**COMMENTS**
**ON**
**WATER QUALITY ANALYSIS**
**OF THE**
**HARPETH RIVER**
**BY**
**AQUAETER**
**FOR HRWA**

**September 19, 2006**

The authors of the draft report use the first nine pages analyzing EPA's Total Maximum Daily Load (TMDL) report, hardly mentioning anything that is related to the City of Franklin's Aquatic Resource Alteration Permit (ARAP) application; which is the current issue. EPA's TMDL report uses computer modeling to estimate the effect of various combinations of pollutant loadings (including the City of Franklin's wastewater treatment plant (WWTP)) on the Harpeth River at low summer flows. As the report correctly points out, federal and state law requires that water quality standards be met at the calculated low flow (7Q10), which the US Geological Survey has calculated to be 0.3 cfs. However, the report says that the EPA used a flow of 17 cfs and argues that the report shows that more flow is needed to achieve water quality standards, so Franklin should not withdraw water. This is incorrect.

It would have been ridiculous for EPA to say that the water quality standards must be met at 0.3 cfs and then do all of its analysis at 17 cfs. The TMDL report shows the flows in the river above Franklin to be from zero to 0.3 cfs, and then says that the upper river CE-Qual model results were coupled with the WASP model at the dam. In addition, Bill Melville of EPA stated clearly that EPA had to artificially increase the flows at Franklin from 0.3 cfs to 1.0 cfs, because the WASP model was unstable at 0.3 cfs. Thus, most of the discussion in the first nine pages of the Aquaeter report is invalid.

Even if it were, however, they may be ascribing too much precision and accuracy to the results of EPA's modeling effort. EPA's WASP model is very sophisticated, but also very complex and data-intensive. There are over 20 variables, constraints, and coefficients which must be either measured or estimated and inserted into the model. EPA did not do enough field work to measure more than about 5 or 6 of them, and the rest were estimated. Thus, the resulting output, while generally a fair description of the behavior of the Harpeth River under normal conditions, should not be considered precise or all-encompassing. Aquaeter even agrees, since its final recommendation is for a major field study which will measure many more of the important coefficients.

The main point to keep in mind, however, is that, in all cases when the 7Q10 flow is being approached, and low dissolved oxygen content in the river may become a problem according to EPA's modeling estimates, the City of Franklin's water treatment plant will not be withdrawing water at all. According to the guidelines proposed in the ARAP application, no water would be withdrawn at river flows of 5 cfs or less.

Also, even though they say that they examined Sulkin's 1987 report, they did not report his major conclusion. He found that, at very low River flows (and velocities); the DO was actually higher when the Franklin Wastewater Treatment Plant discharged more effluent. This conclusion, while it may be counter-intuitive, can be easily explained. At low flows, detention time of water in the pools of the pool-and-riffle Harpeth, where essentially no reaeration takes place because of low velocities, is very long, so bacterial respiration has a long time to utilize oxygen before the water gets to the next riffle. When the WWTP discharge is doubled, the detention time is halved, and the oxygen depletion is halved. This works as long as the WWTP effluent is highly treated, with BOD less than 5 mg/L and DO of over 8 mg/L, so the extra BOD of more effluent doesn't outweigh the extra reaeration caused by higher River velocities and the reduced time for oxygen depletion in the pools. This is confirmed on p. 53 of EPA's TMDL document, where they show that the oxygen sag below the WWTP is less when the WWTP is discharging 12 mgd than when the WWTP is discharging only 6 mgd.

The biggest problem with the report however, is the major over-generalization of their "rule of thumb" on pages 10-11, and the fact that they were highly selective in which data from Figure 5 that they selected to make their point. They say that the Harpeth River needs 100 cfs to protect the DO from dropping below 5 mg/L because the DO on August 5, 2002, did not rise above 5 mg/L at mile 84.4 below the WWTP until the flow approached 100 cfs. However, there is no evidence that the sharp drop in DO on August 2, 2002, was caused by the WWTP. The WWTP flow did not increase from July 31 to August 2, and yet the TDEC data show DO dropped from 5 mg/L to 2 mg/L, and later to zero.

Also, the River flow did not decrease. In fact, the best DO was Sept. 11-15, when Harpeth River flow was only 5 cfs. Something other than decrease in River flow or increase in WWTP flow caused the DO drop, so you cannot say it was necessary for more River flow, or less Water Treatment Plant withdrawal to correct it.

In Figure 4, the DO at mile 84.4, below the WWTP, dropped to zero on August 4, 2003, but no evidence that the WWTP caused it by increasing flow or BOD load. However, the DO at mile 87.7, above the WWTP, dropped sharply on July 31. That drop could not be attributed to the WWTP. The DO at mile 79.8 and mile 45.0 dropped even earlier. Something else, other than the WWTP must have happened. What was it?

Other data, not shown in their report, could explain it. If one plots the rainfall at the WWTP and river flow on the same scale as Figure 4, one sees that a rainfall event of about 0.75 in. on July 29 caused River flow to double, from 10 cfs to 20 cfs. There could have been more rain at other locations, then or at other times, on the tributaries. The DO began to drop at all four stations soon afterwards. The first to drop was mile 45.0, and at all four stations soon afterwards. The last station to show a serious drop was at mile 84.4, just below the WWTP. The DO at mile 87.7, at Main St., above the WWTP, dropped sharply before that at mile 84.4. Thus, the WWTP could not be responsible.

We believe that these two sharp drops in DO, in the absence of increased WWTP flow or loading, was due to the rainfall events following long periods of low flow (below 20 cfs) but adequate DO, which caused runoff containing BOD from non-point sources, or from the extra flow stirring up the sediment on the River bottom, converting slow-acting SOD to fast-acting suspended BOD, or both.

Thus, Aquaeter's over-reliance on their "rule of thumb" is totally inappropriate in this case. It ignores the fact that for much of the time in Figure 2-4, the DO was adequate at all stations, when the Harpeth River flow was only 5 cfs, well below the 100 cfs they say should be the Water Treatment Plant cutoff. It also ignores the fact that this "rule of thumb" is primarily for secondary treatment plant effluent, with BOD of 20-30 mg/L, discharging into normal free-flowing streams, and not for highly-treated effluent like Franklin's discharging into a pool-and-riffle stream like the Harpeth River.

There is no sensitivity analysis or other discussion presented by Aquaeter to show that the proposed withdrawal strategy would have a measurable effect on the DO below the WWTP. We do not believe that it would, and that is why we placed the proposed 20% of flow withdrawal limit in the APAP permit application. There is no credible evidence whatever to support a 100 cfs withdrawal cutoff, and much evidence and experience to refute it, even in Aquaeter's own report.