MFL PEER REVIEW REPORT

Subject: Technical peer review, minimum flows and levels (MFL) determination, Lake Avalon, Orange County, Florida (Contract #SK376F0, Work Order #3)

For: St. Johns River Water Management District (SJRWMD or "District")

Reviewer: Douglas T. Shaw, Ph.D., The Nature Conservancy

Date: April 3, 2009

Introduction and Scope of Review

This letter report comprises my peer review of the District's minimum level re-evaluation for Lake Avalon in Orange Co., Florida, one of six lake MFL evaluations reviewed as part of this contract. The evaluation and proposed minimum levels are documented in the draft SJRWMD technical report ***Minimum Levels for Lake Avalon, Orange County, Florida*** by C. Ware, St. Johns River Water Management District, Palatka, Florida, 2008 ("Lake Avalon MFL Report" or "MFL Report"). My report is based on review of the draft technical report, documentation provided during our field visits to the six lakes August 27-29, 2008, as well as the following supplemental documents:

1. *Minimum Flows and Levels Method of the St. Johns River Water Management District, Florida, USA* by C.P. Neubauer, G.B. Hall, E.F. Lowe, C.P. Robsion, R.B. Hupalo and L.W. Keenan, *Environmental Management 42(6):1101-1114*, 2008.
2. *A Quantitative Method for Determining Surface Water Inundation/ Dewatering Signatures for Riparian Plant Communities,* Draft manuscript by C.P. Neubauer, C.P. Robison, T.C. Richardson, P. Valentine-Darby and G.B. Hall, *Ecological Engineering*, 2008.
3. *Hydrology of Central Florida Lakes – A Primer* by D.M. Schiffer, U.S. Geological Survey, Circular 1137, 1998.
4. *Lake Avalon Minimum Flows and Levels Hydrologic Methods Report* by C.P. Robison, St. Johns River Water Management District, Palatka, Florida, 2008.

Detailed comments below are confined to the Lake Avalon MFL Report.

The scope of the review includes the following:

- Assessment of the adequacy of the environmental data used in the MFL evaluation in terms of quality and length of record
- Assessment of the methods and procedures for data analysis, including statistical analyses where appropriate
- Evaluation of the validity and appropriateness of all assumptions used in the development of MFLs
- Determination if the data, analyses, and interpretation of results support the recommended MFLs.

Review Comments (Page citations refer to Lake Avalon MFL Report unless otherwise noted)

1. Pages 2-3, Factors to be Considered When Determining MFLs and Pages 25-26, Consideration of Environmental Values Identified in Rule 62-40.473, *F.A.C.*– it would be helpful to indicate here which factors were considered in the development of the Lake Avalon MFLs. Also, for riverine MFLs, the District typically contracts or conducts a water resource values (WRV) assessment in addition to preparing an MFL determination study. Because it is not mentioned in the Lake Avalon MFL Report, I am assuming a separate WRV assessment will not be conducted for this MFL. However, it would be helpful if this were clarified in the MFL Report.

2. Pages 19-20, Sandhill Lake Stage Indicators Sampling Procedures and Minimum Frequent high (FH) Lake Stage Indicators – It would be helpful to include better explanation and more information regarding the empirical correction factors (i.e., -0.59 ft, -0.35 ft, -0.24 ft) that are referred to in these sections, citing the Richardson (2006) and Nkedi-Kizza and Richardson (2007) references. Perhaps some additional explanation of why these correction factors were deemed necessary and how they were derived could be included as a footnote or short appendix. In some cases, the correction factors appear to have been derived from the mean correction required at all lakes studied by Richardson or from laboratory experiments. In such cases, it would also be useful to know the variance of the data to understand how well the mean predicts the sample. Field validation of laboratory measurements of the height of the capillary fringe would also be helpful if available.

3. Page 21, Minimum Frequent Low (FL) Lake Stage Indicators – The paragraph beginning with the sentence “Lake stage indicator thresholds used to determine MFLs…typical low levels” is difficult to understand and the first two sentences may need to be re-written for greater clarity. Also, material about the capillary fringe in this and the subsequent paragraph are repetitive, and were also included in the previous section on page 20.

4. Page 40, Lake Avalon – Two Hydrologic Systems -- I concur with the District’s decision to confine for now the recommended minimum levels to

the main (western) lobe of Lake Avalon in light of compelling evidence that the eastern lobe may behave differently when water levels fall below a dividing ridge. However, given their close proximity to each other, it would seem unlikely that the hydrology of the two lobes is completely independent. Ultimately, a single model may be required that explains the differences in both lobes at lower stage levels. Care should also be taken in communicating the recommended Lake Avalon MFLs to ensure that they are not erroneously applied to the eastern lobe until further analysis is complete.

5. Page 42, Minimum Frequent High (FH) Level – In the third paragraph in this section, the first sentence states that "The recommended FH level was calculated from the mean of all elevations of the wet prairie communities…" I assume the mean elevation referred to here is the average minimum elevation of the wet prairie communities. Please clarify in the text.

6. Page 44, Figure 14 and Page 49, Figure 16 – Although the drawdown signatures (SWIDS) from other sandhill lake sites are used only as additional support for the minimum levels recommended for Lake Avalon, it would be helpful if the wide range of variability observed in the signatures shown in these figures were better explained. The wettest and driest sites in each figure (Lake Geneva and Wekiva River for Fig. 14 and Lakes Dias and Pierson for Fig. 16) appear so different from the others that special attention should be given to these to ensure that they are not outliers and are used appropriately in this and subsequent MFL analyses. It would also be helpful to indicate on these figures which sites are sandhill lake sites and which are not.

Findings and Recommendations

1. **Recommendation:** Improve Lake Avalon MFL Report by addressing the editorial comments 1-6 above.

2. **Finding:** Based on my review of the Lake Avalon MFL and Hydrology Reports and field inspection of transects, I feel that the environmental data data from the site and the data collection procedures used to support this MFL determination are appropriate, repeatable and scientifically sound. The District has done a commendable job through research and modeling to gain an understanding of how sandhill lakes such as Johns Lake function over the long term. That knowledge is appropriately incorporated into this MFL determination. As noted above, additional explanation of the observed variability of SWIDS data should be better explained to ensure

that this method is applied and interpreted appropriately in this and subsequent MFL assessments.

3. **Finding:** Similarly, the methods and procedures for data analysis, including selection, parameterization and calibration of the hydrologic model for Lake Avalon are valid and appropriate, and the assumptions used in data analysis and MFL determination are reasonable and justified by the District's previous experience and literature citations. I concur with the District's decision to limit the recommended minimum levels to the main or western lobe of the lake until additional model development and analysis are completed for the eastern lobe.

4. **Finding:** The data interpretation and analyses, which build on the District's extensive previous experience setting MFLs for rivers, lakes and wetlands, is scientifically sound and supports the recommended minimum levels. The decision to focus MFL determination on FH and FL and not recommend a minimum average is reasonable and appropriate. The Lake Avalon MFL determination relies on the natural drawdown and inundation characteristics of stable vegetation communities and soils on site to set minimum frequent low and frequent high. SWIDS are used as additional support for these elevations and return periods and are consistent with the in-situ indicators.