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July 24, 2000

Mr. Robert Cantilli
Nutrient Team Leader
U.S. Environmental Protection Agency
Office of Science and Technology
Ariel Rios Building (4304)
1200 Pennsylvania Avenue, NW
Washington, DC 20460

**RE: COMMENTS ON NUTRIENT CRITERIA TECHNICAL GUIDANCE MANUAL -
LAKES AND RESERVOIRS, FIRST EDITION EPA-822-B00-001**

Dear Mr. Cantilli:

In response to the notice provided in the Federal Register the Association of Metropolitan Sewerage Agencies (AMSA) is pleased to provide its comments concerning the referenced document. Our comments were developed in a three pronged approach including a technical review, presentation of proposed solutions to comments raised in our review, and recommendations for next steps.

Technical Review

1. Criteria foundation / beneficial uses

Traditional water quality criteria and standards (for toxics, dissolved oxygen, etc.) are based upon the development of dose response relationships. In such applications the relationships between pollutant values and effects are specific and measured. The nutrient criteria guidance abandons the approach to threshold effects altogether and relies on technical assumptions too general to be meaningful to the criteria program. The criteria methods assume a "*trophic continuum*" paradigm where the level of impact is thought of as a continuous response to nutrient increases. Our concerns with these assumptions are: (a) there is no distinction is made between enrichment and impairment of uses, (b) trophic continuums may not always exist, (c) the lack of focus on beneficial

uses may negatively affect public support for the program, and (d) the process places an unfair burden on States and stakeholders.

a) There is no distinction made between enrichment and impairment of uses

AMSA agrees that a trophic continuum may exist in many lakes and reservoirs where the effects due to nutrients are generally proportional to the instream concentration and/or loading. This has been shown to occur in many cases within the literature. However, despite these ideal (generally straight forward) conditions to support nutrient management the guidance manual does not provide a means to separate nutrient enrichment from nutrient impairment in a given lake as it should. As a consequence, there is a critical question left unresolved: *At what point along the trophic continuum does nutrient enrichment lead to an impairment of beneficial uses?* For water quality assessment and enforcement purposes establishing a criteria value which serves to separate “enrichment” from “impairment” with regard to effects on beneficial uses is essential. Similar distinctions are made with other water quality criteria (such as toxics, dissolved oxygen, etc) relative to effects and nutrient impacts should be held to a similar level of scrutiny. In both of these situations (toxics and D.O.) a trophic continuum also exists. However, in these cases EPA has made a determination regarding the specific point along the continuum upon which a sufficient impact on species occurs such that beneficial uses are affected. The lack of this particular structure with nutrients is viewed as a fundamental flaw in the process relative to the intent of section 304 of the Clean Water Act. In order to accomplish this requirement it is necessary to clearly identify the designated use in question and then assess its relationship to nutrient loading / concentration in a defensible manner. EPA indicates in the introduction section of the guidance (pp 1-1) that “*over enrichment means the addition of nutrients causing adverse effects or impairment to the designated use(s) of a water body or to the ecosystem*”. Our review of the guidance indicates that the methods fail to deliver on this objective despite the fact it is acknowledged as being important. The critical nature of this particular issue cannot be overstated.

b. Trophic continuums may not always exist

Trophic continuums may exist in many lakes as previously acknowledged. However, in other cases there could be numerous factors present which may serve to prevent a continuous response to nutrients in the classical manner. For example, in some cases nutrient concentrations can be elevated without an increase in chlorophyll or decrease in dissolved oxygen due to light limitations of phytoplankton. In contrast, nutrient concentrations may be low with high chlorophyll values observed because the nutrients are consumed and incorporated into algal biomass. In other cases, grazing of phytoplankton by zooplankton or other secondary consumers may serve to complicate our understanding of the impacts of nutrient driven eutrophication. Although these exceptions are noted in the guidance there is no further attempt made to quantitatively address these complicating issues in the context of criteria derivation. In cases where there is a lack of trophic continuum attempts to relate nutrient values to chlorophyll, light transparency in a simple manner would prove be futile. Our point in this section of the comments is that the nutrient criteria process for a given lake should involve determinations regarding whether the effects

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or continuous or non-continuous. In cases where the effects on response variables are not found to occur along the classic continuum it should receive further analysis and consideration. In those cases calibrated mathematical eutrophication models involving the roles of suspended sediment, grazers, or other factors will be needed to adequately understand the effects of nutrient enrichment on the beneficial uses in question.

c. A lack of focus on beneficial uses may negatively affect public support for the program

AMSA believes that the lack of focus on designated uses will negatively effect the public's support for the nutrient criteria program. The lack of focus on beneficial uses serves to force efforts to establish specific criteria values without a reasonable understanding of what they are supposed to accomplish besides simply managing nutrient concentrations. AMSA believes that the public is not generally interested in the nutrient or chlorophyll values of a lake. Rather, they are interested in its aesthetic qualities, its living resources, or in it's other recreational opportunities. The purpose of nutrient criteria should be to achieve and maintain beneficial uses important to the public not for managing nutrients for nutrients sake. Further investments in nutrient management need to be justified by demonstrations of environmental improvements understandable to the public. This objective can be best accomplished by involving the public directly.

d. The lack of focus on uses places an unfair research and development burden on States

EPA has generally acknowledged in the guidance and has openly admitted in public stakeholders meetings that the nutrient criteria guidance methods may not successfully link nutrient effects to beneficial uses. This will leave the actual burden of developing defensible nutrient and beneficial use linkages to fall upon the individual States and stakeholders. This is viewed as placing an unfair burden on this sector because it involves a significant amount of research and development above and beyond normal implementation. To adopt EPA regional criteria into State standards will leave the States in a position of liability due to their lack of basis in designated uses. To that end the criteria guidance methods are not viewed as particularly useful as a means to successfully implement a State program. Significant resources will be required from States and stakeholders to address the foundational short comings of the guidance with respect to relating nutrient criteria to designated uses as required by the CWA. This is viewed as unacceptable from the stand point that the EPA has left the "hard part" to the States and stakeholders.

2. Reference condition / percentile based approach

A review of the guidance document indicates a technical approach to nutrient criteria for lakes is generally based on the establishment of reference conditions and the statistical distributions of data both within the reference condition and in "other lakes". Although these methods would have value in a screening role, AMSA does not view them as an acceptable method to establish numerical criteria because they do not serve to establish the causative linkages between nutrients and their effects on

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beneficial uses. Beyond that fundamental issue our specific concerns with the details of the methods are as follows:

a. Reference conditions:

A review of the guidance indicates EPA's intentions on basing reference conditions upon the characteristics of largely undisturbed areas. The set of requirements described for establishing reference conditions involves the selection of sites that have largely natural land uses, presence of significant riparian buffers, presence of successful BMPs, lack of discharges, and absence of management controls relative to water level for flood or hydropower purposes. If such undisturbed areas are not available the researcher is directed towards an extrapolation of the undisturbed condition using loading models and/or paleolimnologic reconstruction of flora and/or fauna. Given that the criteria will be based largely on reference conditions defined in such a strict manner it seems only logical to assume that restoring the "other lakes" to a similar reference type condition will be needed to attain the values. A most intractable problem lies in the fact that many of the factors at work in the "other lakes" are due to the largely irreversible effects of urbanization and civilization that are not seen in a majority of the reference lakes. Criteria set in such a fashion are doomed to failure because their attainment may prove impossible to accomplish in a practical manner.

b. Percentiles

The criteria guidance document offers no apparent technical justification for the selection of the various default data percentiles (i.e. upper 75% of reference lakes, lower 25% of other lakes) other than best professional judgement and simplified illustrations. Although AMSA respects the professional judgements of those involved, we contend that a percentile based approach to nutrient criteria development is not scientifically defensible unless those values can be related to beneficial uses which the public can understand and appreciate. This arbitrary selection of criteria values creates cascading problems with respect to management application. It appears only logical to assume that if the criteria for "other lakes" is set at the lower 25th percentile for nutrient levels that the remaining 75% of those lakes will be placed a condition of non-attainment of the criteria. Many of those lakes placed in non-attainment may already support beneficial uses and the criteria. In such cases the criteria will only serve to needlessly lengthen the list of lakes placed on impaired waters lists for TMDL development. Conversely, if the criteria for reference lakes are established at the upper 25th percentile the remaining 75% percentage of reference lakes may not be adequately protected by the higher criteria values. This brings into focus a major problem the percentile approach. It is impossible to determine whether the resulting criteria value will be over protective, under-protective or appropriate because the percentiles of observed data are independent of effects.

It is important to note that AMSA recognizes that there is latitude in the methods to adjust the criteria values either up or down from the referenced percentiles based upon the consideration of additional data or circumstances. Unfortunately, the methods given for such adjustments appear just as arbitrary than the

initial selection of the percentiles. Consistent with the theme of our comments, the fundamental problem with the methods is rooted in a lack of focus on relating beneficial uses to nutrient status. We believe that an appropriate approach would be (1) use existing anti-degradation regulations to prevent further enrichment of high quality waters, and (2) develop nutrient reduction strategies for those not meeting beneficial uses.

3. The development of both nitrogen and phosphorus criteria may not be necessary

The criteria guidance document discusses the roles of phosphorus and nitrogen limitation with respect to algal production (pp 2-3). More specifically, it indicates that the nutrient limitation is most often associated phosphorus with nitrogen limitations occurring in only in a few cases. Despite these findings the guidance indicates a need to establish both nitrogen and phosphorus criteria / standards. AMSA disagrees with this requirement because loading reductions directed towards non-limiting nutrients would represent a waste of expenditures. This is especially the case for nitrogen because point source removal of nitrogen is much more expensive to accomplish than phosphorus from a treatment stand point. The nutrient criteria derivation process needs to take into account a careful analysis of nutrient limitations. Criteria should be established only for the limiting nutrient or on the basis of seasonal differences in those limitations.

Proposed Solutions

The guidance document indicates there is a large body of research and literature that can be used to support criteria development process for the waters in question. Because nutrient dynamics in lakes and reservoirs are generally simpler than in other systems (i.e. rivers and streams, estuaries, and wetlands) the prospects for criteria development are viewed as promising. However, as our technical review indicated, AMSA does not believe the technical approaches have been structured in a manner that is defensible in the context of water quality criteria / standards derivation. An alternative approach is described below to address the concerns outlined in our technical review. We have developed a flow chart to illustrate the structure and the steps that are involved in that approach. The reader should refer to the attached Figure 1 while reviewing this particular section. Each of the topics below provide further elaboration and explanation of the blocks represented in that diagram.

1. Classify water body- Consistent with present methods of the guidance, lakes are classified according to their condition.
2. Establish target use- Beneficial uses are the foundation of the water quality criteria program. The target use represents the specific “end point” or objective that is intended for protection and/or restoration by the criteria. Examples include living resources, biological condition indexes, established nuisance levels of algae, or other established water quality standards such as dissolved oxygen or pH that directly relate to effects on living resources. *Note: Unless at defined nuisance levels, chlorophyll a, secchi depth, turbidity, etc, do not directly represent target uses. They*

represent potential response variables that may or may not be related to beneficial uses. In cases of competing uses (e.g. fisheries vs drinking water), decisions need to be made regarding which use is “target”. The public and stakeholders should be involved in the process of the establishment of target uses and the associated objectives that the nutrient criteria are intended to address. The important point is that the target beneficial use or uses need to be clearly articulated up front as the basis and goal element for the criteria.

3. Establish flag value- Statistical evaluations and statistical demarcations of data distribution (i.e. percentiles) are established relative to reference conditions and/or other no-reference lakes using the methods described in the guidance. Flag values may be developed for nitrogen, phosphorus, chlorophyll a, periphyton, turbidity, or other response variables associated with nutrients. *Note: Flag values are used in the first level of site screening. Flag values are not to be converted directly into criteria because their relationship to impairment of the use is uncertain.*
4. Does site exceed flag value?- Site data are evaluated relative to flag values and a determination is made regarding whether they exceed them.
5. Is target use impaired by N or P?- Employing cause and effect assessments a determination is made regarding whether the established target use (i.e. living resources, biological condition indexes, established nuisance levels of algae, or other established water quality standards such as dissolved oxygen or pH that directly affect living resources) has been impaired by nitrogen and/or phosphorus. Note that clear distinctions are made in this analysis between “nutrient enrichment” and “nutrient impairment”.

Next, dependent upon the outcomes of the above screening steps, there are three potential outcomes for which a given lake can be categorized and prioritized for nutrient criteria development. For discussion purposes they are color coded in the attached diagram (Figure 1).

1. *Green* - The site is not considered enriched because the flag values were not exceeded. Because nutrient values or intermediate response variables are low it is logically assumed there is also lack of nutrient impairment. This condition represents a low priority for criteria development. Site monitoring continues to periodically re-assess its priority for criteria development. Existing anti-degradation tools may be used to prevent enrichment. The development of criteria values to prevent impairments to beneficial uses are re-visited as a third priority after the completion of high and medium priority waters. *Note: Eventual criteria may be greater than flag values given that these sites were not defined as impaired. When appropriate, mechanistic methods similar to the red condition should be used to establish those criteria.*

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2. *Yellow*- The site may be enriched because the flag value was exceeded. Because the flag value was exceeded an analysis of impairment was required, but showed no apparent impairment. This condition represents a medium priority for criteria development. Site monitoring continues to periodically re-assess its priority for criteria development. Existing anti-degradation tools may be used to prevent further enrichment. The development of criteria values to prevent impairments to beneficial uses are re-visited as a second priority after the completion of high priority waters. *Note: Eventual criteria may be greater than flag values given that these sites were not defined as impaired. When appropriate, mechanistic methods similar to the red condition should be used to establish those criteria.*
3. *Red* - Because the flag was exceeded an analysis of impairment was required, which indicated impairment. Due to the presence of nutrient related impairments the site is also considered enriched. This represents a high priority for criteria development. Given a combination of flag values being exceeded and a finding of nutrient impairment, additional analyses (mechanistic models or other tools) are developed and employed. These tools are used to determine the level of nutrient reductions needed to remove the impairment to the use on a site specific basis. The feasibility / use attainability and socio-economic impacts associated with this criteria value are evaluated. Subsequently, criteria are established (and modified as needed by the use attainability and socio-economic analyses) and considered for adoption into water quality standards.

The major elements of the flow chart should apply in all circumstances. However, it was designed as a process to be used in the absence of additional information. In some cases many of the elements (target use, demonstrations of impairment, loading reductions needed to attain use) may be already known. In such cases a duplication of existing efforts should be avoided.

Benefits of The Proposed Solutions

AMSA believes that the approach described above represents a workable framework and compromise to address the issues that AMSA (and others) have identified as weaknesses in the present criteria guidance. The major benefits of the proposed approach are as follows:

1. The basis of the criteria on beneficial uses is consistent with the intent of the water quality standards program. It improves the defensibility of the criteria because without a firm basis in beneficial uses the criteria are subject to challenge at their most fundamental level. The focus on beneficial uses provides a clear path and goal oriented basis for the development of nutrient criteria that the public can understand and support.
2. The use of flag values benefits the program by providing an appropriate application for the work that EPA and others have placed in developing a reference and statistical (percentile) based methods. A

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screening role is viewed as a good use for these methods considering their severe limitations relative to determinations of impairment.

3. The prioritization of nutrient criteria development on the basis of flag values and beneficial use impairment analyses serve to ensure that (1) the 303 (d) listings are not needlessly increased, (2) the resources available to nutrient criteria development are properly focused and commensurate to the level of problem, or a lack of one, and (3) those sites truly in need of attention are identified and corrected sooner because the resources are directed properly towards them. In lakes without impairments due to nutrients existing anti-degradation procedures prevents further enrichment and protects water quality.

Recommendations for Next Steps

AMSA has been working with the EPA with regard to the development of nutrient criteria since its inception. Our efforts on this project have been associated with attendance at various stakeholder meetings, submission of comments to EPA, and attending meetings with EPA staff. AMSA is interested in continuing this cooperative dialogue with the EPA. Although we do not have all of the answers in this set of comments, we feel strongly that the elements and recommendations which we have described are critical to the future success of the nutrient criteria effort. We also believe that they should be incorporated into the guidance document after a collective opportunity to discuss the issues further. As the next step in this process we respectfully request that EPA respond to our comments and offer to meet with AMSA representatives to further deliberate on the issues. AMSA staff would be pleased to arrange the logistics.

I look forward to your comments and meeting with you. If you have any questions, please do not hesitate to contact me at 202/833-4653.

Sincerely,



Ken Kirk
Executive Director

cc: Geoff Grubbs, U.S. EPA
Norman LeBlanc, Hampton Roads Sanitation District
William Hunley, Hampton Roads Sanitation District
Dave Taylor, Madison Metropolitan Sewer District
Dominic DiToro, HydroQual, Inc.

Figure 1. Prioritizing Nutrient Criteria Development

