

September 30, 2003

Jeffrey Wennberg, Commissioner
Vermont Department of Environmental Conservation
103 South Main St. 1 S
Waterbury VT 05671-0401

SUBJECT: Notification of Approval of the 30 Acid Impaired Lakes TMDLs

Dear Commissioner Wennberg:

Thank you for your final submittal of the 30 Acid Impaired Lakes TMDLs. The 30 lakes are listed on Vermont's 2002 §303(d) list as high priorities for TMDL development.

The U.S. Environmental Protection Agency (EPA) hereby approves the 30 Acid Impaired Lakes TMDLs (dated September, 2003). EPA has determined that the 30 TMDLs meet the requirements of §303(d) of the Clean Water Act (CWA), and of EPA's implementing regulations (40 CFR Part 130). Enclosed is a copy of our approval documentation.

I commend you and your staff for your good work on this important project. My staff and I look forward to continued cooperation with the VT DEC in exercising our shared responsibility of implementing the requirements of §303(d) of the CWA.

Sincerely,

Linda M. Murphy, Director
Office of Ecosystem Protection

Enclosure

cc: Wally McLean, Tim Clear, VT DEC

EPA NEW ENGLAND'S TMDL REVIEW

TMDL: 30 Acid Impaired Lakes in Vermont: Adams Reservoir, Big Mud, Bourn, Branch, Duck, Forester, Gilmore, Griffith, Grout, Halfway, Hardwood, Haystack, Howe, Kings Hill, Lake of the Clouds, Little (Woodford), Little Mud (Mt. Tabor), Long Hole, Lye Brook Pond (N), Lye Brook Pond (S), Moses, North (Bristol), Round (Holland), Somerset, South (Marlboro), Stamford, Stratton, Sunset, Turtle, Unknown (Averys Gore).

STATUS: Final

DATE: September 29, 2003

IMPAIRMENT/POLLUTANT: Acid. The TMDLs are proposed for the combined overall acid load to these lakes.

BACKGROUND: The Vermont Department of Environmental Conservation (VTDEC) submitted draft TMDLs and supporting documentation dated July, 2003. EPA-New England provided comments via voice mail on July 28, 2003. VTDEC incorporated EPA's comments into the draft released for public comment, dated August 2003. VTDEC submitted the final TMDL's with a letter dated September 18, 2003.

REVIEWER: Eric Perkins (617) 918-1602.

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 chlorophyll a and phosphorus loadings

for excess algae and reduced clarity in the water column.

A. Description of Waterbody and Background Information

The TMDLs document describes the waterbodies, including location, drainage area, surface area, maximum depth, elevation and water quality class for each lake. It also provides background information on the development of the TMDLs, explaining that VTDEC has been monitoring the chemistry of many of these lakes since 1980.

The TMDL document determines annual loading limits for 30 of the 37 acid impaired lakes identified on the 2002 §303(d) list. Data for the other seven impaired lakes were insufficient to enable the lakes to be included in this TMDL group. Because the source and type of the problematic loading was similar for all the lakes, a single analytical approach was used to determine each lake's loading capacity, or critical load. This approach allowed the packaging of all the lake loading determinations into a single document.

B. Pollutant of Concern

The document describes the pollutant of concern, acidic inputs. The methodology used for determining critical loads incorporates acidic inputs of the two largest contributors of acidity to these lakes, sulfur and nitrogen compounds. The loadings from both of these compounds were combined to derive a total overall acidic input for each lake.

C. Pollutant Sources

The document describes the sources of the acidic inputs, namely sulfuric and nitrogen compounds from atmospheric deposition. These compounds come primarily from upwind out-of-state sources, such as industrial and fossil fuel emissions in the mid-west. There are no stationary sources of these compounds in Vermont. Also, there are no effluent discharges of these compounds to the lakes in this TMDL group (e.g., acid mine drainage).

D. Priority Ranking

The 2002 §303(d) list states that the waterbodies addressed in these TMDLs are scheduled for completion in 2003. This indicates that TMDL development is a high priority for these waters given that the vast majority of §303(d) listed waters are scheduled for TMDL development in future years stretching to 2013.

Assessment: EPA concludes that the TMDL document meets the requirements for describing the waterbodies, pollutant of concern, pollutant sources, 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.

The TMDL document describes the applicable water quality standards beginning on page 3 which include numeric criteria for pH (between 6.5 and 8.5), narrative criteria for alkalinity, and designated uses. VTDEC has established a numeric threshold for the narrative alkalinity criteria to assure that acidic inputs do not prevent the full support of aquatic biota, wildlife and aquatic habitat uses. VT DEC selected an ANC (acid neutralizing capacity or alkalinity) value of 2.5 mg/l CaCO₃ to use as a cutoff in determining impairment. This value has been used historically based on literature information describing minimal impacts on fish macroinvertebrate communities at this level of acidic buffering and is considered by VTDEC to be an adequate measure of potential acid stress on aquatic organisms in Vermont's lake systems. Values above 2.5 mg/l CaCO₃ are considered to provide an adequate level of buffering against acid inputs to protect resident aquatic life.

Additionally, VTDEC considers the level of 2.5 mg/l CaCO₃ to be effective to prevent exceedences (i.e., outside the range) of the pH criteria in the VTWQS, except where such exceedences would occur under natural conditions. This approach is sufficiently protective since exceedences due to natural conditions are not considered a violation of standards in the VTWQS. Given that all of the lakes included in this TMDL document have now been affected by non-natural atmospheric acid deposition, it is difficult to sort out which lakes were naturally below the pH standard in pre-development times. Therefore the water quality targets in these TMDLs are based on the alkalinity criteria rather than the pH standard. In addition, the TMDL document notes that alkalinity has been shown to be a better indicator of harmful biological effects than pH alone, due to the influence of CO₂ and organic acids on pH.

Following implementation of the TMDLs, VTDEC will further assess any lakes that meet the alkalinity criteria but still fall below the pH standard. In the unlikely event that pH violations are found not to be due to natural conditions, additional measures will be considered.

Assessment: EPA concludes that VTDEC has properly described its water quality standards and the relevant criteria and uses. VTDEC's reliance on the value of 2.5 mg/l CaCO₃ to satisfy the narrative alkalinity criteria is adequately documented and this value is also a reasonable surrogate for attaining in-lake pH criteria except where excursions are due to natural causes.

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 Steady State Water Chemistry model (SSWC) was used to quantify the maximum amount of acidity (or critical load) that each watershed can receive and still maintain the ANC criteria of 2.5 mg/l CaCO₃. This model has been used widely for critical load determinations in Canada and northern Europe where acid deposition is a major problem. The SSWC model calculates critical loads based on in-lake water chemistry and also accounts for annual surface runoff amounts and a user specified ANC limit. The ability to set a predefined ANC limit forces the model to output a critical load based directly on VTDEC's water quality target of 2.5 mg/l CaCO₃. The TMDL document lists the critical loads (loading capacities) for each impaired lake in Table 2 (p. 7).

In addition to the critical loads, exceedances of the critical load can be determined by comparing the critical load to recent loading estimates of acidic nitrogen and sulfur compounds. While the calculation of exceedances is not critical for the TMDL, it does provide a means to gauge the extent of the impairment and the level of reductions needed. The critical load exceedances for each lake are included in the TMDL document in Table 3 on page 8.

The use of the SSWC model for critical load determination has many benefits. First, the model has a successful track record in northern Europe and Canada supporting establishment of source reduction targets. Secondly, the inputs for the model were readily at hand so additional data collection was not required. Thirdly, the model has the flexibility to adapt to the user-specific ANC target. This flexibility allows the direct output of the necessary critical loads without additional extrapolation.

The primary weakness of the model is that it can not predict the timing of responses to reduced deposition. The model does not take into account future climate-based changes such as weathering rates and soil base cation depletion which can affect the speed of lake recovery. Therefore, while the model accurately estimates critical loading limits based on current data, it can't predict how long the recovery process may take.

The critical condition for these lakes occurs in the springtime when annual acidity loads peak due to snowmelt runoff events. To be protective during this spring condition, critical loads were calculated based on ANC and base cation data collected during the spring. When the lowest

measured ANC for the lake is used in the critical load calculation, the most conservative critical load is returned. Thus the calculated critical loads are protective for all seasons

The TMDL's are expressed in terms of allowable annual loadings rather than daily loadings. As specified in 40 CFR §130.2(i), TMDL's may be expressed in terms of either mass per unit time, toxicity or other appropriate measures. VTDEC justifies setting an annual load, as opposed to a daily load, because with the variable nature of acidic deposition, both wet and dry, and the internal lake processes that occur over long periods such as seasons and years, a daily loading limit would be difficult to determine and of little use. It's the overall annual acidity load that ultimately affects the lake ANC and thus the biological communities. Also, the springtime in-lake water chemistry, used to calculate a protective critical load, is the result of the annual acidity load that peaks during the springtime snowmelt runoff events.

A note on the units of measurement: The critical loads are expressed in terms of meq/m²/yr, which in this case is a measure of the mili-equivalents of sulfur and nitrogen compounds. These compounds account for virtually all the acid load in Vermont's atmospheric deposition. Mili-equivalents can be converted to kilograms using the following ratio: A kg/ha/yr = 2.082 meq/m²/yr. The units of mili-equivalents are commonly used in the modeling of critical acidity loads because they make it possible to relate in-lake acidity data to inputs from deposition.

Assessment:

EPA concludes that the water chemistry model used to develop the TMDLs has been adequately documented, the loading capacities properly identified, and the critical conditions properly accounted for.

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.

The load allocations for all 30 lakes are presented in Table 4 of the TMDL document. Because there are no point sources, the load allocations were calculated by subtracting the margin of safety (5%) from the critical load for each lake.

Assessment: EPA-New England concludes that load allocations are adequately specified in the TMDLs at levels necessary to attain and maintain water quality standards.

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.

VTDEC has determined that there are no point sources of acidity in the 30 lake watersheds, so the wasteload allocations are all set at zero.

Assessment: EPA concludes that the wasteload allocations have been appropriately set at zero for these TMDLs.

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.

These TMDLs include an explicit 5% allocation to account for any uncertainty in critical load determinations. This MOS is considered appropriate in this instance since the majority of the input data for the SSWC model was current and site specific (loading and water chemistry).

Assessment: EPA-New England concludes that the TMDL document provides an adequate MOS.

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 were developed to be protective of the most environmentally sensitive period (spring), when the lakes exhibit their lowest base cation concentrations associated with high runoff from snowmelt. Critical loads were calculated based on ANC and base cation data collected during this spring period. When the lowest measured ANC for the lake is used in the critical load calculation, the most conservative critical load is returned. Thus the calculated critical loads are protective for all seasons

Assessment: EPA-New England concludes that seasonal variations have been adequately accounted for in the TMDL.

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 VTDEC intends to continue monitoring the chemical status of these acid impaired waters and ideally to initiate biological monitoring. As national efforts to control acid deposition to the northeast United States progress, VTDEC anticipates having the ability to identify resultant changes to the waterbodies. The TMDL document describes a multi-part monitoring plan that includes continued chemical monitoring of the 11 Long-Term Monitoring lakes, macroinvertebrate bioassessments of a portion of these 11 lakes, and chemical monitoring of all the remaining TMDL lakes on a five year rotational basis. The monitoring plan will ensure that VTDEC maintains sufficiently current information on these lakes to document chemical recovery. In addition, VTDEC intends to continue to partner with federal agencies to monitor atmospheric deposition in the state, and to estimate proportionate sulfate and nitrate contributions from emissions originating from Vermont and specific upwind states and Canadian Provinces.

Assessment: EPA-New England concludes that the proposed monitoring by VTDEC will be sufficient to evaluate the effects of TMDL implementation over the next 10 to 15 years. EPA expects to pursue discussions with VTDEC regarding potential assistance with the estimates of proportionate loading contributions from upwind source areas.

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.

Although implementation plans are not a requirement for approving a TMDL, and EPA does not approve implementation plans, the implementation strategy for all the 30 acid impaired lake TMDLs is outlined on page 12. VTDEC indicates that the vast majority of the pollutants contributing to the acid impairments in these lakes come from well beyond Vermont's borders. VTDEC has little direct control over these sources and must rely on national efforts spearheaded by EPA to accomplish the necessary reductions. There are no significant stationary sources of sulfur and nitrogen oxides in Vermont, and in-state emissions from mobile sources are among the lowest in the nation.

EPA and other agencies have advocated before Congress for additional emissions reductions of nitrogen and sulfur compounds in order to reduce both acid rain and other contaminant loadings and improve ambient air quality. Currently, for example, EPA is supporting the Administration's proposed Clear Skies Act that would cut nitrogen and sulfur oxide emissions by 70% from 2000 levels. EPA expects to continue to work with Vermont to address both in-state and out-of-state emissions, and where feasible, to provide monitoring and modeling assistance as discussed under the monitoring plan, above.

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: Reasonable assurances are not required for these TMDLs because the waters are impaired solely by nonpoint sources. However, the TMDL document does provide a discussion of ways to assure progress toward the necessary reductions in the implementation plan.

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.

Assessment:

A summary of the public participation process is included on page 12. VTDEC provided an opportunity for public comment, closing on September 17, 2003 and held a public meeting on September 10, 2003. Notice of the comment period and public meeting was posted on the state's website and announced via newspaper. The DEC received no comments on the TMDL document.

EPA-New England concludes that VTDEC adequately involved the public during the development of the TMDL.

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: VTDEC's letter of September 18, 2003 states that the TMDLs are submitted under Section 303(d) of the Clean Water Act for EPA approval.