GREAT BAY MUNICIPAL COALITION

November 19, 2018

Mr. Clark B. Freise
Assistant Commissioner
NH Dept. of Environmental Services
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Ms. Alexandra D. Dunn
Administrator, EPA New England Region
U.S. EPA – Region 1
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RE: Inapplicability of Latimer & Rego, 2010 to Great Bay

Dear Mr. Freise and Ms. Dunn:

As you are aware, EPA and NH DES have cited to Latimer & Rego, 2010 (and two related papers) as basis for claiming that existing total nitrogen (TN) loadings to Great Bay are excessive and must be below (at a minimum) 100 kg/ha-yr to protect the estuary's eelgrass resources. Following the November 7, 2018 science meeting with Dr. Latimer and receipt of his written response to the questions posed, it is apparent that the article's target TN loading rates have little relevance to the Great Bay Estuary system. We are bringing these issues to your attention now to ensure that you understand that, while the communities are willing to undertake efforts to maintain and improve nitrogen reduction capabilities, we cannot agree with the application of this paper as a "scientifically defensible" basis for imposing TN load limitations in NPDES permits or for declaring that our system is TN impaired. A list of the most obvious technical concerns and system differences are discussed below:

- The Great Bay system has extensive data showing low phytoplankton growth, no reported significant epiphyte growth, and limited macroalgae growth. These are the forms of plant growth that could impair eelgrass populations as noted in Dr. Latimer's paper. His response verified that his 2010 publication was simply a paper exercise based on multiple unverified assumptions that sought to generate a correlation between assumed eelgrass declines in small

embayments with assumed groundwater TN loadings. Dr. Latimer's response verified that no attempt was made to evaluate whether any predicted eelgrass losses were actually due to TN impairment, as evidenced by excessive plant growth. Moreover, as noted in the paper itself, "Direct determination of eelgrass loss was not possible because quantitative data on historical eelgrass extent were not available for any of our estuaries." (Latimer and Rego, 2010). An unverified paper exercise based on multiple assumptions (not applicable to the Great Bay system) is not a scientifically defensible basis for claiming that our system is TN impaired, in the face of multiple detailed assessments (2014 Peer Review, 2018 SOOE Report) and decades of data collection confirming that TN impairment is not demonstrated. In fact, in 2007, the New Hampshire Estuaries Project Technical Advisory Committee ("2007 TAC"), with Dr. Latimer present, concluded to "not spend time researching other estuaries for Option 5 [Reference approach for other estuaries in the ecoregion]. The reference estuaries are too different from Great Bay to be useful. […] Comparison of nitrogen yield between watersheds ignores differences in estuarine flushing. This approach will not be productive." (Attachment 1)

- Defensible application of Dr. Latimer's "comparative ecology" evaluation depends on whether the systems he considered were similar to the Great Bay system. Perhaps the most obvious factor indicating the inapplicability of the proposed approach is the actual data for our system, which confirm unimpaired eelgrass growth from 1990-2005 despite TN loads 5-10 times higher than the created datapoints used to generate the nomograph (see figure below, modified from Latimer and Rego, 2010). As demonstrated in the graphic, the degree of eelgrasses present in Great Bay would qualify as among the healthiest systems evaluated by Dr. Latimer in his nomograph. Moreover, the 30% eelgrass loss that is identified for 2016 was directly caused by the Mother's Day storm of May 2006 – to which the system has never fully recovered. Prior eelgrass losses due to wasting disease in the late-1980's fully recovered under equal or higher TN load conditions. In fact, existing growing season TN/DIN loadings and concentrations are now well below those occurring in the 1980's due to WWTP reductions. Therefore, there is no credible basis to assert that this inability to recover eelgrasses to pre-Mother's Day storm levels is due to TN loading. The system's lack of eelgrass regrowth is obviously due to factors unrelated to nitrogen.

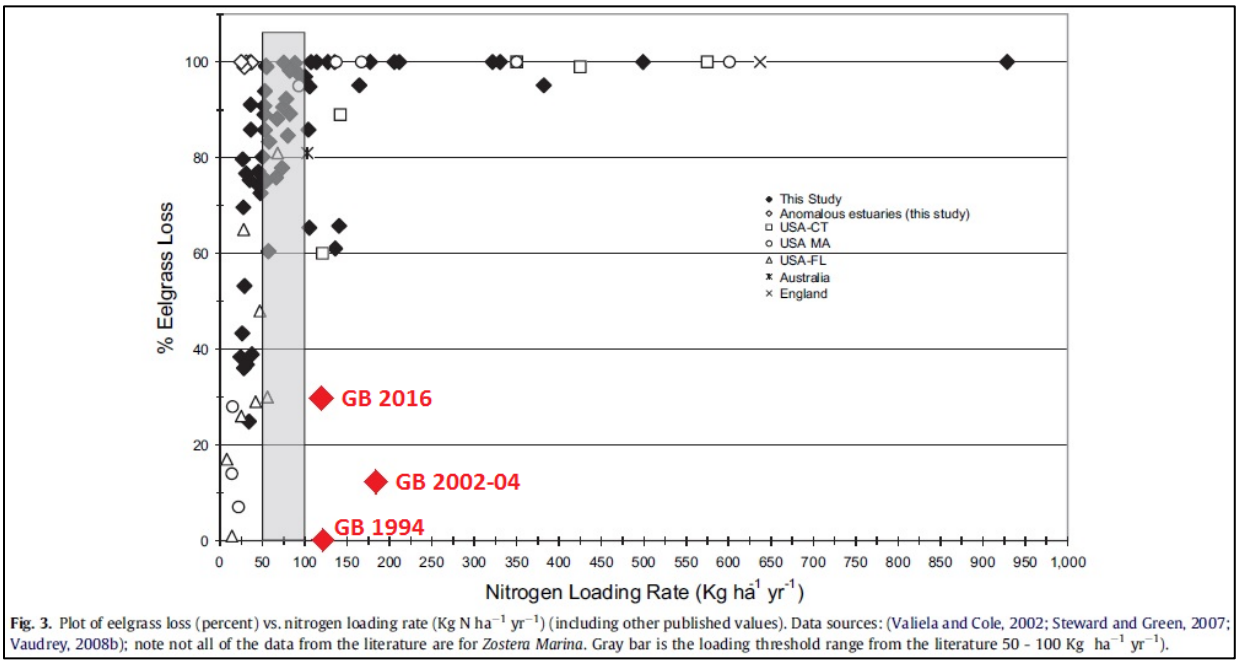


Fig. 3. Plot of eelgrass loss (percent) vs. nitrogen loading rate (Kg N ha^{-1} yr^{-1}) (including other published values). Data sources: (Valiela and Cole, 2002; Steward and Green, 2007; Vaudrey, 2008b); note not all of the data from the literature are for *Zostera Marina*. Gray bar is the loading threshold range from the literature 50 - 100 Kg ha^{-1} yr^{-1}).

As DES and EPA are aware, system-wide TN loads exceeded 200 kg/ha-yr during this period verifying that one cannot assert that this nomograph reasonably reflects TN levels necessary to protect eelgrass populations in this system. When asked whether any estuaries studied in Latimer & Rego, 2010 are similar to Great Bay Estuary segments, Dr. Latimer responded that "portions of Great Bay likely have tidal ranges similar to the study systems." This limited response indicates that there is little resemblance between the areas he assessed and Great Bay Estuary. Moreover, Dr. Latimer acknowledged that none of the systems he assessed reflected the physical conditions of Great Bay Estuary which is a "river dominated" system and has an extreme tidal range that provides direct sunlight exposure for eelgrass during the tidal cycle. This is a primary reason that historical and existing Great Bay TN loads are so much higher with extensive eelgrass beds compared to those systems Dr. Latimer evaluated which had more limited surface water inputs, smaller watershed contributions, and generally lower tidal ranges.

- As discussed at the November 7th meeting, the form of nitrogen Dr. Latimer evaluated originated from groundwater inputs. In response to Mr. Gallagher's inquiries, Dr. Latimer explained that the study's nitrogen loading rates were in fact the modeled total dissolved nitrogen (TDN) groundwater loads (primarily inorganic nitrogen). Thus, the reported nitrogen

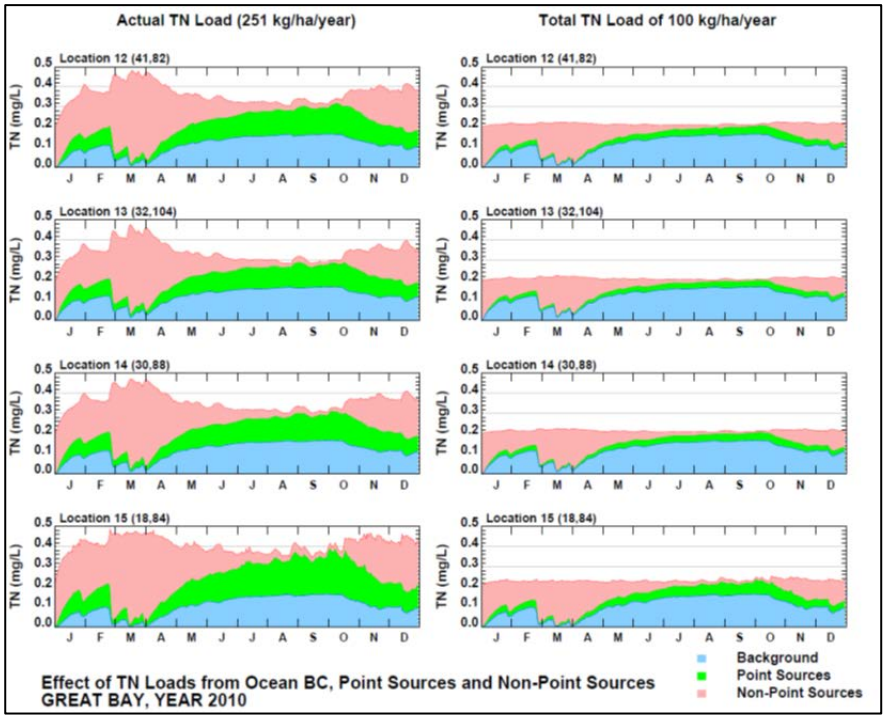
loadings in the study are actually TDN, not TN, loads. Our system is dominated by other far less bioavailable particulate/organic forms of nitrogen originating from watershed surface water inputs. Application of the TN nomograph to Great Bay is an apples and oranges comparison because the forms of TN assessed are plainly not the same. Therefore, to have any utility, only TDN loadings to Great Bay should be considered. On a related note, loads originating from "downstream" waters, such as the Piscataqua River, would also not be considered or would require appropriate adjustment.

- As noted in Dr. Latimer's response, the amount of eelgrass claimed to be missing was purely an assumption that eelgrass could grow in any waters less than 3 meters deep. Assuming this was a realistic assumption, the other factors that could be responsible for the lack of eelgrass present were never assessed, as required by EPA's 2010 Stressor-Response guidance document. In particular, wasting disease was known to have caused major declines in the late 1980's and thereafter in New England waters. Eelgrass literature widely recognizes that real-world variables such as shoreline development, substrate, water clarity (unrelated to excessive algal growth), dredging, current velocity, grazing, or seeding variability all affect eelgrass bed establishment and maintenance (as verified by the continued absence of eelgrass in Little Bay despite the full recovery of Great Bay). A scientifically defensible approach would need to consider these factors in setting a system-wide TN loading target.

- Much of the aerial photographic evidence utilized was taken too early in the growing season to reflect the true maximum extent of eelgrass present, thereby further overpredicting eelgrass losses and the assumed TN load impacts (i.e., "CT, Spring 2006; MA, Spring-Summer 2001; RI, August 2006."). As amply demonstrated in the Great Bay system, the timing of reconnaissance flights has a dramatic impact on areal eelgrass comparisons and therefore also on the conclusions of a comparative study like Latimer and Rego, 2010 which did not account for or evaluate such differences. The critical importance of the proper timing of the aerial photography is noted by NOAA's standard protocol for interpretation of submerged aquatic vegetation from aerial photography cited by Latimer and Rego, 2010: "Obtaining near-anniversary images greatly minimizes the effects of wetland seasonal phenological differences []." (NOAA C-CAP Guidance, 1995) See also, PREP's 2010 *UNH Eelgrass (Zostera marina) Monitoring Program for 2010-2014: Quality Assurance Project Plan*: "Each year, the Program Manager will organize an aerial over-flight in late August or early September to collect aerial imagery of the eelgrass distribution in the estuary at low tide."

- The study's reported protective loading rate was derived and applied as an annual average. Dr. Latimer's response noted this timeframe was chosen because of the loading model that was used, not because of a determination that non-growing season loads are ecologically relevant. Before application to Great Bay, any proposed target loads should be converted to a relevant growing season average.

- The Great Bay Municipal Coalition and HDR|HydroQual hydrodynamically modeled the TN concentrations in Great Bay resulting from an annual TN loading of 100 kg/ha-yr (see figure below).



The results of this modeling effort indicate that the ambient TN concentration in Great Bay would drop to approximately 0.2 mg/L. There is no scientific literature that supports this level of TN as necessary to protect eelgrass. In Chesapeake Bay, for example, even higher levels of TN (0.65 mg/L TN) are allowing for seagrass recovery (Wazniak et al., 2007). This provides further evidence that the Latimer and Rego target TN loading is inapplicable to Great Bay. This low TN concentration is due to the

extreme hydrodynamics of Great Bay Estuary compared to other systems in the Latimer and Rego study – the primary reason for the 2007 TAC conclusions against using TN loading targets.

In light of the explanations provided by Dr. Latimer and our analyses of whether using a 100 kg/ha-yr target produces scientifically defensible results, we do not believe that Latimer and Rego (or the related papers) should be a basis for any regulatory decisions regarding Great Bay Estuary, which are required to be based on defensible scientific approaches for the system in question. As noted, the 2007 TAC already concluded that loading approaches like Latimer and Rego should not be applied in Great Bay. If there is further disagreement on this conclusion, we request this issue be presented to the Peer Review Committee that the parties have used to resolve such issues in the past. Nonetheless, the municipalities are evaluating alternative approaches to advance the conversation.

Sincerely,

/s/

Dean Peschel

cc: Governor Christopher Sununu
Commissioner Robert Scott
GBMC Members

Attachment 1 –

December 7, 2007 New Hampshire Estuaries Project Technical Advisory Committee Meeting Minutes