TUFTS UNIVERSITY
School of Engineering

Professor and Louis Berger Chair in Computing and Engineering

Mr. Dean Peschel
Great Bay Municipal Coalition
c/o City of Portsmouth
680 Peverly Hill Road
Portsmouth, NH 03801

March 22, 2019

Re: Analysis of Technical Justification for Proposed Watershed TN Load Limitations for Great Bay Estuary

Dear Mr. Peschel:

In March 2019, I was contacted by the Great Bay Municipal Coalition (GBMC) to provide technical input on a "new scientific approach" being proposed by USEPA and NHDES to prescribe nitrogen load reductions for the Great Bay Estuary and its watershed. Based on the information provided, I understand that the state and federal agencies are proposing to utilize a 100 kg/ha-yr TN loading cap as necessary for the entire Great Bay watershed to protect eelgrass growth in the system. This nitrogen target was developed primarily from an eelgrass loss-TN loading nomograph created by Latimer and Rego in 2010.[1] This "load cap" is being proposed to form the basis of new nitrogen reduction requirements for wastewater facilities, stormwater contributions, and other non-point sources (such as septic systems). Because I had previously provided analyses of the prior state and federal regulatory efforts (see Chapra 2013[2]) and contributed to the 2014 Great Bay independent peer review, you have requested my opinion on the validity of the new approach being suggested by the regulatory authorities.

[1] Latimer, J.S. and Rego, S.A. 2010. Empirical relationship between eelgrass extent and predicted watershed-derived nitrogen loading for shallow New England estuaries. *Estuarine, Coastal and Shelf Science*, 90:231-240.

[2] Chapra, S.C. 2013. Assessment of whether the department of environmental service's approach to nutrient criteria derivation for the great bay estuary used reliable, scientifically defensible methods to derive numeric nutrient criteria. Declaration before the Environmental Appeals Board of the United States Environmental Protection Agency.

Materials Reviewed and Questions Presented

In addition to Latimer and Rego, 2010, I was provided the following documents:

- March 8, 2019 DES PPT Slides – "Adaptive Management Permitting for Great Bay" (see slides 4-10)
  - Valiela and Cole (2002)[3] – source for % Seagrass cover lost vs. nitrogen loading figure (slide 6)
- 2007 Technical Advisory Committee (including Dr. Latimer as a participant) meeting notes which considered this simplified TN-loading eelgrass loss approach
- A list of technical questions submitted to Dr. Latimer by the Coalition regarding application of Latimer and Rego (2010) nitrogen targets to the Great Bay system
- Dr. Latimer's responses to technical questions and a Word document organizing Dr. Latimer's responses with the corresponding inquiries
- A Great Bay Municipal Coalition letter to EPA/DES dated November 19, 2018 Re: Inapplicability of Latimer and Rego, 2010 to Great Bay
- 2014 Great Bay Peer Review report

You have suggested that I prepare my analysis of Latimer and Rego's approach (as well as the related technical studies) considering the following questions:

1. Is the Latimer and Rego, 2010 approach consistent with accepted scientific methods for assessing TN impacts on estuarine systems?
2. Is the Latimer and Rego, 2010 approach applicable to Great Bay Estuary and does the approach provide reasonable confirmation that TN has impaired eelgrass growth in Great Bay or is preventing its recovery?
3. Is the Latimer and Rego, 2010 method contrary to the 2014 Peer Review and EPA's 2010 Stressor Response peer review?

Analysis of the Latimer and Rego, 2010 Approach

The approach employed by Latimer and Rego (2010) is a generalized and greatly simplified approach (e.g., a screening tool) based upon limited data, hypothetical eelgrass loss/coverage assumptions, and a limited set of ecological/estuarine conditions (primarily small embayments, subject to significant groundwater loading influences and minimal riverine inputs). The results of the nomograph, on its face, suggest an extreme variation of eelgrass "responses" for similar TN system loadings. If this paper was based on "real," not assumed, eelgrass losses and TN loading was the true cause of reported eelgrass "losses" (due to excessive plant growth precluding eelgrass growth as assumed in the paper) this extreme variation in results would not be expected.

As noted in Dr. Latimer's responses to the questions posed, this was a theoretical analysis with no apparent applicability to managing the Great Bay system. The analysis, being generalized and assumption-based, made no effort to scientifically confirm the report conclusions or to claim that it should be universally applied to other systems with significantly different physical, hydrodynamic and/or biochemical conditions governing the occurrence or loss of eelgrass

[3] Valiela, I. and Cole, M.L. 2002. Comparative Evidence that Salt Marshes and Mangroves May Protect Seagrass Meadows from Land-derived Nitrogen Loads. Ecosystems (2002) 5:92-102.

populations in complex ecosystems such as the Great Bay Estuary. Thus, this paper cannot be used to reasonably or reliably forecast eelgrass responses to TN loading for the Great Bay system without explicit confirmation that (1) the predicted eelgrass losses exist and (2) the excessive phytoplankton or macrophyte growth is, in fact, preventing eelgrass recovery in this system.

With respect to other analyses presented such as Valiela and Cole, 2002, those authors also focused on small, protected embayments that had confirmed, extreme macroalgae growth, due to nutrient enrichment. The extreme macroalgae growth prevented eelgrass recovery due to smothering of the eelgrass shoots. These conditions have no apparent relevance to the Great Bay system where such smothering has not been documented as the cause of the existing eelgrass condition.

Responses to Specific Questions Posed

1. Is the Latimer and Rego, 2010 approach consistent with accepted scientific methods for assessing TN impacts on estuarine systems?

   No. This simplified analysis does not address the numerous physical, chemical, or biological factors that need to be considered to produce a scientifically defensible conclusion that nitrogen is impairing a specific estuarine system. There is no EPA-approved or "generally accepted by the scientific community" method for TN loading/eelgrass response that is applicable to estuarine systems, as there can be for lakes assuming sufficient observed response data (not unverified data points) are available to relate nutrient loading to a form of excessive plant growth that may be detrimental to the system.

2. Is the Latimer and Rego, 2010 approach applicable to Great Bay Estuary and does the approach provide reasonable confirmation that TN has impaired eelgrass growth in Great Bay or is preventing its recovery?

   No. For the reasons expressed by Dr. Latimer himself, this approach has no apparent applicability to the Great Bay system. In fact, the data for the Great Bay system confirm it is inapplicable as TN loadings have greatly exceeded the upper TN loading Latimer and Rego indicate will eradicate all eelgrass growth (100 kg/ha-yr) while robust eelgrass growth was maintained in the 1990s through 2005. These data for the Great Bay system are a direct, unambiguous empirical indicator of the "safe" systemwide TN loading at this time, particularly as excessive macrophyte or phytoplankton growth did not occur with those loadings. The more recent data for Great Bay suggest an eelgrass loss of about 30% from historical levels, not the 100% loss expected if the Latimer model was applicable. That would place Great Bay among the least impacted systems assessed by Latimer. Moreover, the factors that would suggest a linkage to TN are not reflected in present measurements. In comparison with the earlier period, phytoplankton levels are essentially unchanged, and epiphytes are not reported to be excessive. Macrophytes are present, but apparently are not preventing eelgrass regrowth each year.

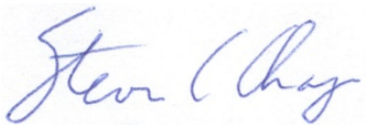
3. Is the Latimer and Rego, 2010 method contrary to the 2014 Peer Review and EPA's 2010 Stressor Response peer review?

   Yes to both aspects of this question. The 2014 Peer Review determined that the available system data did not confirm that TN was the cause of eelgrass decline or periodic low dissolved oxygen readings. The Latimer and Rego, 2010 analysis is not "new" nor is it "data" for this system nor is it reflective of the conditions controlling nutrient dynamics in the Great Bay Estuary. Thus, it cannot be used to demonstrate that the prior peer review conclusions are, in any way, in error.

   EPA's 2010 Stressor-Response methodology specifically requires consideration of the relevant factors (sometimes called "confounding factors") affecting an ecological response of concern when developing system wide nutrient criteria. This analysis fails to consider any of those relevant physical, chemical, or biological factors.

I hope that you find my observations helpful in determining the best path forward for protecting eelgrass resources in the Great Bay system. At this point, I do not see any scientifically defensible basis presented for asserting that additional TN reductions are currently required to protect or restore eelgrass resources. As noted by the 2014 Peer Review, it would be best to focus on the other factors known to affect that form of plant growth to better understand eelgrass dynamics for this system.

Sincerely,



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