NATURAL BACKGROUND AND WATER QUALITY

Guidance document for assessment of aquatic life use support

Minnesota Pollution Control Agency
August 2009

In June 2009 a work group consisting of MPCA staff from the Environmental Analysis and Outcomes Division and Regional Division were formed to develop a strategy to determine how natural background conditions may be considered in the assessment and TMDL listing process. As stated in the team charter (Appendix A) the objective of the work group was to *review the current assessment process for addressing natural background conditions/considerations and recommend an approach for the 2010 list. The approach should recognize the new intensive watershed monitoring design* (MPCA 2009).

At the outset the natural background working group identified a number of ways in which the current approach used to assess waters with natural background considerations has been problematic:

- Concern that waterbodies may be placed on the TMDL list in error without a clear process to consider natural background conditions.
- Lack of a clear review process that ensures technical rigor and documentation for waters that are thought to be impaired by natural background conditions.
- Lack of clear criteria to determine if an impairment is due solely to natural background conditions or not.
- Lack of a consistent approach for biological vs. chemical indicators when natural background conditions are thought to be a factor.
- Potential credibility issue with the public if we list sites with no apparent anthropogenic sources.
- Lack of transparency for the public regarding the basis for what is identified as solely impaired by natural background conditions.
- Questions about the policy implications for those waters identified as solely impaired by natural background conditions with no load allocations to take into account future sources.
- Concern about sampling locations that may not be representative of the full reach.

The problem:

Natural background conditions may confound waterbody assessments particularly when natural background exceeds the chemical water quality standard. In rivers and streams, natural differences in water quality characteristics are related to factors such as stream size, water temperature, habitat, and natural watershed characteristics that vary greatly across the state. The diversity of waterbody types in Minnesota also makes assessment against a single standard for some conventional pollutants challenging. Tailored assessment tools, guidance and standards are required that consider the relevant natural characteristics of each waterbody type. Those tools are in development but questions currently exist about how to evaluate natural background concerns until those tools are available.

There are currently many references to natural background in rules, statutes, effluent limits, impaired waters, and assessments. Minnesota law (Minn. Stat. ch. 115) recognizes that physical, chemical and biological conditions vary in nature and the water quality standards should reflect that fact.

> Minn. Stat. §115.44, subd. 1. *Variable factors. It is recognized that, due to variable factors, no single standard of quality and purity of the waters is appropriate to all waters of the state or to different segments of the same waters.*

In regards to waterbody assessments the Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment, 305(b) report and 303 (d) list, 2010 Assessment Cycle (MPCA, 2009) specifically considers natural background:

"the MPCA must consider many different types of data, different categories of pollutants, different uses of surface waters, the variability in natural systems, and many other variables".

TMDL studies must consider the load allocation from point sources, non-point sources, and natural background in calculation of acceptable load allowances for all impaired waters.

In spite of the references to natural background throughout MPCA guidance and state statute, challenges related to assessment and listing still persist. A process that provides further guidelines and criteria for natural background determinations during assessment is needed to provide consistency in the approach and transparency for decision makers and stakeholders.

Natural background definition:

Although language defining what is considered natural background varies somewhat between state agencies and the USEPA, the common thread among them is that nearly all definitions consider natural background to be the condition that occurs outside of human influence. Minnesota rules 7050.0150, subp. 4 defines the term *"Natural causes" as the multiplicity of factors that determine the physical, chemical, or biological conditions that would exist in a waterbody in the absence of measurable impacts from human activity or influence.* Similarly Ohio EPA [OAC Chapter 3745-1-02] defines *Natural conditions"* as *those conditions that are measured outside the influence of human activities*, and finally USEPA (USEPA 2008) defines natural background level as "*chemical, physical, and biological levels representing conditions that would result from natural processes, such as weathering and dissolution*". The implications of the definition of natural background are clear as it relates to the assessment and listing process. Anthropogenic sources of stress are clearly not a component of natural background as it has been defined. Therefore, a reasonable effort must be made to demonstrate an absence of human impacts before an impaired waterbody can be identified as not needing a TMDL.

Current natural background assessment and listing process:

Currently all credible chemical data are compiled and assessed on a biennial basis to determine if waterbodies are meeting designated uses (figure 1). A pre-assessment dataset is created based on minimum data requirements defined in the MPCA assessment and listing guidance document (MPCA, 2009). The chemical data are combined with the biological information which has been analyzed via a separate process by staff within the Biological Monitoring Units. During the biological pre-assessment the biological data are filtered to exclude data from sites where the habitat, chemistry, and biology indicate a limiting natural condition (e.g. dissolved oxygen, natural barriers, ephemeral streams). All pre-assessment data are then sent to the regional offices for review by staff familiar with the resource and the data collection details.

Once the regional review is completed, a final assessment is conducted by a professional judgment group (PJG) responsible for making the final determination of the data's adequacy and appropriateness for use in waterbody assessments, and assigning each waterbody into a Consolidated Assessment and Listing Methodology (CALM) category (Table 1). The comprehensive list of all the current impaired assessment unit/pollutant combinations (i.e. the Impaired Waters Inventory) is comprised of waterbodies assigned to categories 4 and 5. Waterbodies assigned to category 5 require a TMDL plan whereas waterbodies assigned to category 4 do not require a TMDL due to factors listed in Table 1. Once a final category assignment has been made by the PJG a draft TMDL list is completed for public review and comment before submittal to the USEPA for approval.

Table 1. Minnesota consolidated assessment and listing methodology (CALM) categories and subcategories

Category/ Subcategory	**Category/Subcategory Description**
1	All designated uses are met and no use threatened.
2	Some uses are met; none are threatened and insufficient data to assess other uses.
3A	No data or information to determine if any designated use is attained.
3B	Data are available for a review and generally indicate non-support, but insufficient data and information to determine TMDL impairment. (Example: single lake data point showing non-support)
3C	Data available that currently has no assessment tools to allow its use in assessing. (Example: data with only eco-region expectation standards)
3D	Data are available for a review and generally indicate full support, but insufficient data and information to assess for category 1 or 2.
3E	Data are available for a review, but insufficient data and information to determine full support or TMDL impairment. (Example: lake data just below the threshold showing non-support)
4A*	Impaired or threatened but all needed TMDLs have been completed.
4B*	Impaired or threatened but doesn't require a TMDL because it is expected to attain standards in the near future.
4C*	Impaired or threatened but doesn't require a TMDL because impairment not caused by a pollutant.
4D*	Impaired or threatened but does not require a TMDL because impairment is solely a result of natural sources.
5A	Impaired or threatened by multiple pollutants and no TMDL plans approved.
5B	Impaired or threatened by multiple pollutants and either some TMDL plans approved but not all or at least one impairment is the result of natural conditions.
5C	Impaired or threatened by one pollutant.

* Assessment units falling into category 4 are impaired waters, but are not part of the 303(d) list because of the reasons given above in the category descriptions. EPA has identified subcategories 4A, 4B, and 4C for classifying a segment, where *available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed*. Minnesota has chosen to further subdivide Category 4C into subcategories 4C and 4D to differentiate between cases of impairment due to non-pollutants (4C) and natural background (4D). All category 4 waters appear with the category 5 waters on an impaired waters inventory, which is a comprehensive list of all the current impaired assessment unit/pollutant combinations.

De-listing committee responsibilities:

In a parallel process a delisting committee identifies waters that should be removed from the TMDL list. The primary reason for the committee's recommendation for a waterbody's removal from the list is where new or additional data and information indicate the water is no longer impaired and is meeting standards. Natural background conditions may also result in removal of a waterbody from the TMDL list. A request for delisting candidates is made prior to the PJG meetings. Individuals requesting the delisting must provide credible data to make their case that the waterbody should be removed from the list. The delisting committee conducts an independent assessment taking into consideration all new data that have been provided. A final assessment is made and the list is then modified to reflect the decisions of the delisting committee.

One of the drawbacks of the current process is that it does not include an approach for natural background review until after the assessment and TMDL listing process. As a result, waterbodies with no anthropogenic sources of stress may be listed in CALM category 5 on the TMDL list requiring a TMDL. However, it is likely that a mention to this effect would be made during the PJG meeting and a notation would be made within the comments field of the transparency documentation. On the present TMDL list this situation is most likely a rare occurrence because past monitoring activities have tended to focus where problems are known to exist. However, the move towards a comprehensive condition monitoring strategy (i.e. the intensive watershed monitoring design) includes gathering assessment-level information from Minnesota's more remote watersheds. Therefore, it is anticipated that future assessments will include samples from watersheds with very little anthropogenic impacts. An approach is needed to review new impairments for natural background conditions so the waterbody can be appropriately categorized as needing or not needing a TMDL study.

Proposed guidance for determining naturally low levels of dissolved oxygen in streams:

The work group focused on dissolved oxygen because 1) consideration of all potential parameters simultaneously would be too complicated, 2) dissolved oxygen is a commonly collected parameter used to assess aquatic life use support, 3) Low dissolved oxygen as a natural phenomenon likely prevalent throughout much of Minnesota's low gradient, headwater streams with significant wetland influences, and 4) the general process developed for dissolved oxygen once developed , could likely be applied to other conventional parameters.

The work group developed a framework and decision criteria to determine the status of the 25 assessment units (AUID's) that were identified as having potential natural background issues affecting the 2010 TMDL list (Appendix B). The 25 AUID's were identified by reviewing the comments section of the PJG meeting notes. All 25 AUID's had potential natural background issues related to low dissolved oxygen. The strategy for considering natural background focused on three main components:

1) Establishment of a natural background review team.
2) Development of a GIS based project to identify conditions where natural background conditions are likely to occur and identification of potential anthropogenic sources of stress.
3) A recommended list of indicators that should be considered when sufficient information to make the determination does not currently exist.

The Natural Background Review Team:

The natural background review team will consist of the lead watershed biologist from the North or South Biological Monitoring Units, a regional division representative familiar with the watershed, and a member of the PJG. The objectives of the natural background review team are to:

- Determine if natural factors are the sole source of a low DO impairment using a GIS based tool and other available assessment information where the GIS tools are inconclusive.
- Determine an appropriate monitoring strategy where natural background is strongly suspected to be the sole cause of the impairment but where a decision cannot be made using the GIS based tool and available monitoring data.
- If necessary, identify AUID boundaries for waterbodies that have natural characteristics indicative of low DO environments (i.e. low gradient systems significant wetland influence) with the GIS based tool and available data.
- Participate in PJG workgroup meetings for natural background determinations.

GIS project to identify natural background conditions and anthropogenic sources of disturbance:

The TMDL guidance document for dissolved oxygen (MPCA, 2008) has identified a number of likely sources of natural and anthropogenic stress including: NPDES sources from industrial wastewater, domestic wastewater, feedlots, stormwater, reservoirs, dams, and water withdrawal, non-point sources from small feedlots, row cropping, pastured lands, forestry, physical changes from agricultural drainage, land use, and cultural eutrophication such as high nutrient levels or practices that lead to enhanced decomposition (eg. peat mining). Using these factors as a guide, members of the natural background work group developed a GIS project (Natural Background.mxd in X: Agency files/water/303d/natural background) to evaluate the extent to which each of these factors may contribute to the dissolved oxygen impairment. The existing GIS spatial data layers allow for a comprehensive desktop evaluation of each potential stressor including natural factors such as the prevalence of wetlands within the AUID and stream sinuosity. In addition to the GIS information, the natural background review team may also consider using data from other sources such as STORET, the biological monitoring database, and EDA.

Members of the natural background review team will use the natural background project and other available data to assess the potential for natural and anthropogenic factors to contribute to a low dissolved oxygen reading. The process is at its core a stressor ID process (USEPA, 2000), in which the review team is seeking to eliminate all candidate sources that are of an anthropogenic origin. Reasonable decisions based on weight of evidence and a formal process are the most effective and efficient way of handling these complex questions. In effect, it is the review teams job to determine if it is reasonable to assume that human disturbance in the watershed is (or has) influenced the waterbody in question such that the condition of the resource (as measured by our indicators) no longer represents the natural background condition.

The complete absence of any human disturbance in a watershed is not required to reasonably conclude that the waterbody in question is being influenced solely by natural background conditions. Rather the review team must be able to reasonably conclude that the anthropogenic influences present in the upstream watershed do not

contribute to a low dissolved oxygen condition and that natural factors present at the site and the upstream watershed exist and are likely to account for all of the low dissolved oxygen condition.

An evaluation form (Appendix C) has been created to be used in the evaluation of potential natural and anthropogenic stressors. Members of the natural background review team must review the potential of each stressor to contribute to the impairment by completing the form. One form must be completed for each site within an AUID. (note: It may be very obvious upon an initial scan of stressors within the watershed that anthropogenic sources of stress are numerous and very likely to contribute to an impairment. The natural background workgroup is recommending that in these situations follow up monitoring will be conducted as part of the TMDL evaluation; therefore, an additional effort by the natural background review team is not necessary and the waterbody would be assigned to category 5 (i.e. a TMDL would be required). After completion of all site evaluations members of the group should make a final CALM category recommendation for the AUID and document their reasoning in the recommendation section of the final form. For sites affecting the 2010 list the review team must select category 4D if it is determined that anthropogenic sources do not contribute to the impairment and category 5 if it is determined that anthropogenic sources are a potential factor.

The workgroup recommends that a new CALM category (4E) be created for AUIDs where the evidence strongly suggests that natural background conditions are the sole factor in the impairment but where a limited amount of additional information would be helpful to make the determination. The suggested description for CALM category 4E is "*Impaired or threatened but existing data strongly suggests that a TMDL is not required because impairment is solely a result of natural sources; a final determination of Category 4D will be made in the next assessment cycle pending confirmation from additional information (i.e. water quality or land use)*". For AUID's placed into CALM category 4E a recommendation for future monitoring should be made on the natural background evaluation form (Appendix C) along with a recommended completion date for the follow up monitoring to occur.

Note: Special consideration for AUID's where channelization is the only anthropogenic source of stress within the watershed. In the early 1900's attempts were made to drain many wetlands throughout northern Minnesota. While many of these attempts to drain the land (apparently for agricultural usage) were unsuccessful, these channels remain relatively intact. The natural background workgroup recommends that AUID's with these unique characteristics are placed in category 4C recognizing that the impairment is not caused by a pollutant and a TMDL is not the appropriate tool for resolving this issue.

Indicators used to determine natural background conditions related to dissolved oxygen:

A determination that low DO conditions in a stream are due solely to natural factors requires the identification of known natural factors in the stream watershed, along with the confident conclusion that there exist no human factors that also contribute to the condition. GIS data documenting regulated human activities along with aerial photo and topographic maps make a highly efficient tool for determining the location of anthropogenic stressors and natural features that can influence dissolved oxygen. The evaluation of stressor potential is based on the proximity of the stressor within the watershed, the degree of disturbance relative to the size of the waterbody. In addition, the following questions will be considered:

- Does the source contain or emit any of the critical parameters?
- Are there one or more pathways?

- Is the key parameter persistent enough to impact the reach?
- Does the source discharge the key parameters in the same time period that the impairment occurs?

The GIS review itself may build a strong case for or against the determination of solely natural background. Certainly the discovery of a measurable anthropogenic source in the area influencing the stream will complete the work and allow for a decision. Where questions remain, the following additional indicators might be available to provide more information.

Riparian wetland quality assessment: An assessment of the quality of a riparian or upstream wetland is valuable to recognize anthropogenic influences if degraded, or support natural conditions if in good condition. In most cases if the wetland is of reference quality and upstream water quality parameters for nutrients and dissolved oxygen meet or exceed standards the low DO will be assumed to be due to natural factors.

Biological assessments: Fish and invertebrate populations respond to low DO conditions in predictable ways. For example fish communities often have a characteristic fauna typified by low species richness and an absence of species intolerant to low dissolved oxygen conditions (e.g. darters, redhorse). The agency does not yet have the tools for evaluating fish and invertebrate populations in streams with naturally low dissolved oxygen but expects that these tools will be developed by January 2010. Once the biological indicators are developed we recommend incorporating them into this guidance

Nutrient assessment: An assessment of upstream lake quality (where lakes are present upstream of candidate stream reaches), if sufficient data exist, will be valuable to recognize anthropogenic influences if degraded, or support natural conditions, if healthy. Secchi disc data along with TP and/or chlorophyll data will be used to assess whether or not nutrients exceed natural background. Note that tools like Lake Finder display available data with summary statistics, which will minimize staff time needed to explore upstream conditions. Nutrient numeric standards will allow conclusions about nutrient enrichment in lakes and rivers. The natural background review team may also consider ecoregion criteria based on minimally impacted waters. Documentation of visual observations (e.g. photos of excess periphyton, >30% of bed substrate rule of thumb) will be considered ancillary evidence of nutrient enrichment.

Continuous DO measurements: These data sets during low flow in the warmest months of the year will provide the daily minimum condition, and the dimension of diurnal flux, which can be a great stressor in itself. Disturbed stream systems are more likely to exhibit higher diurnal flux. DO flux in undisturbed naturally low DO systems is typically 2-4mg/l in a 24 hour period. (See more in Appendix D). Monitoring for the purpose of this review should consist of at least two separate events of one week of continuous monitoring during July or August, assuming the week will be warm and sunny, with base flow or low flow conditions and no precipitation in the preceding several days. If these conditions are not met, a second week even in another year would be helpful. TP and chlorophyll grab samples in conjunction with start and end of deployment will add information.

DO grab samples: The value of individual dissolved oxygen readings will probably be limited by the rarity of collecting data longitudinally in a stream early in the day during low flow in the warmest months. However, if available, comparisons of conditions upstream and downstream of natural features influencing DO, primarily wetlands, might demonstrate that they are the sole factors.

In addition to the GIS review, each of these information sources can be explored, as needed and available, to rule out anthropogenic influences, or to identify them. A weight of evidence approach will be used to make the

determination of natural background as the sole source of the impairment. When the review recognizes key missing information that can be addressed with new monitoring, the recommendation should provide specific requirements, identify monitoring resources to accomplish the work, and describe how it will support a decision.

Incorporation of the natural background review into the waterbody assessment and IWM strategy:

As directed in the charter, the group proposed a strategy for integrating the natural background review into a waterbody assessment process that is focused on the MPCA intensive watershed monitoring (IWM) design (figure 2). It was necessary for the natural background workgroup to make some assumptions about how the new assessment process would be conducted because the assessment redesign efforts had not yet taken place when the natural background review process was being developed. The two primary assumptions made by the natural background workgroup were that waterbody assessments occur on an annual cycle along with the IWM cycle and that the PJG meetings occur after the conclusion of the stressor ID (phase II) monitoring.

The proposed strategy outlined below is one way in which the natural background review may be integrated into the assessment process. However, before a decision can be made about how to best factor in a natural background review the Agency needs to consider the topic within the broader context of the assessment redesign. Staff members involved in assessment redesign efforts should take the natural background workgroup's recommendations into account along with all of the other factors that will likely enter into the groups decisions.

The steps below outline the general process for natural background determinations for dissolved oxygen within the context of the IWM schedule. The process would very likely be similar for other parameters that may have a natural background component (e.g. turbidity):

1. Following the IWM monitoring schedule, biological, chemical, and physical data are collected within each major watershed (i.e. 8 digit HUC). The information is stored in the MPCA biological database and STORET.
2. A natural background review database is created incorporating all assessment level data and including all locational information for each sampled site.
3. The natural background review team meets after the initial IWM monitoring but prior to the stressor ID monitoring activities to review the data and determine where violations of the water quality standards exist. In addition to a review of all dissolved oxygen violations the team should consider where the biological data indicate a potential low dissolved oxygen environment. The team is responsible for reviewing all assessment level data that are available for a particular major watershed including all STORET data (i.e. data collected through the IWM and data outside of the IWM).Using general rules identified in the EPA stressor guidance the natural background team determines the significance of anthropogenic and/or natural stressors on dissolved oxygen levels. This step to assess the anthropogenic and natural sources of low DO conditions in the watershed is conducted using a GIS project that is currently located at X:agency files/water/303dlist/natural background folder/natural background.mxd and all other available data. A natural background evaluation form (appendix C) has been created to help the reviewers walk through the evaluation process. Possible outcomes of the evaluation are as follows:

- If after the GIS and available data review, it can be reasonably determined that natural background is the sole source of the impairment the waterbody will be placed in CALM category 4D, designating the waterbody as impaired for low dissolved oxygen based on natural conditions.
- Waters where anthropogenic impacts are apparent through a GIS or available data review will be placed in CALM category 5 requiring a TMDL study.
- If a determination of natural background cannot be made using the GIS tool and through a review of available monitoring information the team will recommend a monitoring strategy that will be acceptable for making the determination of natural background and defining the AUID boundaries associated with the natural background condition .

4. Natural background team members work with the stressor ID monitoring team to incorporate the teams recommendations into the stressor ID monitoring plan.
5. Following stressor monitoring the natural background review database is updated with the new data.
6. The natural background team meets again to review the new data and make a final recommendation including a suggestion of where existing AUID boundaries might be changed to account for the low gradient, wetland dominated environments. All natural background review information is placed in the natural background review database.
7. Natural background review is combined with biological and chemical data into the pre-assessment database. As with all preassessments, the assignments will be considered temporary until after the PJG meetings.
8. Natural background review team participates in PJG meetings to provide information relevant to natural background when considering the final impairment decision.

Tiered aquatic life uses (TALU) and water body classification:

The MPCA is developing a biologically based stream classification framework that is expected to form the basis for a more refined set of aquatic life use categories and accompanying biological and chemical standards known as Tiered Aquatic Life Uses (TALU). The process of classifying water by their natural gradients is a fundamental first step in the development of a Tiered Aquatic Life Use (TALU) based monitoring and assessment program (USEPA, 2005). Minnesota's current stream classification system for aquatic life use and dissolved oxygen standards is based on the assumption that all rivers and streams, with the exception of classes 2A and 7, function similarly with respect to dissolved oxygen (the default classification is class 2B). However, MPCA monitoring data strongly suggests that some stream types are biologically, physically, and chemically different. For example, low gradient, wetland influenced rivers and streams in Minnesota tend to have unique biological assemblages and chemical expectations including a lower DO expectation than the current DO standard for class 2B waters would allow. In a TALU system, these low gradient streams would have their own set of biological and chemical standards. Impairment decisions would be only be made after the correct classification and designated use is assigned. Until a TALU based program is developed and implemented in Minnesota the natural background guidance will allow for the consideration of the unique characteristics of low gradient-wetland dominated systems when making a determination of a streams use-support status.

References

MPCA. December, 2008. Dissolved Oxygen TMDL Protocols and Submittal Requirments. August 28th 2009. http://www.pca.state.mn.us/publications/wq-iw1-09.pdf

MPCA. 2009. Guidance Manual for Assessing the Quality of Minnesota Surface Waters for the Determination of Impairment, 305(b) report and 303 (d) list, 2010 Assessment Cycle

MPCA. June 3, 2009. Water Quality Condition Monitoring-Watershed Sampling Design: Intensive Watershed Monitoring. August 28th, 2009. http://www.pca.state.mn.us/water/monitoring/monitoring-watersheds.html

USEPA, December, 2000. Stressor Identification Guidance Document. Office of Water, Washington DC. EPA/822/B-00/025

USEPA. August, 2005. (draft) Use of Biological Information to Better Define Designated Aquatic Life Uses in State and Tribal Water Quality Standards: Tiered Aquatic Life Uses. Office of Water, Washington DC. EPA-822-R-05-001

USEPA. October 15, 2008. Impaired Waters and Total Maximum Daily Loads, Glossary. August 28th, 2009. http://www.epa.gov/owow/tmdl/glossary.html

Appendix A. Natural background team charter

Assessment of Natural Background Team
Team Charter

DRAFT: 5/4/09 (revised 6/10/09)

Team Name	**Assessment of Natural Background Team**
Purpose/ Mission	Review the current assessment process for addressing natural background conditions/considerations and recommend an approach for the 2010 list. The approach should recognize the new intensive watershed monitoring design.
Membership	❖ Sponsors: Shannon Lotthammer, Marvin Hora ❖ Members: Mark Tomasek, Scott Niemela, Doug Hansen, Howard Markus, Louise Hotka, Dave Christopherson, Bruce Henningsgaard ❖ Team to designate a team leader.
Accountabilities / Expectations	❖ Team members are accountable to the team sponsors. ❖ Team members will consult with other division/agency staff as the approach is developed. ❖ Team members will review and document existing process and procedures. ❖ Team members will develop and recommend those processes and procedures necessary to address natural background in the assessment & listing process, considering the new intensive watershed monitoring design. The design will be an iterative process; the team will outline the initial approach. The approach will be modified for assessments beyond 2010 by this group or its successor as experience is gained in natural background.
Authority	❖ Recommendations will be made for review and approval by the Water Managers Team/Water Quality Forum

Outcomes and Results	❖ Recommend an approach for evaluating natural background conditions for the 2010 listing cycle; note that the approach must not jeopardize our ability to submit the draft list to EPA on time (and therefore may address some of the questions, and defer others to future listing cycles). ❖ Identify further considerations/questions that will need to be addressed for future cycles. ❖ In recommending an approach for addressing natural background, consider the following: 1. How the quantity and quality of assessment data may affect our ability to make a listing decision when natural background may be a factor 1) Quantity and quality of data from sites monitored via the MPCA's intensive watershed monitoring approach 2) Quantity and quality of data from sites outside of the PCA intensive watershed effort 2. What CALM categories are appropriate 3. What are the implications on use attainability analyses and site specific standards efforts 4. What are potential point-source regulatory implications ❖ A recommendation must be developed by the end of July, and review of AUIDs completed by September.
Customer Focus	❖ The primary customers for the listing process are the staff participating in the assessment and listing process. Those customers of the results of the process (including an interest in the transparency and rigor of the process) are MPCA monitoring, TMDL, watershed management and permitting staff; sister agencies; EPA; the regulated and environmental advocacy communities and local government. ❖
Team Processes and Procedures	❖ The team will meet as needed to complete the work in the required time frame; sub-teams can be identified as needed to accomplish the work. ❖ Normally decisions are made on an informed consent model (everyone will live with and support the decision). If agreement cannot be reached the team will ask for input and, if necessary, a decision from the sponsors.

Appendix B. CALM category assignments and monitoring recommendations for 25 AUID's with potential natural background conditions

AUID	8 DIGIT HUC	Impairment	IWM Schedule	Watershed Name	CALM category	Comments
07010101-501	07010101	DO	2013	Mississippi River (Headwaters)	5	
07010101-504	07010101	DO	2013	Mississippi River (Headwaters)	4D and 5	Split, 4D upper reach, 5 lower reach
07010103-524	07010103	DO	2016	Mississippi River (Grand Rapids)	4E	Additional monitoring required to evaluate influence of unsewered community
07010104-502	07010104	DO	2012	Mississippi River (Brainerd)	5	
07010202-545	07010202	DO	2008	Sauk River	5	
07010202-575	07010202	DO	2008	Sauk River	5	
07010203-511	07010203	DO	2009	Mississippi River (St. Cloud)	5	
07010206-565	07010206	DO	2010	Mississippi River	5	
07010207-541	07010207	DO	2012	Rum River	NA	Stream methodology not appropriate, small connector between two lakes
07010207-544	07010207	DO	2012	Rum River	5	
07010207-546	07010207	DO	2012	Rum River	5	
07010207-547	07010207	DO	2012	Rum River	4E	Additiional monitoring required within upstream wetland
07010207-554	07010207	DO	2012	Rum River	5	
07010207-558	07010207	DO	2012	Rum River	5	
07030004-547	07030004	DO	2006	Snake River	5	
07030005-521	07030005	DO	2009	St. Croix River (Stillwater)	5	
07030005-522	07030005	DO	2009	St. Croix River (Stillwater)	5	
07030005-587	07030005	DO	2009	St. Croix River (Stillwater)	5	
09020102-517	09020102	DO	2014	Mustinka River	5	
09020303-508	09020303	DO	2015	Red Lake River	5	
09020305-509	09020305	DO	2017	Clearwater River	5	Follow up with feedlot issue
09020309-502	09020309	DO	2011	Snake River	5	
09020309-506	09020309	DO	2011	Snake River	5	
09020312-504	09020312	DO	2011	Two Rivers	5	
09020312-508	09020312	DO	2011	Two Rivers	5	

Appendix C. Natural Background Evaluation form for determination of potential DO stressors

GIS project Natural Background.mxd is located in X: Agency files/water/303d/natural background.

One evaluation form is required for each sample location within an AUID. The evaluation of stressor potential is based primarily on the proximity of the stressor within the watershed and the degree of disturbance relative to the size of the waterbody. All stressors identified have the potential to contribute to a dissolved oxygen impairment through one or more pathways.

In the evaluation of all stressors consider the following evaluation criteria (USEPA, 2008):

- Does the source contain or emit any of the critical parameters?
- Are there one or more pathways?
- Is the key parameter persistent enough to impact the reach?
- Does the source discharge the key parameters in the same time period that the impairment occurs?

The determination of natural condition will be based upon a weight of evidence approach utilizing the stressors and criteria defined below:

The natural background evaluation process is most efficient when following a predefined series of steps. The following steps have been used successfully in previous natural background reviews:

1. Determine and view watershed boundaries
2. Display land use layer
3. Turn on aerial photos and view watershed and sampling sites for any existing wetlands
4. Identify any existing biological sites
5. review assessment information and data
6. identify and rate natural and anthropogenic stressors

Review date		Reach Description
Assessment Unit ID		
Station ID#s		
Review team members		

Stressor	**Present in watershed (yes/no)**	**Stressor contribution potential (high, moderate, low, none*)**	**Comments (see below for possible factors to consider in evaluating each stressor)**
Natural Factors			
Upstream wetlands (within 3 miles)			
Riparian wetlands at site			
Sinuosity and presence of cutoff channels and oxbows			
Muck or fine organic substrate (if available through habitat evaluation)			
Gradient/presence of riffles (if available through habitat assessment)			

Do not proceed if natural factors indicate sampling location is not a low gradient, wetland influenced habitat. Location is not a candidate for delisting due to natural background

Anthropogenic sources			
Overall land use disturbance			
Industrial or Municipal Wastewater facilities			
Feedlots (permitted)			
Feedlots (unpermitted)			
Reservoirs and Dams (manmade)			
Water withdrawal permits			
Stormwater			
Stormwater unpermitted			
Forest harvest sites			
Row crop agriculture			
Pasture and hay land			
Channelization			
Stressor contribution potential should be ranked “none” if the stressor does not meet one or more of the 4 evaluation criteria listed above, “low” if all evaluation criteria are met but stressors are deemed to be insignificant, “moderate” if all evaluation criteria are met and stressors are more than likely to cause an impact, “high” if all evaluation criteria are met and there is a strong potential for a measurable effect on the site.			

Natural background review team recommendation (specific to the AUID). Include CALM designation and AUID delineation or follow-up monitoring recommendation. Combine and attach all natural background evaluation forms used to evaluate an AUID.

Factors to consider in evaluating the potential contribution from each stressor:

Industrial or Municipal Wastewater Facilities

- Location/proximity of discharge to stream site (within DO sag zone)
- Type of wastewater (noncontact cooling water, POTW, industrial discharge)
- Discharge pollutant levels vs receiving water pollutant levels
- Discharge volume vs receiving water volume
- Discharge type (seasonal, daily, land application)
- P impacts on algae growth/death cycle

Feedlots (permitted)

- Location/proximity to stream site and riparian zone
- Verify accuracy of GIS points using aerial photos
- Permit compliance (no discharge)
- Fish kill history
- Manure application areas & relation to stream & riparian zone, size~~,~~
- Cattle in stream~~,~~
- Manure application on tiled fields

Stormwater (permitted)

- Location/proximity to stream site and riparian zone
- Discharge volume vs receiving water volume
- Type of stormwater (likely stressors include fertilizer/nutrients, BOD/TSS levels, temperature, animal waste)
- What stormwater controls are in place

Reservoirs and Dam (manmade)

- Location/proximity to stream site and riparian zone
- Nutrient status of the reservoir
- Type of release (surface vs. hypolimnetic)
- Water level manipulation, eutrophic ambient conditions

Water withdrawal

- Location/proximity to stream site and riparian zone
- Volume vs receiving water volume
- Number of withdrawals in watershed
- Type of withdrawal (surface or ground water, irrigation, drinking water, etc)
- Irrigation systems, DNR ability to turn off/limit volume during drought
- Potential for unpermitted systems

Feedlots/pasture (unpermitted)

- Location/proximity to stream site and riparian zone
- Fish kill history

- Manure application areas & relation to stream & riparian zone, cattle in stream, manure application on tiled fields

Forestry/row crop/pasture and hay lands

- Location/proximity to stream site and riparian zone
- Percentage of watershed in row crop
- Type of terrain (hilly, soil type, etc)

Physical alterations to the stream or riparian zone

- Is the riparian zone intact at the site and throughout watershed
- Are dams and reservoirs present within the watershed
- Are channelized streams present within the watershed
- Channelization through wetland (channelized stream functions as wetland)
- Likelihood of Ag tile drainage within system

Natural Factors

- Presence of site specific or upstream riparian wetland habitat
- Connections exist between depressional wetlands and stream system
- Highly sinuous channel indicative of low gradient conditions (old channels evident in riparian wetlands)
- From photographs-lack of riffles and coarse substrates

Appendix D. Taken from Heiskary, S., R.W. Bouchard, Jr., and H. Markus, 2009 (August 13th, 2009 draft) Minnesota Nutrient Criteria Development for Rivers. 134pp.

Table 1. Diurnal monitoring sites for 2000, 2006 and 2008 studies. Summary of dissolved oxygen (DO), pH, temperature, and specific conductivity based on sonde deployment.

River/site		**DO**	mg/L		**pH**	SU		**Temp.**		C	**Cond.**	umhos	
2000	Diurnal dates	Min DO	Max DO	Mean Flux	Min pH	Max pH	Mean flux	Min.	Max.	Med.	Min.	Max.	Med.
CWR-70	8/1 - 8/22	5.8	10.5	4.3	8.0	8.8		18	24	20	290	302	298
CWR-35	8/16 - 8/22	6.5	9.5	2.5				17	23	20	374	394	389
UM-1056	8/10 - 8/15	6.2	7.5	0.5	8.1	8.3		22	25	24	285	295	290
UM-872	8/10 - 8/15	4.5	10.0	3.5	8.3	8.8		26	29	27	380	400	389
RU-34	8/8 - 8/14	6.3	12.0	4.2	8.1	8.6		22	26	25	297	338	323
RU-18	8/9 - 8/14	6.0	12.8	4.1	8.4	9.3		22	27	25	260	360	332
CR-23	8/9 - 8/14	5.5	13.0	5.1	8.1	8.8		23	28	26	590	680	651
CR-03	8/9 - 8/14	5.5	13.5	6.1	8.4	8.8		23	28	26	510	620	575
BE-73	8/3 - 8/7	6.5	16.0	6.7	8.0	8.5		22	25	23	530	630	590
BE-54	8/3 - 8/7	6.5	15.0	6.3	7.9	8.5		22	25	24	555	630	588
RE-536	8/15 - 8/22	7.0	9.0	1.4	8.2	8.4		19	26	22	400	650	547
RE-452	8/15 - 8/22	6.5	7.7	0.5	8.2	8.3		21	26	22	500	580	548
2006													
BF-46	7/26 - 8/9	6.1	10.4	2.4	8.2	8.8	0.2	21	29	24	264	297	277
LF-21	7/26 - 8/9	6.4	9.1	0.9	8.0	8.3	0.2	21	28	24	310	342	320
RL-1	7/25 - 8/8	5.1	8.2	1.1	7.9	8.4	0.2	23	27	25	284	297	289
RL-75	7/25 - 8/8	5.0	10.0	1.8	7.7	8.2	0.2	21	28	24	284	294	288
WI-3	7/25 - 8/8	6.3	9.1	1.6	8.3	8.5	0.1	22	32	26	546	612	590
WR-200	7/25 - 8/8	5.1	9.8	2.7	8.1	8.4	0.2	20	32	25	491	573	559
Buff-10	7/26 - 8/7	4.9	11.4	4.4	7.7	8.3	0.3	17	28	22	402	689	626
Buff-01	7/26 - 8/8	5.3	10.2	3.0	8.3	8.7	0.2	22	29	26	528	666	615
OT-1	7/26 - 8/7	6.2	10.9	2.5	8.3	8.8	0.2	23	32	27	408	467	428
UM-872	7/26 - 8/10	5.8	18.2	6.8	8.3	9.1	0.3	25	32	28	173	468	394
RUM-18	7/26 - 8/10	5.5	12.9	4.3	8.2	9.4	0.4	23	31	26	260	371	332
CR-23	7/27 - 8/9	4.0	16.4	6.5	7.9	8.9	0.5	24	32	28	493	685	612
2008													
S. Branch Root	8/21 - 8/28	8.4	13.8	3.8	7.7	8.2	0.2	14	21	17	587	608	599
N. Branch Root	8/21 - 8/28	7.7	13.4	4.1	7.7	8.1	0.2	16	23	19	482	586	575
Bear Creek	8/5 - 8/14	6.7	12.2	3.9	7.7	8.1	0.3	17	24	21	527	567	555
Vermillion River	8/11 - 8/20	7.2	10.6	2.5	7.9	8.3	0.2	15	25	19	520	597	587
Wells Creek	8/21 - 8/26	8.7	10.7	1.0	8.2	8.3	0.1	12	22	17	452	578	477
Maple River	8/5 - 8/13	6.7	13.5	4.7	8.2	8.8	0.4	20	28	24	436	547	502
Rice Creek	8/5 - 8/13	4.8	12.9	5.6	8.2	8.9	0.4	18	28	23	488	588	503
Big Cobb	8/5 - 8/13	6.4	11.7	4.0	7.9	8.6	0.3	20	29	24	489	512	523
Le Sueur	8/5 - 8/13	6.5	12.5	2.9	6.0	8.6	0.7	17	32	24	355	1010	515
Sauk	8/11 - 8/14	6.6	11.3	3.2	8.0	8.5	0.4	20	23	22	443	574	546
Getchell	8/11 - 8/14	2.2	7.2	3.2	7.7	8.2	0.3	20	23	22	595	631	611
Wells (repeat)	8/11 - 8/14	9.5	11.3	1.2	8.0	8.3	0.1						
Minimum		**2.2**	**7.2**	**0.5**	**6.0**	**8.1**	**0.1**	**12**	**21**	**17**	**173**	**294**	**277**
Maximum		**8.7**	**18.2**	**6.8**	**8.4**	**9.4**	**0.7**	**26**	**32**	**28**	**595**	**1010**	**651**
Median		**6.2**	**11.3**	**3.5**	**8.1**	**8.5**	**0.2**	**21**	**28**	**24**	**443**	**574**	**523**
25th %		**5.4**	**9.9**	**2.4**	**7.9**	**8.3**	**0.2**	**18**	**25**	**22**	**304**	**383**	**361**
75th %		**6.5**	**13.0**	**4.3**	**8.2**	**8.8**	**0.3**	**22**	**29**	**26**	**515**	**625**	**588**
Count		**35**	**35**	**35**	**34**	**34**	**23**	**35**	**35**	**35**	**35**	**35**	**35**

Figure 1. Flow chart of current assessment and listing process.

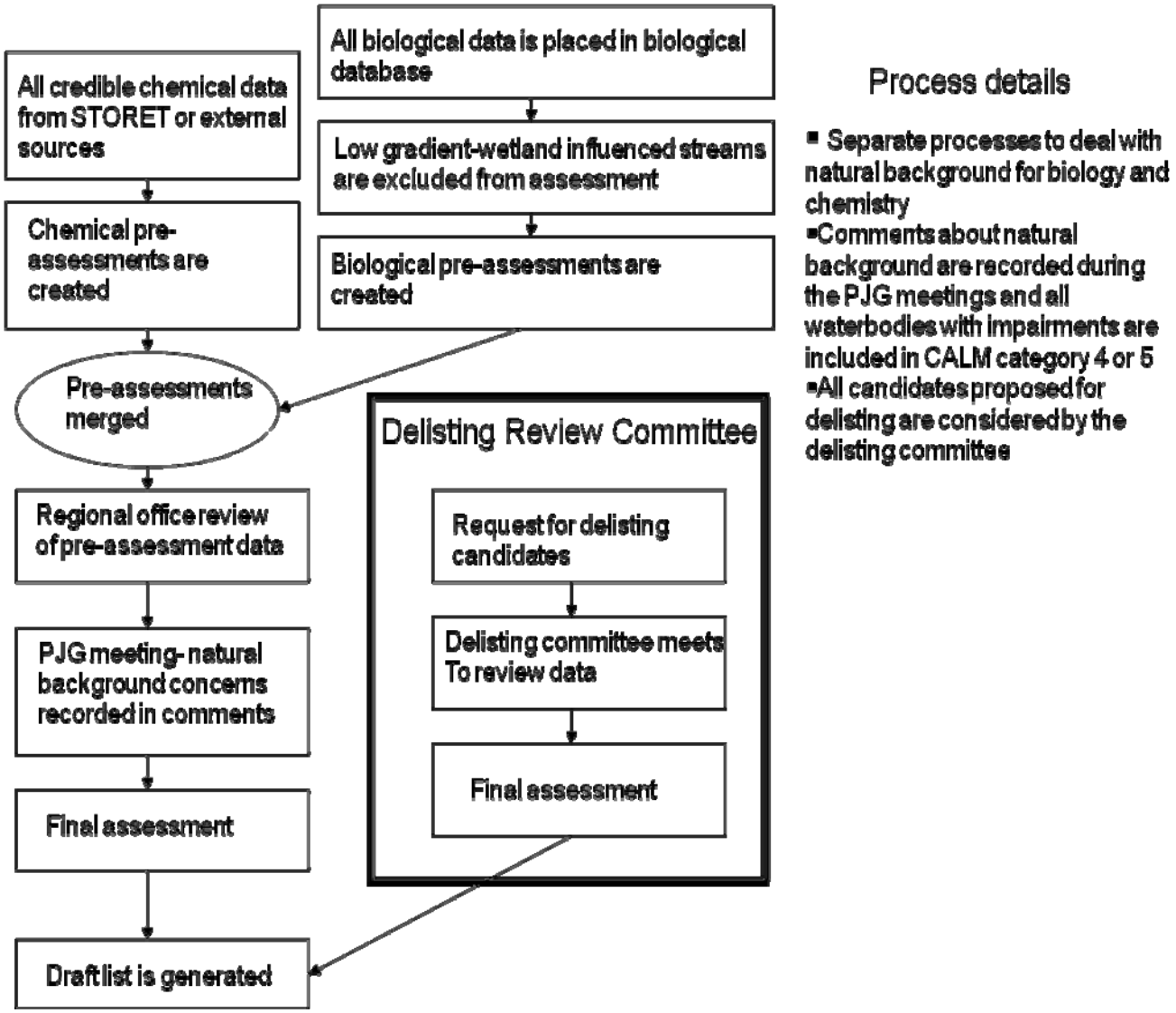
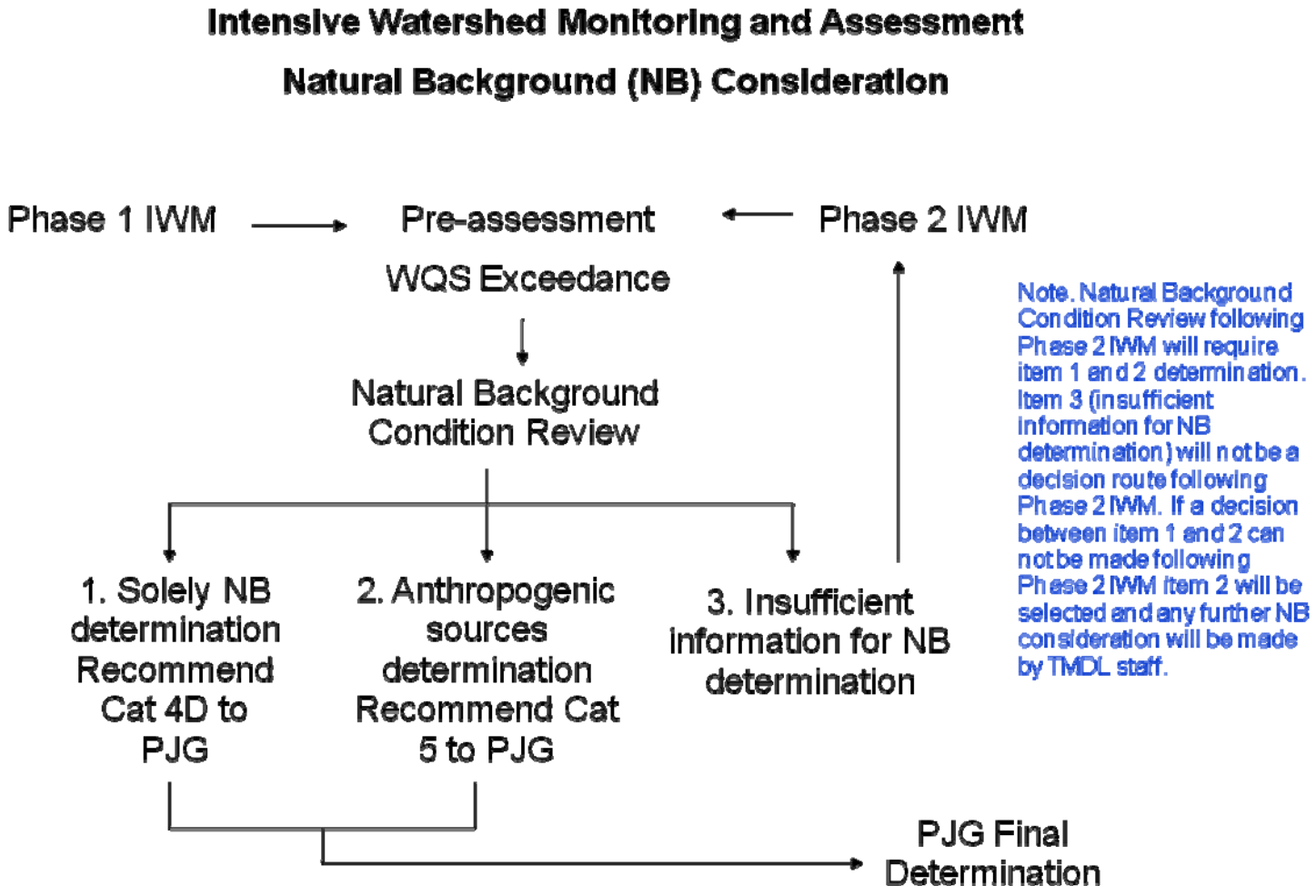
Figure 2. flow chart of a proposed process for review of natural background within an assessment and listing process aligned with the intensive watershed monitoring (IWM) schedule.