

EPA NEW ENGLAND'S TMDL REVIEW

TMDL: **Mousam Lake**, (Upper Basin), York County, Maine
(ME ID#623 3838 located in Acton and Shapleigh, ME)
1998 303(d) list: Trend; <2003 TMDL development.

STATUS: Final

IMPAIRMENT/POLLUTANT: Significant declining trend in water transparency over the past decade; cold-water fish habitat is not being met due to reduced hypolimnetic dissolved oxygen levels. The TMDL is proposed for total phosphorus (TP).

BACKGROUND: The Maine Department of Environmental Protection (ME DEP) submitted to EPA New England the final Mousam Lake TMDL for total phosphorus (TP) with a transmittal letter dated December 10, 2002, followed by a revised report received by EPA electronically on September 24, 2003. All of EPA's September 12, 2002 comments (on the August 21, 2002 public review draft TMDL) were taken into account in the final submission.

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 40 CFR Part 130.

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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.*

The Mousam Lake TMDL describes the waterbody (a dual basin drainage lake) and the cause of impairment in the upper basin as identified in the 1998 303(d) list (decline in water quality trend due to nutrient enrichment of lakes). The document describes the pollutant of concern, total phosphorus, and identifies the location (by tributary subwatershed) and magnitude of phosphorus sources from atmospheric deposition (10%) and from 21 subcategories of land use within the watershed which include: agricultural and forestry practices, shoreline and non-shoreline development (including septic systems and roads), and undeveloped, non-cultural uses (Table 7, page 30 TMDL report).

Information was also presented on other important assumptions made in developing the TMDL:

- The results of soil type analyses were used to adjust total phosphorus loading coefficients (for septic systems). The prevalence of sandy, excessively drained soils (with a permeability rate usually more than 20 inches per hour), especially along the shoreline, create minimal runoff conditions and decrease surface (overland) phosphorus loadings from these soils (page 10 TMDL report; personal communication with Dave Halliwell, ME DEP 9/12/02).
- Groundwater (non-septic system leachate) was considered as a possible source of phosphorus for Mousam Lake due to the porous nature of the soils bordering the lake, but was rejected as a significant source since the contribution is highly speculative (page 10 TMDL report).
- Considerable research was done on septic-related data from town records in order to obtain baseline information on the status of shoreline septic systems. The total phosphorus loading for each system was determined using a model with attributes including distance to lake, age of system, problem ranking, occupants per household, days of occupancy per year, and TP loading to the septic system (page 18 TMDL report).
- Information on population and growth characteristics is provided (page 11 TMDL report) - the dominant human use of the shoreland is residential (both seasonal and year-round occupancy) and recreational.
- Internal sediment recycling is evaluated (page 34 TMDL report), but there was no evidence of sediment-derived phosphorus mass for Mousam Lake, even when calculated as separate basins.
- ME DEP provides an explanation and analytical basis for expressing the TMDL for decreasing water quality trend or trophic state through the surrogate measure of phosphorus loadings, also using measures of Secchi disk transparency (SDT) and chlorophyll *a* (pages 28-29 TMDL report. See also section 2 below which documents ME's water quality standards.)
- ME DEP explains that it was not possible to separate natural background from nonpoint sources (page 28 TMDL report). In this case, not separating natural background is reasonable because of the limited and general nature of the information available (land use categories) related to potential phosphorus sources to the lake. Without more detailed site-specific information on nonpoint source loading, it would be very difficult to separate natural background from the total nonpoint source load, and attempting to do so would add little value to the analysis.

Assessment: EPA New England concludes that the ME DEP has done an admirable job of characterizing the lake's sources of impairment.

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.

The Mousam Lake TMDL describes the applicable narrative water quality standards (see pages 28-29 TMDL report). The report defines applicable narrative criteria, designated uses, and antidegradation policy. "Only the upper basin of Mousam Lake is currently 303(d) listed, however, the TMDL developed for the final report for the upper basin will ensure that water quality standards are maintained in the lower receiving basin as well (page 4 TMDL report)."

ME DEP identifies a numeric water quality target for the TMDL for the upper basin of **8 ppb total phosphorus (TP)** (604 kg TP/yr) which ME DEP predicts will result in the attainment of water quality standards (page 29 TMDL report). The numeric in-lake target was selected using best professional judgement based on available water quality data corresponding to non-nuisance bloom conditions, as reflected in measures of both Secchi disk transparency (>2.0 meters) and chlorophyll-*a* (<8.0 ppb) (page 29 TMDL report). The target is based on a springtime (April and May) average of epilimnion grab/core samples (prior to lake stratification) [personal communication with Dave Halliwell, ME DEP, 9/12/02]. Mousam Lake is a non-colored lake with apparent color <26 SPU (average 14-22 SP) (page 28 TMDL report).

Assessment: EPA New England concludes that ME DEP has properly presented its water quality standards and has made a reasonable interpretation of the narrative water quality criteria in the standards when setting a numeric water quality target.

The 8 ppb target concentration was selected based on review of statewide water quality data for lakes with low levels of apparent color (<26 SPU), lake-specific data, and on water quality goals of ME DEP. EPA New England is satisfied that this review was thorough and, based on our review, EPA concurs that the available data support the conclusion that an in-lake concentration of 8 ug/l will attain Maine's water quality standards.

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.

The loading capacity for the impaired upper basin of Mousam Lake is set at **406 kg TP/yr** (page 33 TMDL report). The loading capacity is set to protect water quality and support uses during critical conditions which occur during the summer season when the potential for nuisance algae blooms is the greatest (page 35 TMDL report).

ME DEP links water quality to phosphorus loading by: (1) picking a target in-lake phosphorus level based on historic state-wide and in-lake water quality data (page 24 TMDL report), (2) using an empirical phosphorus retention model, calibrated to in-lake phosphorus concentration data to determine the pollutant loading corresponding to the desired water quality in the lake (page 34-35 TMDL report), and (3) comparing the loading target to existing phosphorus loadings estimated by applying phosphorus export coefficients to land area with specified land uses (Tables 6, page 30 TMDL report). These analytical methods are widely recognized as appropriate for lake TMDL development.

ME DEP explains that the justification for expressing the loading capacity as an annual load, as opposed to a daily load, lies, in part, in the upper lake basin's relatively long hydraulic residence time (1.3 flushes per year) (page 33 TMDL report). ME DEP notes that the lower southern basin has a much shorter hydraulic residence time of approximately 18 flushes per year.

Assessment: EPA New England concludes that the loading capacity has been appropriately set at a level necessary to attain and maintain applicable water quality standards. The TMDL is based on a reasonable and widely accepted approach for establishing the relationship between pollutant loading and water quality in lakes.

EPA agrees that the critical conditions occur in summer when environmental conditions (e.g., higher temperatures, increased light intensity, etc.) are most favorable for aquatic plant growth. EPA New England also concurs with expressing the TMDL as an annual loading based on the reason provided by ME DEP (hydraulic residence time).

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.

ME DEP calculates that the total load of phosphorus contribution to Mousam Lake must be limited to **406 kg TP/yr** in order to achieve the in-lake target goal of 8 ppb TP (page 35 TMDL report). The TMDL allocates all of this loading capacity as a gross allotment to existing and future nonpoint sources and to natural background. ME DEP's calculation of the current external loading of TP is approximately 636 kg annually (page 30 TMDL report). ME DEP states that additional reductions in external watershed phosphorus loads into Mousam lake will ultimately reverse the downward trend in lake water transparency measures over time.

Assessment: EPA New England concludes that the load allocation is adequately specified in the TMDL at a level necessary to attain and maintain water quality standards. The degree of load reductions necessary to achieve the in-lake phosphorus levels is based in part on an estimate of current loadings.

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.

Mousam Lake is a Class GPA water in Maine. According to Maine statute, “There may be no new direct discharge of pollutants into Class GPA waters.” [38 MRSA 465-A (1) (c)] ME DEP explains that, as there are no known existing point sources of pollution in the Mousam Lake watershed, the waste load allocation for all existing and future point sources is set at 0 (zero) kg/year of total phosphorus (page 35 TMDL report).

Assessment: EPA New England concurs that the WLA component of the TMDL is appropriately set equal to zero based on ME DEP’s determination that there are no existing point source discharges subject to NPDES permit requirements in the lake’s watershed.

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

The Mousam Lake TMDL includes an implicit margin of safety (MOS) through the selection of the numeric water quality target of 8 ppb as well as the selection of relatively conservative phosphorus export loading coefficients for cultural pollution sources (Table 6, page 30 TMDL report). Based on both Mousam Lake historical records and ME DEP’s analysis of a state-wide limnological database for non-colored (or <26 SPU lakes), ME DEP believes that a target of 8 ppb is a very conservative goal because “summer nuisance algae blooms (growth of algae which causes Secchi disk transparency to be less than 2 meters) are more likely to occur at 18 ppb or above. The difference between the in-lake target of 8 ppb and 17 ppb represents a 53% implicit margin of safety for Mousam Lake” (page 36 TMDL report).

Assessment: EPA New England concludes that a substantial MOS (roughly 53% or 680 kg TP/yr) is provided for the following reasons: (1) EPA believes a significant implicit MOS is provided in the selection of an in-lake TP concentration of 8 ppb based on a state-wide data base for lakes of low apparent color, and (2) the adequacy of this MOS is supported by in-lake data.

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 Mousam Lake TMDL considered seasonal variations because the allowable annual load was developed to be protective of the most sensitive time of year - during the summer, when conditions most favor the growth of algae and aquatic plants (page 36 TMDL report). The TMDL is protective of all seasons, given Mousam Lake's (upper basin) average hydraulic retention time of 1.3 flushes/year, and the fact that BMPs implemented (and proposed) have been designed to address TP loading during all seasons.

Assessment: EPA New England concludes that seasonal variation has been adequately accounted for in the TMDL because the TMDL was developed to be protective of the most environmentally sensitive period, the summer season. In addition, phosphorus controls are expected to be in place throughout the year so that these controls will reduce pollution whenever sources are active.

8. Monitoring Plan for TMDLs Developed Under the Phased Approach

EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), recommends a monitoring plan when a TMDL is developed under the phased approach. The guidance recommends that a TMDL developed under the phased approach also should provide assurances that nonpoint source controls will achieve expected load reductions. The phased approach is appropriate when a TMDL involves both point and nonpoint sources and the point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. EPA's guidance provides that a TMDL developed under the phased approach should include a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of water quality standards.

The Mousam Lake TMDL describes the history of water quality monitoring since 1974 (ME DEP and ME Volunteer Lakes Monitoring Program) (page 28 TMDL report). Long-term water quality monitoring within the north and south basins of Mousam Lake will continue to be conducted monthly, from May to October, through VLMP, in cooperation with Maine DEP and the Mousam Lake Region Association. A post-TMDL status update report will be prepared 5-10 years following TMDL approval (page 25 TMDL report).

Assessment: EPA New England concludes that the ongoing monitoring by the Volunteer Lakes Monitoring Program (VLMP) in cooperation with ME DEP and the MLRA is sufficient to evaluate the adequacy of the TMDL.

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.

ME DEP provides specific recommendations for best management practices (BMPs) and actions to take for the reduction of external (watershed derived) total phosphorus loadings to improve water quality conditions in the Mousam Lake watershed (pages 21-25 TMDL report). Of the 5 general sources of phosphorus addressed, shoreline residential sites, poorly-designed and installed septic systems, and roadways provide the most sites for remediation. ME DEP also provides details on current and recent NPS projects that identify additional sites for remedial action, and names of other agencies and groups involved in these partnerships.

Assessment: Addressed, though not required.

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."

ME DEP addresses reasonable assurances by: (1) explaining the priority ranking of Mousam Lake in the context of Maine's 303(d) list and ME DEP's priority watershed list which help set priorities for NPS project funding (page 28 TMDL report); (2) providing information on a considerable amount of current surveys and work in the watershed (page 21 TMDL report); (3) explaining an existing framework of organizations in place able to handle future grant administration and funding, with strong town support (page 25 TMDL report).

Comment: Addressed, though not required.

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 Mousam Lake TMDL is described on pages 36-44 of the report. ME DEP distributed an electronic draft report to the interested public **August 22, 2002** and issued public notice of the public review draft TMDL availability in Sunday editions August 25 and September 12, 2002, in the Kennebec Journal (Augusta) and Portland Press Herald (York County edition), and Thursday edition of the Sanford news (August 29 and Sept. 12, 2002). The public review draft was also posted on-line at <http://www.state.me.us/dep/blwq/comments.htm>. ME DEP and MACD staff also participated in several local education/outreach meetings with lakeshore residents in 2000 - 2001; MACD staff (under contract to ME DEP) were also in contact with town offices and the York County SWCD. The public comment period deadline was September 20, 2002.

ME DEP provided summaries of the preliminary stakeholder review, copies of the public comments, and DEP's response to public comment (pages 37-44). There were 5 respondents during ME DEP's 2-week preliminary stakeholder review in August 2002, but no comments received during the subsequent 30-day public review period.

Assessment: EPA New England concludes that ME DEP has done an admirable job of involving the public during the development of the TMDL, has provided adequate opportunities for the public to comment on the TMDL, and has provided reasonable responses to the public comments.

Data for entry into EPA's National TMDL Tracking System

TMDL Name	Mousam Lake
Lead State	Maine (ME)
TMDL Status	Final
Pollutant ID	515 - (total phosphorus)
TMDL End Point	8 ppb TP
TMDL Type	Nonpoint Source
List ID (from system)	
Impairment ID	("Trend" - declining trend in water transparency; cold water fish habitat not met due to reduced hypolimnetic dissolved oxygen levels.)
Cycle (list date)	1998
Establishment Date (approval)	September 29, 2003
EPA developed	No

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