

Biological Assessment Report

Effects of the AmerenUE Upper Taum Sauk Reservoir Dam Failure on the Macroinvertebrate Community of East Fork Black River, Reynolds County

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Prepared for:

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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**) Directors Office (**DO**), the Field Services Division (**FSD**), Environmental Services Program (**ESP**), Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of the East Fork Black River, Reynolds County, Missouri. The sampling was conducted on December 19, 20, & 21, 2005 to provide data for assessment of impact to the aquatic community from a sudden and massive failure of the Upper Taum Sauk Reservoir. The failure, which occurred on December 14, 2005, resulted in a release of approximately 1 billion gallons of water into a small drainage that flows into the East Fork Black River at Johnson's Shut-Ins State Park (Appendix A & B). Dave Michaelson, Ken Lister, and Carl Wakefield of the WQMS conducted the sampling. Members of the WQMS assisted in the analysis of the samples.

1.1 Objective

The Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure and associated biological criteria could not be utilized since the failure occurred outside the standard index period (mid-March through mid-April or mid-September through mid-October). Therefore, a stand-alone quantitative study was initiated. The objective of the study was to statistically determine if the macroinvertebrate communities of stream reaches impacted by massive flooding caused by the reservoir failure were significantly different than the macroinvertebrate community of an upstream control reach. Macroinvertebrate samples were collected at a control reach immediately upstream of the impact zone and at five longitudinally separate downstream reaches that terminated at the Highway 21/49/72 bridge at Lesterville, Missouri.

1.2 Null Hypothesis

The following null hypothesis was tested in this study: no statistically significant differences ($P < 0.05$) exist between the East Fork Black River macroinvertebrate communities at study locations found within the AmerenUE Upper Taum Sauk Reservoir failure impact zone compared to sites outside this zone.

2.0 Study Area

The East Fork Black River watershed originates in northeastern Iron County near Graniteville, Missouri and Elephant Rocks State Park. It flows southwest from its source to the Shut-in Creek confluence just north of Johnson's Shut-Ins State Park; from this point it flows south through Johnson's Shut-Ins State Park and the AmerenUE Lower Taum Sauk Reservoir to its confluence with the Black River near Lesterville, Missouri (Appendix A). The approximately 94-mi² watershed is mostly rural, with 92% composed of forested land cover (Table 1). The assessed stream reach is classified in the Missouri Water Quality Standards (MDNR 2005a) as a class P stream. The designated uses include Livestock and Wildlife Watering, Protection of Warm Water Aquatic Life, Whole Body Contact, and Drinking Water Supply.

The East Fork Black River is located within the Ozark/Current/Black Ecological Drainage Unit (**EDU**). An EDU is a region in which biological communities and habitat conditions can be expected to be similar. Please see Appendix A for maps of the EDU and the local sampling locations. Table 1 compares the land cover percentages from the Ozark/Current/Black EDU and the 14-digit Hydrologic Unit Code (**HUC**) that contains the sampling reaches of the East Fork Black River. Land cover data were derived from Thematic Mapper satellite data from 2000-2004, and interpreted by the Missouri Resource Assessment Partnership (MoRAP).

Table 1
 Percent Land Cover

	Urban	Crops	Grassland	Forest
Ozark/Current/Black EDU	1.0	0.0	23.0	72.0
HUC 14 #11010007030002 (Stations 1,2,3,4)	0.0	0.0	4.0	91.0
HUC 14 #11010007030001 (Stations 5,6)	0.0	0.0	4.0	93.0

3.0 Site Descriptions

Station #1 (Section 6, Photo 1) (SE ¼ sec. 16, T. 32 N., R. 2 E.) was the most downstream station on East Fork Black River and was located immediately upstream of the Highway 21/49/72 bridge at Lesterville, Missouri. Geographic coordinates of the downstream terminus of the sampling reach are Latitude 37.450897, Longitude -90.827831.

Station #2 (Section 6, Photos 2 & 3) (NW ¼ sec. 21, T. 33 N., R. 2 E.) was located between the Lower Taum Sauk Reservoir and the shut-ins within the Johnson's Shut-Ins State Park boundaries. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.534083, Longitude -90.838674.

Station #3 (Section 6, Photo 4) (SW ¼ sec. 16, T. 33 N., R. 2 E.) was located immediately upstream of the shut-ins within the Johnson's Shut-Ins State Park boundaries. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.539537, Longitude -90.839846.

Station #4 (Section 6, Photo 5) (NW ¼ sec. 16, T. 33 N., R. 2 E.) was located within the Johnson's Shut-Ins State Park boundaries immediately downstream of the debris dam caused by the Upper Taum Sauk Reservoir failure (see Appendix B – Proffit Mountain Scour Channel). This reach had previously been the main channel and was a biological criteria reference site for the MDNR. During the time of sampling, however, the main flow of the East Fork Black River was forced by debris into a high flow channel east of the original channel. At the time of sampling, the main channel was very shallow and mostly filled with sand. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.545990, Longitude -90.842487.

Station #5 (Section 6, Photos 6 & 7) (NE ¼ sec. 8, T. 33 N., R. 2 E.) was located upstream from the Highway N bridge, immediately upstream of the confluence with Shut-in Creek. This reach was within the most upstream area that was impacted by water and debris from the Upper Taum Sauk Reservoir failure. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.555580, Longitude -90.844001.

Station #6 (Section 6, Photos 8 & 9) (S ½ sec. 4, T. 33 N., R. 2 E.) was located upstream from impacts from the upper Taum Sauk Reservoir failure and was considered a control reach. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.559317, Longitude -90.840179.

4.0 Methods

4.1 Macroinvertebrate Collection

A standardized, single habitat, sample collection procedure for coarse substrate was followed as described in MDNR-ESP-208, Standard Operating Procedure for Macroinvertebrate Sampling Using a Hess Sampler (MDNR 2006).

All macroinvertebrate samples received a numbered label affixed to the sampling jar and an internal label after preservation with 80% denatured ethyl alcohol. The corresponding label number was entered onto a chain-of-custody form indicating the date, time, and location of collection and parameters to be analyzed. A chain of custody was completed in a manner consistent with the Standard Operating Procedure MDNR-FSS-002, Field Sheet and Chain of Custody Record (MDNR 2001a). The WQMS field personnel maintained custody of the samples for analyses.

4.2 Macroinvertebrate Laboratory Processing

Laboratory processing was consistent with the description in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a), with the exception that no sub-sampling was performed. Each sample was processed in total under 10x magnification to remove all macroinvertebrates from debris. Individuals were identified to standard taxonomic levels (MDNR 2005d) and enumerated.

4.3 Statistical Analyses

The raw data were entered into the WQMS macroinvertebrate database, which was used to calculate the total number of individuals and taxa richness at each station. Statistical analyses were performed on the total number of individuals and taxa richness to determine if the test stations on East Fork Black River were impaired. Because initial analyses revealed that both data sets failed the assumption of normality, further statistical tests were terminated until this assumption could be met. When raw data includes zero values it cannot be log transformed. A common solution is to add a standard quantity to each raw value so that it is greater than zero.

Each value for number of individuals and taxa richness was increased by one (1). The data were then \log_{10} transformed and the data passed the normality assumption. It is common practice to use this form of data transformation to meet the assumption of parametric statistical tests, especially when the mean is positively correlated with the variance (Sokal & Rohlf 1973). Upon meeting the assumptions of parametric tests, data were analyzed using one-way analysis of variance (ANOVA) and Tukey multiple comparison tests. A commonly accepted probability level ($P < 0.05$) for statistical significant differences was applied. SigmaStat[®] 2.0 software (SPSS Inc., Chicago, IL) was used in the statistical analyses.

4.4 Water Chemistry

Physical and chemical water quality measurements were taken at each sample station. Field measurements included temperature (MDNR 1993), pH (MDNR 2001b), conductivity (MDNR 2000), turbidity (MDNR 2005c), and dissolved oxygen concentrations (MDNR 2002). Grab samples of stream water were collected from each station and preserved in accordance with the Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2002c). Water samples were collected and submitted for analysis using the Field Sheet and Chain of Custody Record (MDNR 2001a). The samples were submitted to the Environmental Services Program's Chemical Analysis Section for analyses of dissolved cadmium, dissolved calcium, hardness, dissolved lead, dissolved magnesium, dissolved nickel, non-filterable residue, and dissolved zinc. All dissolved metals samples were filtered in the field through a 0.45-micron disposable filter.

Stream velocity measurements were collected at each sample station using a Marsh-McBirney Flow-Mate Model 2000. Discharge at each sample station was later calculated using the methods set out in the Flow Measurements in Open Channels (MDNR 2001c).

4.5 Quality Assurance/Quality Control (QA/QC)

4.5.1 Field Meters

All field meters used to collect water quality parameters were maintained in accordance with the Standard Operating Procedure MDNR-ESP-213, Quality Control Procedures for Checking Water Quality Field Instruments (MDNR 2005).

4.5.2 Biological Samples

Approximately 14% of macroinvertebrate samples were checked for accuracy of organism removal from sample debris and for taxonomic identification. These tasks were performed consistent with those methods found in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a).

4.5.3 Biological Data Entry

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with the Standard Operating Procedure MDNR-WQMS-214, Quality Control Procedures for Data Processing (MDNR 2003).

5.0 Data Results and Analyses

5.1 Macroinvertebrate Data

A total of seven replicate macroinvertebrate samples were collected at each station. A Hess Sampler was used to collect each replicate in an area of similar depth and flow conditions. Each replicate sample received a unique sample number. The raw data from each sample are presented on bench sheets in Appendix E. Summarized data, means for total number of individuals and taxa richness per Hess sample (0.086 square meters) and percent change from control means (i.e. station #6), are presented in Tables 2 and 3, respectively.

Table 2
 Total Number of Individuals per Hess Sample

	Station #1	Station #2	Station #3	Station #4	Station #5	Station #6
Replicate #1	202	0	1	2	10	37
Replicate #2	313	4	1	2	48	46
Replicate #3	1051	7	2	0	49	44
Replicate #4	67	4	20	0	37	18
Replicate #5	330	0	4	0	128	37
Replicate #6	318	1	3	0	73	35
Replicate #7	104	5	1	1	40	88
Mean	341.1	3	4.6	0.7	55	43.6
Percent change from control mean	+682%	-93%	-89%	-98%	+26%	—

Table 3
 Taxa Richness per Hess Sample

	Station #1	Station #2	Station #3	Station #4	Station #5	Station #6
Replicate #1	32	0	1	2	5	17
Replicate #2	40	4	1	2	16	16
Replicate #3	54	7	1	0	20	18
Replicate #4	17	3	7	0	15	13
Replicate #5	38	0	2	0	24	16
Replicate #6	42	1	3	0	27	17
Replicate #7	22	4	1	1	24	30
Average	35	2.7	2.3	0.7	18.7	18.1
Percent change from control mean	+93%	-85%	-87%	-96%	+3%	—

5.2 Results of Macroinvertebrate Data Statistical Analyses

Summary statistics (actual) were calculated and included in Appendix C for each data set. One way Analysis of Variance tests were performed on a number of macroinvertebrate individuals and taxa richness data sets to determine whether statistical differences in these parameters occurred among sites.

Initial analyses are presented as a SigmaStat printout in Appendix D. This preliminary analysis revealed that both data sets failed the ANOVA assumption of normality; as a result, further testing was terminated until a log transformation could be performed.

Summary statistics for the data set in which the values for number of individuals and taxa richness were increased by adding one (1) are included in Appendix C (actual +1).

Log₁₀ transformation enabled data to pass the assumptions of normality and equal variance, allowing the completion of ANOVA. The results of this testing are presented as SigmaStat printout sheets in Appendix D (actual +1). For both data sets there were significant differences between means and an All Pairwise Multiple Comparison Procedures (Tukey Test) was initiated (see Appendix D).

To facilitate comparison of significant differences between stations, Tables 4 & 5 were constructed. Each table visually presents a matrix whereby significant differences between stations are represented by an (*) in the grid.

Table 4
 Stations with Significant Difference in Total Number of Individuals

Station #1	*	*	*	*	*	
Station #2	*	*				
Station #3	*	*				
Station #4	*	*				
Station #5						
Station #6						
	Station #6	Station #5	Station #4	Station #3	Station #2	Station #1

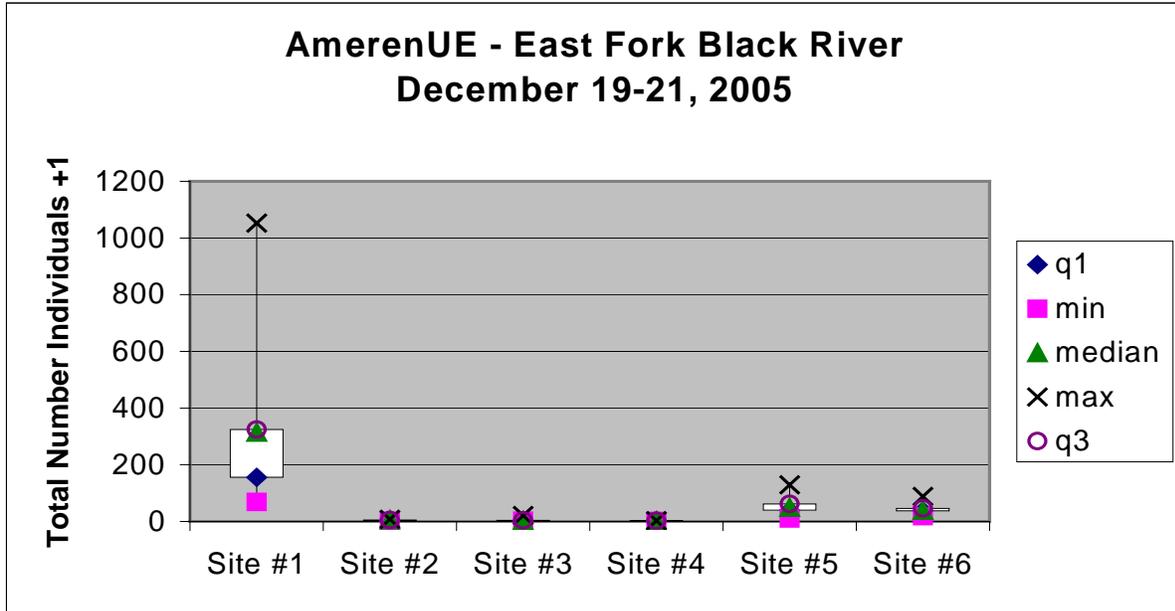
Inspection of the Table 4 grid reveals no significant difference in the mean number of individuals between station #5 and the control station #6. In addition, there were no significant differences among test stations 2, 3, and 4. All stations between the debris dam and Lower Taum Sauk Reservoir show a significant difference in total number of individuals from those at stations 5 and 6. An inspection of the actual +1 data in box plot format (Fig. 1) does not allow easy examination of data because of the large difference in individual numbers between station #1 and all other stations. When placed on a log₁₀ scale (Fig. 2) it is much easier to inspect the data and recognize that stations 2, 3, and 4 are different than stations 5 and 6 in a negative direction, whereas station 1 is different in a positive direction. Therefore, it can be stated that total numbers of individuals were significantly reduced at stations 2, 3, and 4. Using the mean value from the control station, the respective number of individuals at these stations was reduced by 93% at station #2, 89% at station #3, and 98% at station #4 (Table 2).

Table 5
 Stations with Significant Difference in Taxa Richness

Station #1			*	*	*	
Station #2	*	*				
Station #3	*	*				
Station #4	*	*				
Station #5						
Station #6						
	Station #6	Station #5	Station #4	Station #3	Station #2	Station #1

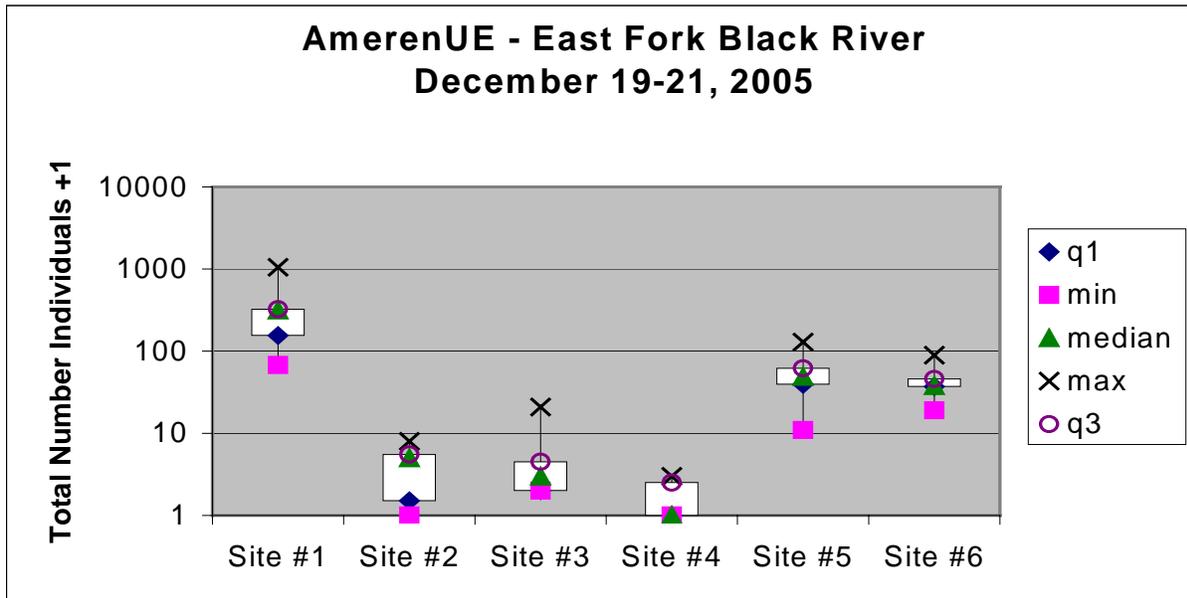
Inspection of the Table 5 grid reveals no significant difference in mean taxa richness between test stations 1 and 5 and control station 6. There were also no significant differences among test stations 2, 3, and 4. However, taxa richness in test stations 2, 3, and 4 were significantly different compared to test station 5 and control station 6. An inspection of the actual +1 data in box plot format (Fig. 3) allows easy examination and recognition that stations 2, 3, and 4 are different in a negative direction. Therefore, it can be stated that taxa richness was significantly reduced at stations 2, 3, and 4. Using the mean value from the control station, the respective taxa richness at these stations was reduced by 85% at station #2, 87% at station #3, and 96% at station #4 (Table 3).

Figure 1
 Box Plots of Number of Individuals (Arithmetic Scale)



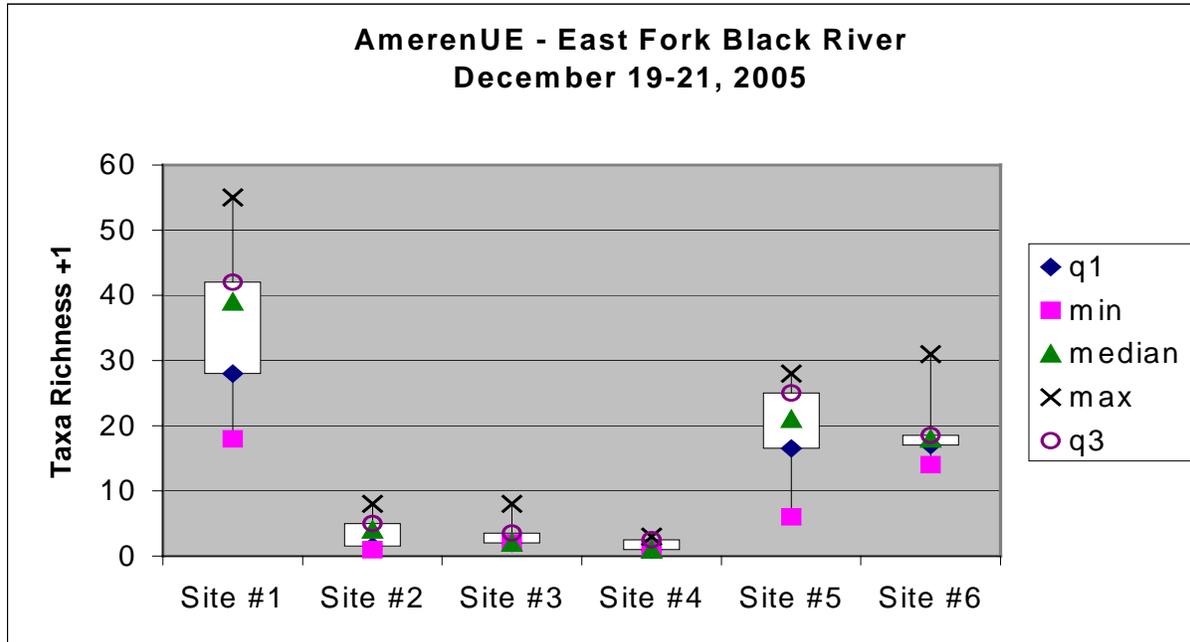
*q1 = 25 percentile and q3 = 75 percentile

Figure 2
 Box Plot of Number of Individuals (Log₁₀ Scale)



*q1 = 25 percentile and q3 = 75 percentile

Figure 3
Box Plots of Taxa Richness



*q1 = 25 percentile and q3 = 75 percentile

5.3 Water Chemistry

Physical and chemical water quality results are presented in Table 6. All samples were collected approximately a week after the failure of the Upper Taum Sauk Reservoir. At this time, water levels at stations 2, 3, 4, 5, and 6 had returned to ambient flow. Station #1 was located downstream of Lower Taum Sauk Reservoir, the recipient of a large amount of sediment resulting from the breach. Water collected at this site was being released through a 16-inch diameter pipe at the base of the Lower Reservoir dam and had much higher turbidity and non-filterable residue compared to upstream sites (see Section 6, photo 1). In addition, flow was much higher at this downstream site compared to the remaining stations. A noticeable decreasing trend in turbidity exists in an upstream direction.

Table 6
 Physical and Chemical Water Quality Results

Sample #	0506887	0506888	0506889	0506890	0506891	0506892
Date	12/19/2005	12/19/2005	12/20/2005	12/20/2005	12/21/2005	12/21/2005
Station	Station # 1	Station #2	Station #3	Station #4	Station #5	Station #6
Dissolved Cadmium - µg/L	*	**0.26	*	*	*	*
Dissolved Calcium - mg/L	10.3	17.1	13.3	17.2	17.3	18.3
Dissolved Oxygen - mg/L	11.6	15.6	15.6	9.6	12.9	13.0
Flow - cfs	50.7	15.2	15.5	1.81	5.58	4.79
pH	7.73	7.09	7.43	6.60	7.36	7.46
Specific Conductivity - µmhos/cm	97.0	175	161	138	154	154
Temperature - degrees C	4.0	5.2	4.4	9.3	3.4	3.3
Turbidity - NTU	>1000	33.4	25.9	50.5	2.58	*
Hardness as CaCO ₃ - mg/L	50.0	84.3	63.2	87.0	88.1	92.6
Dissolved Lead - µg/L	*	**0.42	*	*	*	*
Dissolved Magnesium - mg/L	5.9	10.1	7.28	10.7	10.9	11.4
Dissolved Nickel - µg/L	1.77	1.28	1.3	1.18	1.03	**0.96
Non-Filterable Residue - mg/L	1690	16.0	16.0	82.0	6.0	*
Dissolved Zinc - µg/L	7.94	4.72	4.37	3.98	2.81	2.05

* Below detectable limits ** Estimated value, below Probable Quantitative Limit

6.0 Observations and Photo Documentation

Photographs of relevant conditions at each station are presented in this section.



Photo 1
Station #1. Photo taken facing upstream (north). Flow was elevated, compared to upstream stations, and extremely turbid.



Photo 2
Station #2. Photo taken facing upstream (north). Water was murky, but substrate partially visible. Substrate was mostly large cobble on bedrock.



Photo 3
Station #2. Photo taken facing left descending bank (east). Investigator standing at post-breach high water mark, indicated by arrow.



Photo 4
Station #3. Photo taken upstream of shut-ins near beginning of boardwalk. Water conditions and substrate composition similar to Station 2, with the exception that bedrock was not encountered at this site.



Photo 5

Station #4. Photo taken facing west-southwest. Sample site located in the “West Channel,” a former WQMS biocriteria reference reach buried under several feet of sand-sized sediment.



Photo 6

Station #5. Photo taken facing upstream (northeast). Sample site located upstream of Highway N and confluence with Shut-in Creek. Water was very clear, but substrate covered with fine sediment resulting from reservoir breach.



Photo 7

Station #5. Photo showing presence of sediment covering benthic substrate in riffle habitat.



Photo 8

Control Station #6. Photo taken facing upstream (northeast). Water was clear and substrate free of fine sediment.



Photo 9

Control Station #6. Photo showing absence of sediment covering benthic substrate in riffle habitat.

7.0 Discussion

The results of this study reflect the immediate damage to the aquatic resources of East Fork Black River. This damage is due to what can only be described as extreme flood damage. This type of damage is non-selective to any particular group of organisms and results can be extrapolated to the entire aquatic community. In addition to the macroinvertebrate data collected by ESP, the Missouri Department of Conservation collected fish community and habitat data, which will be reported by them when data analyses have been finalized.

Total number of macroinvertebrate individuals as well as taxa richness observed among study sites varied according to their proximity to scouring flows resulting from the reservoir breach. In areas that were affected by only a thin layer of sediment or increased turbidity, a decline in the macroinvertebrate community compared to the control site was not observed at the time of this study. The total number of individuals and taxa richness were highest at station #1 which, despite elevated flows and higher turbidity, were protected by the Lower Taum Sauk Reservoir dam from the intense flows that had occurred upstream. Station #1 total numbers and taxa richness were higher compared not only to the scour- and sediment-impacted middle reach (stations 2, 3, and 4), but also the upstream station #5 and control station #6. Several factors likely contributed to these higher numbers observed at station #1. Of primary importance is the larger size of the watershed at station #1, compared to the upstream stations. Whereas the watershed upstream of station #1 is approximately 94 mi², the watershed size of the upper two stations was roughly one-quarter this size. Larger watersheds result in larger channel size and, under normal circumstances, increased water quantity. Benthic habitat at station #1 also was more suitable for relatively high macroinvertebrate density compared to many of the upstream stations. Whereas upstream samples (with the exception of station #4) were collected in substrate dominated by cobble and boulder habitat, station #1 had much more gravel and cobble habitat, which tends to have more surface area and interstitial spaces for macroinvertebrate colonization. Benthic substrate depth at the upstream two stations also tended to be shallower with respect to bedrock compared to station #1. This factor would influence the macroinvertebrate community's ability to survive extremely dry conditions, with less hyporheic volume present to serve as a refuge.

Although station #5 was within the reservoir breach impact zone, this site was in an area where floodwater flowed upgradient immediately following the breach and likely slowed at some point, dropping sediment out of suspension prior to reversing flow and continuing down river. The observable effect at station #5 was largely sedimentation (see Section 6, photo 7), with no evidence to suggest that scouring immediately influenced the macroinvertebrate community.

Stations 2, 3, and 4 all were in a river reach that was subjected to inundation and extremely high flows during the first moments following the Upper Reservoir breach. Substrate at stations #2 and #3 appeared to have been extensively scoured by the floodwater. Whereas gravel substrate at the control station #6 had small amounts of organic matter either on the gravel surfaces or in the interstices, there was none observed at station #2 or #3. High flows sufficient to remove organic matter (as well as invertebrates) from these sites was the likely factor resulting in

significantly reduced taxa richness and number of macroinvertebrate individuals observed at these stations. The number of macroinvertebrate individuals and taxa richness was lowest at station #4. Although this station was also within the reach subjected to high flows due to the breach, scouring flows were not the most obvious factor contributing to the low numbers. This station was affected by the deposition of several vertical feet of sand within the channel coupled with approximately 90 percent of the flow being diverted into a separate channel (see Section 6, photo 5).

In addition to the immediate damage caused by water released from the dam failure, the scouring of material from the sides of Proffit Mountain and from the East Fork Black River floodplain left behind massive amounts of sand and clay in the channel and the Lower Taum Sauk Reservoir. This material will continue to have potential negative impacts on the aquatic community for an unknown time period. The long-term damage from this sediment will be the subject of future assessments.

Water quality parameters had largely equilibrated among the sites upstream of the Lower Reservoir at the time of our sampling. As documented from samples collected at station #1, water released from the Lower Taum Sauk Reservoir had much higher turbidity and non-filterable residue than any of the upstream sites due to clay particles remaining in suspension within the reservoir. Somewhat surprising was that conductivity was lower in samples collected at station #1, despite the increase in turbidity. It is possible that higher flows at this station served to dilute charged particles within the water column, leading to a decrease in conductivity.

8.0 Conclusions

1. Reject the null hypothesis that there is no statistically significant difference in the macroinvertebrate communities among study sites.
2. Total number of individuals present at station #1 was significantly higher than all other study stations.
3. Total number of individuals in samples collected within the scour zone (i.e. stations 2, 3, and 4) were not significantly different from one another, but were significantly lower than each of the remaining stations.
4. Station #2 showed a reduction of 93%, station #3 a reduction of 89%, and station #4 a reduction of 98% compared to the control station's mean number of individuals. Total number of individuals at station #1 was 682% higher than the control.
5. The total number of individuals present at station #5 was higher, but not significantly different statistically than control station #6, despite being within the reservoir breach inundation zone. The mean total number of individuals at station #5 was 26% higher than the control.
6. Taxa richness was not significantly different among stations 1, 5, and 6; similarly, there was no difference in taxa richness among stations 2, 3, and 4.
7. Taxa richness was significantly reduced among stations 2, 3, and 4 compared to test stations #1 and #5 and control station #6.

8. Station #2 showed a reduction of 85%, station #3 a reduction of 87%, and station #4 a reduction of 96% compared to the control station's mean taxa richness.
9. Mean taxa richness at station #1 was not statistically significantly different compared to the control, although station #1 had 93% higher taxa richness. Mean taxa richness at station #5 was 3% higher than the control.
10. Water quality parameters—flow, turbidity, and non-filterable residue—were notably higher at station #1.
11. Turbidity was lowest at stations #5 and #6, which were upstream of the scour pond at the base of the Proffit Mountain scour channel.
12. Concentrations of dissolved calcium and dissolved magnesium were lower at station #1, but dissolved zinc was higher at this station, compared to the upstream stations.
13. Conductivity and hardness both were lower at station #1 compared to upstream stations. Little difference in these parameters existed among upstream stations.

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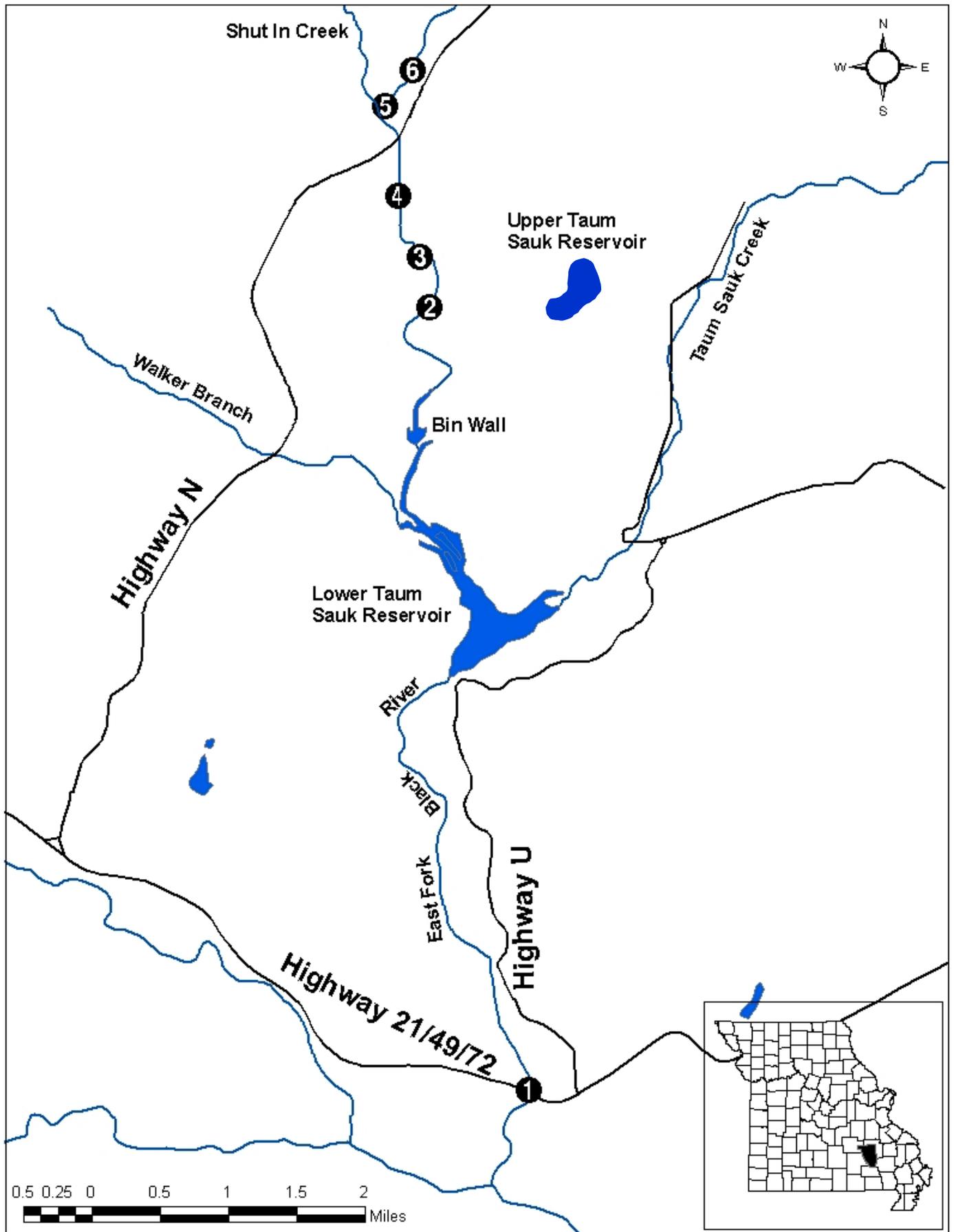
AR:rs:dmt

c: Ed Galbraith, WPP
Leanne Tippett-Mosby, DEQ

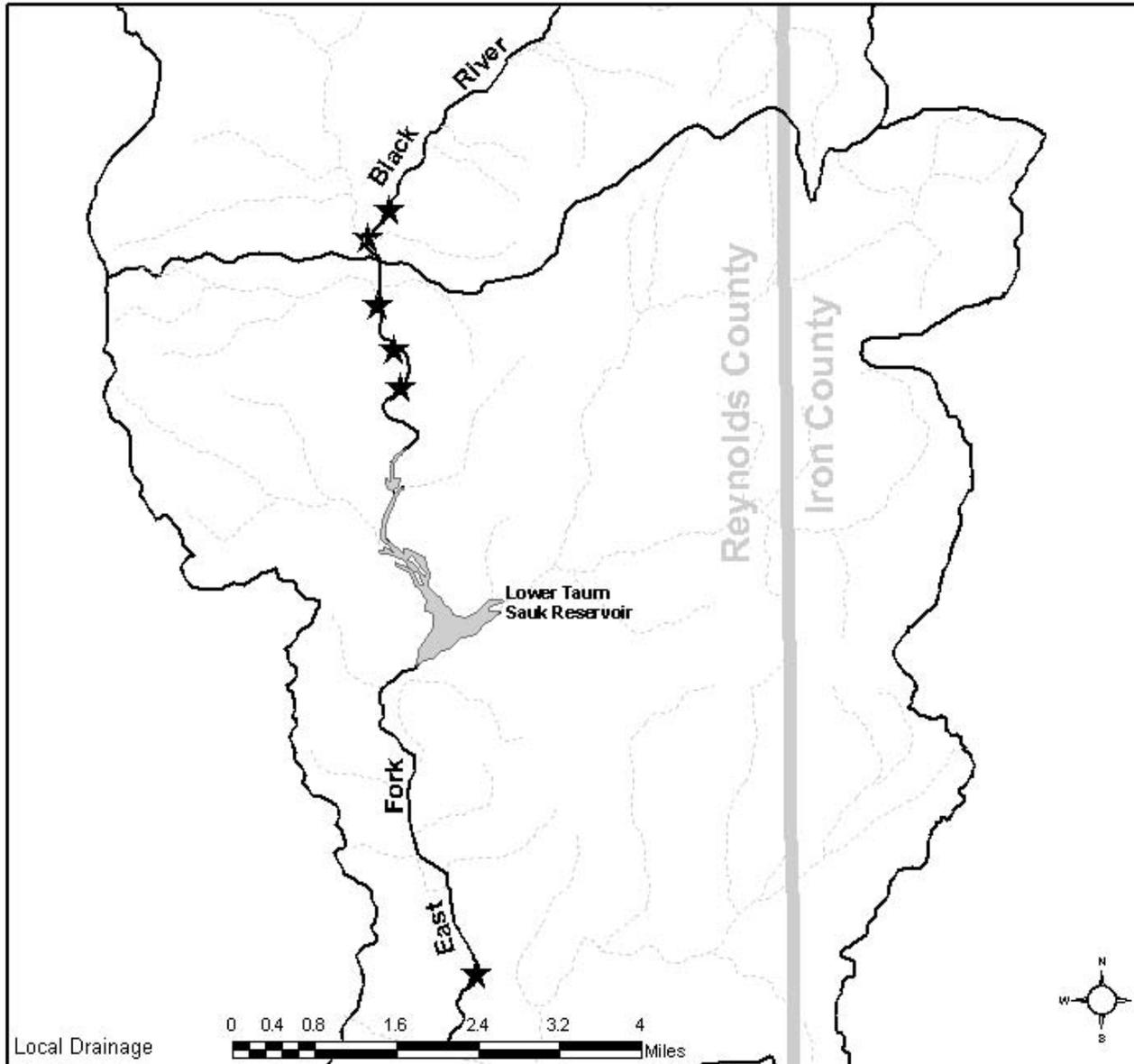
Appendix A

Maps

East Fork Black River Study Stations &
Ozark/Current/Black EDU



East Fork Black River Study Site

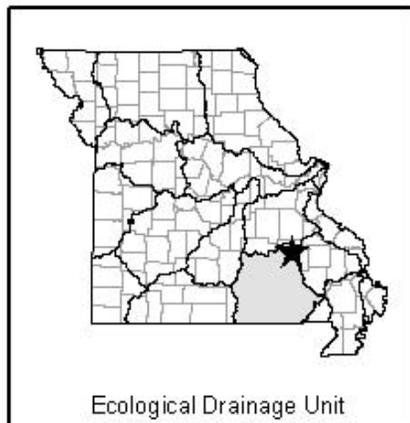


- ★ Sampling Locations
- County Boundary
- Local Drainage
- Stream/River

Local Drainage and Biologic Sampling Site Location

Ecological Drainage Unit (EDU) - An EDU is an area that contains a unique combination of habitats and organisms. Missouri is divided into 19 EDUs as shown in the inset map below. This site is located in the highlighted EDU.

Local Drainage - The local drainage area, also known as an 11 Digit Hydrologic Unit, is shown in the main map at left. This area is a portion of the local watershed. Missouri is split into over 350 such units.

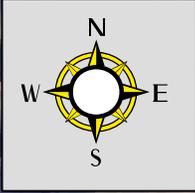


Ecological Drainage Unit

Appendix B

Photograph

Aerial Photograph of Upper Study Site



Appendix C

Descriptive Statistics

Descriptive Statistics: East Fork Black River, December 19-21, 2005

Data source: Total counts_actual

Column	Size	Missing	Mean	Std Dev	Std. Error	C.I. of Mean
Site #1	7	0	341.286	330.405	124.881	305.573
Site #2	7	0	3.000	2.708	1.024	2.504
Site #3	7	0	4.571	6.901	2.608	6.382
Site #4	7	0	0.714	0.951	0.360	0.880
Site #5	7	0	55.000	37.220	14.068	34.423
Site #6	7	0	43.571	21.578	8.156	19.957

Column	Range	Max	Min	Median	25%	75%
Site #1	984.000	1051.000	67.000	313.000	129.500	327.000
Site #2	7.000	7.000	0.000	4.000	0.250	4.750
Site #3	19.000	20.000	1.000	2.000	1.000	3.750
Site #4	2.000	2.000	0.000	0.000	0.000	1.750
Site #5	118.000	128.000	10.000	48.000	37.750	67.000
Site #6	70.000	88.000	18.000	37.000	35.500	45.500

Column	Skewness	Kurtosis	K-S Dist.	K-S Prob.	Sum	Sum of Squares
Site #1	2.076	4.894	0.371	0.004	2389.000	1470335.000
Site #2	0.141	-1.478	0.215	0.384	21.000	107.000
Site #3	2.496	6.372	0.390	0.002	32.000	432.000
Site #4	0.764	-1.687	0.345	0.012	5.000	9.000
Site #5	1.330	2.567	0.278	0.104	385.000	29487.000
Site #6	1.621	3.927	0.312	0.038	305.000	16083.000

Descriptive Statistics: East Fork Black River, December 19-21, 2005

Data source: Taxa Richness_actual

Column	Size	Missing	Mean	Std Dev	Std. Error	C.I. of Mean
Site #1	7	0	35.000	12.557	4.746	11.613
Site #2	7	0	2.714	2.563	0.969	2.371
Site #3	7	0	2.286	2.215	0.837	2.048
Site #4	7	0	0.714	0.951	0.360	0.880
Site #5	7	0	18.714	7.477	2.826	6.915
Site #6	7	0	18.143	5.460	2.064	5.049

Column	Range	Max	Min	Median	25%	75%
Site #1	37.000	54.000	17.000	38.000	24.500	41.500
Site #2	7.000	7.000	0.000	3.000	0.250	4.000
Site #3	6.000	7.000	1.000	1.000	1.000	2.750
Site #4	2.000	2.000	0.000	0.000	0.000	1.750
Site #5	22.000	27.000	5.000	20.000	15.250	24.000
Site #6	17.000	30.000	13.000	17.000	16.000	17.750

Column	Skewness	Kurtosis	K-S Dist.	K-S Prob.	Sum	Sum of Squares
Site #1	-0.0827	-0.387	0.166	0.675	245.000	9521.000
Site #2	0.526	-0.429	0.177	0.618	19.000	91.000
Site #3	2.075	4.399	0.291	0.075	16.000	66.000
Site #4	0.764	-1.687	0.345	0.012	5.000	9.000
Site #5	-0.996	0.856	0.189	0.547	131.000	2787.000
Site #6	2.162	5.372	0.368	0.005	127.000	2483.000

Descriptive Statistics: East Fork Black River, December 19-21, 2005

Data source: Total counts +1

Column	Size	Missing	Mean	Std Dev	Std. Error	C.I. of Mean
Site #1	7	0	342.286	330.405	124.881	305.573
Site #2	7	0	4.000	2.708	1.024	2.504
Site #3	7	0	5.571	6.901	2.608	6.382
Site #4	7	0	1.714	0.951	0.360	0.880
Site #5	7	0	56.000	37.220	14.068	34.423
Site #6	7	0	44.571	21.578	8.156	19.957

Column	Range	Max	Min	Median	25%	75%
Site #1	984.000	1052.000	68.000	314.000	130.500	328.000
Site #2	7.000	8.000	1.000	5.000	1.250	5.750
Site #3	19.000	21.000	2.000	3.000	2.000	4.750
Site #4	2.000	3.000	1.000	1.000	1.000	2.750
Site #5	118.000	129.000	11.000	49.000	38.750	68.000
Site #6	70.000	89.000	19.000	38.000	36.500	46.500

Column	Skewness	Kurtosis	K-S Dist.	K-S Prob.	Sum	Sum of Squares
Site #1	2.076	4.894	0.371	0.004	2396.000	1475120.000
Site #2	0.141	-1.478	0.215	0.384	28.000	156.000
Site #3	2.496	6.372	0.390	0.002	39.000	503.000
Site #4	0.764	-1.687	0.345	0.012	12.000	26.000
Site #5	1.330	2.567	0.278	0.104	392.000	30264.000
Site #6	1.621	3.927	0.312	0.038	312.000	16700.000

Descriptive Statistics: East Fork Black River, December 19-21, 2005

Data source: Taxa Richness +1

Column	Size	Missing	Mean	Std Dev	Std. Error	C.I. of Mean
Site #1	7	0	36.000	12.557	4.746	11.613
Site #2	7	0	3.714	2.563	0.969	2.371
Site #3	7	0	3.286	2.215	0.837	2.048
Site #4	7	0	1.714	0.951	0.360	0.880
Site #5	7	0	19.714	7.477	2.826	6.915
Site #6	7	0	19.143	5.460	2.064	5.049

Column	Range	Max	Min	Median	25%	75%
Site #1	37.000	55.000	18.000	39.000	25.500	42.500
Site #2	7.000	8.000	1.000	4.000	1.250	5.000
Site #3	6.000	8.000	2.000	2.000	2.000	3.750
Site #4	2.000	3.000	1.000	1.000	1.000	2.750
Site #5	22.000	28.000	6.000	21.000	16.250	25.000
Site #6	17.000	31.000	14.000	18.000	17.000	18.750

Column	Skewness	Kurtosis	K-S Dist.	K-S Prob.	Sum	Sum of Squares
Site #1	-0.0827	-0.387	0.166	0.675	252.000	10018.000
Site #2	0.526	-0.429	0.177	0.618	26.000	136.000
Site #3	2.075	4.399	0.291	0.075	23.000	105.000
Site #4	0.764	-1.687	0.345	0.012	12.000	26.000
Site #5	-0.996	0.856	0.189	0.547	138.000	3056.000
Site #6	2.162	5.372	0.368	0.005	134.000	2744.000

Appendix D

Analyses of Variance Results

Thursday, March 02, 2006, 08:48:54

One Way Analysis of Variance: East Fork Black River, December 19-21, 2005

Data source: Total counts_actual

Normality Test: Failed (P = <0.001)

Test execution ended by user request

Thursday, March 02, 2006, 08:40:37

One Way Analysis of Variance: East Fork Black River, December 19-21, 2005

Data source: Taxa Richness_actual

Normality Test: Failed (P = <0.001)

Test execution ended by user request

One Way Analysis of Variance: East Fork Black River, December 19-21, 2005**Data source:** Total counts +1**Normality Test:** Passed (P > 0.200)**Equal Variance Test:** Passed (P = 0.620)

Group Name	N	Missing	Mean	Std Dev	SEM
log10(-Site #1-	7	0	2.387	0.386	0.146
log10(-Site #2-	7	0	0.483	0.378	0.143
log10(-Site #3-	7	0	0.572	0.367	0.139
log10(-Site #4-	7	0	0.179	0.231	0.0874
log10(-Site #5-	7	0	1.658	0.327	0.123
log10(-Site #6-	7	0	1.610	0.198	0.0749

Source of Variation	DF	SS	MS	F	P
Between Groups	5	26.053	5.211	49.951	<0.001
Residual	36	3.755	0.104		
Total	41	29.808			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor:

Comparison	Diff of Means	p	q	P	P<0.050
log10(-Site #1- vs. log10(-Site #4-	2.208	6	18.089	<0.001	Yes
log10(-Site #1- vs. log10(-Site #2-	1.905	6	15.602	<0.001	Yes
log10(-Site #1- vs. log10(-Site #3-	1.816	6	14.872	<0.001	Yes
log10(-Site #1- vs. log10(-Site #6-	0.778	6	6.370	0.001	Yes
log10(-Site #1- vs. log10(-Site #5-	0.730	6	5.979	0.002	Yes
log10(-Site #5- vs. log10(-Site #4-	1.478	6	12.109	<0.001	Yes
log10(-Site #5- vs. log10(-Site #2-	1.175	6	9.623	<0.001	Yes
log10(-Site #5- vs. log10(-Site #3-	1.086	6	8.893	<0.001	Yes
log10(-Site #5- vs. log10(-Site #6-	0.0477	6	0.390	1.000	No
log10(-Site #6- vs. log10(-Site #4-	1.431	6	11.719	<0.001	Yes
log10(-Site #6- vs. log10(-Site #2-	1.127	6	9.232	<0.001	Yes
log10(-Site #6- vs. log10(-Site #3-	1.038	6	8.503	<0.001	Yes
log10(-Site #3- vs. log10(-Site #4-	0.393	6	3.216	0.231	No
log10(-Site #3- vs. log10(-Site #2-	0.0890	6	0.729	0.995	Do Not Test
log10(-Site #2- vs. log10(-Site #4-	0.304	6	2.487	0.504	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

One Way Analysis of Variance: East Fork Black River, December 19-21, 2005

Data source: Taxa Richness +1

Normality Test: Passed (P = 0.090)

Equal Variance Test: Passed (P = 0.041)

Group Name	N	Missing	Mean	Std Dev	SEM
log10(-Site #1-	7	0	1.530	0.168	0.0635
log10(-Site #2-	7	0	0.458	0.360	0.136
log10(-Site #3-	7	0	0.455	0.230	0.0870
log10(-Site #4-	7	0	0.179	0.231	0.0874
log10(-Site #5-	7	0	1.254	0.228	0.0863
log10(-Site #6-	7	0	1.270	0.106	0.0402

Source of Variation	DF	SS	MS	F	P
Between Groups	5	10.931	2.186	39.991	<0.001
Residual	36	1.968	0.0547		
Total	41	12.899			

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

All Pairwise Multiple Comparison Procedures (Tukey Test):

Comparisons for factor:

Comparison	Diff of Means	p	q	P	P<0.050
log10(-Site #1- vs. log10(-Site #4-	1.351	6	15.289	<0.001	Yes
log10(-Site #1- vs. log10(-Site #3-	1.075	6	12.167	<0.001	Yes
log10(-Site #1- vs. log10(-Site #2-	1.073	6	12.139	<0.001	Yes
log10(-Site #1- vs. log10(-Site #5-	0.276	6	3.128	0.257	No
log10(-Site #1- vs. log10(-Site #6-	0.261	6	2.951	0.317	Do Not Test
log10(-Site #6- vs. log10(-Site #4-	1.090	6	12.338	<0.001	Yes
log10(-Site #6- vs. log10(-Site #3-	0.814	6	9.216	<0.001	Yes
log10(-Site #6- vs. log10(-Site #2-	0.812	6	9.188	<0.001	Yes
log10(-Site #6- vs. log10(-Site #5-	0.0157	6	0.177	1.000	Do Not Test
log10(-Site #5- vs. log10(-Site #4-	1.075	6	12.161	<0.001	Yes
log10(-Site #5- vs. log10(-Site #3-	0.799	6	9.039	<0.001	Yes
log10(-Site #5- vs. log10(-Site #2-	0.796	6	9.010	<0.001	Yes
log10(-Site #2- vs. log10(-Site #4-	0.278	6	3.150	0.251	No
log10(-Site #2- vs. log10(-Site #3-	0.00253	6	0.0287	1.000	Do Not Test
log10(-Site #3- vs. log10(-Site #4-	0.276	6	3.122	0.260	Do Not Test

A result of "Do Not Test" occurs for a comparison when no significant difference is found between two means that enclose that comparison. For example, if you had four means sorted in order, and found no difference between means 4 vs. 2, then you would not test 4 vs. 3 and 3 vs. 2, but still test 4 vs. 1 and 3 vs. 1 (4 vs. 3 and 3 vs. 2 are enclosed by 4 vs. 2: 4 3 2 1). Note that not testing the enclosed means is a procedural rule, and a result of Do Not Test should be treated as if there is no significant difference between the means, even though one may appear to exist.

Appendix E

Macroinvertebrate Bench Sheets

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528111], Station #1a

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	2
AMPHIPODA	
Hyalella azteca	1
COLEOPTERA	
Optioservus sandersoni	1
DIPTERA	
Tipula	2
Cricotopus/Orthocladius	16
Eukiefferiella	4
Parakiefferiella	2
Parametriocnemus	5
Dicrotendipes	1
Polypedilum convictum grp	7
Paratanytarsus	1
Rheotanytarsus	20
Tanytarsus	2
Hemerodromia	2
EPHEMEROPTERA	
Isonychia bicolor	4
Stenacron	1
Stenonema femoratum	7
Stenonema pulchellum	2
Ephemerellidae	3
Tricorythodes	1
Caenis anceps	4
Caenis latipennis	6
ISOPODA	
Lirceus	3
PLECOPTERA	
Allocaepnia	58
Prostoia	1
Strophopteryx	26
Taeniopteryx	2
TRICHOPTERA	
Chimarra	14
Cheumatopsyche	1
Agapetus	3
Hydroptila	2
TRICLADIDA	
Planariidae	2

Aquatic Invertebrate Database Bench Sheet Report
 December 19, 2005 - East Fk Black R [0528112], Station #1b
ORDER (Taxa)

CS

Gordiidae	1
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Microcylloepus pusillus	56
Optioservus sandersoni	6
DIPTERA	
Ceratopogoninae	2
Simulium	1
Prosimulium	14
Cricotopus/Orthocladius	17
Eukiefferiella	7
Orthocladius (Euorthocladius)	2
Parametriocnemus	1
Rheocricotopus	1
Tvetenia	1
Polypedilum	2
Polypedilum convictum grp	12
Cladotanytarsus	1
Paratanytarsus	1
Rheotanytarsus	50
Tanytarsus	2
Hemerodromia	8
EPHEMEROPTERA	
Isonychia bicolor	2
Stenacron	2
Stenonema femoratum	8
Stenonema mediopunctatum	5
Eurylophella	7
Tricorythodes	2
Caenis anceps	5
Caenis latipennis	4
Leptophlebia	1
ISOPODA	
Lirceus	3
LUMBRICINA	
Lumbricidae	3
PLECOPTERA	
Allocaepnia	27
Strophopteryx	30
Taeniopteryx	3
Chloroperlidae	1
Isoperla	1
TRICHOPTERA	
Cheumatopsyche	2
Agapetus	13
Hydroptila	2
VENEROIDEA	
Corbicula	6

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528113], Station #1c

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	5
AMPHIPODA	
Hyalella azteca	1
COLEOPTERA	
Ancyronyx variegatus	1
Microcylloepus pusillus	62
Optioservus sandersoni	12
DIPTERA	
Prosimulium	25
Chironomidae	5
Ablabesmyia	1
Nilotanypus	1
Cricotopus/Orthocladius	79
Eukiefferiella	38
Orthocladius (Euorthocladius)	7
Parakiefferiella	3
Psectrocladius	1
Pseudosmittia	1
Dicrotendipes	5
Microtendipes	1
Polypedilum convictum grp	54
Polypedilum illinoense grp	3
Cladotanytarsus	2
Paratanytarsus	7
Rheotanytarsus	293
Tanytarsus	27
Hemerodromia	12
Thienemannimyia grp.	2
EPHEMEROPTERA	
Baetis	1
Isonychia bicolor	11
Heptageniidae	3
Stenacron	2
Stenonema femoratum	9
Stenonema mediopunctatum	7
Stenonema pulchellum	1
Eurylophella	23
Tricorythodes	14
Caenis anceps	32
Caenis latipennis	19
Baetisca lacustris	1
ISOPODA	
Lirceus	11
LUMBRICINA	
Lumbricidae	6
PLECOPTERA	
Allocaepnia	103
Strophopteryx	73

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528113], Station #1c

ORDER (Taxa)	CS
Taeniopteryx	10
Chloroperlidae	2
Helopicus nalatus	2
Isoperla	8
TRICHOPTERA	
Chimarra	21
Cernotina	1
Cheumatopsyche	19
Rhyacophila	4
Agapetus	12
Hydroptila	3
Oxyethira	1
Mystacides	1
VENEROIDEA	
Corbicula	3

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528114], Station #1d

ORDER (Taxa)**CS****DECAPODA**

Orconectes hylas 1

DIPTERA

Cricotopus/Orthocladius 1

Eukiefferiella brevicar grp 6

Polypedilum convictum grp 1

Tanytarsus 1

EPHEMEROPTERA

Isonychia bicolor 3

Stenonema femoratum 2

Stenonema mediopunctatum 1

Eurylophella 2

Tricorythodes 1

Caenis anceps 2

Baetisca lacustris 1

LUMBRICINA

Lumbricidae 5

PLECOPTERA

Allocaenia 14

Strophopteryx 13

TRICHOPTERA

Agapetus 4

TUBIFICIDA

Peloscolex ferox 9

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528115], Station #1e

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	4
DIPTERA	
Simulium	1
Prosimulium	1
Cricotopus/Orthocladius	16
Eukiefferiella brevicar grp	38
Orthocladius (Euorthocladius)	7
Nanocladius	2
Polypedilum convictum grp	16
Rheotanytarsus	13
EPHEMEROPTERA	
Acentrella	2
Isonychia bicolor	11
Stenonema bednariki	5
Stenonema femoratum	2
Stenonema mediopunctatum	7
Stenonema pulchellum	8
Eurylophella	1
Tricorythodes	1
Caenis anceps	5
Caenis latipennis	4
ISOPODA	
Lirceus	18
Caecidotea (Blind & Unpigmented)	1
LUMBRICINA	
Lumbricidae	10
LUMBRICULIDA	
Lumbriculidae	2
MEGALOPTERA	
Corydalus	1
ODONATA	
Gomphidae	1
PLECOPTERA	
Allocaenia	14
Strophopteryx	25
Taeniopteryx	1
Chloroperlidae	1
Isoperla	1
TRICHOPTERA	
Chimarra	79
Cheumatopsyche	8
Ceratopsyche morosa grp	2
Agapetus	11
Hydroptila	1
Oecetis	1
TRICLADIDA	
Planariidae	1
VENEROIDEA	
Corbicula	8

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528116], Station #1f

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	13
COLEOPTERA	
Microcylloepus pusillus	7
Optioservus sandersoni	2
Stenelmis	1
DIPTERA	
Simulium	2
Prosimulium	5
Cricotopus/Orthocladius	5
Eukiefferiella brevicar grp	2
Orthocladius (Euorthocladius)	1
Parametriocnemus	1
Dicrotendipes	1
Polypedilum fallax grp	1
Rheotanytarsus	1
Hemerodromia	1
Thienemannimyia grp.	1
EPHEMEROPTERA	
Dipheter	1
Isonychia bicolor	7
Stenacron	1
Stenonema femoratum	1
Stenonema mediopunctatum	11
Stenonema pulchellum	1
Eurylophella	6
Tricorythodes	5
Caenis anceps	11
Caenis latipennis	3
ISOPODA	
Lirceus	3
LUMBRICINA	
Lumbricidae	3
ODONATA	
Gomphidae	1
PLECOPTERA	
Allocapnia	129
Strophopteryx	52
Taeniopteryx	8
Chloroperlidae	3
Helopicus nalatus	2
TRICHOPTERA	
Chimarra	6
Cernotina	6
Cheumatopsyche	4
Agapetus	4
Hydroptila	1
Helicopsyche	1
Triaenodes	2
TRICLADIDA	
Planariidae	1
TUBIFICIDA	
Peloscolex ferox	1

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528117], Station #1g

ORDER (Taxa)**CS****COLEOPTERA**

Psephenus herricki	4
Microcylloepus pusillus	1
Optioservus sandersoni	9

DIPTERA

Prosimulium	1
Eukiefferiella brevicar grp	2
Hemerodromia	3

EPHEMEROPTERA

Isonychia bicolor	6
Stenonema femoratum	1
Stenonema mediopunctatum	5
Stenonema pulchellum	4
Eurylophella	1
Tricorythodes	1
Caenis anceps	7
Caenis latipennis	1

LUMBRICINA

Lumbricidae	4
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PLECOPTERA

Allocapnia	24
Amphinemura	1
Strophopteryx	21
Taeniopteryx	1
Hydroperla	1

TRICHOPTERA

Agapetus	5
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TUBIFICIDA

Pelosclex ferox	1
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Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528118], Station #2a

ORDER (Taxa)

CS

None

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528119], Station #2b

ORDER (Taxa)

CS

DIPTERA

Polypedilum convictum grp 1

EPHEMEROPTERA

Eurylophella 1

PLECOPTERA

Allocaenia 1

TRICHOPTERA

Cheumatopsyche 1

Aquatic Invertebrate Database Bench Sheet Report
December 19, 2005 - East Fk Black R [0528120], Station #2c

ORDER (Taxa)	CS
DIPTERA	
Simuliidae	1
EPHEMEROPTERA	
Caenis anceps	1
Leptophlebiidae	1
LUMBRICINA	
Lumbricidae	1
MESOGASTROPODA	
Hydrobiidae	1
PLECOPTERA	
Allopnia	1
TRICHOPTERA	
Cheumatopsyche	1

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528121], Station #2d

ORDER (Taxa)

CS

EPHEMEROPTERA

Caenis anceps 2

Caenis latipennis 1

PLECOPTERA

Allocaenia 1

Aquatic Invertebrate Database Bench Sheet Report
December 19, 2005 - East Fk Black R [0528122], Station #2e

ORDER (Taxa)

CS
None

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528123], Station #2f

ORDER (Taxa)

"HYDRACARINA"

Acarina

CS

1

Aquatic Invertebrate Database Bench Sheet Report

December 19, 2005 - East Fk Black R [0528124], Station #2g

ORDER (Taxa)

CS

DIPTERA

Geothocladius 1

Tanytarsus 1

EPHEMEROPTERA

Caenis anceps 1

LUMBRICINA

Lumbricidae 2

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528125], Station #3a
ORDER (Taxa)
TRICLADIDA
Planariidae

CS

1

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528126], Station #3b
ORDER (Taxa)
TRICHOPTERA
Psychomyia

CS

1

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528127], Station #3c
ORDER (Taxa)
EPHEMEROPTERA
Caenis anceps

CS

2

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528128], Station #3d

ORDER (Taxa)

CS

DIPTERA

Ceratopogoninae	1
Ablabesmyia	3
Tribelos	1

EPHEMEROPTERA

Caenis anceps	4
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LUMBRICINA

Lumbricidae	1
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PLECOPTERA

Allocaenia	1
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TUBIFICIDA

Tubificidae	9
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Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528129], Station #3e

ORDER (Taxa)

CS

EPHEMEROPTERA

Heptageniidae

1

TRICHOPTERA

Cheumatopsyche

3

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528130], Station #3f

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Stenelmis	1
EPHEMEROPTERA	
Caenis anceps	1

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528131], Station #3g

ORDER (Taxa)

CS

DIPTERA

Cricotopus/Orthocladius

1

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528132], Station #4a

ORDER (Taxa)

CS

DIPTERA

Geothocladius

1

EPHEMEROPTERA

Baetis

1

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528133], Station #4b

ORDER (Taxa)

CS

DECAPODA

Orconectes hylas

1

TRICHOPTERA

Helicopsyche

1

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528134], Station #4c

ORDER (Taxa)

CS

None

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528135], Station #4d

ORDER (Taxa)

CS

None

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528136], Station #4e

ORDER (Taxa)

CS

None

Aquatic Invertebrate Database Bench Sheet Report
December 20, 2005 - East Fk Black R [0528137], Station #4f

ORDER (Taxa)

CS

None

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528138], Station #4g

ORDER (Taxa)

CS

DIPTERA

Pseudochironomus

1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528139], Station #5a

ORDER (Taxa)

CS

DIPTERA

Pericoma	1
Chironomidae	2
Geothocladius	1
Diptera	5

ISOPODA

Caecidotea (Blind & Unpigmented)	1
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Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528140], Station #5b

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Psephenus herricki	1
Optioservus sandersoni	2
DECAPODA	
Orconectes hylas	1
DIPTERA	
Prosimulium	2
Cricotopus/Orthocladius	5
Eukiefferiella brevicealcar grp	2
EPHEMEROPTERA	
Isonychia bicolor	3
Stenonema mediopunctatum	5
Stenonema pulchellum	5
Eurylophella	2
Caenis anceps	1
PLECOPTERA	
Strophopteryx	1
TRICHOPTERA	
Chimarra	2
Psychomyia	1
Cheumatopsyche	14

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528141], Station #5c

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Psephenus herricki	1
Optioservus sandersoni	3
DECAPODA	
Orconectes hylas	1
DIPTERA	
Prosimulium	3
Cricotopus/Orthocladius	1
Tvetenia	3
Rheotanytarsus	1
EPHEMEROPTERA	
Dipheter	1
Isonychia bicolor	5
Stenacron	4
Stenonema femoratum	4
Stenonema mediopunctatum	1
Stenonema pulchellum	5
Eurylophella	5
Caenis latipennis	2
Baetisca lacustris	1
Leptophlebiidae	1
TRICHOPTERA	
Cheumatopsyche	5
TRICLADIDA	
Planariidae	1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528142], Station #5d

ORDER (Taxa)	CS
COLEOPTERA	
<i>Optioservus sandersoni</i>	2
<i>Stenelmis</i>	1
DIPTERA	
Cricotopus/Orthocladius	1
Eukiefferiella	2
Tvetenia	1
Rheotanytarsus	1
Hemerodromia	1
EPHEMEROPTERA	
Isonychia bicolor	2
Stenonema pulchellum	2
Caenis latipennis	2
LEPIDOPTERA	
Pyrilidae	3
PLECOPTERA	
Strophopteryx	1
TRICHOPTERA	
Chimarra	3
Cheumatopsyche	13
TRICLADIDA	
Planariidae	2

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528143], Station #5e

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	1
BRANCHIOBELLELLIDA	
Branchiobdellida	54
COLEOPTERA	
Psephenus herricki	1
Optioservus sandersoni	3
DECAPODA	
Orconectes hylas	14
DIPTERA	
Prosimulium	1
Eukiefferiella	3
Nanocladius	4
Tvetenia	2
Lauterborniella	1
Polypedilum convictum grp	3
Hemerodromia	1
EPHEMEROPTERA	
Stenacron	2
Stenonema mediopunctatum	1
Stenonema pulchellum	3
Eurylophella	3
Caenis anceps	1
Baetisca lacustris	1
LEPIDOPTERA	
Pyrilidae	1
MEGALOPTERA	
Corydalus	3
ODONATA	
Gomphidae	1
PLECOPTERA	
Strophopteryx	6
TRICHOPTERA	
Polycentropus	1
Cheumatopsyche	17

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528144], Station #5f

ORDER (Taxa)**CS****COLEOPTERA**

Psephenus herricki	3
Dubiraphia	1
Stenelmis	1

DIPTERA

Cricotopus/Orthocladius	3
Diplocladius	1
Eukiefferiella	3
Nanocladius	1
Tvetenia	5
Polypedilum convictum grp	2
Tanytarsus	1
Thienemannimyia grp.	1
Cardiocladius	2
Diptera	1

EPHEMEROPTERA

Isonychia bicolor	4
Stenacron	8
Stenonema mediopunctatum	2
Stenonema pulchellum	4
Eurylophella	2
Caenis latipennis	1

ODONATA

Argia	2
Gomphidae	1

PLECOPTERA

Allocapnia	1
Strophopteryx	1

TRICHOPTERA

Chimarra	4
Psychomyia	4
Cheumatopsyche	13

TUBIFICIDA

Enchytraeidae	1
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Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528145], Station #5g

ORDER (Taxa)**CS****"HYDRACARINA"**

Acarina	1
BRANCHIOBELLELLIDA	
Branchiobdellida	1
COLEOPTERA	
Psephenus herricki	3
Optioservus sandersoni	3
DECAPODA	
Orconectes hylas	1
DIPTERA	
Prosimulium	1
Chironomidae	2
Cricotopus/Orthocladius	1
Eukiefferiella	1
Mesosmittia	1
Tvetenia	1
Thienemannimyia grp.	3
EPHEMEROPTERA	
Acentrella	1
Stenacron	3
Stenonema mediopunctatum	1
Stenonema pulchellum	1
Eurylophella	2
Caenis anceps	1
LEPIDOPTERA	
Pyralidae	2
PLECOPTERA	
Strophopteryx	4
TRICHOPTERA	
Cynellus fraternus	1
Cernotina	2
Cheumatopsyche	2
Helicopsyche	1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528146], Station #6a

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	3
COLEOPTERA	
Optioservus sandersoni	4
Stenelmis	6
DECAPODA	
Orconectes hylas	1
DIPTERA	
Cricotopus/Orthocladius	1
Thienemannimyia grp.	1
EPHEMEROPTERA	
Isonychia bicolor	1
Stenacron	2
Stenonema femoratum	3
Stenonema mediopunctatum	2
Stenonema pulchellum	4
Eurylophella	3
Caenis latipennis	1
Leptophlebiidae	1
LUMBRICINA	
Lumbricidae	1
ODONATA	
Argia	2
TRICHOPTERA	
Helicopsyche	1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528147], Station #6b

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	2
COLEOPTERA	
Optioservus sandersoni	9
DECAPODA	
Orconectes hylas	1
DIPTERA	
Tanytarsus	1
EPHEMEROPTERA	
Isonychia bicolor	1
Stenacron	3
Stenonema femoratum	1
Stenonema mediopunctatum	4
Stenonema pulchellum	5
Eurylophella	7
Caenis latipennis	1
LEPIDOPTERA	
Pyrilidae	1
ODONATA	
Argia	1
TRICHOPTERA	
Psychomyia	1
Cheumatopsyche	7
Agapetus	1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528148], Station #6c

ORDER (Taxa)**CS****"HYDRACARINA"**

Acarina 2

COLEOPTERA

Optioservus sandersoni 6

DIPTERA

Diplocladius 1

Thienemannimyia grp. 1

EPHEMEROPTERA

Stenacron 3

Stenonema femoratum 1

Stenonema mediopunctatum 1

Stenonema pulchellum 11

Eurylophella 8

Caenis anceps 1

Caenis latipennis 2

Baetisca lacustris 1

ODONATA

Gomphidae 1

PLECOPTERA

Taeniopteryx 1

TRICHOPTERA

Chimarra 1

Cheumatopsyche 1

Pycnopsyche 1

TRICLADIDA

Planariidae 1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528149], Station #6d

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	1
COLEOPTERA	
Psephenus herricki	1
Optioservus sandersoni	3
DECAPODA	
Orconectes hylas	1
DIPTERA	
Tanytarsus	1
EPHEMEROPTERA	
Isonychia bicolor	1
Stenacron	1
Stenonema pulchellum	3
Eurylophella	2
Caenis anceps	1
LUMBRICINA	
Lumbricidae	1
PLECOPTERA	
Strophopteryx	1
TRICHOPTERA	
Cheumatopsyche	1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528150], Station #6e

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	3
COLEOPTERA	
Psephenus herricki	3
Optioservus sandersoni	5
DECAPODA	
Orconectes hylas	2
DIPTERA	
Simulium	1
Polypedilum convictum grp	1
EPHEMEROPTERA	
Isonychia bicolor	1
Stenacron	1
Stenonema femoratum	3
Stenonema mediopunctatum	6
Stenonema pulchellum	3
Eurylophella	3
Caenis latipennis	1
Baetisca lacustris	1
LIMNOPHILA	
Ancyliidae	1
TRICHOPTERA	
Cheumatopsyche	2

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528151], Station #6f

ORDER (Taxa)**CS****"HYDRACARINA"**

Acarina 1

COLEOPTERA

Optioservus sandersoni 3

DIPTERA

Tvetenia 1

Thienemannimyia grp. 2

EPHEMEROPTERA

Isonychia bicolor 1

Stenacron 1

Stenonema mediopunctatum 4

Stenonema pulchellum 5

Eurylophella 1

LEPIDOPTERA

Pyralidae 4

LIMNOPHILA

Fossaria 1

Menetus 1

ODONATA

Gomphidae 1

TRICHOPTERA

Polycentropus 1

Cheumatopsyche 6

Ceratopsyche morosa grp 1

TRICLADIDA

Planariidae 1

Aquatic Invertebrate Database Bench Sheet Report

December 21, 2005 - East Fk Black R [0528152], Station #6g

ORDER (Taxa)	CS
"HYDRACARINA"	
Acarina	10
BRANCHIOBELLELLIDA	
Branchiobdellida	5
COLEOPTERA	
Psephenus herricki	2
Optioservus sandersoni	5
DECAPODA	
Orconectes hylas	2
DIPTERA	
Cricotopus/Orthocladius	1
Diplocladius	1
Eukiefferiella	3
Tvetenia	1
Tribelos	1
Tanytarsus	3
Clinocera	1
Diamesa	1
EPHEMEROPTERA	
Isonychia bicolor	2
Heptageniidae	1
Stenacron	1
Stenonema mediopunctatum	5
Stenonema pulchellum	5
Eurylophella	8
Caenis anceps	1
Caenis latipennis	2
ISOPODA	
Lirceus	1
LEPIDOPTERA	
Pyralidae	3
TRICHOPTERA	
Chimarra	1
Cheumatopsyche	13
Agapetus	2
Helicopsyche	3
Leptoceridae	1
TRICLADIDA	
Planariidae	2
TUBIFICIDA	
Tubificidae	1