UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
5 POST OFFICE SQUARE, SUITE 100
BOSTON, MASSACHUSETTS 02109-3912

June 26, 2017

Martin Suuberg, Commissioner
Department of Environmental Protection
One Winter Street
Boston, MA 02108

Re: Approval of the Final Bass River Estuarine System TMDL for Total Nitrogen

Dear Commissioner Suuberg:

Thank you for your Department's submittal of the TMDL analysis for Bass River Estuarine System on May 10, 2017. We appreciate your efforts and involvement with our office to finalize this TMDL. The U.S. Environmental Protection Agency (EPA) has reviewed the document entitled "Final Bass River Estuarine System Total Maximum Daily Load for Total Nitrogen", Control #392.1, May 2017 and it is my pleasure to approve the 9 Total Nitrogen TMDLs. EPA has determined, as set forth in the enclosed review document, that this TMDL meets the requirements of Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 Code of Federal Regulations (CFR) Part 130.

We are very pleased with the quality of your TMDL submittal from the Division of Watershed Management, and commend your efforts to address nutrient-related impacts to the Bass River Estuary. MassDEP's efforts will help restore water quality and prevent further degradation of this, and adjacent, waterbody segments. My staff and I look forward to continued cooperation with the Massachusetts DEP in exercising our shared responsibility of implementing the requirements under Section 303(d) of the CWA. If you have any questions regarding this approval, please contact Ralph Abele at (617) 918-1629 or have your staff contact Bryan Dore of my staff at (617) 918-1211.

Sincerely,

/s/

Arthur Johnson, Acting Director
Office of Ecosystem Protection

Enclosure

cc:
Rebecca Weidman, MassDEP
Kimberly Groff, MassDEP
Barbara Kickham, MassDEP
Lynne Hamjian, EPA
Ralph Abele, EPA
Bryan Dore, EPA

EPA NEW ENGLAND'S TMDL REVIEW

DATE: June 26, 2017

TMDL: Bass River Estuarine System TMDL for Total Nitrogen

STATUS: Final

IMPAIRMENT/POLLUTANT: 9 Total Nitrogen TMDLs (See Attachment 1)

BACKGROUND: EPA Region 1 received the *Bass River Estuarine System Total Maximum Daily Loads for Total Nitrogen* (Control Number: CN 392.1) with a transmittal letter dated May 10, 2017. In addition to the Final Nitrogen TMDL itself, the submittal included, either directly or in reference, the following documents:

- Public Meeting Information and Response to Comments, Appendix D
- Massachusetts Surface Water Quality Standards (WQS)
- Massachusetts Estuaries Project, Linked Watershed-Embayment Approach to Determine Critical Nitrogen Loading Thresholds for the Bass River Embayment System, Towns of Yarmouth and Dennis, Massachusetts. **http://www.mass.gov/eea/docs/dep/water/resources/mep/cape/mep-bassriver-mc.pdf**
- Massachusetts Year 2014 Integrated List of Waters: Final Listing of the Condition of Massachusetts' Waters Pursuant to Sections 305(b), 314 and 303(d) of the Clean Water Act (CN 450.1), December 2015. http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf
- Massachusetts Estuaries Project Embayment Restoration and Guidance for Implementation Strategies, MassDEP 2003. http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/mepmain.pdf

The following review explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with § 303(d) of the Clean Water Act and EPA's implementing regulations in 40 CFR Part 130.

REVIEWERS: Bryan Dore (617-918-1211) e-mail: dore.bryan@epa.gov

REVIEW ELEMENTS OF TMDLs

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. § 130 describe the statutory and regulatory requirements for approvable TMDLs. The following information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Description of Waterbody, Pollutant of Concern, Pollutant Sources and Priority Ranking

The TMDL analytical document must identify the waterbody as it appears on the State/Tribe's 303(d) list, the pollutant of concern and the priority ranking of the waterbody. The TMDL submittal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and location of the sources. Where it is possible to separate natural background from nonpoint sources, a description of the natural background must be provided, including the magnitude and location of the source(s). Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as: (1) the assumed distribution of land use in the watershed; (2) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources; (3) present and future growth trends, if taken into consideration in preparing the TMDL; and, (4) explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments, or chlorophyll a and phosphorus loadings for excess algae.

A. Description of Waterbody, Priority Ranking, and Background Information

The Bass River Estuarine System is one of the largest estuaries on Cape Cod and its watershed is shared by the towns of Dennis and Yarmouth and a very small part of Brewster (see Figures 1 and 2 in TMDL document). The system runs roughly north to south and is comprised of a tidal river connecting a series of large kettle ponds (Mill Pond, Follins Pond and Dinahs Pond) to Nantucket Sound. It also encompasses a small lagoonal tributary basin (known as Davis Beach or School Street Marsh) behind the barrier beach east of the river's mouth which supported salt marsh and has now been partially filled and developed. The barrier beach itself grew from a spit that was formed as marine sands and gravels were deposited east to west by coastal processes during the post-glacial sea level rise. The lithology of the watershed is characterized by sand and gravel deposits in the lower portion of the system, while the upper watershed is comprised of boulders and glacial drift overlying the outwash sand and gravel of the Falmouth moraine.

The Bass River embayment system is a complex estuary composed of two functional types of component basins: embayments (Mill Pond, Follins Pond, Dinah's Pond, Kelleys Bay, Grand Cove, Bass River); and a salt marsh basin (School Street Marsh /Weir Creek). Its ponds and coves delineate a number of subbasins (Davis Beach, Grand Cove, Dinahs Pond, Kelleys Bay, Follins Pond and Mill Pond) and its long tidal reach results in a well-defined salinity gradient from the inlet (most saline) to Mill Pond (least saline). The upper reaches of the system appear to be the most nitrogen sensitive; however, the N loads emanating from the upper portion eventually have an impact on the lower reaches, and therefore the system has to be managed holistically.

The TMDL document presents a sound overview of the estuary system and the companion Massachusetts Estuaries Project final report (April 2011) presents a thorough description of the Bass

River estuarine system. The MEP project divided the Bass River estuary system into 9 distinct areas for analysis: Bass River (characterized as Bass River – Lower, Bass River – Middle, and School Street Marsh), Run Pond, Bass River "Grand Cove" portion, Dinah's Pond, Kellys Bay, Follins Pond, Mill pond, Mill Pond Stream: Weir Creek, and Mill Pond Stream: Muddy Creek. All segments were found to be impaired for nutrients in the MEP Technical Report and will be included on a future List of Waters.

MassDEP has determined that all nutrient impaired segments in the Commonwealth are a high priority. See the Massachusetts 2014 Integrated List of Waters at:
http://www.mass.gov/eea/docs/dep/water/resources/07v5/14list2.pdf

B. Pollutant of Concern

In the Bass River Estuarine System, the pollutant of concern is the nutrient nitrogen. Additional impairments include excess nutrients, dissolved oxygen level, chlorophyll *a*, benthic fauna, eelgrass, and macroalgae.

C. Pollutant Sources

The TMDL document identifies that the predominate sources of controllable N affecting this system originate from on-site subsurface wastewater disposal systems (septic systems). Additional controllable sources include the runoff from impervious surfaces, lawn fertilizers, and landfills. Other sources, not locally controllable, include atmospheric nitrogen deposition to the estuary and natural surfaces (page 13 of the TMDL document).

Assessment: EPA Region 1 concludes that the TMDL document meets the requirements for describing the TMDL waterbody segments, pollutants of concern, identifying and characterizing sources of impairment, and priority ranking.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribe water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. A numeric water quality target for the TMDL (a quantitative value used to measure whether or not the applicable water quality standard is attained) must be identified. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, usually site specific, must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal.

Water quality classification for the saltwater portion of the Bass River estuarine system is SA, while freshwater portions of the system are classified as B. The TMDL document identifies several provisions of the Commonwealth's water quality standards that are relevant to the cultural eutrophication in these waters, including numeric criteria for dissolved oxygen and narrative criteria for nutrients, aesthetics, excess plant biomass, and nuisance vegetation (page 14 of the TMDL document). As stated on page 15 of the TMDL document and in EPA guidance, individual estuarine and coastal marine waters tend to have unique characteristics and therefore, site-specific analyses of the individual water body are typically required. For example, the loading of nitrogen that a specific water body can handle without becoming impaired varies. Factors that influence the effect of nitrogen include: flow velocity, tidal hydraulics, dissolved oxygen, and sediment adsorption and desorption of nitrogen.

The Massachusetts Estuaries Project analytical method is the Linked Watershed-Embayment Management Model (Linked Model), discussed on pages 16-23 of the TMDL document. It links watershed inputs with embayment circulation and nitrogen characteristics, and:

- requires site-specific measurements within each watershed and embayment;
- uses realistic "best-estimates" of nitrogen loads from each specific type of land-use;
- spatially distributes the watershed nitrogen loading to the embayment;
- accounts for nitrogen attenuation during transport to the embayment;
- includes a 2D or 3D embayment circulation model depending on embayment structure;
- accounts for basin structure, tidal variations, and dispersion within the embayment;
- includes nitrogen regenerated within the embayment;
- is validated by both independent hydrodynamic, nitrogen concentration, and ecological data; and
- is calibrated and validated with field data prior to generation of "what if" scenarios.

A sentinel station was identified in the embayment system at a location at which restoration will necessarily result in high quality habitat throughout the system and attainment of water quality standards (page 19 of the TMDL document). For the Bass River system, high quality habitat was defined as stable eelgrass beds in the lower reach of Bass River and healthy infaunal habitat throughout the system. The sentinel station BR-7 was placed within the mid-reach of the Bass River (page 20-21 of the TMDL document, as seen on Figure 5). This site was selected such that the restoration of it would necessarily bring the other regions of the system to acceptable habitat quality levels.

Per the TMDL document, the determination of the critical nitrogen threshold for maintaining high habitat quality with the Bass River estuarine system is based predominately on nutrient and oxygen levels, temporal trends in eelgrass distribution, and benthic community indicators. As there has been no significant eelgrass habitat within the Bass River estuary for more than a decade, determination of a target threshold nitrogen concentration that would restore eelgrass at the sentinel location was based on comparison to other local embayments of similar depths and structure under the MEP studies. Similar systems like Bournes Pond estuary, where eelgrass is confined to the lower estuary, exhibit nitrogen concentrations that support fringing eelgrass at 0.45 mg N/L and within the open water channel at a lower level (0.42 mg N/L), which is very similar to the situation in the Bass River estuary in the vicinity of stations BR-6 and BR-7. (See Sections VII and VIII of the MEP report for a complete discussion of the threshold nitrogen concentration). The target threshold nitrogen concentrations selected for the system is 0.42 mg/L at the sentinel station BR-7 (Table 4, page 19 of the TMDL document). It is important to note that the concentration necessary for healthy eelgrass habitat restoration in the estuary presents some level of uncertainty, which will be addressed by the adaptive management approach taken in the TMDL document. Should the target concentration be met at the sentinel station without eelgrass habitat restoration in the lower reaches of the Bass River, as well as restoration of benthic infaunal habitats in the upper reaches, adaptive management of the target concentrations and load reductions will be re-evaluated (page 50 of the TMDL document). MassDEP's commitment to monitor the receiving water response is, in EPA's view, a reasonable measure designed to manage the inherent uncertainty around selecting an instream target against a backdrop of considerable scientific and technical uncertainty. While there is sufficient basis in the administrative record at the time of approval to conclude that the selected target will be protective, EPA will coordinate with the MassDEP to review any additional monitoring data or other information that may become available concerning eelgrass populations in the

receiving waters, consistent with MassDEP's commitment to evaluate the adequacy of the target.

Assessment: The use of the Linked Model, the description of the process in the TMDL document, and the companion Technical Report to this TMDL document adequately demonstrate the basis for deriving the target nitrogen loads and demonstrating that the targets will achieve water quality standards. EPA Region 1 concludes that MassDEP has properly presented its numeric water quality targets and has made a reasonable and appropriate interpretation of its narrative water quality criteria for the designated uses of the Bass River Estuarine System. In addition, MassDEP's adaptive management approach to the TMDL allows for revision if the target concentration is reached but habitat indicators are not met.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards (40 C.F.R. § 130.2(f)). The loadings are required to be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. § 130.2(i)). The TMDL submittal must identify the waterbody's loading capacity for the applicable pollutant and describe the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In most instances, this method will be a water quality model. Supporting documentation for the TMDL analysis must also be contained in the submittal, including the basis for assumptions, strengths and weaknesses in the analytical process, results from water quality modeling, etc. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation.

In many circumstances, a critical condition must be described and related to physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. § 130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.

As stated in the TMDL document, the Linked Model is a robust and fairly complicated model that determines an embayment's nitrogen sensitivity, nitrogen threshold watershed loading levels and response to changes in the loading rate. A key feature of the approach involves the selection of sentinel locations that have the poorest water quality in the embayment system. If these degraded areas come into compliance with the TMDL, other areas will also achieve water quality standards for nitrogen in the system. This approach captures the critical targets needed to address the impaired segments.

The percent reductions of existing nitrogen loads necessary to meet the target threshold watershed loads range from 0% to 82.82% with an overall required reduction of 47.43% for the Bass River System as a whole (Table 6 below, page 23 of the TMDL document). As described in the TMDL document, these loads represent one scenario using the Linked Model that could achieve the target threshold N concentration at the sentinel station. An alternative scenario to meet the target threshold N concentration can also be evaluated as part of the MEP process, at the town's request.

TABLE 6. Present Watershed Nitrogen Loading Rates, Calculated Loading Rates that are Necessary

to Achieve Target Threshold Nitrogen Concentrations, and the Percent Reductions of the Existing Loads Necessary to Achieve the Target Threshold Loadings*

Sub-embayment	Present Total Watershed Load [1] (kg/day)	Target Threshold Watershed Load[2] (kg/day)	% Watershed Load Reductions Needed to Achieve Target
Run Pond	8.384	8.384	0
Bass River – Lower	36.764	36.764	0
School Street Marsh	11.882	11.882	0
Bass River – Middle	67.674	29.833	-55.92
Grand Cove	7.293	7.293	0
Dinah's Pond	4.337	0.778	-82.06
Kelleys Bay	20.126	3.860	-80.82
Follins Pond	34.121	7.858	-76.97
Mill Pond	27.238	7.847	-71.19
System Total	**217.819**	**114.499**	**-47.43**

[1] Includes fertilizers, runoff, farm animals, landfill, atmospheric deposition to lakes and natural surfaces and wastewater inputs

[2]Target threshold watershed load is the N load from the watershed (including natural background) needed to meet the target threshold N concentration identified in Table 4 on page 19 of the TMDL document.

* From Tables ES-2 and VIII-3 in the MEP Technical Report

The TMDL for each embayment considers all sources of N, and is therefore the sum of the calculated target threshold watershed load, atmospheric deposition load, and benthic flux load from sediment sources (Table 7 below, page 31 of the TMDL document). The TMDLs for Bass River Estuarine System range from 1.088 kg N/day to 113.214 kg N/day. The TMDL for the Bass River System as a whole is 206.289 kg N/day.

Table 7: The Total Maximum Daily Loads (TMDL) for the Bass River Estuarine System

Sub-embayment	Target Threshold Watershed Load[1] (kg N/day)	Atmospheric Deposition (kg N/day)	Nitrogen Load from Sediments[2] (kg N/day)	TMDL[3] (kg N/day)
Run Pond	8.384	0.222	0	**8.606**
Bass River – Lower	36.764	2.995	0	39.759
School Street Marsh	11.882	0.247	3.610	15.739
Bass River - Middle	29.833	3.841	24.042	57.716
Bass River[4]				**113.214**
Grand Cove	7.293	1.071	13.699	**22.063**
Dinah's Pond	0.778	0.310	0	**1.088**
Kelleys Bay	3.860	0.778	17.337	**21.975**
Follins Pond	7.858	2.658	19.540	**30.056**
Mill Pond, Weir Creek, Muddy Creek	7.847	0.833	0.607	**9.287**
Bass River System Total	**114.499**	**12.955**	**78.835**	**206.289**

[1] Target threshold watershed load (including natural background) is the load from the watershed needed to meet the embayment target threshold nitrogen concentration identified in Table 4 of the TMDL Document.
[2] Projected sediment N loadings obtained by reducing the present benthic flux loading rates (Table 5 of the TMDL) proportional to proposed watershed load reductions and factoring in the existing and projected future concentrations of PON. (Negative fluxes set to zero.)
[3] Sum of target threshold watershed load, sediment load and atmospheric deposition load.
[4] The TMDL for East Branch Bass River is the sum of the Lower and Middle and the School Street Marsh.

Assessment: The TMDL document explains and EPA concurs with the approach for applying the Linked Model to specific embayments for the purpose of developing target nitrogen loading rates and in identifying sources of needed nitrogen load reduction. EPA believes that this approach is reasonable because the factors influencing and controlling nutrient impairment were well justified, as demonstrated by the foregoing and the TMDL's administrative record.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity allocated to existing and future nonpoint sources and to natural background (40 C.F.R. § 130.2(g)). Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. § 130.2(g)). Where it is possible to separate natural background from nonpoint sources, load allocations should be described separately for background and for nonpoint sources.

If the TMDL concludes that there are no nonpoint sources and/or natural background, or the TMDL recommends a zero load allocation, the LA must be expressed as zero. If the TMDL recommends a zero LA after considering all pollutant

sources, there must be a discussion of the reasoning behind this decision, since a zero LA implies an allocation only to point sources will result in attainment of the applicable water quality standard, and all nonpoint and background sources will be removed.

Using the Linked Model, MassDEP has identified the portion of the loading capacity allocated to existing and future non-point sources necessary to meet water quality standards. Within the Bass River estuary system, the majority of locally-controllable non-point source loadings are the result of on-site subsurface wastewater disposal systems (septic systems). Additional nitrogen sources include: runoff from impervious surfaces, fertilizers, and landfills. The percent contribution of locally controllable sources of nitrogen to the Bass River system is approximately 82% from septic systems, 8% from stormwater runoff from impervious surfaces (except stormwater from directly-connected impervious areas, which are considered waste loads), 8% from lawn fertilizers, and 2% from landfills. Natural background loading is included in the estimates, but is not presented separately.

MassDEP describes the load allocations for natural background sources (see page 24 of the TMDL document).

Assessment: EPA concludes that the TMDL document sufficiently addresses the calculation of the load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources (40 C.F.R. § 130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and background will result in attainment of the applicable water quality standard, and all point sources will be removed.

In preparing the wasteload allocations, it is not necessary that each individual point source be assigned a portion of the allocation of pollutant loading capacity. When the source is a minor discharger of the pollutant of concern or if the source is contained within an aggregated general permit, an aggregated WLA can be assigned to the group of facilities. But it is necessary to allocate the loading capacity among individual point sources as necessary to meet the water quality standard.

The TMDL submittal should also discuss whether a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. In such cases, the State/Tribe will need to demonstrate reasonable assurance that the nonpoint source reductions will occur within a reasonable time.

The Commonwealth assigned to the WLA those point sources (1) that "discharge" pollutants to waters of the United States within the meaning of the Act and (2) that are subject to the NPDES permitting program (existing and future); it allocated sources that did not meet these two criteria to the LA. Thus, for example, the pollutant loads from MS4s that discharge nitrogen and are subject to the NPDES permit program were included in the WLA, while the remaining sources of nitrogen (e.g., septic systems and WWTFs) that are initially released to ground and enter the receiving waters only after traveling through soils and groundwater, were included in the LA portion of the load.

This approach is reasonable and is consistent with the Act and implementing regulations. By illustration, EPA interprets 40 CFR § 130.2(h) to require that allocations for NPDES-regulated discharges of stormwater be included in the waste load component of the TMDL. On Cape Cod and the

Islands the vast majority of stormwater percolates into the ground and aquifer and proceeds into the embayment systems through groundwater migration. Although the vast majority of stormwater percolates into the ground, there are a few stormwater pipes that discharge directly to water bodies that are subject to the requirements of the Phase II Stormwater NPDES Program. The loadings allocated to such stormwater discharges must be treated as a waste load allocation. Since the majority of the nitrogen loading comes from septic systems, fertilizer, and stormwater that infiltrates into the groundwater, the allocation of nitrogen for any stormwater pipes that discharge directly to any of the embayments is insignificant as compared to the overall groundwater load.

Based on land use, the Linked Model accounts for loading of stormwater, but does not explicitly breakout stormwater into a load and waste load allocation. Nonetheless, based on the fact that generally there are few stormwater discharge pipes within NPDES Phase II communities on the Cape and Islands that discharge directly to embayments or waters that are connected to the embayments, a small relatively insignificant total waste load allocation was calculated for these sources. This is based on the percent of impervious surface within 200 feet of the shoreline that may discharge stormwater via pipes directly to the water body. For the purposes of waste load allocation, it was assumed that all impervious surfaces within 200 feet of the shoreline discharge directly to the water body whether or not they actually do so. This load was calculated to be 0.39% of the total N load, or 1.03 kg/day. Although the loading contribution from the point source discharges is insignificant compared to the non-point sources, the point source discharges are subject to the Phase II Stormwater NPDES Program and their collective load is to be treated as a WLA. In the absence of site-specific information on direct discharge sources, EPA believes the approach set out in the TMDL for the WLAs is reasonable. The specific WLAs are set forth in Appendix B and on pages 24-25 of the TMDL document.

Assessment: EPA concludes that the TMDL document sufficiently addresses the calculation of the waste load allocations, as demonstrated by the foregoing and by the TMDL's administrative record.[1]

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1)). EPA guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the MOS must be described. If the

[1] The categorization of the pollutant sources on Cape Cod (*i.e.*, whether a particular source, or category of sources, is required as a matter of law to be placed within the WLA or LA) has been the subject of recent litigation. On August 24, 2010, CLF filed a complaint in the United States District Court for the District of Massachusetts, captioned *Conservation Law Foundation et al. v. United States Environmental Protection Agency, et al*., Action No. 1:10-cv-11455, challenging EPA's approval of thirteen (13) Total Maximum Daily Load determinations submitted to EPA by the Commonwealth of Massachusetts under section 303(d), 33 U.S.C. § 1313(d), of the Clean Water Act, 33 U.S.C. §§ 1251-1387, as arbitrary and capricious, an abuse of discretion, and in violation of the Administrative Procedure Act, 5 U.S.C. § 706(2). EPA's positions on categorization, margin of safety, seasonal variation and other matters raised in the litigation, including climate change, have been described in the Agency's filings in that case; have been specifically considered and relied upon by EPA for the purpose of these TMDL approvals; and accordingly, have been incorporated into the TMDL's administrative record. Additionally, EPA has considered MassDEP's correspondence of April 3, 2015 regarding these issues, and EPA's analysis thereof has also been included in the administrative record.

MOS is explicit, the loading set aside for the MOS must be identified.

MassDEP employs an implicit MOS in these TMDLs, described in the TMDL document on pages 27-30. There are several factors that contribute to the margin of safety inherent in the approach used to develop this TMDL including:

1) **Use of conservative data in the Linked Model as follows**:
    - Nitrogen concentrations in the watershed that were used in the model are conservative because the model assumes 100% of the groundwater discharge load enters the embayment, and stream flow entering the embayment was directly measured to determine attenuation;
    - Agreement between the modeled and observed values has been approximately 95%;
    - Water column nitrogen validation dataset is conservative. High or low measurements are marked as outliers;
    - Reductions in benthic regeneration of nitrogen are most likely underestimates based on a reduced deposition of PON, due to lower primary production rates under the reduced N loading in these systems; and

2) **Conservative sentinel station/target threshold nitrogen concentrations.** The target nitrogen concentration was chosen based on sites that had stable eelgrass or benthic animal (infaunal) communities, and not those just starting to show impairment, which would have slightly higher N concentration. Meeting the target threshold N concentrations at the sentinel stations will result in reductions of N concentrations in the rest of the system; and

3) **Conservative approach.** The target loads were based on tidally averaged N concentrations on the outgoing tide, which is the worst case condition because that is when the N concentrations are the highest. The N concentrations will be lower on the flood tides and therefore this approach is conservative.

Assessment: EPA concludes that the approach used in developing the TMDL provides for an adequate implicit MOS, as demonstrated by the foregoing and by the TMDL's administrative record.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA § 303(d)(1)(C), 40 C.F.R. § 130.7(c)(1).

The TMDLs for the water body segments identified in the document are based on achieving the nitrogen loads during the most critical time period, i.e., the summer growing season. Since the other seasons are less sensitive to nitrogen loading, the TMDLs are protective of all seasons throughout the year. Seasonal variation is addressed on page 30 of the TMDL document.

Assessment: Since the other seasons are less sensitive to nitrogen loading, EPA concludes that the TMDL is protective of all seasons throughout the year.

8. Monitoring Plan

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), and EPA's 2006 guidance, Clarification Regarding "Phased" Total Maximum Daily Loads, recommend a monitoring plan

when a TMDL is developed using the phased approach. The guidance indicates that a State may use the phased approach for situations where TMDLs need to be developed despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future. EPA's guidance provides that a TMDL developed under the phased approach should include, in addition to the other TMDL elements, a monitoring plan that describes the additional data to be collected, and a scheduled timeframe for revision of the TMDL.

The TMDL document presents two forms of monitoring that would be useful to determine progress towards achieving compliance with the TMDL (page 35 of the TMDL document). MassDEP's position is that TMDL implementation will be conducted through an iterative process where adjustments may be needed in the future. The two forms of monitoring include 1) tracking implementation progress as approved in the Dennis and Yarmouth CWMP plans and 2) monitoring water quality and habitat conditions in the estuaries, including but not limited to, the sentinel stations identified in the MEP Technical Report. Relative to water quality MassDEP believes that an ambient monitoring program much reduced from the data collection activities needed to properly assess conditions and to populate the model, will be important to determine actual compliance with water quality standards. Although more specific details need to be developed on a case-by-case basis, MassDEP believes that about half the current effort (using the same data collection procedures) would be sufficient to monitor compliance over time and to observe trends in water quality changes. In addition, the benthic habitat and infaunal communities would require periodic monitoring on a frequency of about every 3-5 years. Finally, in addition to the above, existing monitoring conducted by MassDEP for eelgrass should continue into the future to observe any changes that may occur to eelgrass populations as a result of restoration efforts.

Assessment: EPA concludes that the anticipated ambient water quality monitoring program approved in the CWMP by MassDEP is sufficient to evaluate the adequacy of the TMDL and attainment of water quality standards, although is not a required element of EPA's TMDL approval process.

9. Implementation Plans

On August 8, 1997, Bob Perciasepe (EPA Assistant Administrator for the Office of Water) issued a memorandum, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," that directs Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired solely or primarily by nonpoint sources. To this end, the memorandum asks that Regions assist States/Tribes in developing implementation plans that include reasonable assurances that the nonpoint source load allocations established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The memorandum also includes a discussion of renewed focus on the public participation process and recognition of other relevant watershed management processes used in the TMDL process. Although implementation plans are not approved by EPA, they help establish the basis for EPA's approval of TMDLs.

The implementation plan for the total nitrogen TMDL for the Bass River system is described on pages 31-35 of the TMDL document. EPA concludes that the approach taken by MassDEP is reasonable because of the resources available to the towns to address nitrogen such as the CWMP, additional linked model runs at nominal expense, assessment of cost-effective options for reducing loadings from individual on-site subsurface wastewater disposal systems, as well as reductions in stormwater runoff and/or fertilizer use within the watershed through the establishment of local by-laws and/or the implementation of stormwater Best Management Practices. The Towns of Dennis and Yarmouth are covered by the Phase II MS4 stormwater permit and therefore compliance with the permit will contribute to reducing the nitrogen load to the watershed of the Bass River estuary. It should also be noted that a small portion of the Town of Brewster is in the Bass River watershed, and should be included when coordinating efforts to maximize the reduction in N where possible. MassDEP advised

the towns to incorporate the nitrogen loading reduction strategies outlined in the Massachusetts Estuaries Implementation Guidance report http://www.mass.gov/eea/docs/dep/water/resources/a-thru-m/mepmain.pdf into the implementation plan.

Assessment: MassDEP has addressed the implementation plan. Although EPA is not approving the implementation plan, EPA has concluded that it outlines a reasonable approach to implementation, as demonstrated by the foregoing and by the TMDL's administrative record.

10. Reasonable Assurances

EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources. In a water impaired by both point and nonpoint sources, where a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will happen must be explained in order for the TMDL to be approvable. This information is necessary for EPA to determine that the load and wasteload allocations will achieve water quality standards.

In a water impaired solely by nonpoint sources, reasonable assurances that load reductions will be achieved are not required in order for a TMDL to be approvable. However, for such nonpoint source-only waters, States/Tribes are strongly encouraged to provide reasonable assurances regarding achievement of load allocations in the implementation plans described in section 9, above. As described in the August 8, 1997 Perciasepe memorandum, such reasonable assurances should be included in State/Tribe implementation plans and "may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs."

The TMDL targets for point sources in this TMDL are not less stringent based on any assumed nonpoint source reductions, so documentation of reasonable assurance in the TMDL is not a requirement. However, MassDEP addresses the concept of reasonable assurance insofar as it relates to overall TMDL implementation on pages 36-37 of the Final TMDL. In addition, Dennis and Yarmouth have demonstrated their commitment to implement this TMDL through the comprehensive wastewater planning that they initiated well before the generation of this TMDL. The towns expect to use the information in this TMDL to generate support from their citizens to take the necessary steps to remedy existing problems related to nitrogen loading on-site subsurface wastewater disposal systems, stormwater runoff (including lawn fertilizers), and to prevent any future degradation of these valuable resources. Enforcement of local, state, and federal programs for pollution control contribute to the level of reasonable assurance. There are also financial incentives to encourage the towns to follow through with its plans and prevent further degradation to water quality.

Assessment: Because MassDEP did not increase WLAs based on expected LA reductions, reasonable assurance is not required. However, EPA acknowledges MassDEP's reasonable assurance discussion for the record.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. § 130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. § 130.7(d)(2)).

Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

The public participation process for the Bass River Estuarine System TMDL is described on page 37 of the TMDL document. MassDEP publically announced the draft TMDL and copies were distributed to key stakeholders. A public meeting to present the results of and answer questions on this TMDL was held on December 14, 2016 at the Dennis Council on Aging for all interested parties. The public comment period was extended until close of business January 16, 2017 and comments received at the public meeting and received in writing within the comment period were considered by MassDEP. The attendance list, public comments from the meeting, written comments received by MassDEP, and the MassDEP responses are included in Appendix D of the TMDL document. MassDEP fully addressed all comments received in Appendix D of the TMDL document.

Assessment: EPA concludes that MassDEP has done a sufficient job of involving the public in the development of the TMDL, provided adequate opportunities for the public to comment and has addressed the comments received as set forth in the response to comment section of the TMDL document.

12. Submittal Letter

A submittal letter should be included with the TMDL analytical document, and should specify whether the TMDL is being submitted for a technical review or is a final submittal. Each final TMDL submitted to EPA must be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final submittal, should contain such information as the name and location of the waterbody, the pollutant(s) of concern, and the priority ranking of the waterbody.

Assessment*:* On May 10, 2017, MassDEP submitted the Final Bass River Estuarine System TMDL For Total Nitrogen (Control #392.1) and associated documents for EPA approval. The documents contained all of the elements necessary to approve the TMDL

Attachment 1: Bass River Estuarine System: Nine Total Nitrogen TMDLs (taken from Appendix C of the TMDL)

Sub-embayment	Segment ID/Description	Description	TMDL (kgN/day)
Run Pond	MS96265_2018[1]	Dennis	**8.606**
Bass River - Lower			39.759
School Street Marsh			15.739
Bass River - Middle			57.716
Bass River[2]	MA96-12	Route 6, Dennis/Yarmouth to mouth at Nantucket Sound, Dennis/Yarmouth (excluding Grand Cove, Dennis)	**113.214**
Bass River "Grand Cove" portion	MA96-118_2018[1]	"Grand Cove" portion of Bass River, north of Main Street (Route 28), Yarmouth	**22.063**
Dinah's Pond	MA96-112_2018[1]	Yarmouth	**1.088**
Kelley's Bay	MA96-113_2018[1]	Dennis/Yarmouth	**21.975**
Follins Pond	MA96-114_2018[1]	Dennis/Yarmouth	**30.056**
Mill Pond	MA96-117_2018[1]	Yarmouth	**7.332**
Mill Pond Stream: Weir Creek	MA96-116_2018[1]	Headwaters, outlet Mill Pond, Yarmouth to mouth at confluence with Muddy Creek, Yarmouth	**1.629**
Mill Pond Stream: Muddy Creek	MA96-115_2018[1]	Headwaters, outlet North Dennis Road Pond, Yarmouth to mouth at inlet Follins Pond, Yarmouth	**0.326**
Total for Bass River Estuarine System			**206.289**

1 To be included in a future Integrated List of Waters

2 Bass River TMDL includes Lower and Middle Bass River and School Street Marsh (Weir Creek), as referenced in the SMAST Technical Report

Data for entry in EPA's National TMDL Tracking System							
TMDL Name		**Bass River Estuarine System TMDL for Total Nitrogen**					
Number of TMDLs*		9					
Type of TMDLs*		Total Nitrogen					
Number of listed causes (from 303(d) list)		1					
Lead State		Massachusetts (MA)					
Individual TMDLs listed below							
TMDL Segment name	TMDL Segment ID #	TMDL Pollutant ID# & name	TMDL Impairment Cause(s)	Pollutant endpoint (Class: geometric mean;10% or SSM^{+})	Unlisted?	NPDES Point Source & ID#	Listed for anything else?
Run Pond	MA96-265_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
Bass River	MA96-12	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	No	-	Fecal Coliform (TMDL)
Bass River – Grand Cove	MA96-118_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-

Dinah's Pond	MA96-112_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll *a*), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
Kelleys Bay	MA96-113_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
Follins Pond	MA96-114_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
Mill Pond	MA96-117_2018	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-

Mill Pond Stream: Weir Creek	MA96-116_201	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
Mill Pond Stream: Muddy Creek	MA96-115_20181	772 (Total Nitrogen)	772 (Total Nitrogen), 791 (Nutrient/Eutrophication Biological Indicators), 1333 (Dissolved Oxygen Deficit), 100 (Algal Growth/Chlorophyll a), 170 (Benthic Macroinvertebrate Bioassessments), 384 (Degraded Habitat)	0.42 mg/L Total Nitrogen	Yes	-	-
TMDL Type		Nonpoint Sources					
Establishment Date (approval)*		Jun 26, 2017					
EPA Developed		No					
Towns affected*		Brewster, Dennis, Yarmouth					