model files on the SAM File Sharing website. Please contact Chuck Regan (Chuck.Regan@state.mn.us) for questions about the SAM files.

The HSPF models are calibrated at established gaged sites, and this scale must be taken into account when interpreting model results. For most HUC8 watersheds, there is a gage at the outlet and two interior gages. However, some watersheds, particularly those in the northern part of the state, have fewer interior gages, and some watersheds, particularly those in the southern part of the state, have more. If using the results on a scale that is smaller than the scale of calibration, the results need to be evaluated to ensure that they are applicable to the smaller scale. Outputs that should be evaluated include pollutant runoff concentrations and unit area loads by land cover.

Reference model reports if models were used in the source assessment or TMDL development. The MPCA PM should consider posting the model reports on the project website to facilitate EPA review.

C.6. Dissolved vs. particulate phosphorus

Phosphorus TMDLs are typically written for total phosphorus (TP), which includes dissolved and particulate forms of phosphorus. However, dissolved phosphorus is more biologically available than particulate phosphorus and can therefore have a disproportionate impact on water quality. For phosphorus TMDLs, consider differentiating between dissolved and particulate phosphorus sources in both the source assessment and the implementation strategies sections of the TMDL report. Addressing dissolved phosphorus in the TMDL report

[8] *These Tableau reports can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

will increase the likelihood that dissolved phosphorus will be addressed in subsequent planning documents such as One Watershed, One Plans.

Please see the following information in the MN Stormwater Manual:

- Dissolved phosphorus in stormwater runoff—sources and management strategies
- Phosphorus in stormwater
- Ratios of particulate to dissolved phosphorus

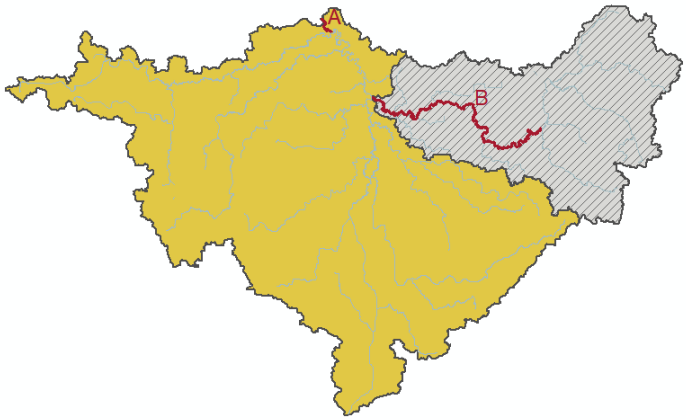
D. TMDL tables

D.1. Boundary conditions

Boundary conditions (BCs) are used to set aside load for a geographic area in a TMDL watershed without establishing load allocations (LAs) or WLAs for that area. Boundary conditions are assigned a load in the TMDL table and can be used in Minnesota under several circumstances:

- If a TMDL for a water body upstream of the water body in question has already been developed or is in progress, a BC can be established at the outlet of the upstream water body. The TMDL of the upstream water body must be for the same pollutant as the TMDL of the water body in question. Because allocations have already been established (or are in progress) for the upstream water body, they do not need to be defined again in additional TMDLs unless there is a need for further pollutant reductions. The BC can be calculated proportional to area or as flow multiplied by the water quality standard (WQS). See the Lake Pepin and Mississippi River Eutrophication TMDL Load Report (2021) for an example in an approved TMDL report (Section 5.6—St. Croix River Basin and Cannon River Watershed upstream of Lake Byllesby).
- If part of an impairment watershed is in another state, in Canada, or part of tribal land, a BC allocates a lump sum load to the area that does not fall under Minnesota's jurisdiction. Minnesota cannot establish allocations for other jurisdictions, and any reductions needed in the neighboring jurisdiction must be consistent with Minnesota's standards and not more stringent. This must be stated in the TMDL report. The BC is typically calculated proportional to area. See the Upper Iowa River and Mississippi River–Reno Watersheds TMDL (2020) for an example in an approved TMDL report (Section 4.4—Boundary conditions).
- A boundary condition can be used if a water body in the watershed of an impairment has been assessed as fully supporting for the TMDL pollutant and is not listed as impaired. Because the upstream water body meets the relevant WQS, MPCA assumes that the sources in the watershed of the unimpaired water body do not contribute to impairment of the downstream water body. The BC can be calculated proportional to watershed area or based on flow at the boundary condition multiplied by the WQS or by the existing pollutant concentration in the upstream water body. See the Lake Pepin and Mississippi River Eutrophication TMDL Load Report (2021) for an example in an approved TMDL report (Section 5.6—Upper Mississippi River Basin upstream of Aitkin and Minnesota River Basin upstream of the Lac qui Parle Dam).

  Consider the hypothetical example below. An *E. coli* TMDL is being developed for Reach A, and Reach B has been assessed as meeting *E. coli* water quality standards. Reach B is upstream of Reach A. A BC is established at the outlet of Reach B, and we assume that *E. coli* sources in the Reach B watershed do not contribute to the Reach A impairment. The TMDL table includes an allocation for the Reach B watershed that collectively covers all sources; WLAs or LAs are not required for individual sources in the Reach B watershed.



To determine if a water body has been assessed as fully supporting for the TMDL pollutant, use the parameter judgments table or map in the Water Quality Assessment Results Data Viewer (publicly available) and/or CARL (available internally at the MPCA) in consultation with MPCA assessment staff where needed.

- A boundary condition can be used if an upstream water body functionally separates the watershed of an impairment. For example, the Lac qui Parle Dam drains a large reservoir system, dampening the downstream delivery of pollutants. The Lac qui Parle Dam was used as a boundary condition in the 2004 Lower Minnesota River Dissolved Oxygen TMDL (Section 5.1), the 2020 Minnesota River and Greater Blue Earth River Basin Total Suspended Solids TMDL Study (Section 5.3), and the 2021 Lake Pepin and Mississippi River Eutrophication TMDL Report (Section 5.6).

D.2. TMDL applicability period

The months that the TMDL and allocations apply should be stated in the TMDL report for each TMDL table. The TMDL applicability period is related to the months that the WQS apply, but is not necessarily the same. Below are some examples:

- *E. coli*: For class 2 water bodies, the WQS apply April–October and the TMDL and allocations will typically apply during those months. For class 7 water bodies, the WQS apply May–October and the TMDL and allocations will typically apply during those months.
- TSS: April–September (the months that the TSS standard applies).
- Phosphorus
  - Lakes: Whereas lake eutrophication WQS apply June–September, TMDL analysis is typically done on an annual basis. Annual P loads to a lake are estimated, and the TMDL is calculated as the annual P load to the lake that will allow the lake to meet WQS during June–September. If the loading analysis is annual, then the TMDL applicability period should be January–December. For some lakes (e.g., those with a short residence time), the TMDL analysis will be a shorter time frame; in this case the TMDL applicability period will be the same time frame as the TMDL analysis, typically June–September.
  - Streams: The river eutrophication standards apply June–September. Because the TMDL analysis is done on a seasonal basis, the TMDL applicability period is June–September.
- Chloride, nitrate, temperature: January–December (WQS apply year-round, and the analysis typically applies year-round.)
- Oxygen demand (e.g., sediment oxygen demand [SOD], carbonaceous biochemical oxygen demand [CBOD], nitrogenous biochemical oxygen demand [NBOD]): DO impairments are often addressed with SOD, CBOD, and/or NBOD TMDLs. The DO WQS apply year-round, and therefore the TMDL applicability period will typically be year-round.

A TMDL report may explicitly state variations on a TMDL applicability period. For example, the Chippewa River Un-ionized Ammonia TMDL (2004) assigns different sets of TMDL allocations to different seasons and flow conditions; therefore this TMDL has multiple sets of TMDL allocations with differing TMDL applicability periods.

To ensure that the TMDL applicability period is clearly stated, the information should be included along with every TMDL table in a TMDL report. The TMDL report template includes the following as a part of TMDL tables*: TMDL and allocations apply XXX–XXX [list months]*.

The TMDL applicability period should not be confused with the critical conditions analysis, which takes into account critical conditions for stream flow, loading, and water quality parameters in developing the TMDL and allocations. For certain types of impairments such as DO and temperature, critical conditions are low flow, warm conditions which typically occur in July and August. In this case, the TMDL is developed to be protective of the water body during all conditions, including the critical conditions. Unless explicitly stated that the TMDL applies only during the critical conditions, it is assumed that the TMDL applies year-round.

D.3. Wastewater WLAs

During TMDL development, the MPCA project manager should contact all permittees that are assigned WLAs to inform the permittees of the TMDL project and of their upcoming WLA and to solicit input that might help in the calculation of the WLA. One exception would be if an *E. coli* or TSS WLA for a wastewater permittee is consistent with current permit limits, the permittee does not need to be contacted.

a. WLAs and permit limits

Section 4.1.3.1 of the TMDL report template summarizes the approach to calculating municipal and industrial wastewater WLAs. A summary table presents the wastewater WLAs, along with associated information such as permit name and number, surface discharge station, design flow, and permit limit. The table also states whether each existing permit is consistent with the WLA assumptions (Y/N option):

- "Yes" can indicate:
  - The existing permit limit is consistent with the TMDL WLA. The permit limit does not need to *equal* the WLA in order to be *consistent with* the WLA (e.g., phosphorus water quality based effluent limits [WQBELs] are calculated as the product of the WLA and a multiplier).
  - The wastewater discharge does not require a limit for the pollutant because it does not have a reasonable potential to cause or contribute to impairment.
- "No" indicates that, at permit reissuance, WQBELs and/or additional monitoring requirements will need to be considered by permitting staff.

b. When wastewater WLAs exceed the loading capacity

Please confirm all wastewater WLAs with the MPCA Wastewater–TMDL Liaison (Marco Graziani). This guidance addresses a unique situation that occurs with some wastewater WLAs in stream TMDLs. For additional information on calculating wastewater WLAs, please see River Eutrophication Standards Total Maximum Daily Loads Wasteload Allocation Guidance and Total maximum daily load guidance: Interpreting wasteload allocations for the development of water quality based effluent limits.

In some stream TMDLs, the total daily loading capacity in certain flow zones is less than the wastewater WLAs calculated from treatment facility design flows and effluent concentration assumptions. This is an artifact of using design flows for allocation setting and results in these point sources appearing to use all (or more than) the available loading capacity. In reality, actual treatment facility flow can never exceed stream flow, as it is a component of stream flow. To account for these unique situations, where needed, the WLAs in these flow zones should be expressed as an equation rather than an absolute number:

Allocation = flow contribution from a given source x concentration

(water quality standard or NPDES permit concentration)

This amounts to assigning concentration-based allocations for the lower flow zones. Because the calculations of other allocated loads, including the LA, are often based on first subtracting the wastewater WLAs from the loading capacity, other approaches may be needed to define other allocations. The following are two options:

1. Express other allocations as the above equation. If there are allocations that are estimated independently (e.g., a boundary condition or natural background), these allocations should be presented as loads in the table. Additionally, because the margin of safety (MOS) is typically calculated as a percent of the loading capacity, the MOS should also be presented as a load in the table.

   The following is an example TMDL table:

TMDL Parameter	Flow Zone				
	Very High	High	Mid	Low	Very Low
	TSS Load (lb/d)				
WLA: Construction and Industrial Stormwater	61	18	6.2	1.9	– [a]
WLA: OMG Midwest Inc/Southern MN Construction Co Inc (MNG490131)	905	905	905	905	– [a]
WLA: Jeffers WWTP (MNG580111)	128	128	128	128	– [a]
WLA: Comfrey WWTP (MN0021687)	19	19	19	19	– [a]
Load Allocation	78,726	22,699	7,288	1,534	– [a]
Margin of Safety	8,871	2,641	927	288	40
Loading Capacity	88,710	26,410	9,273	2,876	395
90th Percentile Existing Concentration (mg/L)	154				
Estimated Percent Reduction	58%				

   a. The permitted wastewater design flows exceed the stream flow in the indicated flow zone(s). The allocations are expressed as an equation rather than an absolute number: allocation = (flow contribution from a given source) x 65 mg/L (or NPDES permit concentration) x conversion factors.

2. Calculate other allocations (e.g., LA and stormwater WLAs) based on the proportion of the allocation to the loading capacity (or loading capacity minus MOS) in the low flow zone, or other similar equation. For example, in the table above, the WLA for construction and industrial stormwater in the very low flow zone could be expressed as 1.9/(2,876–288) x (395–40).

c. New or expanded wastewater discharges

After an approved TMDL study establishes WLAs for point source dischargers, WLAs that are found to be incorrectly calculated can be corrected, and under certain circumstances existing discharges can be expanded and new discharges can be added through the MPCA's Expanded WLA Justification Process for New or Expanding WWTP Discharges (link available internally at MPCA). Through the process it must be determined that the expanded WLA will not cause or contribute to impairment and that the permit's effluent concentration limit will remain at or below the in-stream target for the applicable TMDL. This **process is only intended for the modification of *E. coli* and TSS wastewater WLAs** and is not intended to be applied to stormwater or feedlot WLAs. EPA agrees that these WLA adjustments are not TMDL modifications, which would require a new public notice of the entire TMDL. However, the change in WLA will be public noticed with the draft NPDES/SDS permit.

New and expanded NPDES wastewater discharges can be added as *E. coli* and TSS WLAs to a TMDL while maintaining water quality standards, provided the effluent limit (as a concentration) remains at or below the in-stream target. When the effluent limit is equal to or less than the TMDL target (which is typically the water quality standard), discharge from the facility provides the assimilative capacity that is required to offset the increased pollutant load. Because a new or expanding facility increases both load and flow, the increased load will not cause an increase in the *E. coli* or TSS concentration in the stream.

The MPCA's Watershed PM supports the process outlined in Expanded WLA Justification Process for New or Expanding WWTP Discharges (link available internally at MPCA) by providing the following information to the MPCA permit writer related to the wastewater discharger and relevant approved and draft TMDLs:

- After the permit writer notifies the PM of permit issuance/reissuance, the PM will inform the permit writer if there are approved TMDLs or TMDLs in progress that may affect the WWTP's permit limits, or if there are concerns or issues (on behalf of an LGU or identified in a TMDL or WRAPS report) with the WWTP and/or its discharge that could be addressed or corrected during the permit reissuance. The PM can find approved TMDL WLAs that are assigned to the permittee in the MPCA's Tableau report TMDL WLAs (link available internally; note the filter for "Approved TMDL" and "Effective WW permit").
- When a PM is notified that an expanded WLA was requested, the PM will review the justification and consider the questions in the list below. The PM will discuss the analysis with the permit writer and/or the Wastewater–TMDL Liaison (Marco Graziani or Holly Mikkelson).
  - Is the expanded WLA for TSS, *E. coli*, or fecal coliform? The WLA expansion process applies only to these parameters.
  - Is an expanded WLA consistent with the approved TMDL? Does the permit's effluent limit exceed the water quality standard? For example, a stream with a 10 mg/L TSS water quality standard and a permit with a TSS concentration limit that is greater than 10 mg/L, expansion of the WLA would not be appropriate.
  - For expanded TSS WLAs: If the TSS TMDL was developed for a turbidity impairment, what is the TSS target in the TMDL and what is the current TSS standard in the impaired water body? Is the impaired reach meeting the TSS standard or is it still impaired? Is a new TMDL going to be written? Is there a new TMDL in draft form? How does that affect the request for an expanded WLA?
  - What is the projected increase in flow? Is it from a mechanical facility (continuous discharge) or a stabilization pond facility (seasonal discharge)? How large (e.g., flow, channel dimensions) is the receiving water body (stream/ditch)? Will the increased flow cause stream bank or stream bed erosion and scouring issues that could lead to potential TSS issues downstream? Can those potential TSS issues be alleviated with erosion protection (e.g., rip rap) at the discharge point or a daily limit on the flow for stabilization pond facilities? This evaluation is completed by MPCA wastewater review engineers as part of review of the plans and specifications for construction of a WWTF. If the PM has concerns about erosion, please contact the review engineer.

The MPCA needs to be protective of water quality and ensure that TMDL requirements are met; however, the above considerations should be balanced with the timelines of the permitting process. Permit issuance/reissuance should be delayed only when there is conflict between the TMDL and permit limits or requirements that, when resolved, will lead to improved water quality and reasonable permit limits and requirements.

There should be open communication between the PM, permit writer, and the Wastewater–TMDL Liaison (and potentially effluent limits staff) during this process. Please contact Marco.Graziani@state.mn.us, Holly.Mikkelson@state.mn.us, or Denise.Oakes@state.mn.us if you have questions about the process.

D.4. MS4 WLAs

During TMDL development, the MPCA project manager should contact all permittees that are assigned WLAs to inform the permittees of the TMDL project and of their upcoming WLA and to solicit input that might help in the calculation of the WLA (e.g., defining the permitted area of MS4s).

Two primary steps are used to develop WLAs for permitted MS4s: first approximate the permitted area and then develop the WLA for the permitted area. These two steps are distinct but related because the MS4 WLA is dependent on how the MS4 area is approximated.

a. Approximating permitted MS4 area

Delineation of MS4 areas is needed in order to clarify which areas within the jurisdictional or property boundaries of the MS4s generate or convey permitted stormwater. The approach used to define the MS4 area can affect the magnitude of the MS4 WLA (e.g., a larger MS4 area may lead to a larger WLA). The Minnesota Stormwater Manual provides guidance on what discharges should be included in the TMDL wasteload allocation for MS4 stormwater. This guidance addresses how to determine if an area within the *jurisdictional* boundary of an MS4 is considered to be within the *permitted* MS4 area.

Delineations of the actual permitted area of an MS4 typically are not available for TMDL studies; therefore, the permitted MS4 area often is approximated. The following are examples of approaches that can be used to approximate the permitted MS4 area:

- Entire jurisdictional area: Using the full jurisdictional area of a city or other type of MS4 will result in the largest permitted MS4 area and requires the lowest level of effort to define the permitted area. Keep in mind, however, that some cities and township MS4s are only permitted within the urbanized area and other platted areas within the jurisdiction. (See Section A.6: Permitted municipal separate storm sewer systems.)
- Land use or land cover: Based on data such as the National Land Cover Database (NLCD), use the area within the jurisdictional or property boundary identified as impervious or developed to approximate the permitted area. Land use or planned land use data such as the Metropolitan Council's Regional Planned Land Use data for the Twin Cities metropolitan area can also be used to approximate the permitted areas, following the guidance on what discharges should be included in the TMDL wasteload allocation for MS4 stormwater in the Stormwater Manual.
- Delineate: Include the area that is in the jurisdictional or property boundary and that drains to an MS4's stormwater conveyance (e.g., stormsewers, roadside ditches). This entails delineating the drainage areas to stormwater conveyance in cities, townships, and universities/colleges. The direct drainage areas to public waters would be excluded from the permitted area. Whereas this approach is the most accurate estimate of the permitted area, delineation requires the highest level of effort and will typically not be feasible for a TMDL project if the information is not already available. The approach may be feasible if the MS4 area that drains to an impaired water body is relatively small.
- Average right-of-way width for transportation corridors: For road authorities that are MS4s (i.e., MnDOT and certain counties), only the road surface, county or state-owned property surface, and associated conveyance (e.g., roadside ditches, stormsewer) are considered permitted area. MnDOT often delineates the permitted area for TMDL projects. A county's permitted MS4 area can be approximated by the average right-of-way width along county roads that are in the census-defined urbanized area multiplied by the county road lengths. (See Section A.6: Permitted municipal separate storm sewer systems.)

In the report, describe how the permitted area was approximated. Even if the entire jurisdictional area was used, this must be explicitly stated. If an MS4's approximated permitted area is very small, please investigate further to determine if the area actually does drain to permitted stormwater conveyance (e.g., examine aerial imagery and elevation data and/or contact the MS4).

b. Developing MS4 WLAs

WLAs for MS4s can be individual (i.e., one for each MS4) or categorical (i.e., a lump WLA for all or a subset of MS4s). MS4 permittees are required to report annually on their pollutant reductions for each WLA that requires a reduction. The reporting includes a list of all implemented BMPs that reduce pollutant loads applicable to WLAs for oxygen demand, nitrate, TSS, and total phosphorus; the implementation status of BMPs included in the compliance schedule at the time of final application submittal; and an updated estimate of cumulative TSS and total phosphorus load reductions. *E. coli* or fecal coliform WLAs require mapping and source reduction prioritization plans, while chloride WLAs carry tracking and education requirements.

MPCA Stormwater prefers individual WLAs for MS4s over categorical because categorical WLAs are more difficult for a permittee to determine how much of the WLA is their responsibility and what their individual reduction should be.

There are different ways of dividing the load among the various allocations. The Stormwater Manual provides options in the guidance for categorical TMDLs. Although this part of the manual describes approaches for MS4s to interpret a categorical stormwater WLA, the concepts can be used to explore approaches to calculating individual MS4 WLAs. If the area approach is used, the MOS and other non-watershed allocations (e.g., boundary condition, wastewater WLAs, and internal loading) are typically subtracted from the loading capacity before the remaining load is divided up by watershed area.

In the TMDL report, describe how the WLA was determined.

c. Percent reductions and existing loads in MS4 WLAs

Because most MS4s do not have the ability to calculate their pollutant loads without extensive modeling, MS4s may depend on percent reductions to demonstrate compliance with permit requirements. Please include a percent reduction when possible. Zero percent reductions for MS4 WLAs should only be used when justified. (Including zero percent reductions for MS4 WLAs results in no MS4 permit requirements for that impairment).

For phosphorus TMDLs, please also include the existing phosphorus load from MS4s. This information will allow the MPCA to track phosphorus load reductions and achievement towards meeting WLAs in TMDLs.

d. MS4 maps

Determining MS4 WLAs is heavily dependent on spatial data, and boundaries of municipalities and urban areas change over time. Therefore, it is essential to have a map showing the boundaries used to determine the WLA at the time of TMDL development. Please use multiple maps as needed to ensure that the approximated permitted MS4 areas are clear.

e. Documentation of approach and GIS data

In addition to the required report maps described above, MS4s will need the modeling assumptions and GIS data that were used in WLA development to complete their reporting requirements for the state. The following modeling assumptions should be described in the TMDL report (or appendix):

- Approach and modeling assumptions used to estimate the permitted MS4 area
- Approach used to calculate the WLA for the estimated permitted area
- Assumptions used to estimate existing MS4 loads and/or MS4 percent reductions to meet WLAs (if this information is provided in the TMDL report)

At the conclusion of a TMDL project, the MPCA project manager needs to ensure that the consultant or other TMDL writer (including MPCA staff) provides the GIS data. The data should be stored in the appropriate location so that Agency staff can access them and provide them to MS4 permittees upon request. (See Section E.3: Watershed *project* deliverables guidance.)

- Subwatershed boundaries for each individual impaired water body
- Approximated MS4 area used in WLA calculations (if developed for the project)

D.5. Construction stormwater WLA

For TMDLs where the pollutant is TSS, phosphorus, or oxygen demand, NPDES-permitted construction stormwater must be given a WLA. Construction stormwater WLAs typically assign loads to construction stormwater that is permitted through the General Stormwater Permit for Construction Activity (MNR100001). MPCA assumes that permittees in compliance with the requirements of a Construction Stormwater (CSW) permit are achieving their WLA. See Technical guidance used by MPCA to develop guidelines for setting TMDL WLAs for regulated stormwater in the Minnesota Stormwater Manual for information about stormwater and TMDLs. (Note, however, that some elements are outdated.) The TMDL report template includes CSW language that should be used in TMDL reports (Section 6.1.2 in Reasonable Assurance and Section 8.1.1 in Implementation Strategy Summary).

In certain rare cases, the BMPs described in Section 23 of the Construction Stormwater General Permit may not be considered adequate to meet the water quality goals. A TMDL may prescribe specific BMPs that will allow permittees to come into compliance with water quality goals. The additional BMPs should be listed in the implementation strategies section of the TMDL report, and the TMDL table should include a footnote that references the additional BMPs.

This guidance describes how to calculate a CSW WLA. The most common approach to developing CSW WLAs in Minnesota is to set a categorical WLA that lumps all CSW into one CSW WLA. The recommended approach is to estimate the five-year average percent of the watershed area that is under permitted construction activity. The percent area is then applied to the total load allocated to the watershed (often calculated as TMDL – MOS – RC [reserve capacity] – WWTP WLA) to represent the CSW WLA.

The following are two methods that can be used to estimate the percent of the watershed area that is under permitted construction activity:

1. Use a HUC8 watershed average, presented in the Tableau report All watersheds, from the Tableau workbook CSW permit coverage by county and watershed[9]. The percentages reported in the table represent the median percent of the watershed that is under permit coverage during the selected time period. The default time period in the report is the previous five years; this time period can be changed in the "Year" selection to the right of the table.
2. Use site-specific data from the Tableau report CSW Sites[9]. After making the following recommended selections, the sites can be downloaded and plotted using GIS to evaluate the permitted sites in the area of interest:
    a. Show me = Sites with coverage DURING the timeframe below
    b. Watershed name = [select the HUC8 watershed of interest]
    c. Start and end dates: [select the most recent 5-year period]
    d. Type = Coverage (uncheck the Transfer Modification selection)

D.6. Industrial stormwater WLA

For TMDLs where the pollutant is TSS or phosphorus, NPDES-permitted industrial stormwater must be given a WLA. TMDLs for oxygen demand or pH may require an industrial stormwater WLA; please contact the Stormwater–TMDL Liaison (Anna.Bosch@state.mn.us) if you are developing a TMDL for oxygen demand or pH.

Industrial stormwater (ISW) WLAs assign loads to industrial stormwater that is permitted through the following NPDES/SDS permits:

- Industrial Stormwater Multi-Sector General Permit (MNR050000).
    - Permits numbers that begin with "MNRNE" are "no exposure" permits and do not need to be accounted for in a TMDL.
- Nonmetallic Mining/Associated Activities General Permit (MNG490000).
    - In the "SI_final_list" from the DataDesk (see Section A.5), these permits are categorized as "Wastewater" under the "Program" field, because the permit covers dewatering discharge.
    - To find the permits with stormwater components, select the MNG49 permits that are categorized as anything stormwater-related under the "StnSubtype" field (e.g., Stormwater, Non-specific Runoff; MNG49 Stormwater, Non-specific).
- Individual permits that have industrial stormwater runoff components.
    - In the "SI_final_list" from the DataDesk (see Section A.5), these permits are categorized as "Wastewater" under the "Program" field, and the "StnSubtype" will indicate stormwater.

[9] *This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

- Filter out all of the MNG49 surface discharge stations. Evaluate the remaining surface discharge stations to determine if they represent industrial stormwater that is regulated through an individual permit. There are typically only a handful of them in a watershed, if any.

The "industrial disturbed areas" are provided in the "ISW_acres" field in the SI_final_list from the Data Desk, associated with the "Facilities" records (under the "Group" field). Areas are available for the general permits, but not for the nonmetallic mining permits or individual permits. If there is regulated stormwater associated with nonmetallic mining or individual permits in the watershed, please evaluate these sites to determine if they represent a substantial area and/or pollutant load.

Using the area information, calculate the percent area of the watershed that is covered by permitted industrial stormwater. The percent area is then applied to the total load allocated to the watershed (often calculated as TMDL – MOS – RC – WWTP WLA) to represent the ISW WLA. The WLA is typically a small percent of the loading capacity.

D.7. Margin of safety

Please see the MPCA's guidance on TMDL margin of safety.

D.8. Percent reductions in TMDL tables

Percent reductions in TMDL reports are not required by EPA, but they are useful for interpreting TMDLs, and the MPCA generally encourages the use of percent reductions. Because there are many unknowns and a lot of variability in data sets, it is important to acknowledge in the report that the percent reduction is a rough estimate and is meant to describe the general level of effort needed to reduce pollutant loads or concentrations.

There are different methods to estimate percent reductions needed to meet TMDLs:

- Load-based: Comparison of the estimated existing load compared to the loading capacity. This can be calculated overall for the water body, or can be calculated by flow zone if using load duration curves. The estimated existing load is typically based on monitoring data, but modeled load could also be used. The smaller the sample size, the more uncertainty there is in the estimate.
- Concentration-based: Comparison of the estimated existing concentration of the pollutant compared to the water quality standard. Similar to the load-based calculations, the existing concentration is based on monitoring data, and smaller sample sizes lead to greater uncertainty. Concentration-based percent reductions are often used when there is a lower level of confidence in the load estimates. Concentration-based reductions can also be calculated by flow zone or overall for the impairment.

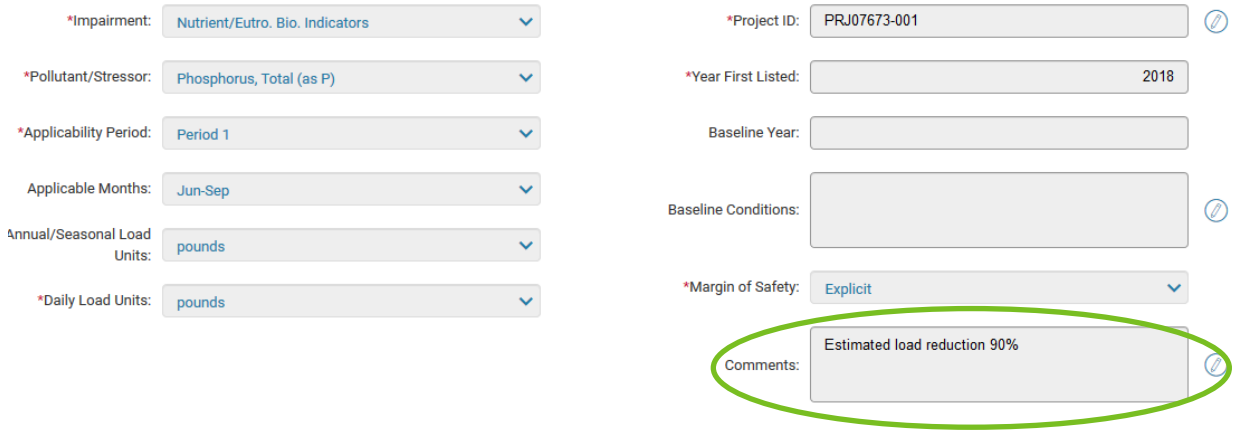
In general, percent reductions should not be calculated when limited data are available.

Often the percent reduction is calculated to align with the way that water bodies are assessed for that parameter:

- TSS: A stream exceeds the TSS standard if the standard is exceeded more than 10% of the days of the assessment season (April – September). The percent reduction is often calculated as the difference between the 90th percentile load or concentration and the loading capacity or water quality standard, respectively.
- *E. coli*: A stream exceeds the *E. coli* standard if any monthly geometric mean (by individual month or all months aggregated across multiple years) exceeds the monthly geometric mean standard, or if more than 10% of individual values exceed 1,260 organisms per 100 mL. *E. coli* TMDLs in Minnesota are typically calculated using the monthly geometric mean standard. A common percent reduction calculation is based on the maximum observed monthly geometric mean concentration compared to the monthly geometric mean standard. Another approach has been to estimate existing load for each flow zone based on monitoring data, and compare that to the loading capacity of the respective flow zone.
- Phosphorus: A stream or lake exceeds the phosphorus component of the eutrophication standards if the seasonal average exceeds the standard. Percent reductions for lakes are often based on estimated existing seasonal/annual load to the lake compared to the seasonal/annual loading capacity. Percent reductions for streams are based on seasonal averages and can be load or concentration-based.

If percent reductions are included in a TMDL report, please describe how it was calculated.

Entering into Tempo: For an individual WLA or LA, if you enter baseline and allowable load, Tempo will calculate reduction and percent reduction. If you calculate one overall percent reduction for an impairment, there is currently no specific place to enter it in Tempo. Some project managers have entered it as text in the "Comments" field at the top of the page, for example:



If you do present one overall percent reduction for the impairment, please enter it here to document it and to facilitate transferring the value to a new Tempo field that might be created in the future.

See also Percent reductions in TMDLs from the Watershed Division monthly staff meeting (4/15/2020; link available internally to MPCA staff).

D.9. High percent reductions for internal loading in TMDL tables

TMDL tables for lake phosphorus impairments often include internal loading as a phosphorus source and assign an LA and percent reduction specifically for internal loading. In many cases, the percent reduction is quite high, often reaching 100%. The following is sample text that can be used in a TMDL report to explain the 100% reduction in internal loading; please review it first to make sure that it applies to the lake and model in question.

> The Bathtub model implicitly assumes an average rate of internal loading. In some cases, additional internal load was added to the model during calibration; this internal load represents loading that is in addition to the average rate assumed in the model. The percent reduction for internal loading in the TMDL tables refers to the additional internal load. That is, a 100% reduction in internal load indicates that the additional internal load needs to be reduced until the total internal load equals the average rate of internal loading that is implicit in Bathtub.

The following could be used as a footnote to a TMDL table:

> 100% reduction in internal load assumes that the additional internal load is removed, and the remaining internal load to the lake equals the average rate of internal loading that is implicit in Bathtub.

D.10. Unallocated load

The concept of "unallocated load" has been used in some TMDLs, and discussions (in 2019) led to the recommendation to preferably not use it in TMDLs. Unallocated loads were used in stream TMDLs where the estimated existing loading was less than the loading capacity in some flow zones but not others. We do not want to allow pollution to increase up to the WQS, and the concept of unallocated load was to align TMDLs with the protection part of the Watershed Approach. Although the concept is a good one, and protection can be included in the text of the TMDL report, **it is better *not* to define explicit allocations for unallocated load.** Please see TMDL development: "unallocated load" in Reviewing total maximum daily load reports for more information.

D.11. Reserve capacity

Reserve capacity in a TMDL is load that is set aside for future new or expanded discharges. Including reserve capacity in TMDLs is optional. The decision of whether to set aside load as reserve capacity has implications for the other allocations (LA and WLA) in the TMDL—the more load that is set aside for future sources, the less load is available to be allocated to existing sources. We cannot know what all of the future sources are, and when we include an RC we have to decide which of the potential future sources merit an allocation as reserve capacity.

To date, reserve capacity in Minnesota has been used only in phosphorus TMDLs for *existing, unsewered populations*, but may be applicable to other circumstances in the future. In Minnesota, reserve capacity has not been used to provide WLAs for new and/or expanding industrial or municipal discharges.

Future increases in regulated stormwater are not addressed with reserve capacity in Minnesota. The TMDL report template (Section 5.1) contains language that provides a mechanism to transfer load to an MS4 WLA under various circumstances, without the use of reserve capacity.

Include reserve capacity in a TMDL report if necessary for future wastewater discharges. If a reserve capacity is not assigned in a TMDL, it does not need to be discussed in the TMDL report.

After a TMDL report is approved, if a new or increased regulated pollutant source comes to a watershed and there are no available allocations, an offset would be required to obtain a permit. Check the MPCA's Water quality trading webpage for more information.

The following is an approach that can be used to calculate reserve capacity for existing, unsewered populations; other options may be considered:

1. Determine the watershed's unsewered population by subtracting the population connected to permitted WWTPs from the watershed population. The population connected to the WWTP is typically estimated based on census tracts within municipal boundaries. This may not be the best methodology in watersheds that include sanitary districts or other area-wide wastewater utilities. In smaller watersheds it may be possible to obtain user data directly form the wastewater utilities.
2. Estimate that 10% of the existing unsewered population may eventually be connected to an NPDES permitted WWTP. This could be a new facility or connection to an existing facility in the watershed.
3. MPCA has estimated the total phosphorus in human waste as 0.88 kg/capita/year[10].
4. An 80% reduction through treatment is assumed.
5. Reserve capacity = (watershed population – municipal population) x 0.88 kg/capita-year x 20%

D.12. Rounding in TMDL tables

In a TMDL table, it is preferable to round the numbers consistently throughout the table. There are two basic ways of rounding numbers consistently. You can round to a specific number of *decimal places*, or you can round to a specific number of *significant digits*. Many people use the *decimal place* approach because it is the most simple. The example on the left below is rounded to two decimal places. However, what if the allocations had values with a much wider range, like the example on the right?

1.65	12.6537
0.33	0.0033
+ 66.98	+ 1,866.9839
68.96	1,879.6409

Because of the one really small value (0.0033), you would have to extend all of the other allocations out to four decimal places in order to be consistent. However, with the other values, using that many decimal places makes

[10] *Barr Engineering. 2004. Appendix H in Detailed Assessment of Phosphorus Sources to Minnesota Watersheds. Prepared for Minnesota Pollution Control Agency, Saint Paul, MN.*

it look like we can be really precise with our estimate, that we know that the value is exactly 1,879.6409. To avoid this, you can instead round to a consistent number of significant digits instead of a consistent number of decimal places.

At its most simple, a significant digit is a non-zero number. In the examples below, the values are rounded to two significant digits. This approach provides the greater level of precision needed with the smaller value, yet the precision is not over-stated with the larger numbers. The same goes with the second example on the right, where each of these numbers has two significant digits.

$$\begin{array}{r} 1.7 \\ 0.33 \\ +\ 67 \\ \hline 69 \end{array} \qquad \begin{array}{r} 13 \\ 0.0033 \\ +\ 1{,}900 \\ \hline 1{,}900 \end{array}$$

Here are the basic rules of significant digits:

- A significant digit is:
  - Any non-zero digit (1, 2, 3, 4, 5, 6, 7, 8, 9)
  - Any zero that falls in between two non-zero digits (6<u>0</u>4, 0.6<u>0</u>4)
  - Any zero that is to the right of the decimal point and to the right of a non-zero digit (63.<u>0</u>, 0.063<u>0</u>)
- These zeros are not significant:
  - All leading zeros (013, 0.013)

Here are some examples of how many significant digits are shown in each number. Test yourself!

Number	# of Significant Digits
552	3
552.0	4
552.06	5
552.060	6
5052.6	5
0.0505	3
0.5520	4

Selecting a consistent number of significant digits often helps a TMDL table so that the values add up correctly. For example, in the following TMDL table, the sum of the individual WLAs is 0.158, which is 0.16 when rounded. The sum of the individual LAs is 58. The sum of all of the individual allocations and the MOS is 61.258, which rounds to 61. The sum of the WLA sum, the LA sum, and the MOS also rounds to 61.

TMDL Component		P (lb/yr)
WLA	Total WLA	0.16
	Construction stormwater	0.079
	Industrial stormwater	0.079
LA	Total LA	58
	Watershed	20
	SSTS	1.0
	Atmospheric deposition	24
	Internal load	13
MOS		3.1
Loading capacity		61

For MPCA project managers: When entering allocations into Tempo, pay attention to rounding. In the above example, Tempo will sum up the individual WLAs and show the total WLA as 0.158 (0.079 + 0.079). This is fine, because 0.158 rounded is 0.16, which is what is in the TMDL table. If, when you round the value in Tempo, it does *not* match with the value in the table that suggests that an edit needs to be made somewhere.

See also pages 44–46 in Reviewing total maximum daily load reports.

E. Miscellaneous

E.1. TMDL report peer review team

This information pertains to TMDL report review prior to review by the supervisor and manager.

The following MPCA staff should review all draft TMDL reports, regardless of whether there are regulated stormwater and/or wastewater sources:

- TMDL writer (Andrea Plevan, Jeff Strom, or Kaity Taylor)—please contact Andrea Plevan if a TMDL writer is not yet assigned to your project
- Anna Bosch, Stormwater–TMDL Liaison
- Marco Graziani, Wastewater–TMDL Liaison
- Feedlot staff (specify which report sections to review)

This should be at least the second time that you have contacted the Stormwater and Wastewater–TMDL Liaisons. The same staff should be contacted at the beginning of the project to confirm existing and potential future permitted stormwater and wastewater sources.

Besides the above staff, there is no defined report review team for TMDL reports. Consider consulting other staff, as needed, for specific portions of the report:

- Subject matter expert(s), as applicable.
- Other project managers in region, as available.
- Local partners and core team.

Consider asking your supervisor and manager to review the TMDL report as *part of* the peer review team instead of *after* peer review. This may be especially helpful if you or your supervisor are new or if the TMDL report involves a new or unique approach.

E.2. Naming of TMDL reports

To differentiate watershed TMDL reports from TMDL reports completed in prior watershed approach cycles, the titles of watershed TMDL reports should include the year when the report was finished (i.e., last edits made). For example, if a draft report was completed in November 2020 but approved in 2021, the title would include 2020. However, if edits are made to the draft report in 2021 and the TMDL is approved in 2021, the title would include 2021. The web team lists the EPA approval date in parentheses adjacent to the document title. An example PDF title and website entry would be: Chippewa River Watershed TMDL, 2021 (wq-iw8-xxx) (EPA approval xx/xx/xxxx).

E.3. Watershed project deliverables

The Watershed Project Deliverables page in the Lorax (available internally to MPCA staff) provides instructions regarding where to save files for completed Watershed projects such as TMDLs and WRAPS reports:

- Modeling files (non-HSPF): Modeling files (e.g., Bathtub models, spreadsheet models) are to be stored in the Watershed Project Models folder on the X drive (available to MPCA staff).
- GIS files: Contact Watershed GIS staff for a location to save the project GIS files.

E.4. Use of links in TMDL reports

When inserting URLs in a TMDL report, please insert only the most important links and select links that should have the most longevity. Instead of inserting URLs in the body of the report, consider referencing documents in the TMDL report and adding links to the references in the "Literature cited" section.

For example:

Report text: "Other components of the larger effort include the Vermilion River Watershed Monitoring and Assessment Report (MPCA 2018), the Vermilion Stressor Identification Report (MPCA 2019), …"

In "Literature cited":

MPCA (Minnesota Pollution Control Agency). 2018. *Vermilion River Watershed Monitoring and Assessment Report*. Document #wq-ws3-09030002b. July 2018. https://www.pca.state.mn.us/sites/default/files/wq-ws3-09030002b.pdf

MPCA (Minnesota Pollution Control Agency). 2019. *Vermilion Stressor Identification Report*. Developed by Kevin Stroom. Document #wq-ws5-09030002a. April 2019. https://www.pca.state.mn.us/sites/default/files/wq-ws5-09030002a.pdf

E.5. Lake depth terminology

Minnesota water quality standards acknowledge that shallow lakes often differ from other lakes in many characteristics, and these differences lead to different expectations of water quality in shallow lakes vs. non-shallow lakes. Many of the differences stem from the lake's vertical mixing status, or how frequently the water mixes from top to bottom. A shallow lake typically mixes many times over the growing season; this is referred to as "polymictic." Deeper lakes typically remain stratified for longer periods of time and mix twice annually—once in the spring and once in the fall; this is referred to as "dimictic." A lake's mixing status influences its biology and water quality.

A "shallow lake" is defined in Minn. R. 7050.0150, subp. 4 as "an enclosed basin filled or partially filled with standing fresh water with a maximum depth of 15 feet or less or with 80 percent or more of the lake area shallow enough to support emergent and submerged rooted aquatic plants (the littoral zone)." In three of Minnesota's ecoregions (North Central Hardwood Forests, Western Corn Belt Plains, and Northern Glaciated Plains), numeric criteria for shallow lakes differ from numeric criteria for other lakes and reservoirs (Minn. R. 7050.0222). The terminology that the Minnesota Rule uses is "shallow lakes" for lakes that meet the definition of a shallow lake and "lakes and reservoirs" for those that do not. ("Reservoir" is defined in Minn. R. 7050.0150, subp. 4 based on hydraulic residence time.) Using this definition, a lake with a maximum depth of 15.6 feet and 79% littoral would not be officially classified as a shallow lake in Minnesota. However, this lake might still be expected to show characteristics of a shallow lake, although likely less extreme than a lake with a maximum depth of six feet and 100% littoral. Note that the phrase "deep lake" is not defined nor used in Minn. R. 7050. The phrase *is* used in MPCA's 2005 report, Minnesota Lake Water Quality Assessment Report: Developing Nutrient Criteria, although the report acknowledges that some lakes display characteristics in between those of shallow and deep lakes. Draft documentation to support revisions to water quality standards for some lakes in Minnesota distinguishes stratified and mixed lakes, which generally correspond to dimictic lakes and shallow (polymictic) lakes, respectively.

Please be judicious when using the phrase "deep lake." If a lake does not meet the definition of a shallow lake in Minnesota, it does not necessarily mean that it is a deep lake in terms of its ecology and mixing status. It still might exhibit characteristics of a shallow lake, and calling it a deep lake could mislead the reader into making assumptions about the lake that are not appropriate. Be descriptive in the discussion of the lake, describing a lake's mixing status (if known) in addition to lake depth.

E.6. *E. coli* and fecal bacteria terminology

The MPCA uses *E. coli* concentrations as an indicator of fecal contamination of surface waters. While not necessarily a hazard to human health itself, *E. coli* are commonly found in the fecal waste of warm-blooded animals. *E. coli* can indicate the presence of fecal waste and therefore the potential for hazardous pathogens in surface waters, which could lead to human illness after contact or ingestion of water during recreational activities.

E. coli are one of many species of bacteria; there are thousands and potentially millions of species of bacteria on Earth. Most of these bacteria are harmless to human health, and in fact, many bacteria are beneficial to human health.

In water quality reports, the word "bacteria" is often used in place of "*E. coli*," suggesting that all bacteria are an indicator of fecal contamination or that all bacteria are pollutants. Using the word "bacteria" to mean pathogenic bacteria misleads the public or the non-scientist into thinking that all bacteria are bad, which is an unhelpful public health message. In place of "bacteria," you could use "fecal bacteria," "indicator bacteria," or simply "*E. coli*" throughout the TMDL, WRAPS, or other water quality report. If you do choose to use "bacteria" to mean fecal bacteria or *E. coli*, please define it the first time it is used to clarify that the intention is to refer to fecal indicator bacteria.

E.7. Lake alum treatment database

The Tableau report Alum treatments in Minnesota[11] provides an inventory of the lakes for which the MPCA has been notified of an alum treatment. This information can be helpful for staff completing impairment assessment—knowing that an alum treatment occurred can help interpret water quality data. The information may also be helpful to Watershed Division staff working on water quality projects such as TMDL and WRAPS reports.

E.8. Water quality trading

Water quality trading can help achieve compliance with WLAs or water quality based effluent limits. Water quality trading can also offset increased pollutant loads in accordance with antidegradation regulations. Water quality trading reduces pollutants (e.g., total phosphorus or total suspended solids) in rivers and lakes by allowing a point source discharger to enter into agreements under which the point source "offsets" its pollutant load by obtaining reductions in a pollutant load discharged by another point source operation or a nonpoint source or sources in the same watershed. The MPCA must establish specific conditions governing trading in the point source discharger's NPDES permit or in a general permit that covers the point source discharger. The MPCA implements water quality trading through permits.

Water quality trading is included in the TMDL report template as a potential implementation strategy and should remain in TMDL reports to allow for future trading agreements. Water quality trading would need to be implemented through a point source permit. See the MPCA's Water Quality Trading webpage for more information, including the MPCA's 2021 Water Quality Trading Guidance and a list of water quality trades in Minnesota. For more specific information regarding water quality trading agreements in a specific watershed, please contact the Wastewater–TMDL Liaison (Marco.Graziani@state.mn.us).

[11] *This Tableau report can only be accessed internally at MPCA. If you would like to view the report, please request it from your MPCA contact.*

E.9. Cost estimates

Minn. Stat. § 114D.25, subd. 1 requires TMDLs to include "a range of estimates of the cost of implementation of the TMDL; and, for point sources, the individual wasteload data and the estimated cost of compliance addressed by the TMDL."

Data sources that can be helpful include the following:

- NRCS EQIP payments for BMP implementation; these payments are used in HSPF–SAM cost scenarios. The BMPs are predominantly agricultural BMPs.
- NBMP, PBMP, and NP-BMP spreadsheets: Watershed nitrogen and phosphorus BMP assessment tools developed by University of Minnesota and MPCA.
- Agricultural BMP Handbook for Minnesota (Lenhart and Peterson, 2017).
- Minnesota Stormwater Manual: BMP construction costs, maintenance costs, and land requirements.
- The Minnesota Nutrient Reduction Strategy (MPCA 2014): Section 5.6.1 for generalized wastewater treatment costs for phosphorus. If the scope of the project allows for more detailed analysis, it is preferable to communicate directly with WWTP staff for more tailored cost estimates and/or a facilities plan.

MPCA plans to develop guidance on estimating costs in a future revision of All Things TMDL.