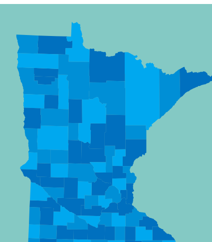
Wastewater rules

December 2019

Antidegradation Guidance

Guidance for new antidegradation rule promulgated 2016

MINNESOTA POLLUTION CONTROL AGENCY



Authors

Elise Doucette
Scott Kyser
Pam Rodewald
Stephanie Handeland
Brandon Smith
Holly Mikkelson
Theresa Haugen
Steve Weiss

Minnesota Pollution Control Agency

520 Lafayette Road North | Saint Paul, MN 55155-4194 |

651-296-6300 | 800-657-3864 | Or use your preferred relay service. | Info.pca@state.mn.us

This report is available in alternative formats upon request, and online at www.pca.state.mn.us.

Document number: wq-wwprm2-65

Contents

Introduction **1**

What is required in an antidegradation assessment? 1

Part I – Ambient water quality analysis **1**

Define pollutants of concern **2**

Is wastewater flow rate a pollutant of concern? 3

Will there be a net increase in loading for the pollutant of concern in my discharge? 3

Mass cap limits for the pollutant of concern currently controlled by effluent limits 5

Municipal mass cap limit example 6

Determining existing authorized load for a pollutant not currently controlled by an effluent limit ... 8

Determining existing surface water quality for pollutants of concern 9

Does MPCA have data I can use to determine existing water quality? 10

How much data do I need to determine existing water quality? 10

What waterbodies do I need to be concerned with when determining existing water quality? 11

What kinds of calculations need to be made to determine existing water quality? 11

Determining degradation to surface water quality due to increased pollutant loading 12

When determining the change in water quality, do I need to consider the assimilative dilution capacity of the receiving body? 13

Will there be a violation of a water quality standard because of the increase in loading? 14

Part II – Alternatives and economic analysis **14**

So you cannot avoid a net increase in loading of a pollutant of concern. Now what? 14

Step 1. Identify alternatives that avoid net increases in loading and minimize degradation 15

Step 2. Elimination of alternatives 15

Step 3. From the remaining alternatives, identify the one that results in the least degradation 16

Step 4. Starting with the highest ranked (i.e., least degrading) alternative, assess whether implementation would result in substantial economic impacts 17

Municipal facilities step 4A. Conduct primary test – calculate and evaluate the municipal preliminary screener value 18

Municipal facilities step 4B. Conduct secondary tests – debt, socioeconomic and financial indicators 19

Municipal facilities step 4C. Assess whether the costs of implementing an alternative would be substantial 21

Industrial facilities step 5. Complete financial impact analysis 21

Example of municipal WWTP 23

Step 1. Identify alternatives that avoid net increases in loading and minimize degradation 24

Step 2. Eliminate from consideration alternatives that: 25

Step 3. Eliminate from consideration alternatives that are not cost-effective 25

Step 4. From the remaining alternatives, identify the one that results in the least degradation yet will not cause substantial economic impacts 26

Step 4A. Rank cost-effective alternatives from least to most degrading 26

Step 4B. Select least degrading alternative that would not result in substantial economic impacts 26

Step 4C. Conduct Primary Test – calculate and evaluate the municipal preliminary screener value 26

Step 4D. Conduct secondary tests – debt, socioeconomic and financial Indicators 27

Step 4E. Assess whether the costs of implementing an alternative would be substantial (Public projects) 28

Appendix A: Non-public data and antidegradation 30

Process for submitting not public data 30

List of Tables

Table 1: Potential pollutants of concern for antidegradation analysis........ 3

Table 2: Hypothetical optional mass cap limit to avoid antidegradation assessment and review. 6

Table 3: Estimated number of ambient water quality samples needed for determining existing water quality........ 11

Table 4: Recommended river flow for use in antidegradation environmental analysis estimate. 13

Table 5: Secondary test indicators........ 20

Table 6: Assessment of substantial impacts matrix........ 21

Table 7: Present worth of each remaining alternatives........ 25

Table 8: Alternatives scale 26

Table 9: Example of alternatives' calculations........ 27

Table 10: Secondary test inputs........ 27

Table 11: Scores for Secondary Test indicators 28

Table 12: Three alternatives scored in relation to the matrix 29

List of Figures

Figure 1: Decision tree for determining whether a project constitutes a net increase in loading........ 5

Figure 2: Municipal wastewater treatment plant annual rolling average effluent phosphorus concentration (orange) and limit (blue) 7

Figure 3: Municipal wastewater treatment plant annual rolling total effluent phosphorus load (orange) and limit (blue)........ 7

Figure 4: Municipal wastewater treatment plant effluent chloride (blue) and total dissolved solids (orange) concentrations. 8

Figure 5: Chloride concentration in the Long Prairie River upstream of the municipal wastewater treatment plant outfall. 12

Introduction

The purpose of this document is to provide guidance on implementation of the state and federal antidegradation rules for National Pollutant Discharge Elimination System (NPDES) wastewater permits. The state's antidegradation rules are found in Minnesota Rules parts 7050.0250 to 7050.0335, and, for the Lake Superior Basin, Minnesota Rules Part 7052.0300 to 7052.0380.

Antidegradation rules exist to protect, maintain and achieve high quality surface water by protecting the existing uses and water quality. Antidegradation requirements are implemented through the issuance and enforcement of NPDES permits and other control documents issued by the Minnesota Pollution Control Agency (MPCA) which regulate surface water pollution. Antidegradation procedures are required when a permit application is made for a regulated activity that is anticipated to result in a net increase in loading or other causes of degradation to waters of the state.

Degradation is only allowed if the MPCA's antidegradation review concludes that it is necessary to accommodate important economic and social development. This document includes guidance on determining if an antidegradation review is needed, how to complete the applicant's antidegradation assessment portion of the overall review, as well as examples. This document may be updated in the future as more examples are available.

What is required in an antidegradation assessment?

The assessment needs to include three critical elements:

1. An ambient water quality analysis
2. An alternatives analysis
3. An economic analysis

The ambient water quality analysis is a comparison of current water quality conditions to the future water quality conditions if the proposed activity is completed. In order to do this comparison portion, the project proposer must know the current authorized load of pollutants (as defined in the NPDES permit) and projected loading, to determine if there is a measurable change in water quality. More details on the ambient water quality analysis are in Part I of this document.

If the proposed project results in a measurable change, the assessment needs to include analysis of all non-degrading alternatives that were eliminated with reasoning, information showing the degradation is prudently and feasibly minimized and that it is needed to allow for important economic and social development. Details on this portion of the assessment are included in Part II of this document.

Part I – Ambient water quality analysis

The ambient water quality analysis is one of three critical pillars of an antidegradation assessment. The project proposer must determine the extent to which existing good water quality might be affected by a proposed project. The section below focuses on 1) defining the pollutants of concern, 2) determining existing ambient water quality, 3) calculating the extent to which water quality will be changed, and 4) avoiding the need for an antidegradation assessment altogether through a commonly used off-ramp – accepting a permit condition that sets mass cap limits. If a new or expanded wastewater discharge is being proposed, it is strongly recommended that the project proposer make a formal request for preliminary effluent limits. The preliminary effluent limit review will identify pollutants of concern, provide optional mass cap limits to avoid the need for an antidegradation assessment, and indicate any new or anticipated effluent limits. This combination of factors may significantly affect the required type of treatment design. In some cases, the preliminary effluent limits review may identify gaps in ambient or effluent water quality data needed in order to complete the antidegradation assessment.

Define pollutants of concern

The initial steps of the antidegradation assessment is defining the pollutants of concern. Antidegradation assessments for wastewater discharges are completed on an individual pollutant-by-pollutant basis. All pollutants that will experience a net increase in loading must be considered in the antidegradation assessment and review process. The statement of need and reasonableness (SONAR) for the antidegradation rulemaking package states that it is unreasonable to expect wastewater dischargers to consider every possible pollutant that could be present in a wastewater effluent. However, the SONAR provides the following general guidelines about how to define or limit the pollutants of concern for an antidegradation review.

Pollutants of concern are:

- Pollutants that, if increased, may contribute to a biologically relevant change in water quality;
- Pollutants reasonably expected in a discharge or as a result of a proposed activity;
- Anticipated to cause degradation (i.e., measurable change to existing water quality made or induced by human activity resulting in diminished conditions of surface waters); and
- Any pollutant that already has an effluent limitation in a previous wastewater permit.

The guidelines above are broad and general; the tables below help define the pollutants of concern based on whether the discharger is an industrial or municipal wastewater treatment plant (WWTP). These tables are meant to provide guidance about what parameters the antidegradation assessment needs to cover, but are not meant to be definitive. The MPCA reserves the right to consider additional pollutants of concern in the antidegradation review as the situation warrants.

Each receiving water and wastewater discharger is unique. Pollutants of concern should be discussed with the MPCA prior to developing the antidegradation review, and the MPCA recommends that project proposers begin this discussion early in their planning process. Defining the pollutants of concern early in the antidegradation process is extremely important.

The parameters of concern for municipal dischargers are generally more clear, due to consistency in the discharge from municipality to municipality (Table 1). The exception is municipal WWTPs that receive and treat waste from industrial users in their community. The types of wastes these industrial users discharge varies widely based on the type of industry and the MPCA will use best professional judgement to consider these industries when defining pollutants of concern.

Industrial discharges have widely varied discharge volumes, pollutant types and treatment systems. Because of the diversity of industrial dischargers in Minnesota, it is impossible to develop a single comprehensive list of pollutants of concern for industrial dischargers. The table below is not definitive, but is a good place to start. Pollutants may be not be considered pollutants of concern if the project proposer can demonstrate that there will be no net increase in authorized load of those pollutants. Often, a project may start with a larger list of pollutants of concern. As the project moves forward this list is often whittled down to only include those pollutants that will result in a net increase in loading. See next section for more detail.

Table 1: Potential pollutants of concern for antidegradation analysis

Pollutant	Municipal	Industrial
Carbonaceous Biochemical Oxygen Demand	✓	✓
Total Suspended Solids	✓	✓
Total Phosphorus	✓	✓
Ammonia	✓	✓
Nitrate	✓	✓
Chloride	✓	✓
Mercury	✓	✓
Temperature		✓
Heavy Metals (Cu, Cd, Co, Pb, Cr, Ni, Zn, Ag)[1]	✓	✓
Sulfate[2]	✓	✓
Selenium		✓
Arsenic		✓

[1]Only considered if a significant industrial wastewater user such as a metal plater is likely to expand their pollutant loading to the municipal WWTP.

[2]Only considered if the outfall is upstream of a wild rice waterbody. Contact MPCA with questions.

Is wastewater flow rate a pollutant of concern?

Wastewater flow rate is not a pollutant of concern, but because wastewater effluents contain pollution, wastewater discharge flow rate is used as a surrogate for pollution loading from dischargers. Pure water free of pollution is by definition not capable of polluting the environment. However, wastewater is a "vector" for pollution because the water carries pollutants within it. The water that WWTPs discharge frequently contains pollution that can affect downstream surface water quality if not properly treated or managed.

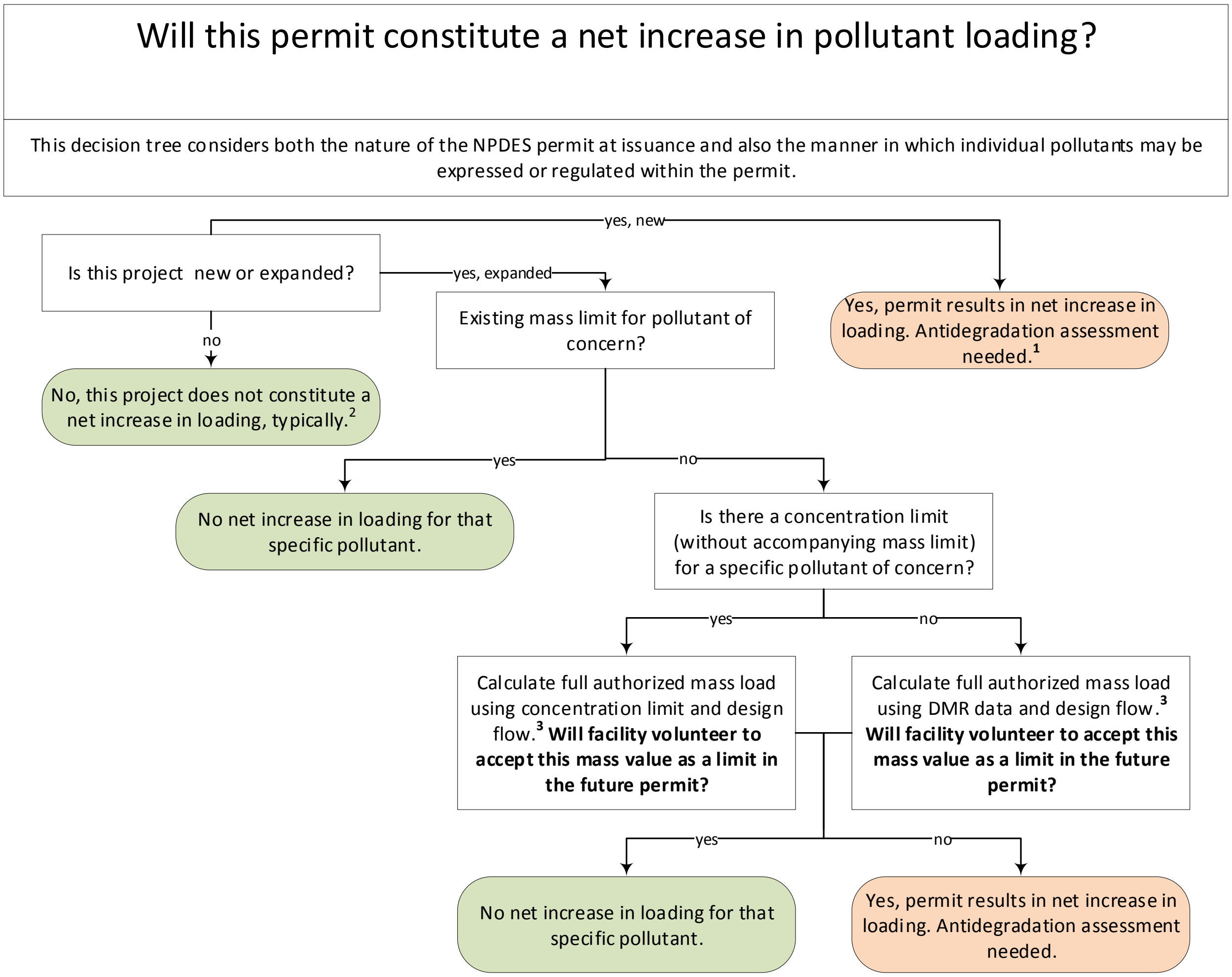
Will there be a net increase in loading for the pollutant of concern in my discharge?

All truly new discharges will result in a net increase in loading for pollutants of concern. The receiving water, and perhaps other downstream waters, will not have already experienced the impact of this discharge. Therefore, the project proposer must determine the extent to which the project will change downstream lake and river water quality for all pollutants of concern. In some circumstances, a permittee may want to relocate their outfall to a new location shortly downstream of the existing outfall. The existing and new outfalls terminate and initiate operations consecutively. In this circumstance, the receiving water has long received pollutant loading from the existing discharge and therefore there will be no new impact on water quality conditions from the new outfall. In this later example, the outfall relocation would not be a truly new discharge.

Expanded discharges will also result in a net increase in pollutant loading unless they receive permit conditions that require continued operation to be at or below the existing full authorized load. For some parameters, the existing (pre-expanded) facility may already have a mass limit which defines this full authorized load. In other situations, the facility will have a concentration limit. The full authorized load of the existing facility can be calculated from the old concentration limit and the historic design flow value. Other pollutants of concern may not have limits in the old permit. These may still be pollutants of concern. In these situations, the authorized load of the existing discharge may be calculated using a combination of DMR discharge data and the existing, pre-expansion, design flow. The facility may decide to accept an optional mass cap limit to avoid completing an antidegradation assessment, or they may decide to not accept this mass limit and the future permit will constitute a net increase in loading, thereby requiring a full antidegradation assessment and review.

The determination of whether an antidegradation assessment is needed depends on the type of proposed activity, the range of existing limits, and whether a discharger is willing or able to accept mass cap limits or other permit conditions (Figure 1). Again, optional mass cap limits will be provided with a preliminary effluent limits review request letter. The project proposer will then need to determine the existing assimilative capacity of the receiving water(s) and that of the proposed increase in loading. In some cases projects with expanded flows can avoid all increases in net loading and thereby avoid the need to complete an antidegradation assessment. In many other cases, this is either not possible, or the permittee may choose to provide the antidegradation assessment. The determination of what pollutants must be included in the assessment as part of the antidegradation review is likely to be an iterative process and dependent upon multiple variables.

Figure 1: Decision tree for determining whether a project constitutes a net increase in loading



[1] In some circumstances, a facility may move an outfall shortly downstream of the existing discharge, soon to be discontinued. In this case, the receiving water will have already received the impact of historic loading, and the "new" outfall will not constitute a new impact on biological communities. An antidegradation assessment is not needed in this rare circumstance.
[2] Most reissuances will not constitute a net increase in loading. In unusual circumstances a significant industrial user may expand operations thereby resulting in an increase in loading of a specific pollutant. Situations will be explored on a case-by-case basis.
[3] For specific details, follow internal guidance on calculating mass cap limits associated with antidegradation.

Mass cap limits for the pollutant of concern currently controlled by effluent limits

"Mass cap limits" are an option for existing dischargers looking to avoid an antidegradation assessment and review while still maintaining high surface water quality. The concept is that if an existing discharger already has a mass-based effluent limit in their permit for a pollutant and the discharger is looking to expand their permitted amount of flow, then they could agree to accept mass cap limits.

"Mass cap limits" means agreeing to meet the currently permitted mass-based effluent limit for the pollutant or parameter of concern while simultaneously expanding permitted flow rate. The table below provides an example of how this works. In the example, the current active permit has both concentration and mass limits for the parameter of concern and the WWTP is permitted at a flow rate of 1 million gallons per day (MGD). The WWTP wants to expand to a 2 MGD flow rate but does not want to perform an antidegradation review. They can choose to continue to meet the current mass and concentration limits at the expanded flow and, as a result, there would be no net increase in pollutant loading. In this scenario, agreeing to mass cap limits would effectively halve the required concentration because the flow rate doubled and the mass limit remained the same. It is up to the permittee to decide whether they can meet the mass cap limits when they evaluate this option.

Table 2: Hypothetical optional mass cap limit to avoid antidegradation assessment and review.

		Current Permit	**Expanded Permit**
Flow	Unit	1 MGD	2 MGD
Permit Limit	mg/L	25	25
Effective Concentration	mg/L	25	12.5
Mass Limit	kg/day	94.6	94.6

To date, most dischargers have chosen mass cap limits. They use charts such as the ones above to help them make their decision.

Municipal mass cap limit example

A municipal WWTP was looking to expand its flow rate and did not want to increase net loading of any pollutant, degrade water quality, or trigger the need for an antidegradation review. They were particularly concerned about their phosphorus limits and wanted to understand whether they had excess capacity for phosphorus treatment. They used the graphs below to determine that they were discharging well below their existing phosphorus concentration limits and could expand their flow rate while still meeting their currently permitted phosphorus concentration and mass limits. Freezing mass limits was an effective solution that maintained existing water quality and allowed the discharger to expand their flow rate. Upon request, the MPCA can easily make these graphs for your WWTP or supply data to assist in your decision making.

Figure 2: Municipal wastewater treatment plant annual rolling average effluent phosphorus concentration (orange) and limit (blue)

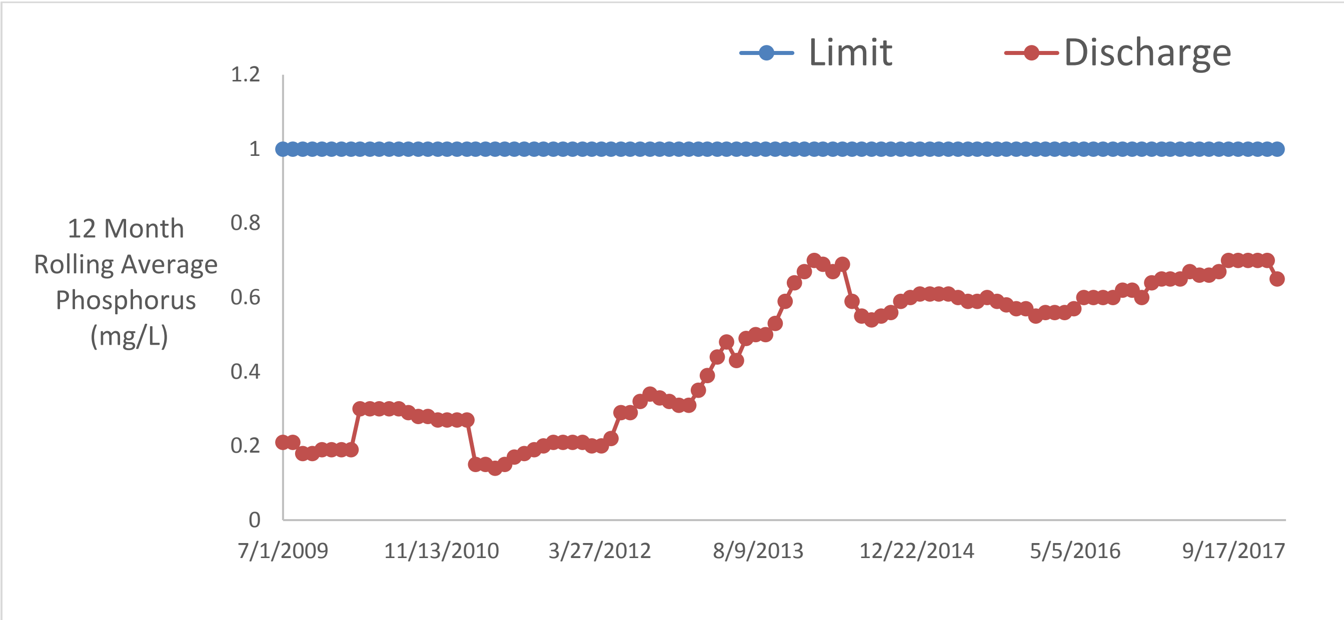
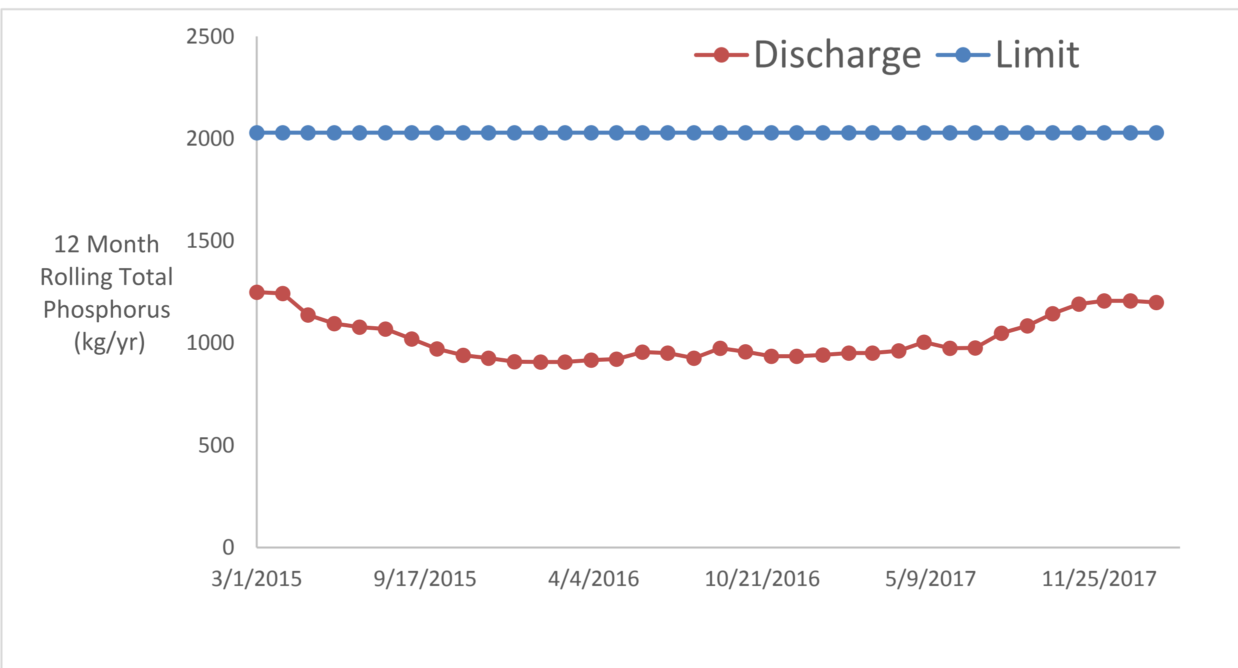


Figure 3: Municipal wastewater treatment plant annual rolling total effluent phosphorus load (orange) and limit (blue)



Determining existing authorized load[1] for a pollutant not currently controlled by an effluent limit

Determining the existing authorized load for a parameter not currently controlled by an effluent limit always requires wastewater effluent monitoring.

The MPCA prefers to use the equation below to determine existing loading of a pollutant from a WWTP. There are some parameters and circumstances for which this equation is not applicable. The MPCA prefers to use the units of kilograms per day (kg/day) to evaluate mass loading but for some parameters, such as phosphorus, a different unit of measurement is more appropriate.

$$Existing\ Authorized\ Mass\ Load\ = Q * C$$

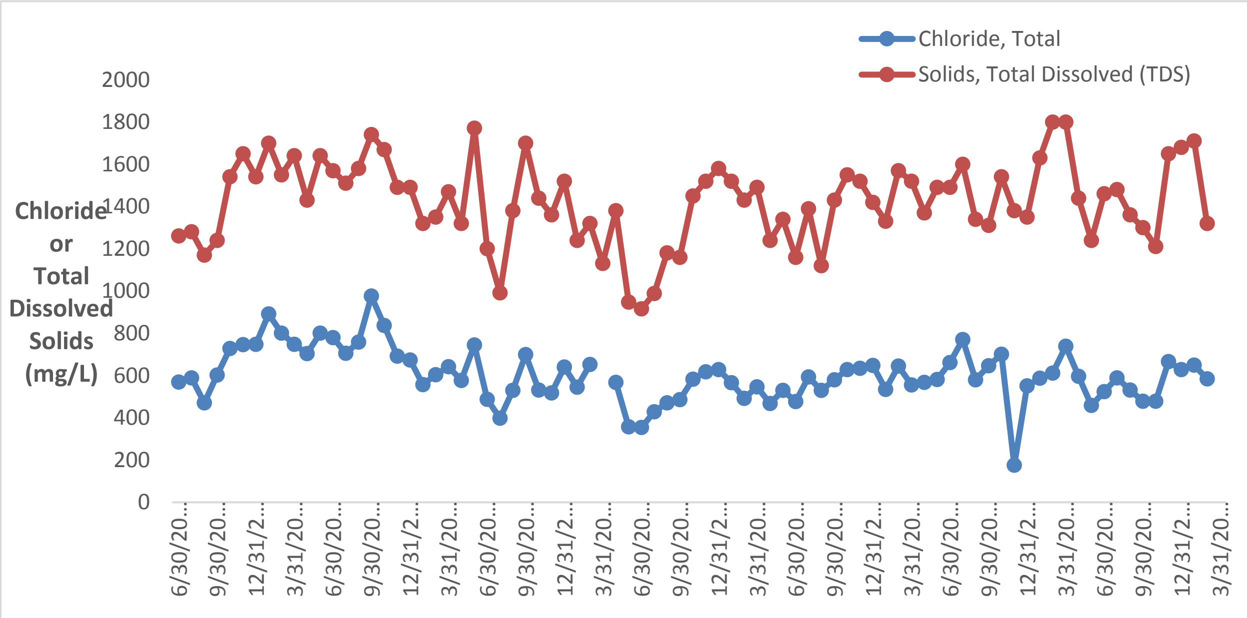
Q = permitted hydraulic design capacity[2]

C = recorded effluent concentration

Example of municipal chloride and total dissolved solids existing mass loading calculation

The municipality has monitored for chloride and total dissolved solids in its effluent since 2011 (figure below). The highest recorded chloride concentration is 976 mg/L and the highest recorded total dissolved solids concentration is 1,800 mg/L. The concentrations for these two parameters are relatively consistent over time, so using the maximum recorded value was an appropriate way to characterize existing loading of chloride. The average wet weather design flow for the WWTP is 1.82 MGD. Using the equation above, existing mass loading for the WWTP is 6,700 kg/day of chloride and 12,400 kg/day of total dissolved solids.

Figure 4: Municipal wastewater treatment plant effluent chloride (blue) and total dissolved solids (orange) concentrations.



1 Authorized load from existing regulated activities (Minn. R. 7050.0255, subp. 2)
2 The permitted hydraulic design capacity will frequently be equivalent to the average wet weather design flow (AWWDF) or maximum design flow (MDF) for municipal and industrial permits, respectively.

Determining existing surface water quality for pollutants of concern

The first step in evaluating surface water quality is to determine the designated uses of the relevant impacted (downstream) waterbodies (Minn. R. 7050.0280, subp. 2.B.(1)). Once the designated use classes for a water are known, the applicable water quality standards can be determined. All Minnesota surface waters are classified into a combination of seven designated use classes that range from drinking water consumption to aquatic life to industrial use. Additionally, some waters have special designations such as being Outstanding Resource Value Waters (ORVWs). These designations can be found in Minn. R. 7050.0470 and 7050.0335.

The next step is determining existing surface water quality for every pollutant of concern (Minn. R. 7050.0280, subp. 2.B.(2)). Determining existing water quality is necessary in order to characterize the extent to which water quality will be degraded due to the expected increase in pollutant loading from the discharger.

Three methods can be used to determine existing water quality: real data, reference data, and models (Minn. R. 7050.0260). First, real data from the water of interest can be used to determine existing water quality. If available, existing ambient water quality data can be used. These data could be data already collected by MPCA or an equivalent agency with technical expertise and experience, for example, Metropolitan Council Environmental Services (MCES), U.S. Geological Services (USGS), Minnesota Department of Natural Resources (DNR), etc. If existing data are not available, the project proposer may collect data using accepted methods for collection and laboratory analysis. Discuss timing, quantity, and location of the sampling effort with MPCA prior to events. Details will vary pending pollutant and waterbody. Second, reference waters could be used as surrogates for existing water quality in the waterbody of interest. Third, a water quality model could be used to characterize existing conditions.

Minn. R. 7050.0270 does provide methods for performing an antidegradation assessment without using quantifiable data-based methods. However, quantifying existing water quality using data is a reasonable expectation for wastewater dischargers and determinations of existing water quality should be made using quantifiable data. Although technically allowed by rule, the MPCA expects that good faith efforts to quantify changes will be attempted.

Minn. R. 7050.0260 specifies the methods to determine existing water quality. The rule language (copied below) provides a hierarchy of methods for determining existing water quality. Preference is given for actual water quality data collected by the MPCA with secondary preference for water quality data collected by outside parties. Less preference is given to data collected at nearby waterbodies and modeled water quality data.

The methods in Minn. R. 7050.0260 are suggestive and not particularly specific. The Rule does not specify the important details about specific data quantity needs, statistical calculations and other data processing concerns. This guidance aims to provide answers to specific data questions but it is wise to confer early with the MPCA about your specific data processing approach and data needs.

Minnesota Administrative Rules

7050.0260 DETERMINING EXISTING WATER QUALITY.

Subpart 1. **Methods.** Existing water quality shall be determined using methods described in items A to D. The methods are listed in descending order of priority. Lower priority methods shall be used only if higher priority methods are not reasonably available. More than one method shall be used when a single method does not adequately describe existing water quality.

A. Using commissioner-approved monitoring data that exist at the time the determination of existing water quality is undertaken.

B. Monitoring surface waters, provided that samples are collected in a manner and place and of such type, number, and frequency as may be considered necessary by the commissioner to adequately reflect the condition of the surface waters. Samples must be collected, preserved, and analyzed following accepted quality control and quality assurance methods and according to the procedures in part 7050.0150, subpart 8.

C. Identifying reference surface waters that have similar physical, chemical, and biological characteristics and similar impacts from regulated and unregulated activities.

D. Use of a water quality model to characterize existing conditions in the surface water, provided that the model uses data from the same watershed as the surface water under review for existing conditions.

Subp. 2. **Consideration of existing regulated activities.** For surface waters impacted by activities that are regulated by existing control documents, existing water quality includes surface water conditions that are anticipated at loadings or other causes of degradation authorized in the applicable control document.

Does MPCA have data I can use to determine existing water quality?

Yes. You should plan to use all information the MPCA has available.

The MPCA has millions of water quality data points in its various water quality databases. There are ample groundwater, surface water, and wastewater effluent data points that can be made available to you. These data are publically available, and the MPCA will do its best to pre-process this data into useful formats needed to determine existing water quality. You can find information about surface water monitoring data at https://www.pca.state.mn.us/water/surface-water-data-submittal-review-and-reports. This page shows MPCA staff to contact. MPCA staff can also help you determine whether you need to collect any additional data. Staff can also help gather and process flow data from USGS gauges.

How much data do I need to determine existing water quality?

The amount of data needed to determine existing water quality is dependent on the pollutant of concern and the waterbody in question. There is no universal number of data points that will work for every parameter in every situation.

For some parameters a single data point could be sufficient to determine existing water quality, and for other parameters, continuous monitoring over the course of several days would be necessary to determine existing water quality. Some water quality parameters vary seasonally (algae, temperature), bi-modally (dissolved oxygen, pH), or with receiving water flow rate (TSS, TP). Furthermore, some parameters vary depending on the water body type. The takeaway is that the natural environment is complex and often difficult to easily quantify using water quality data. **Contact the MPCA about the number of data points you will need to determine existing water quality.**

However, as a general rule, ten data points is a good place to start to appropriately determine existing water quality. Specific exceptions are:

Table 3: Estimated number of ambient water quality samples needed for determining existing water quality.

Parameter	Data Needs
Total Phosphorus	Two summers and twelve data points
Carbonaceous Biochemical Oxygen Demand	
Chlorophyll-a	

What waterbodies do I need to be concerned with when determining existing water quality?

In practice, for almost every parameter, only the first immediate receiving waterbody would need to be considered. This is because the first receiving water has the greatest potential impact from the permitted discharger. For most parameters, if the degradation of existing water quality is minimized in the first downstream water, then degradation will also be minimized for all other downstream waters.

The exceptions to the above rule are: 1) pollutants that have a wasteload allocation (WLA) from a total maximum daily load (TMDL) study, and 2) phosphorus. Some effluent limits in permits are derived from a WLA found in a TMDL and to expand that WLA would require re-doing the TMDL. The MPCA has a database that tracks all limits derived from a TMDL and upon request can easily provide this information to you. Contact the MPCA early about whether downstream waters are covered by a TMDL.

Phosphorus effluent limits in Minnesota are calculated on a watershed-wide basis and effluent limits are often set to protect waters far downstream of the discharger. Contact the MPCA early about what downstream waters you should be concerned about for your discharge with respect to phosphorus.

What kinds of calculations need to be made to determine existing water quality?

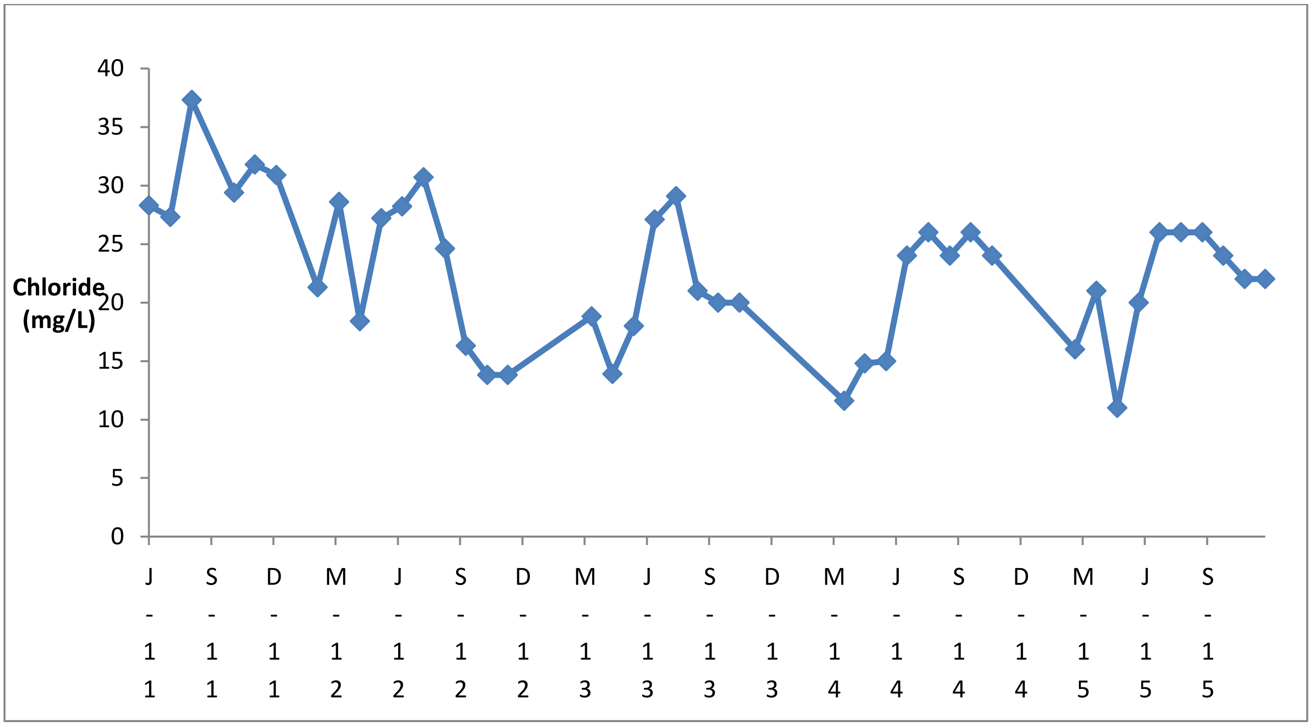
The specific type of calculation that needs to be made to determine existing water quality will vary based on the pollutant, the measured concentrations of the pollutant, and the waterbody being considered. There is no universal rule for how to perform the calculations needed to determine existing water quality, but some guidelines and examples are provided below. When determining existing water quality, the primary concern should be answering this question: **What statistic best describes the data set for my pollutant of concern in the waterbody I'm concerned about?**

Example 1: Existing water quality determination for chloride

A WWTP needed to expand its chloride loading and, as a result, an antidegradation review was required. It was necessary to define existing concentrations of chloride in the receiving water in order to calculate the changes to existing water quality because of the expanded chloride loading. The permittee chose to use a location upstream of the discharge on the Long Prairie River to sample because this location was not impacted by a discharger.

The permittee sampled upstream of the discharge location on the Long Prairie River on a monthly basis for several years and the samples they collected can be seen in the figure below. The concentrations of chloride were fairly consistent and ranged from 11 to 37 mg/L and did not significantly vary with river flow rate. This consistency of concentration led the MPCA to determine that using an arithmetic average to characterize the central tendency of this dataset was appropriate. **Ultimately, the average chloride concentration of 23 mg/L was used to characterize existing water quality.**

Figure 5: Chloride concentration in the Long Prairie River upstream of the municipal wastewater treatment plant outfall.



Determining degradation to surface water quality due to increased pollutant loading

This step allows for the discharger and the MPCA to determine whether the net increase in pollutant loading from the discharger will violate a downstream water quality standard and quantifies the amount of future water quality degradation from the increased pollutant load.

This is an essential step in the antidegradation review process and will always require some form of calculation using numeric data. Typically, a steady-state mass balance approach will be used to estimate the degradation to water quality; however, other methods such as computer modeling could be used.

The steady-state mass balance formula used to estimate the amount of degradation that would occur because of changes to water quality can be found below.

$$C_{Future\ Water} = \frac{Q_{WWTP} * C_{Future\ WWTP} + Q_{Water} * C_{Existing\ Water}}{Q_{Water} + Q_{WWTP}}$$

$C_{Future\ Water}$ = The expected future surface water concentration

Q_{WWTP} = The applicable design flow of the wastewater plant in question

$C_{Future\ WWTP}$ = The expected future wastewater plant concentration

Q_{Water}= The applicable low flow rate for the waterbody in question (See section below)

$C_{Existing\ Water}$ = The expected future surface water concentration upstream of the WWTP

When determining the change in water quality, do I need to consider the assimilative dilution capacity of the receiving body?

Yes.

Low flow receiving water conditions represent the period when point sources have the greatest potential to impact receiving water quality. Minn. R. 7053.0195, subp. 7, requires control of pollutants from point source dischargers to ensure water quality standards are maintained at specified minimum stream flows. For most pollutants of concern, we protect for the annual 7Q10 flow rate of the receiving water. The annual 7Q10 is the lowest 7-day average flow that is expected to occur once every 10 years. Contact the MPCA for the low flow rates applicable to your discharge.

There are some pollutants, such as ammonia and phosphorus, that have different protective low flow rates in rule (see table below). For some pollutants, such as mercury and acute WET testing, the MPCA does not allow any assimilative capacity for dilution. If the discharge you are considering is located in the Lake Superior Basin, contact the MPCA because the Lake Superior Basin has some unique low flow levels that must be considered.

Table 4: Recommended river flow for use in antidegradation environmental analysis estimate.

Pollutants of concern	Protective low flow level for calculating assimilative capacity in the receiving water
Carbonaceous Biochemical Oxygen Demand	Annual 7Q10
Total Suspended Solids	Annual 7Q10
Total Phosphorus	Average of all summer days and/or 20th Percentile (80% exceeds)
Ammonia	Seasonal 30Q10
Nitrate	Contact MPCA
Chloride	Annual 7Q10
Bacteria	Annual 7Q10
Temperature	Contact MPCA
Mercury	No dilution allowed

Pollutants of concern	Protective low flow level for calculating assimilative capacity in the receiving water
Heavy Metals (Cu, Cd, Co, Pb, Cr, Ni, Zn, Ag)	Annual 7Q10
Sulfate	Contact MPCA
Selenium	Contact MPCA
Arsenic	Annual 7Q10
Antimony	Annual 7Q10

Will there be a violation of a water quality standard because of the increase in loading?

Minnesota antidegradation rule does not allow any violation of a water quality standard due to an increase in pollutant loading from a discharger. Therefore, the MPCA cannot approve a wastewater permit with an increase in pollutant loading that would permanently cause a violation of a water quality standard.

Every discharger performing an antidegradation review is required to demonstrate that the increased pollutant loading will not cause a violation of a water quality standard for every pollutant of concern. Using the above mass balance equation is a good first place to start to determine whether a water quality standard will be violated.

Water quality standards can be found in Minn. R. 7050 and 7052. If you are having trouble determining what the applicable water quality standards are for your discharge, call the MPCA. The MPCA can also help you define what it means to cause a violation of a water quality standard.

Part II – Alternatives and economic analysis

So you cannot avoid a net increase in loading of a pollutant of concern. Now what?

The Permittee must submit documentation that it has examined multiple alternatives and determined that a net increase is loading is unavoidable. The selected project must be the alternative that is the least degrading prudent and feasible option.

The following steps are a suggested approach for identifying the least degrading prudent and feasible alternative. More information on each step in the approach follows.

1. Identify alternatives that avoid net increases in loading and minimize degradation.
2. Eliminate from consideration alternatives that:
    - Are not consistent with sound engineering practices;
    - Are not consistent with sound environmental practices;
    - Are not legal; and
    - Do not have supportive governance.
3. From the remaining alternatives, identify the one that results in the least degradation yet will not cause substantial economic impacts.
4. Rank alternatives from least to most degrading. Starting with the highest ranked (i.e., least degrading) alternative, assess whether its implementation would result in substantial economic

impacts. If the assessment indicates that the highest ranked alternative would result in substantial economic impacts, the next highest ranked alternative is evaluated until one is found that will not result in substantial economic impacts.

Step 1. Identify alternatives that avoid net increases in loading and minimize degradation

In this step the applicant identifies a range of pollution control alternatives which would avoid additional loading altogether or which would minimize degradation. The following alternatives are examples that may be considered depending upon applicability:

- Holding tanks with transport to a permitted WWTP.
- Pipeline conveyance to a permitted WWTP (regionalization, or sewering a current direct discharge).
- Pollution prevention, pollution minimization and/or pretreatment techniques.
- Modified, additional or enhanced treatment technology alternatives and treatment levels.
- Reduction in the scale of the activity, such as downsizing the project and/or implementing water conservation practices so that a land disposal method might be used.
- Discharge to alternative locations.
- Loading offsets/pollutant trading, such as point-to-point trading and point-to-nonpoint trading.
- Recycle/reuse of pollutants and/or water.
- Improved operation and maintenance of existing pollution prevention and WWTPs.
- Land application and/or infiltration, such as spray irrigation, rapid infiltration, mound systems.
- Alternative water supply source(s) and/or alternative water supply treatment technologies, such as a water supply with lower pollutant levels, hardness levels.

Step 2. Elimination of alternatives

MPCA staff are aware that some of these alternatives may not be reasonable; however, the review should address all of them explicitly. For example, the use of holding tanks with transport to permitted WWTPs would not be reasonable for a WWTP discharging 2 MGD. This review is not just for MPCA use. Evaluations need to demonstrate to the general public that all alternatives were considered, even if it that consideration is a simple statement indicating that the alternative is not feasible on this scale. The applicant is encouraged to work with MPCA staff in identifying which alternatives should reasonably be evaluated. Eliminate alternatives that:

- Are not consistent with sound engineering practices;
- Are not consistent with sound environmental practices;
- Are not legal; and
- Do not have supportive governance.

Sound engineering

Eliminating alternatives that are not consistent with sound engineering practices ensures only proven and reliable alternatives are considered. Pollution control technologies are continually evolving and improving. Some newer pollution control technologies hold promise in their ability to treat wastewater. The applicant may propose the implementation of such technologies but will need to provide adequate information regarding effectiveness and reliability. A particular technology may be approved by the MPCA with the condition that if the proposed technology does not meet project pollutant control targets, the applicant must adopt conventional or other pollution control measures.

Sound environmental practices

Alternatives under consideration should be consistent with sound environmental practices. Factors to consider may include:

- Impacts to other media (e.g., land, air and groundwater);
- Sensitivity of receiving waters to degradation;
- Impacts on threatened and endangered species;
- Potential to generate secondary environmental impacts;
- Timing of discharge (e.g., continuous versus seasonal discharge); and
- Energy use.

Legal

Alternatives that cannot be legally implemented should be removed from consideration. An example of an alternative that is not legal is the use of treatment chemicals (or chemical concentrations) that are prohibited by law. As another example, some cities may have zoning restrictions that prohibit subsurface treatment systems in certain areas.

Supportive governance

The implementation of a given alternative should also have supportive governance. For example, some cities, townships or sanitary districts may support or not support regionalization.

Step 3. From the remaining alternatives, identify the one that results in the least degradation

Rank alternatives from least to most degrading.

When ranking alternatives, the applicant will need to consider a number of factors pertinent to the proposed discharge. These may include, but are not limited to, the following.

- Multiple parameters of concern.
  - A single discharge may have more than one parameter of concern.
- Treatment effectiveness.
  - Some alternatives will likely provide varying degrees of treatment for each parameter of concern. For example, an alternative that does a good job in treating total suspended solids (TSS) may also be effective in treating parameters associated with suspended solids, but may not have much impact on dissolved parameters.
- Relative loading rates of each parameter of concern.
- Fate of parameters of concern.
  - Some parameters may be conservative, meaning that they remain in the water column or sediments for a long period of time (e.g., metals), while others are attenuated relatively quickly (e.g., CBOD).
  - Some parameters may, through chemical, physical or biological processes, convert into byproducts which may be less or more degrading than the discharged parameter.
  - Some parameters accumulate in aquatic plants and/or animals, while others do not.
- Sensitivity of the high quality waters.
  - Size of the water body.
  - Amount of available assimilative capacity.

    - Timing of discharge. The ranking of alternatives should reflect water quality impacts when beneficial uses are most susceptible to the effects of degradation. Stream critical conditions generally occur at low flows, such as in autumn.
    - Water quality trends. For example, even though a water may be of high quality, monitoring data may show increasing concentrations of pollutants that indicate it could become impaired in the relatively near future.
- Impairments and Total Maximum Daily Loads (TMDLs).
    - Antidegradation rules require high water quality degradation from regulated sources to be minimized. There will likely be situations where the receiving water is not of high quality for a particular parameter or pollution (e.g., the water body is on the most recent 303d Impaired Waters List for a specific Class 2 standard). If there is an EPA-approved TMDL for that parameter, the selection of the least degrading alternative will be influenced by the TMDL's WLA. For example, if a WLA requires a WWTP to discharge no more than 1,000 pounds of total phosphorus, the antidegradation alternatives analysis is bound by this limitation. If a waterbody is on the most recent 303d List and there is not an EPA-approved TMDL for a given parameter of concern, the discharge must not contribute to the impairment. Again, this would influence the selection of the least degrading alternative.

Considering the number and interactions of factors to be considered, the applicant is encouraged to work with MPCA staff in identifying the least degrading alternative.

Step 4. Starting with the highest ranked (i.e., least degrading) alternative, assess whether implementation would result in substantial economic impacts

If the assessment indicates that the highest ranked alternative would result in substantial economic impacts, the next highest ranked alternative is evaluated until one is found that will not result in substantial economic impacts. This analysis will differ for industrial and municipal facilities. Both are outlined below.

The purpose of the substantial economic impact analysis is to assess the extent to which economic development may be affected by implementing the preferred pollution control alternative. This step utilizes EPA's "Interim Economic Guidance for Water Quality Standards" for public sector projects. The referenced worksheets are found on EPA's Economic Guidance for Water Quality Standards Webpage. The webpage also contains Excel spreadsheets which provide automatic calculations once the necessary information is supplied. Use of the Excel spreadsheets will save time in conducting the analysis.

The analysis is not designed to determine the exact impact of pollution control costs on an entity. It merely provides indicators of whether pollution control costs would result in a substantial impact. The applicant is not obligated to use these tools, but may find them useful.

The process for determining whether the economic impact is substantial is described below in the sections on Primary and Secondary Tests for municipalities, and the Financial Impact Analysis for industries. If the economic impact of implementing the top-ranked alternative is not substantial then that alternative is preferred and should be implemented. If the economic impact of implementing this alternative is found to be substantial, the next highest ranking alternatives are evaluated until an alternative is found for which the economic impacts are not substantial.

Municipal facilities step 4A. Conduct primary test – calculate and evaluate the municipal preliminary screener value

Whether or not minimizing high water quality degradation is likely to interfere with development due to additional public-sector costs is determined by jointly considering the results of two tests. The first test is a "screener" to establish whether the community can clearly pay for the project (Worksheet D).

To assess the financial burden that total pollution control costs are expected to have on households, an average annualized pollution control cost per household should be calculated for all households in the community that would bear project costs. This can be accomplished by applying the following steps (which, again, can be avoided by utilizing the EPA spreadsheets):

1. Up-front capital and other costs (identified in Step 3) must be converted into an annual amount. Add the annual operating cost.
2. If there will be any recoverable salvage value at the end of the pollution control project, then these costs need to be converted into annualized costs and subtracted. Again, these costs need to be multiplied by an annualization factor.

Total annualized costs are calculated by adding the annualized up-front costs plus annual operating costs minus annualized salvage values. The per-household annualized cost is then calculated by dividing this total by the number of households that will bear the pollution control expense.

The analysis must establish which households will actually pay for pollution control and what proportion of the costs will be borne by households. Then, these apportioned project costs are added to existing pollution control costs (if there are any) already paid by the households.

If project costs were estimated for some prior year, these costs should be adjusted upward to reflect current year prices using the average annual national Consumer Price Index (CPI) inflation rate for the period. The CPI inflation rate is available from the Bureau of Labor Statistics. An additional source reporting the CPI inflation rate is the *CPI Detailed Report* (www.bls.gov/cpi/cpi_dr.htm), which is published monthly by the U.S. Department of Labor, Bureau of Labor Statistics. Alternatively, costs may be calculated using cost indices published by the Engineering News-Record Cost (see http://enr.construction.com/economics/). These indices provide a wide range of construction costs by large metropolitan areas.

In calculating the total annual cost of pollution control per household, current costs of pollution control (if there are any) that households bear must be considered along with the projected annual costs of the proposed pollution control project. The existing cost per household usually can be obtained from the most recent municipal records. For example, use the most recent operating revenues of the sewer enterprise fund, divided by the number of households served. If the portion of proposed project costs that households are expected to pay is known or is expected to remain unchanged, then use Worksheet Q to calculate the total annual cost of pollution control per household. If the portion paid by households is based on flow, then refer to Worksheet Q: Option A as well.

The Municipal Preliminary Screener (Worksheet D) estimates the total per household annual pollution control costs to be borne by households (existing costs plus those attributable to the proposed project) as a percentage of median household income. The screener is written as follows:

$$Municipal\ Preliminary\ Screener = \frac{Annual\ pollution\ control\ cost\ per\ household}{Median\ household\ income} \times 100$$

Median household income information for many municipalities is available from the U.S. Census. To estimate median household income for the current year, use the CPI inflation rate for the period between the year that median household income is available and the current year.

Depending on the results of the screener, the community is expected to incur small, mid-range, or large economic impacts (see Worksheet S). For a given alternative, if the average annual cost per household (existing annual cost per household plus the incremental cost related to the proposed project) is less than 1.0% of median household income, then the cost of implementing the pollution control measure is not expected to impose a substantial economic hardship on households and would likely not interfere with economic development. In such cases, the applicant should implement the alternative because it is the one that results in the least degradation yet is prudent and feasible. Continuing on to the next step is generally not necessary. However, the applicant may choose to evaluate the alternative by conducting the Secondary Tests if he or she believes debt, socioeconomic and other financial factors would show that implementation of the alternative does indeed cause substantial economic impacts.

Communities are expected to incur mid-range impacts when the ratio of average annual pollution control costs to median household income is between 1.0 and 2.0%. In these situations the applicant moves on to the Secondary Tests for further evaluation of the alternative.

If the average annual cost per household exceeds 2.0% of median household income, then the alternative likely places a large financial burden on many of the households within the community and the cost of implementing the pollution control measure may interfere with economic development. Again, the applicant moves on to the Secondary Tests for further evaluation of the alternative. An exception to conducting the Secondary Tests may be where a Municipal Preliminary Screener Value is very high (e.g., above 5). In these cases, the applicant, in consultation with the MPCA, could remove the alternative from further evaluation and move on to evaluating the next ranked alternative.

Municipal facilities step 4B. Conduct secondary tests – debt, socioeconomic and financial indicators

Again, this step utilizes EPA's "Interim Economic Guidance for Water Quality Standards" for public sector projects. The referenced worksheets are found on EPA's Economic Guidance for Water Quality Standards Webpage. (Worksheet T and Worksheet U)

The Secondary Tests are designed to build upon the characterization of community identified in the Municipal Preliminary Screener. The Secondary Tests indicate the community's ability to obtain financing and describes the socioeconomic health of the community. Indicators describe debt, socioeconomic, and financial management conditions in the community. Using these indicators and the scoring system described below, the impact of the pollution control costs is estimated. Specifically, applicants are required to present the following indicators for the community:

Debt indicators

- Bond rating (if available) - a measure of credit worthiness of the community; and
- Overall net debt as a percent of full market value of taxable property - a measure of debt burden on residents within the community.

Socioeconomic indicators

- Unemployment rate - a measure of the general economic health of the community; and
- Median household income - a measure of the wealth of the community.

Financial management indicators

- Property tax revenue as a percent of full market value of taxable property - a measure of the funding capacity available to support debt based on the wealth of the community; and
- Property tax collection rate - a measure of how well the local government is administered.
- Reference tables provided at the end of this document list potential data sources for Secondary Test indicators and example data sources for Secondary Tests for two different communities.

Worksheet T can be used to estimate each of the indicators. The table below summarizes the indicators and what is considered to be a strong, mid-range, or weak rating.

Table 5: Secondary test indicators

Secondary Indicators	Weak	Mid-Range	Strong
Bond Rating	Below BBB (S&P) Below BAA (Moody's)	BBB (S&P) BAA (Moody's)	Above BBB (S&P) or Baa (Moody's)
Overall Net Debt as Percent of Full Market Value of Taxable Property	Above 5%	2%-5%	Below 2%
Unemployment	More than 1% above National Average	National Average	More than 1% below National Average
Median Household Income	More than 10% below State Median	State Median	More than 10% above State Median
Property Tax Revenues as a Percent of Full Market Value of Taxable Property	Above 4%	2%-4%	Below 2%
Property Tax Collection Rate	< 94%	94% - 98%	> 98%

The secondary score is calculated for the community by weighting each indicator equally and assigning a value of 1 to each indicator judged to be weak, a 2 to each indicator judged to be mid-range, and a 3 to each strong indicator. A cumulative assessment score is arrived at by summing the individual scores and dividing by the number of factors used. Worksheet U guides the applicant through this calculation. The cumulative assessment score is evaluated as follows:

- Less than 1.5 is considered weak
- Between 1.5 and 2.5 is considered mid-range
- Greater than 2.5 is considered strong

If the applicant is not able to develop one or more of the six indicators, he or she must provide an explanation as to why the indicator is not appropriate or not available. Since the point of the analysis is to measure the overall burden to the community, the debt and socioeconomic indicators are assumed to be better measures of burden than the financial management indicators. Consequently, if one of the debt or socioeconomic indicators is not available, the applicant should average the remaining financial management indicators and use this averaged value as a single indicator with the remaining indicators. This averaging is necessary so that undue weight is not given to the financial management indicators.

Municipal facilities step 4C. Assess whether the costs of implementing an alternative would be substantial

The results of the Primary and Secondary Tests are considered jointly in determining whether the community is expected to incur substantial impacts that would interfere with economic development. As shown in the table below, the cumulative assessment score for the community is combined with the estimated household burden. The combination of factors establishes whether impacts can be expected to be substantial.

Table 6: Assessment of substantial impacts matrix

Secondary Score	**Municipal Preliminary Screener**		
	Less than 1.0%	**Between 1.0 and 2.0%**	**Greater than 2.0%**
Less than 1.5	?	X	X
Between 1.5 and 2.5	†	?	X
Greater than 2.5	†	†	?

In the matrix, “X” indicates that the impact is likely to interfere with economic development. The closer the community is to the upper right hand corner of the matrix, the greater the likelihood. Similarly, “†” indicates that the impact is not likely to interfere with development. The closer to the lower left hand corner of the matrix, the smaller the likelihood. Finally, the “?” indicates that the impact is unclear and the applicant will need to justify why the alternative is not prudent or feasible.

Industrial facilities step 5. Complete financial impact analysis

Evaluating whether or not a private entity can pay for additional treatment to avoid degradation of water resources requires review of primary and secondary measures of the financial impacts that would result from that treatment. To assess the financial burden resulting from actions taken to reduce degradation of high water quality on a private entity, the costs of implementing the alternatives identified in Step 3 should be annualized (Worksheet G), and a financial impact analysis should be completed to assess the extent to which existing or planned activities and/or employment will be reduced as a result of the solution being evaluated. This analysis should include a primary measure of how the facility’s profitability would be affected, as well as evaluating impacts of liquidity, solvency, and leverage as secondary measures.

Using the annualized cost of the pollution control measures, ratios are calculated both with and without the additional compliance costs (taking into consideration the entity’s ability, if any, to increase its prices to cover part or all of the costs). Comparing these ratios to each other and to industry benchmarks provides a measure of the impact on the entity. This guidance provides a cursory review of the financial tests discussed in EPA’s “Interim Economic Guidance for Water Quality Standards,” which can be referenced for a more detailed discussion of each of the factors, as well as additional resources that can be used in completing the full financial impact analysis.

For all of the tests, it is important to look beyond the individual test results and evaluate the total situation of the entity. While each test addresses a single aspect of financial health, the results of the four tests should be considered jointly to obtain an overall picture of the economic health. The ratios and tests should be calculated for several years of operations, and account for the impact of any expansions on the inputs for the analysis.

The Profit Test measures what will happen to the discharger's earnings if additional pollution control is implemented. If the discharger is making a profit now but would lose money with the pollution control, then the possibility of a total shutdown or the closing of a production line must be considered. Greatly reduced profits are also of concern. In the case of a proposed facility or proposed expansion if estimated profits would drop considerably with pollution control, then the development might not take place.

Two pieces of information are needed for the Profit Test. The first piece is the total annual cost of the required pollution control from Worksheet G. The second piece is the earnings information from the entity's income statement (Worksheet H).

$$Profit\ Test = \frac{Earnings\ Before\ Taxes}{Revenues}$$

The Profit Test should be calculated with and without the cost of pollution control. In the former case, the annualized cost of pollution control (including O&M) is subtracted from the discharger's earnings before taxes (revenues minus costs excluding income taxes) for the most recently completed fiscal year.

The Profit Test can be calculated using Worksheets H, and I. Earnings before taxes (EBT) should be calculated for at least the three previous fiscal years in order to identify any trends or atypical years. Earnings with pollution control costs should be calculated for the latest year with complete financial information.

Although complicated, the analysis should consider whether the discharger or firm would be able to raise its prices in order to cover some or all of the pollution control costs.

To evaluate the secondary factor of liquidity, the Current Ratio should be calculated for each of the last three full fiscal years for which there are data. Comparing ratios for three years will identify any trends that are developing and will ensure that the most recent year is not an unusual year that might distort the results of the analysis.

The Current Ratio is calculated by dividing current assets by current liabilities.

$$Current\ Ratio = \frac{Current\ Assetts}{Current\ Liabilities}$$

The Current Ratio can be calculated using Worksheet J. The general rule is that if the Current Ratio is greater than 2, the entity should be able to cover its short-term obligations. While a Current Ratio of greater than 2 indicates that the entity can probably cover its short-term obligations, the impact of a major capital investment such as the pollution control project must be judged in conjunction with the other three financial tests.

The next secondary factor to be considered is solvency. As with liquidity, there are several possible tests for solvency. One commonly used solvency test (called Times Interest Earned) compares income before interest and taxes to interest expenses. Another solvency test, the Beaver's Ratio, compares cash flow to total debt. This test has been shown to be a good indicator of the likelihood of bankruptcy.

$$Beaver's\ Ratio = \frac{Cash\ Flow}{Total\ Debt}$$

The Beaver's Ratio can be calculated using Worksheet K. Cash Flow is a measure of the cash the entity has available to it in a given year. Since depreciation is an accounting cost -- a cost that does not use any currently available revenues -- it is added back to reported net income after taxes to get cash flow. Total debt is equal to the current debt for the current year plus the long term debt, since current debt includes that part of long-term debt that is due in the current year.

If the Beaver's Ratio is greater than 0.20 the discharger is considered to be solvent (i.e., can pay its long-term debts). If the ratio is less than 0.15 the discharger may be insolvent (i.e., go bankrupt). If the ratio is between 0.15 and 0.20, then future solvency is uncertain.

The final secondary test factor is leverage. Leverage tests measure the extent to which a firm already has fixed financial obligations and thus indicates how much more money a firm is capable of borrowing. Most leverage tests compare equity to some measure of debt or fixed assets. The Debt to Equity Ratio is the most commonly used method of measuring leverage. Unlike the ratios discussed above, the debt to equity ratio cannot be easily calculated for a single facility; it must be calculated for the firm, since it is usually the firm, not the facility, that borrows money. The ratio measures how much the firm has borrowed (debt) relative to the amount of capital which is owned by its stockholders (equity). The ratio also should be calculated with at least three years of data.

The Debt to Equity Ratio is equal to Long-Term Liabilities (long-term debt such as bonds, debentures, and bank debt, and all other noncurrent liabilities like deferred income taxes) divided by Owners' Equity. Owner's Equity is the difference between total assets and total liabilities, including contributed or paid in capital and retained earnings. For publicly held firms, use Net Stockholders Equity (which is the equivalent of Total Stockholder Equity minus any Treasury Stock).

$$Debt\ to\ Equity\ Ratio = \frac{Long\ Term\ Liabilities}{Owners\ Equity}$$

The Debt to Equity Ratio can be calculated using Worksheet L. Since there are no generally accepted Debt/Equity Ratio values that apply to all types of economic activity, the ratio should be compared with the ratio of firms in similar businesses. If the entity's ratio compares favorably with the median or upper quartile ratio for similar businesses, it should be able to borrow additional funds.

For entities with special sources of funding, leverage is not an appropriate measure of their ability to raise capital. Examples are agriculture and affordable housing, where special loan programs may be available. In these cases, an analysis of the probability that the project would receive this money is appropriate.

Example of municipal WWTP

The scenario below illustrates an alternatives analysis for a small publically-owned municipal WWTP. Using EPA's interim economic guidance worksheets, the analysis identifies the least degrading prudent and feasible alternative. The MPCA recognizes that the following scenario is very simple, but the intent is to provide clear illustration of the processes involved and relative outcomes. Through this example, the MPCA is not in any way suggesting that one pollution control method is superior to another. The costs identified in the scenario are for illustrative purposes only and are not necessarily meant to reflect actual costs for a given alternative.

Background

The town has a population of 250 households. This is currently an unsewered town where existing wastewater treatment includes individual subsurface sewage treatment systems (ISTS), cesspools, septic tanks connected to drain tiles that discharge to drainage ditches and straight pipes to drainage ditches. Some of the ISTS are conforming; however, many are failing and the cesspools and discharge lines are not in conformance with Minnesota rules. The town is proposing to upgrade their system and examine the different options available for treatment and disposal.

The town is located seven miles from a larger city with a regional WWTP which has capacity to accept the additional flows. Antidegradation procedures have already been conducted for the regional WWTP based on its design capacity. If the regional WWTP were to accept additional loading that would exceed its design capacity, it will need to undergo antidegradation procedures. If the regional WWTP is unable to accept additional loading, a small nearby Class 2B stream is a likely candidate to receive treated wastewater.

The town is a bedroom community for the larger, nearby city. The larger city is financially well off and has a strong commercial and industrial base. Many people who work in the larger city are moving to the small town to live but continue to work in the larger city. The median household income, estimated at $42,000, was obtained from the most recent census data. The CPI is used to inflate this to the current year. The annual average CPI in 2000 was 172.2 while the current CPI value is 236.3. Thus the current inflation-adjusted median household income for this town is: $\$42{,}000 \times \frac{236.3}{172.2} = \$57{,}634$. (Note: adjusting the median household income from the census year when it was determined to the current inflation-adjusted value can be done within the spreadsheets provided by the EPA.)

The applicant consulted with the MPCA early in the planning process and the MPCA identified standard secondary treatment parameters (5-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), phosphorus (P) and fecal coliform) as the parameters of concern. The MPCA also directed the applicant to MPCA's Environmental Quality Information System (EQuIS) database which provides flow and parameter concentration data within the nearby Class 2 stream. The stream, which is of high quality for the parameters of concern, experiences low flows during the summer months. Depending on the alternatives considered, nitrate (NO_3) contamination may also be a concern because of the high water table.

Step 1. Identify alternatives that avoid net increases in loading and minimize degradation

The applicant has identified the following six reasonable alternatives:

Alternative 1 – City-wide collection and connection to a regional WWTP ("Regionalization").

This option includes a centralized collection system with service connections to all properties and a force main to a regional WWTP with treatment capacity to accept the additional flows.

Alternative 2 – Individual subsurface sewage treatment systems ("ISTS").

This option includes ISTS for each domestic location and specially sized facilities for any commercial/ industrial facilities in town. All ISTS use septic tanks, soil-based treatment and subsurface soil discharge. Since there is no surface water discharge, degradation of surface waters is not anticipated. Impacts to groundwater are considered when a subsurface discharge is proposed and adequate nitrate levels at the property boundary need to be achieved.

Alternative 3 – Town-wide collection and centralized large subsurface sewage treatment system ("LSTS")

This option includes a centralized collection system with service connections to all properties and a centralized soil-based treatment and subsurface soil discharge. Like Alternative 2, there is no surface water discharge and no resulting surface water impacts. The same assumptions made in Alternative 2 regarding impacts to groundwater apply to this option.

Alternative 4 – Town-wide collection and a mechanical WWTP ("Mechanical WWTP")

This option includes a centralized collection system with service connections to all properties, a force main from the town to the WWTP site and a mechanical WWTP. This also includes a continuous surface water discharge. Secondary treatment limits and a phosphorus limit would likely be included in the permit for this WWTP.

Alternative 5 – Town-wide collection and a stabilization pond with spray application ("Pond/spray")

This option includes a centralized collection system with service connections to all properties, a force main from the town to the pond site and a 2 or 3-cell stabilization pond/spray system. Instead of a surface water discharge, this option includes a spray application system for effluent disposal. Nitrate contamination of groundwater will also need to be evaluated.

Alternative 6 –Town-wide collection and a controlled discharge stabilization pond ("Pond")

This option includes a centralized collection system with service connections to all properties, a force main from the Town to the pond site and a 2 or 3-cell stabilization pond system. This also includes a controlled surface water discharge. Secondary treatment limits and a phosphorus limit would likely be included in the permit for this WWTP. Phosphorus removal could be accomplished through chemical application to the pond system by using a pontoon boat or through chemical addition using a control structure between the primary pond(s) and the secondary pond.

Step 2. Eliminate from consideration alternatives that:

- Are not consistent with sound engineering practices;
- Are not consistent with sound environmental practices;
- Are not legal;
- Do not have supportive governance.

Alternatives 2 and 3 (ISTS and LSTS) are not viable because after a review of groundwater elevation data, it was determined that in much of the area groundwater is too high to provide the proper separation between the groundwater and the ISTS or LSTS trench. Also, it was determined that most town lots are too small to allow placement of a drain field and achieve proper setback from wells. Options 1, 4, 5 and 6 are the remaining reasonable alternatives. Area requirements needed for the placement of a pond and spray irrigation system or a mechanical plant can reasonably be met. Nitrate contamination of groundwater from spray irrigation (Alternative 5) is not a concern in this case because the large area in which spraying would occur, attenuation in the soil, and plant uptake mitigates the impacts.

Step 3. Eliminate from consideration alternatives that are not cost-effective

Table 7: Present worth of each remaining alternatives

Alternative (Treatment Option)	Present Worth*
Alternative 1 – Regionalization	$4.5 million
Alternative 4 – Mechanical WWTP	$3.1 million
Alternative 5 – Pond/spray	$3.2 million
Alternative 6 – Pond system	$3.0 million

*Present worth calculated assuming 2% interest rate over a 20-year term.

Step 4. From the remaining alternatives, identify the one that results in the least degradation yet will not cause substantial economic impacts

Step 4A. Rank cost-effective alternatives from least to most degrading

The applicant considered the factors described on pages 18 and 19 and has ranked the remaining alternatives from least to most degrading.

Table 8: Alternatives scale

Alternative	Least degrading rank
Alternative 5 – Pond/spray	1
Alternative 6 – Pond system	2
Alternative 4 – Mechanical WWTP	3

Alternative 5 is the least degrading because it completely eliminates the discharge to the stream. Between Alternatives 4 and 6, the factor which had the greatest influence on ranking was the seasonal difference in the stream flow. Controlled discharge pond systems release effluent during periods of high flow (i.e., the wettest 180 consecutive days) allowing for greater dilution which in turn results in lower concentrations of pollutants in the stream. The mechanical WWTP would discharge year-round, including summer months when there is the least dilution. In this situation, the summer flow is low enough where the concentration of at least one parameter of concern in the stream would approach exceedance of water quality standards. For this reason, Alternative 6 (Pond system) was considered less degrading than Alternative 4 (Mechanical WWTP).

Step 4B. Select least degrading alternative that would not result in substantial economic impacts

Starting with the least degrading alternative (Alternative 5) the applicant determines whether the pollution control costs are substantial using Worksheet D. If they are, the applicant conducts the analysis for the next highest ranked alternative (Alternative 6) and so on until an alternative is found for which the economic impacts are not substantial.

Step 4C. Conduct Primary Test – calculate and evaluate the municipal preliminary screener value

The table below shows total annualized cost, annualized cost per household and the percent of median household income of the remaining alternatives. The total annualized costs were calculated using the financing interest rate over the term of the loan. For example, Alternative 4 entails capital costs (which include construction costs for both the collection system and WWTP) of $2,388,200. The project is able to get financing of these capital costs at an interest rate of 2.0% over a 20 year term. Using this rate and term, the total capital cost is converted into an annualized cost based on a financing interest rate and term, which is then added to the estimated annual operations and maintenance cost for the project of $64,260 to get a total annualized cost of $189,283. Using Worksheet Q, annualized cost per household equates to $1,052. The final column in the table shows the per-household annual pollution control costs as a percentage of median household income for the community. Again using Alternative 4 as an example, the annualized cost per household of $1,052 is divided by the community's inflation-adjusted median household income of $57,634 and then multiplied by 100 for a Preliminary Municipal Screener value of 1.8%. Similar calculations are done for each of the other treatment options.

Table 9: Example of alternatives' calculations

Least degrading rank	Alternative (Treatment Option)	Total Annualized Cost	Annualized Cost per Household	Preliminary Municipal Screener Value
1	Alternative 5 – Pond/spray	$198,786	$1,211	2.1%
2	Alternative 6 – Pond system	$186,391	$1,118	1.9%
3	Alternative 4 - Mechanical WWTP	$189,283	$1,052	1.8%

Step 4D. Conduct secondary tests – debt, socioeconomic and financial Indicators

Worksheets T and U can be used to estimate secondary indicators, which as described above include six different indicators of debt, socioeconomic, and financial management conditions. The table below lists the Secondary Test inputs for this particular community.

Table 10: Secondary test inputs

Data	Source	Value
Direct Net Debt ($)	Community Financial Statements Town, County or State Assessor's Office	$1,000,000
Overlapping Debt ($)	Community Financial Statements Town, County or State Assessor's Office	$0
Market Value of Taxable Property ($)	Community Financial Statements Town, County or State Assessor's Office	$12,000,000
Bond Rating (for uninsured bonds)	Standard and Poor's or Moody's	Baa
Community Unemployment Rate (%)	Census of Population Regional Data Centers	5.3%
National Unemployment Rate (%)	Bureau of Labor Statistics	7.2%
Community Median Household Income (not adjusted for inflation)	Census of Population	$42,000
State Median Household Income (for same time period as Community MHI) ($)	Census of Population	$58,906
Property Tax Collection Rate (%)	Community Financial Statements Town, County or State Assessor's Office	88.0%
Property Tax Revenues ($)	Community Financial Statements Town, County or State Assessor's Office	$80,000

All of the above data is entered into Worksheet T and then Worksheet U is used to calculate the secondary score.

The table below shows how this community scores for all of the Secondary Test indicators.

Table 11: Scores for Secondary Test indicators

Indicator	Secondary Indicators			Score
	Weak [a]	Mid-Range [b]	Strong [c]	
Bond Rating **Worksheet T**	Below BBB (S&P) Below Baa (Moody's)	BBB (S&P) Baa (Moody's)	Above BBB (S&P) Above Baa (Moody's)	2
Overall Net Debt as Percent of Full Market Value of Taxable Property **Worksheet T**	Above 5%	2% - 5%	Below 2%	1
Unemployment **Worksheet T**	Above National Average	National Average	Below National Average	3
Median Household Income **Worksheet T**	Below State Median	State Median	Above State Median	1
Property Tax Revenues as a Percent of Full Market Value of Taxable Property **Worksheet T**	Above 4%	2% - 4%	Below 2%	3
Property Tax Collection Rate **Worksheet T**	< 94%	94% - 98%	> 98%	1
	a. Weak is a score of 1 point		**SUM**	**11**
	b. Mid-Range is a score of 2 points			
	c. Strong is a score of 3 points		**AVERAGE**	**1.8**

For each secondary indicator, a score of 1 indicates Weak performance for this indicator (Overall Net Debt as a Percent of Full Market Value of Taxable Property, Median Household Income and Property Tax Collection Rate in this example); a score of 2 indicates Mid-Range performance (Bond Rating in this example); and a score of 3 indicates Strong performance (Unemployment and Property Tax Revenues as a Percent of Full Market Value of Taxable Property in this example). Summing the scores for all six indicators yields a total score of 11, and an average score of 1.8. Note that the Secondary Test scores are just dependent on the characteristics of the community and are independent of the treatment alternative being considered. Also note that if the data was not available to calculate all six indicators, then the average of all the indicators that could be calculated would be considered.

Step 4E. Assess whether the costs of implementing an alternative would be substantial (Public projects)

The results of both the Primary and Secondary Tests are considered jointly in determining whether the community is expected to incur substantial impacts that would interfere with development. The Substantial Impacts Matrix is used to assess the combination of the cumulative assessment score (Secondary Tests) with the estimated household burden (Municipal Preliminary Screener) to ascertain whether the economic impacts of each feasible pollution control alternative would be expected to be substantial. The three alternatives scored according to the Substantial Impacts Matrix, are as follows:

Table 12: Three alternatives scored in relation to the matrix

	Municipal Preliminary Screener		
Secondary Score	**Less than 1.0%**	**Between 1.0 and 2.0%**	**Greater than 2.0%**
Less than 1.5			
Between 1.5 and 2.5		Pond system, Mechanical WWTP	Pond/Spray
Greater than 2.5			

Recall, from the initial explanation of the Substantial Impacts Matrix, the cell in the table where Pond/Spray falls entail impacts that are likely to be substantial. Therefore this alternative is eliminated from consideration. The only remaining alternatives are the Pond system and Mechanical WWTP options, in spite of the fact that both fall within a cell where economic impacts are unclear. In this case, the least degrading prudent and feasible alternative is the Pond system. This is because while the Municipal Preliminary Screener indicated that the community can afford to pay for either the Pond system or the Mechanical WWTP, the Pond system is less degrading.

Industrial Facilities

All remaining alternatives after completing Step 2 should be evaluated for cost-effectiveness according to EPA's "Interim Economic Guidance for Water Quality Standards." To complete this analysis, total costs for the remaining alternatives should be determined, and expressed as an annual cost. Once annual costs have been derived for each alternative, starting with the lowest annual cost, evaluate each alternative to determine whether widespread economic impacts would result from implementing the alternative according to the factors discussed in the EPA guidance. If an alternative indicates widespread impacts would result, eliminate that alternative and all remaining options with a higher annual cost.

Rank all remaining alternatives that will not result in widespread impacts according to the amount of degradation to existing water quality, and select the alternative that results in the least degradation.

Appendix A: Non-public data and antidegradation

The majority of the MPCA's information is classified as public data. The Minnesota Government Data Practices Act (MGDPA) found in Chapter 13 of Minnesota Statutes classifies all governmental data as public unless a specific federal law, state statute or temporary classification classifies the data as not public. There are also other Minnesota statutes besides the MGDPA that classify certain types of data as not public. Many state agencies have data classification provisions contained in the authorities that are specific to their agencies. For example, Minn. Stat. § 116 deals with the MPCA and Minn. Stat. § 116.075 specifically classifies some MPCA data as not public. Data practices-related regulations can also be found in Minn. R. 1205.

There are some types of data within the MPCA that are classified as not public. One type is "trade secret information". "Trade secret information" is defined as a formula, pattern, compilation, program, device, method, technique or process that is supplied by an individual or organization that is the subject of efforts that are reasonable under the circumstances to maintain its secrecy and that derives independent economic value, actual or potential, from not being generally known. Information submitted by an industrial source may be exempt from public disclosure if identified and qualified as "trade secret information."

Process for submitting not public data

If a permit holder would like any of the data contained in a permit application or variance request form designated not public, the applicant will need to submit a letter to the MPCA Commissioner stating the specific sections, subsections, passages, tables, table cells etc. that it would like to have classified as not public data. The letter should cite the federal law, Minnesota statute or temporary classification which enables the request (e.g., Minn. Stat. § 13.37, subd. 1b or Minn. Stat. § 116.075, subd. 2). The letter should also state the justification(s) for this not public data classification. (This procedure is described in Minn. R. 7000.1300, subp. 1.)

If an applicant has concerns about sensitive information contained in future submittals (such as final reports), the MPCA would suggest that these submittals be accompanied with a not public data classification request letter (as per the above-described procedure) which lists the specific information for which a not public data classification is being sought.

To make this process easier, the MPCA suggests that the not public data contained within a submittal be segregated from the public data contained within it so that these data can be easily removed from the report if the MPCA determines that they are classified as not public (e.g., placed within an appendix). If the not public data appears throughout the submittal and cannot easily be segregated within the document, it may be helpful to provide a not public version of the submittal (which will be maintained as not public data at the MPCA if it is determined that the data in question are classified as not public) as well as a redacted version of the submittal that has the not public data contained within it removed.