

2. EXECUTIVE SUMMARY

Nitrogen enrichment is a widespread problem, leading to cultural eutrophication of coastal ecosystems worldwide. Cultural eutrophication is a condition caused by excess nutrient loads from human sources, leading to increased algal growth, reduced dissolved oxygen and adverse ecological impacts. Many estuaries are identified as being “at risk” or already affected by excess nitrogen loading, which may affect as many as 89 estuaries on Cape Cod.

The Massachusetts Estuaries Project (MEP) partnership was organized to provide a technical underpinning for development of total maximum daily loads (TMDLs), especially the establishment of water quality goals, source assessments and recommendations for source reductions. Nitrogen delivery to Cape Cod estuaries from human sources is dominated by septic inputs delivered to local waters through groundwater transport. This presents a unique challenge to local stakeholders who desire to protect and restore these sensitive ecosystems for their important contribution to the local lifestyle and economy.

This scientific peer review was sponsored by the Cape Cod Water Protection Collaborative (Collaborative), an agency of Barnstable County. The purpose was to conduct an independent scientific peer review of the MEP methodology for developing appropriate TMDLs for the estuaries and embayments of Cape Cod, and the use of that methodology as a basis for wastewater and nutrient management planning and implementation on Cape Cod. This scientific peer review process was independent and objective, and operated externally from the Collaborative and from any other Cape Cod stakeholders.

The Panel finds that the MEP modeling approach is scientifically credible. It is consistent with current understanding of existing conditions for Cape Cod estuaries, based on available data. The components in the approach are well-known and documented. Computation of watershed nitrogen loads is strongly data-driven and quantitatively linked to estuarine nitrogen concentrations. A fundamental principle in the development and application of environmental models to inform management decisions is that there should be compatibility among the study questions and objectives, available data and resources, and level of model complexity. The Panel finds that the level of complexity in the components and linkages of the MEP modeling approach is simple, parsimonious and well balanced within this context.

The Panel also finds that the MEP modeling approach is functionally adequate. This approach is specifically designed for groundwater dominated systems and explicitly considers nitrogen loads from septic systems, the dominant controllable watershed source of nitrogen for Cape Cod estuaries. The MEP modeling approach is appropriate and useful for evaluating alternative scenarios and informing nutrient management plans, and is consistent with existing nationwide TMDL practices.

The Panel recommends that the MEP modeling approach be considered within the larger context of the overall decision support system and not be limited to just the linked watershed-embayment model. The Panel further recommends that an adaptive management framework be used for this decision support system, which integrates the watershed-embayment model. This integration should include continued monitoring, data analysis and modeling to improve scientific understanding and reduce uncertainties in the physical, chemical and biological processes in the watersheds and estuaries.

The Panel recommends that the towns proceed within this adaptive management framework to develop and implement wastewater and nutrient management plans, and make improvements along the way to reduce management uncertainties. This will ensure that TMDL implementation is not compromised due

to a lack of information, and that progress will be made in the most cost-effective manner while gathering new information to improve upon the scientific analysis, and the initial wastewater and nutrient management plans.