ADDENDUM

In 2003, the U.S. Environmental Protection Agency (EPA) Region 4 published a report titled, "EPA Cahaba River: Biological and Water Quality Studies, Birmingham, Alabama, March/April, July, and September 2002" (available on EPA Region 4's website at http://www.epa.gov/Region4/sesd/reports/2002-0809.html). Based on a request for correction received, EPA re-evaluated the contents of the Cahaba River report and is issuing this addendum to provide clarification and corrected information. The information in this addendum does not alter the main conclusions of the Cahaba River Report, but does provide additional information regarding the following four areas addressed in the report:

- Duplicate sampling stations from streams where macroinvertebrate data was collected
- Indicator Assemblage Index (IAI) with respect to using Station CR-ATa as a control site
- Family-level identifications and the effect on benthic metric calculations
- Opinions held by field malacologists that excessive algal growth affects the density and decline of mussel populations

Duplicate Sampling

Station CR-ATa is located immediately upstream of CR-AT. The station reach of CR-ATa was selected for duplicate sampling based on its similarity in habitats and flow regimes to station CR-AT. Station CR-ATa was sampled for benthic macroinvertebrates for the purpose of providing a duplicate sample to ascertain if the sampling methodology was repeatable. The study plan does not address acceptance criteria for this type of information. Presently there is no documented, widely accepted method for comparison of duplicate samples. In 2006, Region 4 plans to participate in a Method Performance Project with the Region 4 states in an effort to address the issue of duplicate sample comparability. Field sampling, laboratory analysis, and data analysis were based on guidance put forth in EPA 841-B-99-002 and the Ecological Assessment Branch SOP. Biological metric results offer a basis for comparison of CR-AT and CR-ATa in regard to the question of method repeatability. Previous studies (Wallace et al. 1996; Barbour et al. 1992) have identified the Biotic Index and the EPT Index as robust measures for detecting stress in stream ecosystems. The Biotic Index at CR-AT and CR-ATa were 5.30 and 5.51, respectively. Results for the EPT Index at CR-AT and CR-ATa were the same (12). Please note, this value is a correction from the original report. See the attached errata sheet. Another metric, Total Taxa, yielded similar results at CR-AT and CR-ATa (33, 36 respectively). Values for the metric %Dominant Taxon at CR-AT and CR-ATa were 9 and 12, respectively; this indicates community balance in that no species are predominant in the collections at either CR-AT or CR-ATa. Results for the metric %EPT indicate that the pollution-sensitive EPT fauna were well represented at both CR-AT and CR-ATa; 87 individuals were collected at CR-ATa while 123 individuals were collected at CR-AT. In regard to the %Ephemeroptera metric, mayflies were abundant in collections from both CR-AT and CR-ATa; 87 individuals were collected at CR-AT and 47 were collected at CR-ATa. More Chironomids were collected at CR-ATa (60) than at CR-AT (29) thus affecting the %Chiromid + Annelid metric. A discussion on the IAI metric is provided later in this text. The duplicate sampling at CR-ATa resulted in collection of 23 taxa out of 36 that were also collected at CR-AT which translates into a high degree of community similarity. This information, coupled with the similarity in the robust metric results (EPT Index, Biotic Index) and the Total Taxa results, support the fact that the method utilized for benthic macroinvertebrate sampling is repeatable.

Indicator Assemblage Index (IAI): Results using CR-ATa as site control

Since the CR-ATa site is a duplicate for the CR-AT site, it could be used as an alternate site control. If CR-ATa is used as the site control, half of the test sites would have different IAI impairment results than were obtained using CR-AT as the site control. Four stations would be changed to "no impairment" (UT-1, CR-BT, CR-BH, and BC-4). Impairment would still be indicated at two stations (BC-2, and CR-AH). However, if one looks closely at the CR-ATa results for the %CA (Chiromids/Annelids) component and the %EPT (Ephemeroptera/Plecoptera/Trichoptera) component of the equation for calculating the IAI, it becomes readily apparent why the impairment classifications per the IAI at CR-ATa would be different from CR-AT. The IAI contrasts the ratio of tolerant versus intolerant species at a control versus a test site. At CR-ATa, two species of tolerant midges (Rheotanytarsus and Polypedilum) were abundant at CR-ATa and led to the collection of twice as many Chironomids (60 individuals) as was collected at CR-AT (29 individuals). Also, the intolerant species were slightly less at CR-ATa (87 individuals) as compared to CR-AT (123 individuals). Given these two facts, and since the IAI is an abundance-related metric, the IAI results led to different impairment classifications when CR-ATa was used as a basis for comparison.

EPA does not recommend the use of a single biological metric, such as IAI to determine ecological impairments. As noted in the EPA Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates and Fish, the use of a multiple suite of biological metrics “form the foundation for a sound, integrated analysis of the biotic condition to judge attainment of biological criteria”.[1] Previous EPA studies in the Cahaba River conducted in 2001 identified a suite of biological metrics (EPT Index, Taxa Richness, %EPT, % Ephemeroptera, Biotic Index, % Dominant Taxon and IAI) that were sensitive to stress. Accordingly, these same metrics were adopted for use in evaluating the 2002 benthic macroinvertebrate data. A description of these metrics can be found on pages 16-17 of the main body of the Cahaba River Report. Metrics (in addition to the IAI) that indicated impairment in the benthic macroinvertebrate community were the EPT Index, Taxa Richness, % EPT, % Ephemeroptera, and % Dominant Taxon. For example, upper Cahaba River watershed stations (CR-BT, UT-1, LCC-1, and LCR-2) had from 2 to 5 metrics with results that

[1] Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C., .pg 9-7

indicated impairment. In the middle Cahaba River watershed (stations CR-AH, CR-BH, and CR-6) a range of 2 to 5 metrics were exhibiting impairment. Metric results from the lower Cahaba River watershed stations (CR-7, BC-2, BC-3, BC-4 and SC-1), with the exception of SC-1, revealed 3 to 5 metrics that were indicating impairment. As pointed out in the 2002 EPA report, SC-1 had high quality habitat and a diverse benthic macroinvertebrate community.

The Cahaba River Report also documents impairments in the area of fish communities, sediment quality, nutrient enrichment and excessive algal growths. A fish survey of the Cahaba River watershed, conducted by the Geological Survey of Alabama (GSA) as part of the 2002 EPA study, reported a decline in pollution-intolerant fish species with a concomitant increase in pollution-tolerant fish species. In addition, endangered species such as the gold-line darter and the Cahaba shiner have been adversely affected. Findings by the 2002 GSA survey are in agreement with past studies (2000) by investigators from the University of Alabama/Birmingham (UAB). Stream geomorphology and classification studies indicated a shift from coarser substrates at Cahaba River watershed stations above Trussville to finer substrates at stations below Trussville and the heavily developed middle reach of the Cahaba River. Studies in 1998 by investigators from UAB have also reported excessive sedimentation affecting the biology of the Cahaba River. As reported in the 2002 EPA report, excessive nitrogen and phosphorus inputs have contributed to excessive and widespread growths of filamentous periphyton. Elevated nitrogen and phosphorus concentrations were reported in both the 2002 spring and summer sampling events at stations in the entire Cahaba River study area.

Family level identifications and the effect on benthic metric calculations

One specimen from the family Hydropsychidae and two specimens from the family Heptagenidae collected at CR-AT were only identified to the taxonomic level of family due to damage. Damaged specimens were also present at other stations and the ERRATA addresses the changes when these specimens are not counted in the EPT Index and Total Taxa calculations. When calculating the EPT Index this would change the EPT Index at CR-AT from 14 to 12. Three damaged specimens of Hydropsychidae were present at CR-ATa; when these are not counted in the EPT Index calculation, the EPT Index results (12) would then be identical to that of CR-AT (12). This metric represents only one of eight biological metrics used in evaluating the benthic macroinvertebrate data. In addition, not including the Hydropsychidae and Heptagenidae family level identifications in the Total Taxa count for CR-AT only changes the Total Taxa from 35 to 33. In like manner, not including the family level Hydropsychidae at CR-ATa would change the Total Taxa at CR-ATa from 37 to 36. Again, due to the low numbers of individuals identified to the family level (2 individual specimens from the family Heptagenidae and 1 individual specimen from the family Hydropsychidae at CR-AT and 3 specimens from the family Hydropsychidae at CR-ATa) metric results for the Biotic Index (BI) would also be minimally affected. These minor changes do not impact the main conclusions of the Cahaba River Report.

Opinions held by field malacologists that excessive algal growth affect the density and decline of mussel populations.

Opinions expressed in the Cahaba River Report by Dr. Hartfield were not used as a basis for conclusions made in the Cahaba River Report. They were used in the Discussion section. In a 2002 personal communication, cited in the References to the Cahaba River Report, Dr. Hartfield indicated that "among all field malacologists he contacted, there was a clear consensus of opinion that the occurrence of excessive attached algal growth closely correlates with decline and disappearance of mussel populations." Fueling the excessive algal growths, are elevated nutrients (nitrogen and phosphorus) as identified in the 2002 EPA Cahaba River Report.

Dr. Hartfield is a recognized authority in malacology. He has been involved in many field investigations; and, in fact, one of his reports cited in the 2002 EPA Cahaba River Report was prepared for the Jefferson County Environmental Authority. It is stated upfront in the 2002 EPA Cahaba River Report that this is an opinion of experts in the field of malacology who have observed this phenomenon.

Studies cited in the "Cahaba and Little Cahaba Rivers: Biological and Water Quality Studies, Birmingham, AL, August 27-31, 2001". U.S.EPA, Region 4, SESD, Ecological Assessment Branch, Athens, GA":

Wallace, J. Bruce, Jack W. Grubaugh, and Matt R. Whiles. 1996. Biotic Indices and Stream Ecosystem Processes: Results from an Experimental Study. Ecological Applications 6(1): 140-151.

Barbour, M.T., J.L. Plafkin, B.P. Bradley, C.G. Graves, and R.W. Wisseman. 1992. Evaluation of EPA's Rapid Bioassessment Benthic Metrics: Metric Redundancy and Variability Among Reference Stream Sites. Environmental Toxicology and Chemistry 11(4): 437-449.

ERRATA

As mentioned in the ADDENDUM, the changes below are a result of not counting organisms identified to the family level in calculating the EPT Index and Total Taxa.

Page 16 – reported taxa at CR-AT should be 33 instead of 36.

Page 16 – reported EPT taxa should be 12 instead of 15.

Page 17 – greatest Taxa Richness was seen at CR-ATa (36) rather than CR-AT.

Page 17 – Taxa Richness range for the six Cahaba River mainstem stations should be 30 to 36 instead of 31 to 36.

Page 17 – Taxa Richness value at UT-1 should be 23 instead of 24.

Page 18, Table 3 – EPT Index at UT-1 should be 3 instead of 4.

Page 18, Table 3 – Taxa at UT-1 should be 23 instead of 24.

Page 18, Table 3 – EPT Index at CR-AT should be 12 instead of 15.

Page 18, Table 3 – Taxa at CR-AT should be 33 instead of 36.

Page 18, Table 3 – EPT Index at CR-ATa should be 12 instead of 13.

Page 18, Table 3 – Taxa at CR-ATa should be 36 instead of 37.

Page 18, Table 3 – EPT Index at CR-BT should be 9 instead of 10.

Page 18, Table 3 – Taxa at CR-BT should be 31 instead of 32.

Page 18, Table 3 – EPT Index at CR-BH should be 10 instead of 11.

Page 18, Table 3 – Taxa at CR-BH should be 32 instead of 33.

Page 18, Table 3 – EPT Index at CR-6 should be 6 instead of 7.

Page 18, Table 3 – Taxa at CR-6 should be 30 instead of 31.

Page 18, Table 3 – EPT Index at SC-1 should be 12 instead of 13.

Page 18, Table 3 – Taxa at SC-1 should be 26 instead of 27.