

## EPA NEW ENGLAND'S TMDL REVIEW

**TMDL:** Lake Carmi, Franklin, Vermont  
Waterbody VT05-02L01

**STATUS:** Final

**DATE:** April 8, 2009

**IMPAIRMENT/POLLUTANT:** Aesthetics and contact recreation due to excessive phosphorus loading. The TMDL is calculated for total phosphorus (TP).

**BACKGROUND:** The Vermont Agency of Natural Resources (VANR) submitted to EPA New England the final Lake Carmi TMDL for total phosphorus (TP) with a transmittal letter dated October 14, 2008.

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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 TMDL describes the waterbody and the cause of impairment as identified in the 303(d) list. The lake is impaired by total phosphorus and ranked high for TMDL development. Lake Carmi is a relatively shallow lake located in Franklin, VT, a small town in the northwestern part of the state. The lake is 1,402 acres in size and has a watershed area of 7,710 acres. The lake is located in an agricultural region of the state and 44% of its watershed is tilled or untilled farm land.

Forty-five percent of the watershed is wooded or wetland, including Franklin Bog at the lake's southern end. The lake is natural, but a dam controls the water level and keeps the water about 2 feet higher than its natural level. This dam was constructed in the mid 1800s to provide power for a sawmill and was rebuilt in the early 1970s. Currently, the dam is operated by the Vermont Department of Environmental Conservation.

Lake Carmi has a history of late summer algal blooms resulting in conditions that residents find objectionable and will not swim in. There was a period in the 1990s when conditions improved, but they have since worsened. Currently residents report that a bloom can occur any time during the summer, with late summer still being the time of the most intense algal growth. During the summers of 2006 and 2007, these blooms tested positive for cyanobacteria. Incidences of cyanobacteria in Lake Carmi have been increasing over the years, corresponding with increasing occurrences in other lakes in Vermont, but have been found in Lake Carmi dating back to 1976.

Lake Carmi has a history of water quality measurements dating back to 1980. Volunteer monitors measure for total phosphorus, chlorophyll-a, and Secchi transparency. While it appears that over the years, water quality in the middle of the lake is improving, watershed residents indicate that the quality of waters in the lake margins has declined in recent years. The mean total phosphorus concentration, based on a 23 year record, is 28 ppb.

The modeling used for this TMDL was based on estimates of watershed phosphorus loads as well as estimates of septic and internal loads which were created with the use of Wisconsin Inland Lakes Modeling Suite (WILMS). Land Use export estimates were made based on several calculations and GIS land use analysis, which is a method that is widely used and easy to implement. Septic loads were also calculated and based on a procedure that relies on the number of persons annually using septic systems adjacent to the lake, the per-capita phosphorus loss to septic systems, a factor relating to septic system integrity, and a factor relating to soil phosphorus retention. Internal loads were also calculated using the average of three WILMS methods. The wastewater treatment facility load which discharges to ground water rather than surface water was calculated by multiplying the daily flow, the groundwater concentrations and the number of operation days (the facility operates only seasonally).

Table 4 of the TMDL presents the magnitudes of major phosphorus source categories based on the modeling and calculations described above. It shows that the load from watershed tributaries (1,421 kg/yr) makes up the bulk of the total loading, while the internal load (97 kg/yr), septic load (15 kg/yr), and the wastewater treatment facility load (2 kg/yr) are estimated to be much smaller. Table 1 of the TMDL breaks out the watershed tributary load by land use, and shows that agricultural land is estimated to contribute 85% of the load, urban categories 7%, forest and wetland 3%, and direct deposition to the lake surface 5%.

**Assessment:** EPA Region 1 concludes that Vermont Agency of Natural Resources has done an adequate job of describing the waterbody, pollutant of concern, and pollutant sources.

## 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 TMDL report describes the applicable water quality standards including designated uses, applicable narrative criteria, and antidegradation provisions (page 11 of the TMDL report).

Since Vermont's water quality standards do not include applicable numeric criteria for phosphorus, a target concentration was selected for Lake Carmi. Based on historical monitoring and past instances of use attainment, VANR selected a target phosphorus concentration of 22 ppb, to be measured as a summer time average at two specific monitoring locations. This concentration is expected to both eliminate algae blooms and limit the proliferation of littoral aquatic plants – objectives consistent with Vermont's narrative phosphorus criteria.

**Assessment:** EPA Region 1 concludes that VANR has properly presented its water quality standards and has made a reasonable interpretation of the narrative water quality criteria when setting the numeric water quality target.

## 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.*

To calculate the loading capacity VANR turned to the suite of models used to estimate total phosphorus loading (described in Section 1 above). This time, the models were used to achieve 22 ppb as a final concentration. The average of the four models was taken to set the loading capacity at **1,027 kg/yr**. A table (Table 5) of these data is provided in the TMDL submittal.

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

EPA's November 15, 2006 guidance entitled "Establishing TMDL 'Daily' Loads in Light of the Decision by the U.S. Court of Appeals for the D.C. Circuit in *Friends of the Earth, Inc. v. EPA, et al.*, No.05-5015, (April 25, 2006) and Implications for NPDES Permits," recommends that TMDL submittals express allocations in terms of daily time increments. This guidance also acknowledges that the decision of the U.S. Court of Appeals for the Second Circuit, *NRDC v. Muszynski*, 268 F.3d 91 (2<sup>nd</sup> Cir. 2001), established the controlling legal precedent for cases brought in the Second Circuit, which includes Vermont. In this decision, the Court required a reasoned explanation for the choice of any particular non-daily load. EPA believes that VANR has provided a reasonable basis for not including daily loads in this TMDL. As the TMDL document makes clear, in-lake concentrations of phosphorus in a lake such as Lake Carmi are not affected by variations in daily inputs, but rather by long-term cumulative inputs over a season or more. The expression of the loading capacity and load limits on an annual basis is therefore a logical and effective approach in this case.

#### **4. 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.*

VANR established an explicit margin of safety of 10% of the total loading capacity, or 103 kg/yr. The TMDL report indicates that this additional loading reduction will better ensure that the lake will attain the annual target of 22 ppb and applicable water quality standards.

**Assessment:** EPA Region I concludes that with an explicit MOS of 10%, VANR has provided an adequate MOS for this TMDL.

#### **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.*

There are currently no permitted point source discharges to Lake Carmi, so VANR has set the WLA at zero. The TMDL report indicates that there is uncertainty related to future VT NPDES point sources, but if a VT NPDES permit were to be sought for a discharger to Lake Carmi, the TMDL would be re-opened.

**Assessment:** EPA Region I concludes that VANR has appropriately set the WLA to zero, based on VANR's determination that there are no point source discharges subject to NPDES permit requirements in the watershed.

## **6. 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.*

VANR chose to set the WLA at zero and therefore the LA for phosphorus was calculated as the total loading capacity minus the margin of safety. It was set at **924 kg/yr**.

**Assessment:** EPA Region I concludes that the load allocation is adequately specified in the TMDL at a level necessary to attain and maintain water quality standards.

## **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 Lake Carmi 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 algae blooms are most severe. Thus, the TMDL is protective of all seasons.

**Assessment:** EPA Region I 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**

*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.*

While the TMDL report does not include a separate monitoring section, it is clear from other sections of the report that VANR plans to continue supporting the long-term lay monitoring program to assess trends.

**Assessment:** EPA Region I concludes that the ongoing lay monitoring program is sufficient to evaluate success of the TMDL and its implementation.

## **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 Lake Carmi Phosphorus Reduction Action Plan is described on page 15 of the TMDL report, and includes recommendations for future work. Specific recommendations for action items address improvements needed in all land use types within the Lake Carmi watershed such as residential development, agriculture, roads, and forests.

**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.”*

**Assessment:** Not required, because the WLA was set at zero.

## **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 for the Lake Carmi TMDL is described on page 14 of the report. A comment period ran from August 8 thru September 26, 2008. The comment period was noticed in a regional newspaper and on the VT DEC website. VT DEC also hosted a well-attended public meeting within the Lake Carmi watershed on September 11, 2008 to present the TMDL and to answer questions. At the close of the comment period, VTDEC received just one comment in support of the TMDL. No VTDEC response was necessary.

**Assessment:** EPA Region I concludes that VANR has done an adequate job of involving the public during the development of the TMDL and provided adequate opportunities for the public to comment on the TMDL.