Implementing the Aquatic Life Narrative Standard

1. Policy: Implementing the Aquatic Life Narrative Standard

A. Background

During the development of revisions to the Class 3 and Class 4 water quality standards, Tribal partners and stakeholders expressed serious concerns about the protection of aquatic life. Many felt that the numeric values in the existing Class 3 and, especially, Class 4A water quality standards were providing some degree of protection to aquatic life, particularly from the impacts of ionic pollutants such as bicarbonates, total dissolved salts, specific conductance, and sulfate. However, commenters also noted that the values in the existing Class 3 and 4 water quality standards are not sufficient to protect aquatic life.

The choice of values in a water quality standard is inextricably linked to the beneficial use that the standard is designed to protect. The values in the existing Class 3 and Class 4 water quality standards were designed to protect the Class 3 and Class 4 beneficial uses – industrial consumption and agriculture. The values in the existing Class 2 water quality standards were designed to protect aquatic life beneficial uses. Values cannot simply be moved between use classes. The MPCA agrees that additional water quality standards are needed to fully protect Class 2 aquatic life beneficial uses from the impacts of certain pollutants – particularly ionic or salty parameters. There is active research around the appropriate magnitude or level of those Class 2 standards, specifically around chloride and sulfate, that MPCA anticipates being the foundation for a future Class 2 rulemaking. Because this present rulemaking is to revise Class 3 and Class 4 standards to protect industrial consumption and agriculture beneficial uses, the consideration of aquatic life beneficial use protection is not relevant.

While not relevant to the current Class 3 and Class 4 rulemaking, it may be helpful to share information on steps the MPCA is taking related to Class 2 aquatic life and ionic pollutants. This document lays out an interim approach to protecting aquatic life from the adverse impacts of ionic pollutants, until numeric standards for those pollutants are developed and incorporated through future rulemaking into Minnesota's Class 2 water quality standards.

B. Narrative Standard to Protect Aquatic Life

This interim approach is grounded in Minnesota's Class 2 narrative water quality standard to protect aquatic life. The main expression of the narrative standard is in Minn. R. 7050.0150, Subp. 3. This states that "For all class 2 waters…the normal aquatic biota and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of aquatic biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters."

In addition, Minn. R. 7050.0222 contains narrative statements that the quality of each surface water with a Class 2 designation should be "such as to permit the propagation and maintenance of a health community of…aquatic biota and their habitats[,]" as appropriate to the Class 2 subclass (Class 2A cold water, Class 2B warm or cool water, Class 2D wetlands).

While a narrative standard provides a clear statement of the conditions that should be present in waterbodies, it does not provide numeric values that must be met to ensure those conditions. It therefore is less easily used to craft permit conditions, and an additional step is needed in order to implement narrative standards in discharge permits.

C. Implementing Narrative Standards

The additional step(s) needed to implement a narrative standard in a facility permit include the concept of a "translator." A "translator" is a process or method to regulate a permitted point source discharger to ensure compliance with a narrative standard. The EPA offers guidance on the use of translators and they are used by many states. A translator often results in a numeric effluent limit for a specific pollutant which, if met, ensures that the narrative standard is met in the waterbody. Although a translator can be developed as part of the design of a narrative standard, it can also be developed as part of separate implementation procedures.1 Minnesota's Class 2 narrative standard to protect aquatic life has been in place for some time, but has not had separate implementation procedures.

Stakeholders and Tribal partners have asked the MPCA to develop a mechanism to implement the Class 2 narrative standard in 7050.0150 in permits – namely by figuring out a way to "translate" the narrative standard into numeric effluent limits that can be applied to permitted facilities that discharge to Minnesota's waters. Key pollutants of concern that stakeholders have raised for potential development of translators are "salty" or ionic parameters (such as specific conductance and sulfate) and nitrate.

The MPCA agrees that clearer implementation procedures for the Class 2 narrative aquatic life standard are warranted. This document lays out those procedures, which may ultimately result in one or more of a wide range of permit conditions – ranging from monitoring requirements to effluent limits based on water quality conditions and goals. Although this document is specific to protecting aquatic life from salty parameters, a general process could be extrapolated to any pollutant likely to have an impact on aquatic life, depending on the available data and information. If numeric standards for protecting aquatic life are adopted through rulemaking, the translator process would no longer be needed for those pollutants.

There are some exceptions to the permitting framework described below. Waterbodies that are currently identified as impaired for chloride, are known to have naturally high background levels of chloride, or are determined to have chloride as the primary stressor will not be subject to this narrative translator, as aquatic life standards for chloride already exist.

[1] More information can be found in EPA's Water Quality Standards handbook, chapter 3.

2. Permitting Framework for Protecting Aquatic Life from Salty Parameters

The remainder of this document lays out a framework for implementing the Class 2 aquatic life narrative standard. The process is designed to identify the Class 2 waterbodies that are potentially impacted by ionic or salty parameters; and then support a case-specific determination of permit conditions necessary to ensure that the Class 2 aquatic life narrative standard is maintained.

A. Determining Waterbodies Impacted by Specific Conductance

The first step in the process is to determine those waterbodies most likely to have aquatic biology that is adversely impacted by salty pollutants, as indicated by specific conductance. Specific conductance was chosen as the surrogate indicator for multiple individual ionic pollutants.

Developing Metrics to Evaluate Impacts

First, specific conductance is a known stressor to aquatic life. Although the impact of a specific individual ion may be more important to certain aspects of the biological community, the generalized impact of specific conductance to the biological community and aquatic ecosystem health is well documented (Cañedo-Argüelles, et. al. 2013, Dunlop, et. al. 2008, Nielsen, et. al., 2003) . Second, while it would be ideal to have indicators reflective of individual ions, or ion mixtures, these standards are not yet available, and even when available they may not be sensitive to all life stages of sensitive native taxa. Third, conductivity is well known to be correlated with anthropogenic stress, including urban development, agriculture, and mining activity. The ion mixture associated with each of these disturbance categories may differ, but, again, the generalized impact of conductivity is well documented. Finally, conductivity is one of the most commonly collected water quality parameters, and the MPCA has a very large dataset in which both biological data and specific conductance are collected concurrently. This large dataset has allowed for a robust approach to the development of tools to support this narrative translator, including calculation of regional benchmarks, as well as developing the relationship between aquatic life use support and conductivity.

The MPCA collects biological and water quality data throughout the state to determine if waterbodies are meeting aquatic life use goals. The primary biological indicators used in assessment of aquatic life are fish and macroinvertebrates. Macroinvertebrates are well known to be sensitive to many of the constituent ions that comprise specific conductance, and thus are the focus of this screening tool (Clements and Kotalik, 2015; Kefford, 1998; Hart et. al., 1990).

To determine if a waterbody is potentially adversely impacted by specific conductance, the MPCA proposes a weight of evidence approach that considers three metrics that represent different ways of looking at the relationship between specific conductance and biological response. All metrics were considered based on the last 10 years of information, in keeping with MPCA's assessment window.

- **MIBI** - The macroinvertebrate index of biotic integrity (MIBI) scores that are used in assessing aquatic life in rivers and streams. The MIBI was designed and calibrated to be an indicator of overall stress on the biological community, and is therefore our ultimate endpoint in determining if anthropogenic stressors are impacting aquatic life. It was not designed to respond to any one stressor, but it is capable of showing a response to a single stressor, if that stressor is the overwhelming influence impacting aquatic health. When attempting to understand if the aquatic life of a stream is being impacted by a suspected stressor, the first step is to look at the MIBI score.

- **Conditional Probability** - A conditional probability approach based on a relationship between specific conductance and attainment of the MIBI General Use criterion. The conditional probability model was developed to reflect the extent to which conductivity measurements may be in alignment with impairment of the biological community, and allow us to make an inference about the potential impact of specific conductance when biological data is not available.

- **Regional Benchmarks** - Regional benchmarks based on the Criterion Continuous Concentrations (CCC). - An approach comparing measures of specific conductance to draft "benchmark" values that were calculated using a field-based method for the determination of water quality criteria (Cormier and Suter, 2013; US EPA, 2011). The benchmark values were developed as ecotoxicological endpoints to reflect the response of taxa that are sensitive to specific conductance. These values represent the point at which 5% of sensitive taxa are no longer present. These benchmark values were calculated for the purpose of supporting waterbody screening using data collected by the MPCA biological monitoring program from 1996 through 2018.

Evaluating Waterbodies Based on Metrics

After developing these three metrics, the MPCA reviewed individual waterbodies (lakes and stream reaches) and analyzed their conditions relative to each of the three metrics. A summary of the evaluation is provided in Attachment 1.[2]

1) Attainment of aquatic life use based on macroinvertebrate index of biotic integrity (MIBI) scores.

The MPCA currently has biological indicator data collected from 6800 monitoring locations, representing 3390 waterbodies, or stream segments, throughout Minnesota. Each waterbody is assigned a reference number called the Waterbody Identification number, or WID; there may be multiple monitoring locations within a WID.

The MPCA regularly assesses waterbodies to determine whether they fully support the aquatic life beneficial use based on fish and macroinvertebrate indices of biotic integrity (MIBI) scores. Assessment of biological condition is done at the waterbody level, and is the result of a weight of evidence approach that considers all assemblage-specific information collected in the 10-year window associated with the assessment. The MPCA's detailed methods for assessment can be found in the *Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment: 305(b) Report and 303(d) List.*

When considering the potential for adverse impacts of specific conductance on aquatic life, aquatic life use support can be analyzed at both the waterbody level (WID), or reach level.

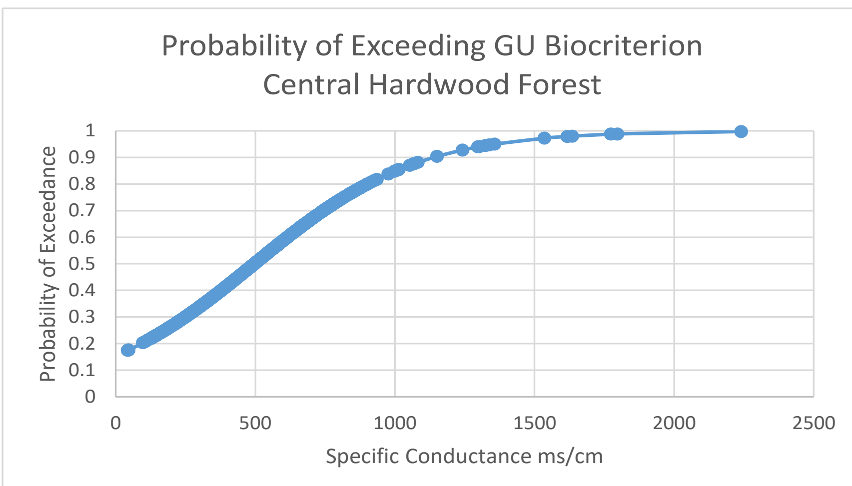
[2] This data is available in tabular format to allow for a straightforward interpretation of both summarized and site-specific data. It can be provided in more detail upon request.

Initial screening of aquatic life use should be done based on waterbody level assessment results. Reach level information can be analyzed if a more granular approach is needed to determine impacts of specific conductance on aquatic life.

2) **Conditional probability of meeting general aquatic life use (GU) goals based on measurements of specific conductance**.

Binary logistic regression was used to determine the probability of meeting the macroinvertebrate index of biotic integrity (MIBI) general use biocriterion based on measured values of specific conductance, for the purpose of determining potential biological impacts in areas where no biological data was present. Binary logistic regression is a modeling tool used to determine the probability of a binary event occurring (pass/fail) for a given predictive variable. In this case, that is the probability of meeting the biological standard, as demonstrated by the MIBI, based on the known specific conductance data. Conditional probability equations were derived based on datasets grouped at the level 3 ecoregion. Pass/fail outcomes were based on support/non-support of the relevant station-specific biocriterion; the predictive variable used was specific conductance. Coefficient values, constant values, and the equation used in the calculation of regional conditional probabilities are included below in Table 1.

Figure 1. Example conditional probability plot



Measures of specific conductance and associated conditional probabilities can be considered at both the waterbody and station levels. Aggregating specific conductance data at the waterbody level is done by taking the average values by month/year when multiple data points are present. Site specific and daily values are available for a more granular approach to understanding waterbody conditions. Similar to waterbody values, site-based specific conductance values are averaged values by month/year when multiple data points are present.

The logistic regression outputs for most ecoregions suggest that a more conservative (high) value be used to infer a likelihood of impairment for any given waterbody. For the purposes of this tool, any waterbody or station with a conditional probability value of 75% or higher should be flagged for further investigation of biological stress related to specific conductance.

Note on use of ecoregions. Ecoregions are biogeographic regions that reflect a recurring pattern of ecosystems associated with a characteristic combination of geology, soil, landform, vegetation, climate, land use, wildlife, and hydrology (Omernik 1987, 1995). Ecoregions are defined at four, hierarchical levels. Level 3 ecoregions are commonly used by the EPA and other states to define regions for the development of water quality criteria (EPA, 2019). Minnesota has seven level three ecoregions.

3) Attainment of regionally derived benchmarks for specific conductance.

Criterion continuous concentration (CCC) values are intended to be used as a surrogate for chronic (long-term) exposure criteria and are designed to be protective of 95% of the native genera for a region. CCCs were derived at the level 3 ecoregion level from a field-based relationship between specific conductance and macroinvertebrate data (U.S. EPA, 2011; Cormier and Suter, 2013; Cormier, Zheng, and Flaherty, 2018). Regional benchmarks based on updating these CCCs were calculated by the MPCA using a statewide dataset collected by its biological monitoring program from 1996-2018. CCCs are based on the derivation of two relationships, one at the genus level and one at the community level. The genus-based relationship identifies the extirpation concentration (XC_{95}) for specific conductance for each genus in the ecoregion. The XC_{95} is the specific conductance value associated with the 95th percentile of the distribution of occurrence of each genus. The community level relationship identifies the 5th percentile hazard concentration (HC_{05}), and is the value used for the CCC. The HC_{05} is based on the cumulative rank distribution of XC95 values for the region. It reflects the specific conductance value that is protective of 95% of native regional macroinvertebrate genera. The taxa that disappear first are those considered most sensitive to increases in specific conductance. For each ecoregion, sensitivity values were determined for each genera that occurred a minimum of 20 times. These values can be made available for a more refined analysis of community level data at the site specific level.

These CCCs serve as regional benchmarks used to interpret measures of specific conductance. These values are present in the summary table, and are listed in Table 1 below.

Table 1. Regional specific-conductance benchmarks, regional coefficient and constant values, and equation for calculation of conditional probabilities.

Minnesota Ecoregion	Regional Benchmark For Specific Conductance	Coefficient for conditional probability calculation	Constant for conditional probability calculation
46 – Northern Glaciated Plains	1333 µS/cm	0.001021	0.095666
47 - Western Cornbelt Plain	1117 µS/cm	0.001349	0.080323
48 – Lake Agassiz Plain	859 µS/cm	0.002758	-2.06005
49 – Northern Minnesota Wetlands	405 µS/cm	0.003147	-1.74711
50 – Northern Lakes and Forests	329 µS/cm	0.001938	-1.40971
51 – North Central Hardwood Forests	488 µS/cm	0.003426	-1.70203
52 – Driftless Area	628 µS/cm	0.003886	-2.71473

Conditional Probability Equation: CB = 1/(1+EXP(-(coefficient*SC)-constant)))

Using these three metrics allows the MPCA to determine those waterbodies that are potentially experiencing aquatic life impacts due to salty parameters.

The clearest demonstration of impacts is a failing MIBI score. Those waterbodies where the MIBI scores indicate that the aquatic life use is not fully supported can be further reviewed using estimates of conditional probability and regional benchmarks, to determine if conductivity is likely to be the reason for the concern. If the conditional probabilities suggest a high likelihood (i.e. > 75%) that the specific conductance levels would cause the waterbody to “fail” the general use biocriterion and/or the specific conductance is above the regional benchmark, then the waterbody should be further investigated at the station level to determine if specific conductance values are problematic throughout the waterbody.

If no MIBI score is available, then reviewing the conditional probability and specific conductance compared to the benchmark alone will provide an indication. Prior to reaching conclusions about the impacts of specific conductance, it should be determined if there is additional information available. For instance, a stressor identification report for the associated waterbody could provide a more detailed assessment of the specific stressors on the aquatic community, perhaps differentiating between specific conductance and other pollutants. Similarly, if a biological effluent review has been completed for any effluent present in the waterbody it may describe potential impacts related to an effluent, and may identify potential causes. More detail is provided in the next section as to how additional information may be used or gathered, if deemed necessary for the next steps.

Note on this evaluation and aquatic life use goals. When assessing streams for aquatic life, two different approaches are used in the determination of appropriate aquatic life use goals.

For streams in which biological and habitat data have been collected, each waterbody segment is given a use class based on the tiered aquatic life use (TALU) approach (MPCA, 2016). TALU criteria differ based on habitat, channel, and biological characteristics. This use class approach is only applied to the direct interpretation of biological data. When interpreting MIBI scores in the context of aquatic life use support, it is best to maintain the tiered use approach, as this is ultimately the manner in which aquatic life use support is determined. Therefore, for waterbodies in which biological data was available, review of biological condition was done using the weight of evidence-based assessment and associated tiered aquatic life use (TALU) criterion.

When assessing aquatic life use based on non-biological water quality parameters, there is typically only a single use applied, the general use (GU). The general use is the middle tier in the tiered use approach; prior to the implementation of the TALU approach the general use was the only use applied to biological data. When making translations between specific conductance and aquatic life use for the conditional probability model, it was determined that it would best to make the general use the benchmark for comparing biological data and specific conductance. Therefore, conditional probabilities were developed using the TALU general use criteria, which makes no provision for habitat or stream channel modifications, and is way to compare all stream segments similarly. The water quality benchmarks could be considered as a surrogate for water quality criteria, and as a means to compare regional water quality conditions to a level of pollution that is likely protective of aquatic life.

Note on non-invertebrate aquatic life.

This evaluation was constructed to evaluate benthic macroinvertebrates, as they are generally the most sensitive to salty pollutants. They are more sensitive than fish species. However, some commenters raised questions about the protection of aquatic plants, particularly wild rice. MPCA scientists have done some investigation of Minnesota wetland plant response to salinity stressors: conductivity, chloride, and sulfate. They note that “aquatic plants are sensitive to specific conductance, chloride and sulfate and their response should be considered in development of any aquatic life salinity related criteria or standards development". The MPCA therefore would consider the response of wetland plants to these pollutants as we proceed in future rulemakings to develop aquatic life based water quality standards.

Although the review notes that additional data and analysis regarding wetland plant responses are needed, the MPCA scientists did construct preliminary XC95 values for select wetland plant species related to conductivity both statewide and in three ecoregions. Extirpation response benchmark or XC95 (extirpation concentration at 95%) represents the concentration below which 95% of observations of specific species occur. This included estimates of XC95 values with conductivity for wild rice, statewide and in the mixed wood plains ecoregion. These respective XC95 values for wild rice were 407 µS/cm statewide and 398 µS/cm in the mixed wood plains ecoregion. These values are roughly similar to those constructed for macroinvertebrate response to conductivity. Therefore, the interim approach to protecting aquatic life should be sufficient for both macroinvertebrates and wetland plants.

Identifying Dischargers

If available indicators point to a potential problem with specific conductance for a waterbody, then a plan needs to be developed for approaching permitting for sources that discharge to those waters.

The next step is to identify dischargers and determine which dischargers are likely to be discharging levels of ionic pollutants that are contributing to high levels of specific conductance. If dischargers are unlikely to be contributing to high levels of specific conductance (demonstrated either through monitoring of their effluent or based on knowledge of the type of discharger), those dischargers may not need to be further evaluated.

Some dischargers in Minnesota do monitor for levels of ions in their effluent, and we have general knowledge of the types of industries and activities that are likely to have high ionic strength effluent. Based on data currently available, looking at:

- Facilities with elevated effluent salt concentrations; and
- Facilities with likely ions in their discharge and that have a continuous wastewater discharge to low dilution ratio stream.

The MPCA has developed an initial list (Attachment 2) of facilities that are discharging to waterbodies that are potentially impacted by specific conductance and that may have effluent characteristics that mean they are likely contributing to the levels of specific conductance. This list is based on current information, but should be considered as screening level information and analysis. Facility design flow rates, which are shown in the table, are usually much higher than actual flows from the facility. Some discharges may no longer be active. The MPCA will consider refined facility-specific information during the permitting process. In addition, other dischargers – or new facilities – that meet the requirements may also need to be considered in this process. It is particularly likely that facilities that do not currently monitor ions are not on the list of dischargers.

Permitting Process

In these cases, a permitting plan will be developed to, as needed, refine our understanding of the sources and impacts of specific conductance in the waterbody and determine what actions need to be taken to help improve conditions. We intend to focus on individual permit holders, not those with general permits. Once the MPCA has identified a facility with the potential to discharge salts that may negatively impact aquatic life, further evaluation and appropriate permit conditions will be considered during the process of the next permit issuance.

When a permit for one of the dischargers identified above is being revised (or if a new permit is being issued for a discharge including ions that impacts one of the identified water bodies), the MPCA's permitting process will consider the need to review and gather additional information. If information to complete the types of analyses listed in the "additional analysis and review" column is not available, a first step may be to establishing permit conditions to require collection of additional information. The MPCA may also establish permit conditions or a permit limit for specific conductance (or one or more of the pollutants that contribute to specific conductance) in order to protect aquatic life.

Potential actions that could be taken during permitting would depend on the condition of the waterbody and the characteristics of the permitted facility.

MPCA envisions a transparent process that includes engagement with the permittee, Tribes, and stakeholders or interested parties. That process will include a case-by-case evaluation, depending on the specific situation and the characteristics of the permitted facility. In some cases, limits required for other standards or other reasons may be deemed sufficient to protect aquatic life in the identified reaches where specific conductance may be a concern. In some cases, more data gathering and monitoring may be needed. Or, permit conditions that limit specific conductance (or a component thereof) may be needed to ensure aquatic life is protected.

The following table lays out some potential actions based on conditions.

Table 2. Potential Actions based on Waterbody and Effluent Conditions

<table>
<tr><th>Waterbody Conditions</th><th>Additional Analysis and Review</th><th>Effluent Conditions</th><th>Permit Options
(If Needed After Additional Analysis)</th></tr>
<tr><td rowspan="4">Clear Concern
• IBI score – failing/ impaired

• Conditional probability – high (> 75%); and
• Regional Benchmark – exceeded</td><td rowspan="4">• Biological assessment - Could the facility’s effluent be a potential cause or contributor to water or biological quality? What watershed and local conditions might be causing a less than optimal biological condition? Have stressor ID reports investigated listed impairments?
• Natural Background Review – How do downstream specific conductance/ions levels compare to background?
• What permit limits are being imposed (e.g. chloride limit; antidegradation limits or caps)? Will they limit ions in the discharge?</td><td>Known – High ions</td><td>• Permit limit based on regional benchmark
• Pollutant investigation and minimization plan
• Ongoing biological and/or chemical monitoring</td></tr>
<tr><td>Known – Low ions</td><td>• Ongoing biological and/or chemical monitoring</td></tr>
<tr><td>Unknown – Likely high ions</td><td>• Effluent monitoring
• Pollutant investigation and minimization plan
• Ongoing biological and/or chemical monitoring
• Discharge cap</td></tr>
<tr><td>Unknown – Likely low ions</td><td>• Effluent monitoring</td></tr>
<tr><td rowspan="2">Probable Concern
• IBI score – failing/ impaired

• Conditional probability – high (> 75%); or
• Regional Benchmark – exceeded</td><td rowspan="2">• Biological assessment - Could the facility’s effluent be a potential cause or contributor to water or biological quality? What watershed and local conditions might be causing a less than optimal biological condition? Have stressor ID reports investigated listed impairments?
• Natural Background Review – How do downstream specific conductance/ions levels compare to background?</td><td>Known – High ions</td><td>• Ongoing biological and/or chemical monitoring
• Pollutant investigation and minimization plan</td></tr>
<tr><td>Known – Low ions</td><td>• One-time biological and/or chemical monitoring</td></tr>
</table>

Waterbody Conditions	**Additional Analysis and Review**	**Effluent Conditions**	**Permit Options (If Needed After Additional Analysis)**
	• What permit limits are being imposed (e.g. chloride limit; antidegradation limits or caps)? Will they limit ions in the discharge?	Unknown – Likely high ions	• Effluent monitoring • Ongoing biological and/or chemical monitoring • Pollutant investigation and minimization plan
		Unknown – Likely low ions	• Effluent monitoring
Potential Concern • IBI score – not available • Conditional probability – high (> 75%); **and** • Regional Benchmark – exceeded	• Biological assessment - Could the facility's effluent be a potential cause or contributor to water or biological quality? What watershed and local conditions might be causing a less than optimal biological condition? Have stressor ID reports investigated listed impairments? • Natural Background Review – How do downstream specific conductance/ions levels compare to background? • What permit limits are being imposed (e.g. chloride limit; antidegradation limits or caps)? Will they limit ions in the discharge?	Known – High ions	• Ongoing biological and/or chemical monitoring
		Known – Low ions	• Likely none
		Unknown – Likely high ions	• Effluent monitoring • Ongoing biological and/or chemical monitoring
		Unknown – Likely low ions	• Likely none
Possible concern • IBI score – not available • Conditional probability – high (> 75%); **or** • Regional Benchmark – exceeded	• Biological assessment - Could the facility's effluent be a potential cause or contributor to water or biological quality? What watershed and local conditions might be causing a less than optimal biological condition? Have stressor ID reports investigated listed impairments? • Natural Background Review – How do downstream specific conductance/ions levels compare to background?	Known – High ions	• One-time Biological data gathering
		Known – Low ions	• Likely none

Waterbody Conditions	Additional Analysis and Review	Effluent Conditions	Permit Options (If Needed After Additional Analysis)
	• What permit limits are being imposed (e.g. chloride limit; antidegradation limits or caps)? Will they limit ions in the discharge?	Unknown – Likely high ions	• Effluent monitoring
		Unknown – Likely low ions	• Likely none

Additional Details

Additional Analysis and Review

- *Biological Assessment*. For facilities identified as potentially impacting aquatic life by a salty discharge, MPCA staff should conduct a biological effluent review as part of the permit process. Part of the focus should be on checking and confirming the conditions that led to the inclusion of the waterbody and facility on this list. The information provided in this document is based on a high- level screening of specific conductance. Additional site-specific information could be evaluated to make a more complete assessment of the biology and whether the narrative standard is being met.

  The MPCA's guidance to staff working on a biological effluent limit review is to consider some of the following - *Could any of the effluent discharge parameters be a potential cause or contributor to water or biological quality? How does the downstream station(s) compare with upstream or adjacent stations? What watershed and local conditions might be causing a less than optimal biological condition downstream of the facility? Is the watershed highly disturbed (e.g., landuse, channelization, feedlots)? Is the habitat in fair-poor condition and might be a limiting factor? Does the water chemistry indicate an issue? Also look for stressor ID reports that may have investigated listed impairments.*

  MPCA staff should work on evaluation of additional available information in order to improve understanding of the biological condition and likely stressors downstream of the facility, to demonstrate the need for a permit condition. If sufficient data is not available, collection of such data may be required as part of the permit.

- *Natural Background Review.* Some parts of Minnesota have naturally higher ions. Although the regionally-based specific conductance benchmarks used in the screening may account for, the situation should be considered to determine if the facility is the cause of impact.

- *Possible Impact of Other Permit Limits.* Facilities may be receiving permit limits based on other rules or processes. These limits should be evaluated to determine if they are sufficient to mitigate the facility's impact on aquatic life from specific conductance. Specific items to review include:

  - Evaluation of downstream water quality standards and development of needed effluent limits to protect those downstream waters.

    - Minnesota rules require protection of downstream waters, including waters of other states or tribes that have different water quality standards. If a limit is needed to protect a specific conductance or other salty parameter standard for a downstream state, that limit may be sufficient to mitigate any potential harm from specific conductance in a more local waterbody.

  - Antidegradation analysis and review, where applicable, and any resulting effluent limits.

    - A new or expanding source that is likely to result in a net increase in loading or other causes of degradation needs to conduct an antidegradation review and analysis. The analysis needs to ensure the maintenance of all existing uses. If a permit limit for a salty parameter is needed to ensure that existing uses are maintained, that limit may be sufficient to mitigate concerns about the impacts of specific conductance. Some facilities may accept a limit – often a mass cap limit - in order to avoid going through an antidegradation review. Again, such a limit might be sufficient.

- Evaluation of other needed limits, especially chloride. In many cases, facilities have high levels of multiple ions and actions needed to control one – such as chloride – will serve to reduce all of them.

Effluent Conditions

Some dischargers in Minnesota monitor for levels of ions in their effluent, and we have general knowledge of the types of industries and activities that are likely to have high ionic strength effluent. These include: mining, food processing, and similar industries. In reviewing facilities for potential permit conditions under this protocol, MPCA staff will consider the available information about the facility's discharge including 1) whether they have monitored elevated effluent salt concentrations; 2) whether they are likely to have such concentrations but are unmonitored; and 3) the likely impact based on the facility's discharge (continuous or not) and the size of the receiving water (low dilution ratio).

Permit Options (If Needed After Additional Analysis)

The additional analysis and review may demonstrate that one or more permit conditions are needed in order to ensure that the facility is not causing or contribution to conditions that violate the narrative biological standard. Potential permit conditions, which could be imposed individually or in conjunction, could include:

- Monitoring
    - If biological data is lacking in the waterbody of concern, or if existing data is more than 10 years old, then biological data may need to be collected in the location or locations that best represent the waterbody and help refine our understanding of potential local impacts, stressors, and enable calculation of an IBI. Data collection may also be required on some kind of ongoing basis to ensure conditions do not degrade.
        - Collection of biological data to date has been done almost solely by MPCA. MPCA would work with permittees to determine the most appropriate way to collect data – whether that be direct collection by MPCA, with the permittee providing any necessary access to the waterbody, or for MPCA to provide guidance and information to ensure that the permittee can collect the data.
    - There may also be a need to collect water chemistry data paired with the biological data, or as a standalone to verify previously collected MPCA data. Again, this may be one time or ongoing.
    - A facility may be required to monitor their effluent for specific conductance or a suite of salty parameters, to better determine their likely impact on the receiving water.
- Pollutant investigation and minimization
    - Facilities may be require to take actions to understand and minimize their pollution, without a specific numeric effluent limit. These actions would be similar to those the MPCA has recommended for facilities that have applied for a chloride variance. (See

https://www.pca.state.mn.us/sites/default/files/wq-wwprm2-71.pdf) Facilities would investigate the specific sources of ionic pollutants in their discharge, and develop a minimization plan.

- Numeric effluent limits
  - In cases where the evaluation shows that the facility may be causing or contributing to a biological impairment and the need is to prevent conditions from worsening, the effluent limit may be a cap on specific conductance or other ionic pollutant (either a specific individual ion or another appropriate related indicator, such as TDS), limiting pollution to current levels.
    - This may be based on best operation of any existing pollution control equipment – which could also be coupled with requirements to continue to work to minimize pollution.
  - In cases where the evaluation clearly shows that the facility is causing or contributing to a biological impairment, the permit conditions would include specific effluent limits, likely to be based on meeting a specific water quality value for a given pollutant, which may be based on existing benchmark or criteria values or established as a site-specific standard.

Lists of Waters and Dischargers

The following tables identify the waterbodies identified based on the four ranges of possible concern listed above, and the dischargers to each. These facilities will be reviewed during permitting as described in this document, but their presence on this list does not constitute a decision on a need for permit conditions to protect aquatic life from the impact of salty parameters.