Memorandum

To: Jon Jones, P.E., Wright Water Engineering

From: Marty D. Matlock, Ph.D., P.E., C.S.E, UA CARS

Re: IRW TMDL Model Selection Memo Comments

Date: December 20, 2010

I have reviewed the document titled "Model Selection for the Illinois River TMDL in AR/OK" and offer the following comments.

The selection of HSPF for watershed modeling is consistent with Aqua Terra's core competency. This model, integrated into BASINS, a stand-alone GIS platform, is reasonable if the calibration and validation process is transparent and well documented. Dr. Donigian of Aqua Terra is broadly recognized as a leading expert in HSPF and in model calibration. The major concern is if USEPA has allocated adequate resources for Aqua Terra to conduct this analysis with full rigor.

The minimum level of rigor for allocation of loads in a complex watershed TMDL should be calibration and validation over the range of expected outcomes. A suite of calibration metrics should be applied to analyze hydrology (base flow and storm conditions) and water temperature (indicator of groundwater and interflow calibration) at each USGS gaging station; in-stream processes including sediment and nutrient loads, and biotic processes including chlorophyll density and concentrations.

The selection of EFDC for lake modeling is reasonable for lake hydrodynamics and thermodynamics. This model would be most advantageous in three-dimensional analysis. However, detailed bathymetry and sectional monitoring of Tenkiller Ferry Reservoir have not been completed for over 15 years. The sediment and nutrient regimes of the riverine, transitional and lacustrian zones have changed in that time period. Collecting adequate data to model the lake system would require at a minimum two years, and an estimated $250,000 in direct costs. These data are critical for understanding and modeling the ecological productivity and hydrogeochemical elements in EFDC when analyzed at three dimensions. As with HSPF, Aqua Terra is qualified to do this work, provided they have adequate resources and time.

Both models should be calibrated and validated across conditions that bracket existing conditions, to the extent possible. Using a model to predict a parameter or condition outside the range of calibration is not good modeling practice. The challenge for Aqua Terra in the Illinois River Basin (IRB) is that conditions have been changing for 10 years; phosphorus loads from point and nonpoint sources have been decreasing, sediment loads predominantly from hydrologic regimes alteration have been increasing, stream bed sediment and gravel load have been increasing whilesize has been decreasing. Riparian cover has decreased across the upper IRB. Calibration and sensitivity analysis using data from before 2004 will misrepresent the current and future condition of this ecosystem.

Sensitivity analysis should be performed for both models as part of the calibration and validation process. The most sensitive input variables that impact the outcome parameters of concern should be characterized for each of the bracketed conditions. The relative sensitivity of each input variable should be stable across model conditions.

Uncertainty analysis should be performed to determine the variability and uncertainty associated with model outputs. Without uncertainty analysis the utility of the model to predict outcomes for critical parameters is compromised. Any remediation strategy should predict outcomes that are significantly different from current conditions. Failure to predict significant changes in outcome parameters undermines the utility of the model for policy.