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May 12, 2010

Thomas Burack, Commissioner
NHDES
29 Hazen Drive, PO Box 95
Concord, NH 03301

Re: Nutrient Criteria: Request for Rulemaking and Open Peer Review Process for NHDES Approach to Developing Nutrient Water Quality Standards for the Great Bay Estuary

Dear Commissioner Burack:

As you know, on April 9, 2010, a letter was submitted by the New Hampshire communities of Dover, Durham, Exeter, Newmarket, Portsmouth and Rochester, requesting that NHDES initiate a formal rulemaking proceeding including an open and independent peer review of the scientific approach which NHDES utilized to develop Nutrient Water Quality Standards for the Great Bay Estuary. Our communities are intensely interested in the health of the Great Bay Estuary and rely upon it for the quality of life enjoyed by its citizenry. However, we are extremely concerned that NHDES's nutrient impacts and criteria evaluation has failed to fully and properly evaluate the effect of nutrients on eelgrass populations and measures necessary to ensure protection of the Great Bay Estuary resources. We believe that the current nutrient criteria analysis is misplaced because of inadequate data and lack of assessment tools needed to properly evaluate this complex system. This lack of critical information caused NHDES to make assumptions about the causal relationship between nutrient levels and the environmental health of the Bay, which are simply not warranted and not supported by reliable scientific data. If these misplaced assumptions are not corrected, the Great Bay's valued resources will not be restored or protected and an enormous waste of scarce municipal resources will occur. Such an occurrence is not in anyone's interests.

The concern expressed by these communities in the April 9, 2010 letter has been heightened by the development of additional information over the last month. On April 27, 2010, the Science Advisory Board ("SAB") finalized its review of EPA's guidance document, Empirical Approaches for Nutrient Criteria Derivation. At the time of the April 9, 2010 letter, the SAB's analysis was only in draft form. The final report demonstrates quite clearly that the type of approach taken by NHDES to

develop its June 2009 Numeric Nutrient Criteria for the Great Bay Estuary, has been discredited as having significant flaws. This report underscores why it is essential that reliable data be used to confirm rather than presume the existence of cause and effect relationships when assessing environmental impairments and considering the need for nutrient criteria.

The municipalities have engaged the assistance of Hall & Associates of Washington, D.C. to evaluate the NHDES Numeric Nutrient Criteria document in light of the SAB findings. Hall & Associates was instrumental in obtaining SAB review of the EPA guidance document entitled "Empirical Approaches for Nutrient Criteria Derivation". Attached hereto as Exhibit A are the preliminary comments of Hall & Associates with respect to the extent to which the SAB findings impact the NHDES' nutrient criteria document. This additional information demonstrates that the NHDES Numeric Criteria are based on a scientifically flawed methodology and the NHDES needs to reevaluate. An open and independent peer review of the NHDES nutrient criteria document is critical not only to provide a document based upon accepted scientific principles but also to accomplish acceptance of these criteria within the general public. In the event that NHDES elects to continue to move forward with the EPA review by the Office of Science and Technology, over the communities' objection, the comments of Hall and Associates also include "charge questions."

The health of the Great Bay Estuary can best be preserved by a scientifically based regulatory program which can focus regulatory actions where they can achieve benefits most efficiently and effectively. We therefore request that NHDES withdraw its request to EPA that the nutrient criteria document be reviewed by the EPA Office of Science and Technology through a closed peer review and defer further action on this proposal until additional information on the need for nutrient criteria related to eel grass is developed. All parties are interested in protecting the Great Bay Estuary, and there is no need to develop a program based on assumption when the ability to obtain the necessary information that could guide decision making is possible.

If DES agrees to such deferral, we believe that there are several steps for which there is substantial consensus with the communities which can be helpful to assure that the review process results in a regulatory approach that provides environmental benefits and avoids misspending tax dollars on ineffective supposed solutions. The communities are willing to discuss a commitment of funding and support for the following approach.

1. Establish an independent peer review panel to review the NHDES Numeric Nutrient Criteria document through an open process which allows for public comment and scientific input. The communities believe that this process can begin providing valuable information to NHDES and the communities within six months of reaching an agreement on this or a similar approach.

2. Undertake a thorough hydrodynamic model to be performed for the Great Bay Estuary to provide insight on nutrient/sediment transport and other mechanisms that have substantial influence on eelgrass health.

3. Establish a supplemental environmental project, such as an eelgrass and/or shellfish restoration project, aimed at providing data relevant to water quality improvement.

In conclusion, the New Hampshire communities of Dover, Durham, Exeter, Newmarket, Portsmouth and Rochester recognize that NHDES, as the regulatory agency charged with compliance with state and federal law, is the ultimate decision-maker on what numeric levels of nutrients are appropriate for the Great Bay Estuary. These communities share NHDES' concern and recognize they also share the responsibility for achieving compliance with scientifically based regulatory criteria. We look forward to discussing the best way that we can work together to achieve our mutual goals.

Very truly yours,

City of Portsmouth on behalf of
Dover,
Durham,
Exeter,
Newmarket,
Portsmouth, and
Rochester,

By Counsel for the City of Portsmouth,

Nelson, Kinder, Mosseau & Saturley, P.C.

E. Tupper Kinder, Esquire

ETK/sma
Encls.
cc: The Honorable Governor John H. Lynch
The Honorable Judd A.Gregg, United States Senate
The Honorable Jeanne Shaheen, United States Senate
Congresswoman Carol Shea-Porter
Congressman Paul W. Hodes
John Bohenko, Portsmouth City Manager
J. Michael Joyal, Jr., Dover City Manager
John Scruton, Rochester City Manager
Edward J. Wojnowski, Newmarket Town Administrator
Todd Selig, Durham Town Administrator
Russell J. Dean, Exeter Town Manager
Harry Stewart, NHDES
Paul Currier, NHDES
Orville B. Fitch, II, Esquire Deputy Attorney General
Carl Dierker, Esquire U.S. EPA Region 1 General Counsel
Ephraim King, Director, U.S. EPA Office of Science and Technology
Lauren J. Noether, Esquire Senior Assistant Attorney General
Peter H. Rice, City Engineer
Suzanne Woodward, Assistant City Attorney

EXHIBIT A

Assessment of Appropriate Peer Review Charge Questions For Evaluation of the Numeric Nutrient Criteria for the Great Bay Estuary, New Hampshire

Prepared by
Hall & Associates
Washington, D.C.

The New Hampshire Department of Environmental Services (DES) recently proposed draft numeric criteria for total nitrogen to protect eelgrass habitat in the Great Bay Estuary. [1] The Report indicates that multiple lines of evidence were used in a "weight-of-evidence" analysis to derive the proposed numeric nutrient criteria. The Report states that data sources were chosen based on relevance to a conceptual model of eutrophication in estuaries. This would imply that total nitrogen (TN) was the cause of excessive plant growth in the Great Bay Estuary, which in turn caused the reduced light penetration that adversely affected eelgrass growth. The evaluation concluded that low dissolved oxygen and loss of eelgrass habitat were the most important impacts to aquatic life from nutrient enrichment and recommended ambient thresholds for TN concentration to address these impacts. Correlations between TN concentrations and chlorophyll-a, dissolved oxygen, and water clarity were assessed using linear regressions to establish the proposed numeric criteria.

Unrelated to this development, the EPA Science Advisory Board, Ecological Processes and Effects Committee, recently considered draft guidance on Empirical Approaches for Nutrient Criteria Derivation developed by EPA.[2] This guidance document described regression techniques for evaluating data for nutrient criteria derivation, such as the linear regressions used by DES for the Great Bay Estuary. The SAB cited significant deficiencies in this approach. Prior to the issuance of the SAB report, the City of Portsmouth requested that the draft nutrient criteria undergo a similar peer review. The assessment below summarizes the SAB findings relevant to the empirical nutrient criteria development approach used for the Great Bay Estuary, critiques the charge questions suggested by DES and EPA, and presents more relevant charge questions for consideration by the peer review panel, given the SAB findings.

EPA Science Advisory Board Findings on Utility of Empirical Approaches for Nutrient Criteria Development

In general, the SAB found that empirical approaches cannot be used as a stand-alone demonstration that criteria are justified. In reviewing EPA's draft guidance manual, the SAB reached the following findings that are relevant to review of the draft total nitrogen criteria developed for Great Bay Estuary.

- A clear framework for statistical model selection is needed. This framework should include: 1) an assessment of whether analyses indicate that the stressor-response approach is appropriate; 2) selection criteria to evaluate the capability of models to consider cause/effect and direct/indirect relationships

[1] New Hampshire Department of Environmental Services. June 2009. Numeric Criteria for the Great Bay Estuary.

[2] US EPA Science Advisory Board, Ecological Processes and Effects Committee. April 27, 2010. SAB Review of Empirical Approaches for Nutrient Criteria Derivation.

between stressors and responses; 3) consideration of model relevance to known mechanisms and existing conditions; 4) establishment of biological relevance; and 5) ability to predict probability of meeting designated use categories. (at xix, first bullet response on Charge Question 6)

- Without a mechanistic understanding and a clear causative link between nutrient levels and impairment, there is no assurance that managing for particular nutrient levels will lead to the desired outcome. (at 6, first paragraph)
- [T]he empirical stressor-response approach does not result in cause-effect relationships; it only indicates correlations that need to be explored further. (at 41, bullet #1)
- In order to be scientifically defensible, empirical methods must take into consideration the influence of other variables. (at 24, 2nd bullet from bottom) The statistical methods in the Guidance require careful consideration of confounding variables before being used as predictive tools. ... Without such information, nutrient criteria developed using bivariate methods may be highly inaccurate. (at 24, first complete bullet)

EPA has also provided additional background documentation regarding what should constitute an acceptable "weight of evidence" approach used in criteria development. (*"Using Field Data and Weight of Evidence to Develop Water Quality Criteria", Cormier et al, 2008 SETAC*). That document, prepared by EPA's Office of Research and Development, specifies the following, with respect to criteria derivation:

> *Development of numeric WQC is based on 3 basic assumptions: First, causal relationships exist between agents and environmental effects. Second, these causal relationships can be quantitatively modeled. Finally, if exposures to the causal agent remain within a range predicted by the quantitative model, unacceptable affects will not occur and designated uses will be safeguarded. Therefore, for criteria to be valid there must be evidence that the criteria are based on reasonably consistent and scientifically defensible causal relationships.*

Issues of Concern with Numeric Nutrient Criteria Development

The findings in the SAB report are directly applicable to the evaluations presented in the Report to support the proposed numeric nitrogen criteria, particularly with regard to the assumed relationship between eelgrass habitat and annual median total nitrogen concentration in the Great Bay Estuary. The Report (at 55, et seq.) attempts to establish a linkage between eelgrass habitat and total nitrogen via its effect on water clarity (light attenuation). The Report presents a multivariate linear regression linking light attenuation to phytoplankton (chlorophyll-a), colored dissolved organic matter (CDOM), non-algal turbidity, and water. The Report cites a study by Morrison et al. (2008) that determined the relative contribution of each of these factors to the light attenuation coefficient, indicating the following contributions: water (32%), phytoplankton (12%), CDOM (27%) and non-algal turbidity (29%). These factors are reported to explain 95 percent of the variance in the observed light attenuation measurements. The Report then presents linear regression analyses relating *total nitrogen* to median turbidity and to median light attenuation coefficient as the basis to support the proposed total nitrogen criteria.

The Report presents no mechanistic model linking total nitrogen to non-algal turbidity and the total nitrogen – water clarity regression jumps over underlying factors influencing

light attenuation. The SAB report repeatedly warns that such regressions do not demonstrate cause-and-effect, and such a demonstration is needed to provide assurance that compliance with the criteria will protect the designated use. For example, that fact that TN is associated with non-algal particulates (turbidity) does not mean that controlling TN from all sources will control turbidity. Rather, if non-algal particulates are somehow controlled, turbidity would be reduced and the nitrogen associated with these particulates will also be controlled. However, waste load allocations limiting TN from POTWs, which is primarily present in the dissolved form, will have no effect on non-algal particulates and would be inappropriate if the real goal was to reduce turbidity.

The Report must provide a mechanistic model linking the stressor (nitrogen) to the responses (water clarity, eelgrass habitat) before the proposed relationships can be accepted. Of the four factors acknowledged to influence light attenuation, only phytoplankton growth is mechanistically associated with nitrogen, but the Report does not present a regression analysis for phytoplankton and light attenuation. For biologically available nitrogen to affect light attenuation, changes in concentration or loading must result in phytoplankton (chlorophyll-a) changes that are significant with respect to light attenuation. However, the data presented in the Report indicate that algal levels are quite low given the available nutrients. The fact that median phytoplankton levels are low suggests that nutrient concentrations are <u>not</u> the primary factor controlling phytoplankton growth and, therefore, nitrogen control may not significantly affect phytoplankton levels. Moreover, given the assessment indicating that only 12% of the light attenuation coefficient is attributed to phytoplankton, there is no reasonable expectation that light attenuation is significantly related to median total nitrogen due to the effect of nitrogen on phytoplankton growth. *Consequently, it appears that the entire premise of the draft criteria is misplaced.*

To be scientifically defensible, these concerns regarding the relationship between nitrogen, phytoplankton, and light attenuation must be addressed. The Report needs to provide the following evaluations:

- An analysis demonstrating that median total nitrogen controls phytoplankton growth in the Great Bay Estuary;

- A mechanistic analysis demonstrating that a reduction in median phytoplankton concentration will occur, and the impact of this reduction on light penetration, if the proposed criteria are achieved;

- A mechanistic analysis demonstrating that a TN reduction is required to address non-algal turbidity;

- A mechanistic analysis demonstrating the light attenuation goals will be achieved by reducing dissolved forms of nitrogen;

- An assessment of factors influencing light penetration that co-vary with TN and may otherwise explain or control the available light for submerged aquatic vegetation; and

- An analysis showing that (1) eelgrass losses are tied to TN increases and (2) eelgrass will be restored if the proposed criteria are achieved.

Charge Questions

The DES and EPA suggested that the peer review panel evaluate the proposed nutrient criteria with respect to the following charge questions.

- **Transparency**

  Is the process for the development of the criteria well described and documented?

- **Defensibility**

  Were accepted sampling and analysis methods used?

  Was a QA/QC process used and documented?

  Are the designated uses of the Great Bay clearly articulated?

  Is there a clear discussion of the logic of how the criteria protect those designated uses?

- **Reproducibility**

  Does analysis of the available data reproduce the results included in the report?

These proposed charge questions do not address the concerns identified by the SAB on the use of empirical approaches to develop numeric nutrient criteria. The SAB noted that the relationship between nutrients and designated use impairments is often very complex, with many confounding factors. For this reason, the SAB recommended that nutrient criteria be developed using a weight-of-evidence approach that significantly reduces uncertainty and that a clear causative link be established between nutrient levels and use impairment. These concerns are not addressed with the proposed charge questions. The basic problem with the proposed peer review is that it fails to seek confirmation on whether the Great Bay nutrient criteria report has (1) established the existence of a direct causal relationship between light penetration, eelgrass losses and TN concentration, (2) fully evaluated the factors that influence light penetration and (3) demonstrated the impact of the suggested TN reductions on algal growth/light penetration improvement. These key issues, among others, should be the focus of the peer review.

In order to address the concerns raised by the SAB and to ensure that the final numeric criteria are scientifically defensible, we recommend that the following charge questions be posed to the peer review committee.

Proposed Charge Questions

1. To be scientifically defensible, the Numeric Nutrient Criteria for the Great Bay Estuary must be based on the correct underlying causal model that considers all of the

significant factors affecting the causal variable (light penetration) and designated uses of concern (eelgrass).

a. Has the report adequately documented that lower light penetration was the cause of eelgrass losses? Was the level of light penetration used to set nutrient targets demonstrated to be necessary to support healthy eelgrass growth?

b. Has the Report adequately confirmed that ambient TN concentration increases since 1997 were the cause of eelgrass losses in the Bay and that other factors were not responsible for this condition?

c. Do the linear regressions presented in the report demonstrate cause-and-effect relationships between total nitrogen and the designated use metric (light penetration)?

d. Is the linear regression relating TN to turbidity scientifically defensible and will TN control result in significant changes in turbidity with respect to light attenuation in the estuary?

e. Has the evaluation confirmed that TN is the factor controlling phytoplankton chlorophyll 'a' concentration and that reducing TN will significantly reduce the level of plant growth with respect to light attenuation?

f. Has the Report documented that dissolved forms of nitrogen discharged by wastewater facilities or present in runoff must be controlled to achieve light penetration goals?

2. Has the uncertainty in the regression analysis been addressed sufficiently to support a target of 0.25 – 0.30 mg N/L (annual median)?

3. The Report establishes a median annual instream concentration of total nitrogen and a 90^{th} percentile chlorophyll-a concentration as the basis for maintaining compliance with the instantaneous dissolved oxygen water quality standard.

   a. Is it scientifically defensible to establish an annual median total nitrogen concentration to protect an instantaneous minimum dissolved oxygen concentration?

   b. Is it scientifically defensible to establish a 90th percentile chlorophyll-a concentration to protect an instantaneous minimum dissolved oxygen concentration?

Please contact John C. Hall at 202-463-1166 or jhall@hall-associates.com if you have any questions regarding the information contained in this document