Great Bay Total Nitrogen General Permit
Summary of Nitrogen Threshold

New Hampshire classifies the Great Bay estuary as a class B water. Among other things, Class B waters must satisfy the following narrative water quality criteria:

- All surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region. Env-Wq 1703.19(a).

- Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring. Existing discharges containing phosphorus or nitrogen, or both, which encourage cultural eutrophication shall be treated to remove the nutrient(s) to ensure attainment and maintenance of water quality standards. Env-Wq 1703.14(b) & (c).

"Cultural eutrophication" is defined in the NHWQS as "the human-induced addition of wastes that contain nutrients to surface waters, resulting in excessive plant growth or a decrease in dissolved oxygen, or both." Env-Wq 1702.15.

The draft fact sheet includes an extensive discussion of the scientific evidence for nitrogen-driven impairments in Great Bay (pp. 14-19), then sets forth a detailed discussion of studies that analyze nitrogen loading rates necessary to protect estuarine environments and evaluates their applicability to Great Bay (pp. 21-23). EPA proposes a numeric threshold of 100 kg ha^{-1} yr^{-1} based on those studies, a comparison to Narragansett Bay, and site-specific reports, analyses and conclusions which confirm the applicability of the loading approach to the Great Bay estuary. There are a range of available thresholds from the peer-reviewed scientific literature. EPA's decision to rely on existing peer-reviewed literature was made with the recognition that there is no available dynamic water quality TN model with which to fine tune the threshold. Development of a dynamic water quality model for TN will be challenging given the nature of the TN loading into Great Bay, which is predominated by NPS, and the complexity of the receiving waters. Given this, EPA concluded that an adaptive management approach using these literature values was a reasonable manner in which to frame the permit; this approach accounts for uncertainty by initially calling for a gross reduction in TN loading, which will be followed by fine tuning based on a monitoring program designed to follow actual receiving water responses. Should a defensible dynamic model be completed at some point in the future, those results may, of course, further inform the permit result. EPA's approach thus accommodates the desire by certain municipalities to develop additional science and management tools relating to TN impacts on Great Bay as part of an adaptive management approach.

EPA's analysis does not depend on any single study or comparison as the sole basis for this approach but relies on a broad understanding of available literature and site-specific data in Great Bay as well as comparable estuaries. More specifically, the first two scientific studies (i.e., Valiela & Cole, 2002 and Hauxwell et al., 2003) provide an upper threshold of 100 kg ha^{-1} yr^{-1} as an area-normalized nitrogen load for entire estuaries. This threshold is clearly applicable to the

Great Bay Estuary based on Great Bay's specific inclusion in the study. The third scientific study (*i.e.*, Latimer & Rego, 2010), provides a smaller scale analysis by evaluating estuarine embayments and concludes that area-normalized nitrogen loading to such embayments must also not exceed the same upper threshold. Finally, the comparison to Narragansett Bay acts to provide a direct comparison on a larger scale that actual area-normalized nitrogen load reductions similar to those proposed in this permit have been effective towards achieving water quality standards. This comparison confirms that such an approach is justified and that it is reasonable to expect a similar result in the Great Bay estuary. This is particularly true given that a 2007 NOAA report (discussed in the fact sheet) characterizes both Great Bay and Narragansett Bay with the same degree of susceptibility to nitrogen-induced eutrophication (*i.e.*, "moderately susceptible"). While any one of these lines of support may be sufficient to establish the threshold of 100 kg ha^{-1} yr^{-1} as a reasonable target, the fact that they each independently reinforce the same threshold gives EPA confidence that this threshold, as part of an adaptive management approach, is an effective means to protect eelgrass and achieve water quality standards throughout the Great Bay estuary.