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**MEMORANDUM**

**TO:** Bruce Nelson, Executive Director  
Alexandria Lakes Sanitary District

**FROM:** John C. Hall

**DATE:** November 3, 2009

**RE:** Sufficiency of Draft TMDL and Suggested Alternative Implementation Approach  
to Achieve Shallow Lake Ecological Objectives

We have been requested to review the draft TMDL document that provided MPCA's modeling and impact assessment for Lake Winona. We have also reviewed the various expert opinions and analyses of the modeling used as the basis for establishing the TMDL nutrient load restrictions for point and non-point sources. These analyses have been authored by LimnoTech, HydroQual and Wenck. Based on our review of the modeling methodology employed for TMDL development, the limitations of such modeling for shallow lakes and the uncertainties explained in the draft Phase 3 TMDL Report prepared by AECOM, it is our opinion that the modeling report cannot serve as a sufficient basis (legally or technically) for establishing TMDL load reduction requirements. The report is, however, sufficient to establish a series of management actions that are necessary to achieve the water quality objectives for Lake Winona. The following presents the basis for this conclusion.

**Regulatory Background and Analysis of Modeling Report**

TMDL development is governed by the provisions of Section 303(d) of the Clean Water Act as well as the implementing regulations found at 40 CFR Part 130. Without going into great legal detail, the TMDL process is supposed to ensure WQS are attained through reduction in point and non-point pollution sources to the level "necessary to attain and maintain applicable ...standards

...with a margin of safety that takes into account any lack of knowledge concerning the relationship between effluent limitations and water quality.” 40 CFR 130.7(c)(1). Where non-point sources are responsible for the use impairment, states are supposed to identify the measures to be undertaken to remedy the condition.<sup>1</sup>

Point source controls are not always required to remedy pollutant impacts though they typically are the focus of TMDL actions. As specified in the federal TMDL rules, a TMDL may be “expressed in terms of either mass per time, toxicity or other appropriate measures.” (40 CFR 130.2 – definition of a TMDL). Where both point and non-point sources are responsible for non-attainment, but best management practices may remedy the situation, alternative measures to point source reduction are allowed to be implemented to achieve water quality goals so long as there are “reasonable assurances” that the measures will be sufficient. Thus, non-pollution control measures, such as canopy restoration have been established as the TMDL measures, where such actions are projected to reduce temperature levels in streams to achieve applicable standards. Finally, where there is considerable uncertainty regarding the efficacy of certain control measures, a phased approach to TMDL implementation is allowable.<sup>2</sup> Such phased actions provide the regulatory authority with the information needed to ensure that appropriate requirements are being imposed. Phased TMDL approaches have been taken in western mining areas where non-point sources preclude stream restoration. In these cases, point source control measures have been deferred pending assessment of the improvements attained through best management practice implementation.

As with all actions under the Clean Water Act, the basis for the pollution control decision must be made on “scientifically defensible” analyses using the “applicable water quality standards.” Where modeling analyses are used to develop the TMDL limits, the model must have a “rational relationship” to the reality it purports to represent. See, *Appalachian Power Co. v. EPA*, 249 F. 3d 1032, 1053 (D.C. Cir 2001). With respect to the TMDL process, if it is apparent that the model cannot reasonably predict the degree of water quality that will restore use impairments and achieve applicable standards, reliance on such modeling would be arbitrary and capricious. Moreover, EPA rules require that site-specific data be used in rendering TMDL decisions “wherever possible.” 40 CFR 130.7 (c) (1)(i). By using such data, greater assurance is provided that the chosen pollutant reduction or other management measures are necessary and will ensure

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<sup>1</sup> “For all section 303(d)-listed waters impaired solely or primarily by non point sources, each State should describe its plan for implementing load allocations for non point sources... At a minimum, each State implementation plan should include: Reasonable assurances that the non point source load allocations established in TMDLs (for waters impaired solely or primarily by non point sources) will in fact be achieved. These assurances may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs. In the case of Federal lands, these specific assurances should reflect applicable Memoranda of Agreement or other mechanisms to achieve implementation of needed management practices;...” Memorandum from R. Perciasepe, Assistant Administrator, EPA to Regional Administrators and Regional Water Division Directors, “New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)” (August 8, 1997).

<sup>2</sup> “The development of TMDLs should be accomplished by setting priorities, considering the geographic area impacted by the pollution problem, *and, in some cases, using a phased approach to establishing control measures based on the TMDL*” Guidance for Water-Quality-based Decisions: The TMDL Process, US EPA, 1991, EPA440-4-91-001, Chapter 2, Step 3 (emphasis added).

attainment of applicable standards. Regarding the model evaluation conducted for Lake Winona and the various factors contributing to the current water quality condition, several major concerns are noted below.

- The chosen model cannot reasonably predict the conditions that will allow the lake to achieve a “clear water state” such that submerged vegetation is restored (Opinions of LimnoTech and HydroQual);
- The model predictions with respect to TP reduction benefits have wide uncertainty due to a) the inability to predict how sediment phosphorus releases affect the overlying water column; and b) the failure to assess how re-establishment of submerged vegetation will affect future sediment release rates (Opinions of LimnoTech and HydroQual);
- The modeling failed to account for how carp populations are potentially influencing the exceedance of applicable standards for algae, TP and secchi depth by mobilizing sediment bed nutrients and suspended solids. (Opinion of HydroQual) These sources, as well as the absence of submerged vegetation, will continue and preclude lake restoration, regardless of the point source load restrictions, unless the appropriate resource management measures are undertaken. (Opinion of Wenck);
- The model is not calibrated to the relevant site-specific data sets. The Phase 3 Report failed to consider or reflect the available site-specific algal data such that there is no certainty that any of the model predictions are valid. Analysis of water quality information (pre-carp) for Lake Winona indicated significantly less restrictive total phosphorus requirements would be needed to attain a clear water state (Opinion of HydroQual);
- The model fails to account for the effects of stabilized lake levels that will preclude restoration of a clear water state, regardless of how point source loads are controlled. Unless lake drawdown occurs, no meaningful improvement in water quality will be attained as submerged vegetation will not be able to be reestablished (Opinion of Wenck); and,
- The analysis provides no “reasonable assurance” that applicable water quality objectives can be achieved through the suggested point and non-point controls without the implementation of other management options (i.e., drawdown, rough fish elimination) (Opinion of Wenck).

Based on these observations, the Phase 3 TMDL Report has serious deficiencies and limitations. As there is no rational basis to believe that the model can predict the transition from an algal dominated condition to a submerged plant dominated condition, the model cannot be used as a scientifically defensible tool for determining the necessary point and non-point control measures required to assure attainment of applicable standards. Moreover, based on the more recent in-lake data (post-carp domination), it is apparent that major factors that will control future water quality were not evaluated to any meaningful degree. Consequently, because several factors

critical to the restoration of the lake were not evaluated *and these factors control the lake's ecology*, the uncertainty in the modeling is just too great and there is no reasonable basis to believe that the model reasonably predicts algal levels that will occur if the suggested point source reductions are imposed. In particular, it should be noted that the HydroQual analysis indicates that a significantly higher chlorophyll 'a' level (above 20 µg/l) would be sufficient to ensure the requisite degree of water clarity is obtained (i.e., near one meter secchi depth) once turbidity caused by the suspended solids component is controlled through elimination of carp, lake drawdown and reestablishment of submerged plant vegetation. The preliminary HydroQual analysis indicates that a TP level ranging 100-150 µg/l may fully maintain shallow lake ecological objectives *if the other necessary lake restoration activities are undertaken*.<sup>3</sup> In any event, failure to undertake the necessary lake management steps will preclude attainment of ecological conditions identified as critical by MPCA for a healthy shallow lake environment (e.g., floristic diversity, substantial rooted/ submerged plant growth).

### **Suggested Approach**

Despite the flaws in the technical analysis, it is apparent that the current situation in the lake is not consistent with adopted water quality objectives and objectives will not be obtained unless additional best management practices and other pollution reduction measures are undertaken. Under these circumstances a phased implementation approach is appropriate. By implementing various lake management options first (drawdown, carp elimination), along with moderate point source improvements, the uncertainty associated with the degree of pollutant reduction necessary to achieve shallow lake ecological objectives/uses would be greatly reduced. For example, if rough fishes are eliminated and drawdown of the lake occurs, then reestablishment of submerged plant growth is a highly probable event. These steps will reduce TP resuspension and the suspended solids level and well over 50% of the lake is expected to have submerged plant vegetation. At that point, the lake algal/secchi depth response can be evaluated and the degree of additional point source nutrient reduction required to be achieved (if any) will be known with much greater certainty. In addition, other point source load mitigation options such as relocation of the outfall to the northern extreme of the lake would become a viable option, if necessary and cost effective. Properly structured, that alternative would produce a major reduction in nutrient load impacts to Lake Winona while avoiding any increase in loading to the downstream waters. This alternative becomes a more viable solution once submerged plant growth is reestablished.

The TMDL rules do not require that a specific load reduction be implemented when other "appropriate measures" are being undertaken as the solution to remedy water quality impairment and the degree of point source reduction necessary to achieve water quality objectives is not known. We suggest that such a phased/adaptive management approach be taken that addresses the major components of the problem – rough fish, sediment phosphorus and suspended solids loads and ALASD plant loading. The following "appropriate measures" are suggested as sufficient to meet TMDL compliance objectives at this time:

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<sup>3</sup> In other TMDL evaluations, MPCA has appropriately accounted for the effect of non-algal suspended solids on compliance with transparency objectives (e.g., Lake Byllesby and Pepin TMDLs).

1. Optimize performance of the existing filtration facilities with the goal of achieving a 150 µg/l phosphorus level on a long term average basis (further addresses the impact of ALASD loadings on the lake and reduces the impacts on downstream waters);
2. Draw down the lake to allow consolidation of the sediments and reestablishment of the submerged plant population (addresses a major portion of the existing sediment nutrient and suspended solids loads impacting water clarity and ensures submerged plant growth will occur);
3. While the lake is drawn down, eliminate the rough fish population to reduce future nutrient and suspended solids resuspension in the deeper waters of the lake (addresses residual loading caused by rough fishes and allows for a more balanced fishery);
4. Monitor the effect of these measures on water quality in and leaving the lake (addresses residual concerns over impacts to Lakes Agnes and Henry). Presently, data do not indicate that the ALASD discharge has a measurable impact on Lake Le Homme Dieu).

If these measures are as effective as anticipated, it is unlikely that further significant load reduction measures will be necessary to achieve a clear water state sufficient to support robust submerged plant growth in Lake Winona. Future monitoring will then determine whether any additional load reduction measures (or discharge relocation) are needed to achieve applicable standards or whether modified water quality objectives are appropriate to achieve shallow lake ecological objectives.