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November 23, 2009

Mr. Jim Courneya
Minnesota Pollution Control Agency
714 Lake Avenue, Suite 220
Detroit Lakes, MN 56501

Subject: **Response to Comments on the Draft Lake Winona TMDL Phase 3 Report by Limno Tech**

Dear Mr. Courneya:

The following is the response by AECOM to the LimnoTech memorandum dated 9/28/09 commenting on the draft Phase 3 LK Winona TMDL report. Limno Tech reviewed the Draft Phase 3 Report on behalf of the Alexandria Lakes Area Sanitation District.

Comments on the Summary:

Limno Tech Comment: *The predictive capacity of the Bathtub model is limited for shallow turbid-water lakes such as Lake Winona, especially ones that may transition between ecological states.*

Response 1: The phosphorus standard is the primary standard that needs to be met as a result of the TMDL. Lake Winona receives more than five times the load of phosphorus it can assimilate. As such, the management changes needed are clear, a substantial reduction in the phosphorus loadings. As stated in the public meeting on September 27, 2009, the predictions of reductions needed for phosphorus can be simply computed using the principal of conservation of mass, especially in light of the fact that the ALASD discharge is approximately 80 percent of the inflow and external phosphorus load. That is, given the inflow rate of ALASD, the phosphorus concentration of the ALASD discharge determines the phosphorus concentration in the lake. For the lake to meet the phosphorus water quality standard, the concentration of the ALASD inflow will need to be less than the 60 ppb ecoregion phosphorus standard for shallow lakes. This conservation of mass relationship will only become stronger when the flow rate of ALASD increases from the present discharge rate of approximately 2.5 mgd closer to the permit limit of 3.75 mgd. Bathtub correctly predicts that the ALASD discharge will need to be below 60 ppb, there is no uncertainty with this fact. The high phosphorus loads entering Lake Winona overwhelms the natural nutrient relationships to be expected in a shallow lake. It does not make

sense to expect Lake Winona to presently have the water quality and ecological characteristics of a typical shallow lake. Reducing the phosphorus discharges to meet the phosphorus standard will allow the lake to return to a state where natural processes can become controlling, and will positively affect the chlorophyll-a concentrations and secchi depths present in Lake Winona.

Limno Tech comment: *The model is useful for showing that internal phosphorus sources are a large contributor to the phosphorus concentrations in Lake Winona. Water quality targets cannot be attained, regardless of the level of treatment at ALASD, until these internal sources are controlled. Control of internal sources will require transition back to a clear-water state, which cannot be attained through external nutrient controls alone. The transition will require control of rough fish and re-establishment of a macrophyte community.*

Response 2: The ALASD discharge is the primary source of phosphorus entering Lake Winona by any mechanism, either external or internal. Figure 4-2 of the draft TMDL shows the strong relationship between the ALASD loading rate and the internal loading rate. The magnitude of the internal load is directly related to the magnitude of the ALASD phosphorus load from year to year. As the ALASD phosphorus load goes up, so does the internal load and vice versa. Phosphorus from the ALASD discharge that reaches the sediments is quickly cycled back into the water column where it can be exported to the next lake downstream. Reducing the ALASD loading rate will reduce the internal load proportionally. Management of internal loading can be completed sequentially, and does not require a return to a clear water state for significant internal load reductions to occur. Lake Winona returning to a clear water state is a management goal, not a physical limitation that must be met for substantial progress to be made in the restoration of Lake Winona. Restoration of macrophytes requires a significant reduction in the ALASD nutrient loading.

Limno Tech Comment: *The report is cognizant of the above limitations, noting that: 1) model predictions are highly uncertain, 2) the purpose of this model application is not to identify specific wastewater nutrient reductions, and 3) transition to a marcrophyte-dominated clear-water state will need to control factors other than nutrients.*

Response 3: Model predictions are not considered to be highly uncertain, as described in Response 1. That is, even a simple mass balance calculation shows the phosphorus load reduction necessary for the phosphorus standard to be met. It is believed that because the magnitude of the load is high, a multistep approach is needed such that substantial load reduction progress can be made to allow a more natural lake environment to become reestablished. At that point the more naturally occurring Lake Winona ecosystem can be reassessed, and adjustments made to the management strategy. A highly complex and much more expensive modeling effort is not needed to make this determination, an exercise that would be subject to many of the same limitations and data constraints faced when using the Bathtub model. That is, given the present state of Lake

Winona, any modeling approach requires reanalysis after substantial reductions have been made to adjust the management strategy according to restoration progress that has been made.

Limno Tech Comment: *The suitability of this modeling to support TMDL development will ultimately depend on how model results are used in the upcoming implementation plan. The model, even with large uncertainty, is useful for identifying that water quality standards cannot be met until the lake transitions to a clear-water state. This information can be used to guide adaptive implementation efforts or perhaps a change in water quality standards. The model is not sufficiently reliable to define the specific load reductions necessary to meet existing water quality standards.*

Response 4: We agree with the adaptive management approach, which was our recommendation in the both the Phase 3 and draft TMDL reports. We disagree with the remainder of this comment, the response to which is included in Responses 1-3.

Limno Tech Comment: Section on Applicability of Bathtub Model to Shallow Lakes

Response 5: One reason Bathtub was selected is because it will give reasonable results for a reasonable level of effort at this stage in the restoration of Lake Winona. That is, the condition of Lake Winona is dominated by the long term high nutrient inputs that have and are occurring, and not by processes typical of a natural shallow lake. The data needed to confirm long term restoration outcomes can only be obtained through starting the restoration process and observing the results as phosphorus loads decrease. Any model could be criticized at this stage because data needed to confirm the final outcomes is not available. Uncertainty will be managed by updates of model predictions using data from ongoing monitoring programs that show how the lake is responding to management efforts. The magnitude of phosphorus reductions needed is known from simple mass balance calculations and a complex model would not contribute to predictions of reductions needed for this pollutant. Use of a different model for chlorophyll-a or secchi depth would still be subject to data limitations because of the magnitude of the restoration needed, and would provide limited benefits to phosphorus concentration predictions.

Limno Tech Comment: Section on Lake Winona TMDL Modeling

The comment incorrectly states that watershed loads are highly uncertain due to the apparent lack of any model calibration. In fact, WinSLAMM, the model used, has been calibrated through use of many detailed stormwater monitoring efforts by multiple agencies such as the US Geological Survey in multiple states including Minnesota, as documented in the Lake Winona TMDL Phase 3 report. These calibrations provide predictions having a high degree of reliability to management agencies such as MPCA, and allow these agencies to equitably interpret predicted loadings when comparing predictions for different MS4s. There is no reason to believe that the City of Alexandria, or LaGrand Township, have conditions that are different from the cities that were part

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of the many monitoring programs used to obtain the WinSLAMM model calibrations. Furthermore, an important aspect of the watershed load predictions is the climatic conditions that occur at a particular city. We used hourly rainfall data from the Alexandria Airport, located a half mile from Lake Winona, for the years it was available (5 of 9 years modeled). For the other years we used hourly rainfall data from St. Cloud. Therefore, the climate conditions occurring at Lake Winona have been accounted for in the watershed modeling effort. The comparison of WinSLAMM model predictions to stormwater monitoring results from the Clean Lakes Program further confirms the basis of the WinSLAMM model calibrations (Table 4-1, Draft Lake Winona TMDL). This table shows the model predictions closely match stormwater monitoring results from the Lake Winona watershed.

The comment discusses how modeling started with an annual analysis, which identified that internal loading must be occurring and are critical that the internal load sources were not individually enumerated by the various mechanism that could contribute to internal load. ALASD annual phosphorus loads vary substantially from year to year which means that the phosphorus budget must vary substantially from year to year. The work reported in the Draft Lake Winona TMDL shows the strong correlation between the ALASD loading rate and the internal load rate. There are large year to year variations in internal load because the internal load responds to the large annual variations in the ALASD phosphorus load discharged to Lake Winona. The calibration obtained shows a relative long term equilibrium that exists in Lake Winona during the analysis period between the ALASD discharge and the internal load rate. Furthermore, the biogeochemical phosphorus release testing data indicates the importance of that mechanism of internal loading in Lake Winona. The present data indicate that phosphorus discharged from ALASD undergoes a rapid recycling via biogeochemical processes. It should be stated furthermore, that the comment implies that there is a precise method of differentiating between possible sources of internal load, which is not the case.

Sincerely,

Roger A. Clay

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