



Missouri
Department of
Natural Resources

Biological Assessment Report

**Macroinvertebrate Community Assessment of the East Fork
Black River and Black River Following the AmerenUE Upper
Taum Sauk Reservoir Failure**

Reynolds County, Missouri

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Errata

Throughout this report, we erroneously referred to one of the tributary stations as Shut-In Creek. We have since learned that the waterbody at this station goes by the name of Imboden Fork and it will be referred to as such in subsequent reports.

Executive Summary

On December 14, 2005 the Upper Reservoir portion of the AmerenUE Taum Sauk Hydroelectric Facility in rural Reynolds County, Missouri suffered a catastrophic failure which resulted in the release of approximately 1 billion gallons of water within the span of roughly 15 minutes. Floodwater from the 680-foot-wide reservoir breach scoured a channel for approximately 1.6 miles along the western slope of Proffit Mountain and entered the East Fork Black River (East Fork) in Johnson's Shut-Ins State Park (**JSISP**) at the base of the mountain. The erosive force of the flood removed trees, boulders, and topsoil from the mountain and affected segments of the river with heavy sediment deposition or channel scour. One area of particularly heavy deposition was the debris dam formed at the base of Proffit Mountain. It was deposited perpendicular to the river channel and redirected the majority of discharge into a high-flow channel east of the East Fork mainstem. Immediately downstream from the debris dam, the East Fork channel was filled with approximately four vertical feet of sand-sized sediment. Because of the debris dam and sediment deposition, there was only minimal surface flow in the channel coming from subsurface flow through the depositional material and the floodplain.

A biological assessment using macroinvertebrates was performed to assist in measuring natural resource damages. This assessment was conducted in two phases: 1) an initial study using quantitative sampling methods; and 2) a standardized semi-quantitative method. Quantitative samples for the first study (Appendix C) were collected December 19-21, 2005 to document any immediate effects to the macroinvertebrate community resulting from floodwater scour and deposition. Macroinvertebrate and water quality samples were collected from six stations located between the Highway 21 bridge (downstream of the Lower Taum Sauk Reservoir), to an upstream station located beyond the floodwater impact zone (upstream of the Highway N bridge). Total number of macroinvertebrate individuals as well as Taxa Richness observed among study sites varied according to their proximity to scouring flows and sediment deposition 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 initial study. Total number of individuals and Taxa Richness among three test stations within JSISP, however, were significantly different ($p \leq 0.002$) in a negative direction compared to the two upstream stations and the downstream station, indicating that these two parameters were significantly reduced. Although the downstream station had elevated flows and very high turbidity readings (>1000 NTU) at the time of the December sampling, the number of macroinvertebrate individuals were significantly higher ($p = 0.002$) than the remaining stations, including the upstream control. Although the number of taxa collected within the downstream sample was nearly double that of the next nearest site, the difference was not statistically significant ($p = 0.257$). Several factors likely accounted for the downstream station having greater macroinvertebrate abundance and taxa richness. First, this site was protected by the Lower Taum Sauk Reservoir from the intense scouring flows and heaviest sediment deposition. In addition, this downstream station had a watershed that was roughly four times the size of the uppermost site. Larger watersheds result in larger channel size and, under normal circumstances, increased water quantity. Benthic habitat at the downstream station, which was dominated by gravel and cobble substrate, also was more suitable for relatively high macroinvertebrate density compared to many of the

upstream stations. The cobble and boulder habitat at upstream stations was interspersed with bedrock (with the exception of the site covered in sand) providing poorer quality and quantity of surface area for macroinvertebrate colonization. Water quality parameters collected during the initial assessment were comparable among sites, with the exception that flow was higher at the downstream station and, as stated earlier, turbidity levels exceeded our instrument's upper detection limit of 1000 NTU.

The second assessment phase, the semi-quantitative method, uses macroinvertebrate data to develop four biological metrics—Taxa Richness, EPT Taxa, Biotic Index, and Shannon Diversity Index—to calculate Macroinvertebrate Stream Condition Index (MSCI) scores. The first set of East Fork Black River samples used in the semi-quantitative assessment were collected pre-event on September 22 and 23, 2005 and were intended to assist in decision making during the Federal Energy Regulatory Commission relicensing process. Because the East Fork Black River had been one of seven Biological Criteria Reference Streams within the Ozark/Black/Current Ecological Drainage Unit, macroinvertebrate data existed from the river reach within JSISP dating back to 1999. In addition to the reference site, macroinvertebrates were collected from three stations between Highway 21 and the Lower Reservoir dam. Following the release, nine sites were added to the study. Macroinvertebrate and water quality samples were collected from a total of 13 stations located in the East Fork Black River, Shut-In Creek, Taum Sauk Creek, and the Black River during spring (March and April) and fall (September) 2006. Results of these three sample seasons are presented in the main body of this report.

Benthic sediment conditions in the East Fork Black River downstream of the Lower Reservoir changed between December 2005 and March 2006. As mentioned above, the river reach downstream of the Lower Reservoir was extremely turbid—a condition later learned to be a result of clay particles being drawn from the base of the dam through a 16-inch pipe used to maintain flow in the lower East Fork. After the incident, agency personnel had been advised by AmerenUE that the intake for the pipe was located an (unknown) elevation above the base of the dam. This statement was assumed to be true due to turbidity levels being approximately equal in the Lower Taum Sauk Reservoir and the East Fork Black River below the reservoir. However, by the time it was realized that the intake pipe was actually drawing sediment-laden hypolimnetic reservoir water, a considerable amount of clay had accumulated in the East Fork Black River between the dam and the Black River confluence.

The semi-quantitative macroinvertebrate assessment presented in this report is separated into three general groupings. First, a longitudinal assessment is made which compares biological metrics and MSCI scores upstream to downstream. This longitudinal assessment is further divided to compare stations downstream of the Lower Reservoir to each other and to data collected prior to the release. Stations located upstream of the Lower Reservoir are compared similarly. Second, biological assessments were conducted on tributary stations and an upper East Fork station, all of which were unaffected by the release and served as control sites. Finally, due to the high turbidity and benthic sediment in the lower East Fork, three Black River stations were included in the study. A Black River control station located upstream of the East Fork confluence was used to gauge any effects that turbidity and sedimentation may have had on the macroinvertebrate community.

Macroinvertebrate Stream Condition Index scores downstream of the Lower Reservoir tended to decrease from downstream to upstream, with the station nearest the dam achieving only a partially supporting MSCI score in fall 2005. During fall 2005, the upstream control within JSISP also had a partially supporting MSCI score, lower than either of the two previous sampling events at this site. In addition to calculating biological metrics and MSCI scores for the spring 2006 data (the first sampling event following the release), macroinvertebrate assessments were made for each individual habitat sampled (flowing water over coarse substrate, nonflow, and rootmat) to judge the effects of clay deposits that had come through the Lower Reservoir dam. Scores for spring 2006 coarse substrate samples showed the greatest change of any habitat, being consistently lower than those collected during the previous fall. By the fall 2006 sample season, scores of most habitats had increased to approach or surpass pre-event scores. Although the substrate in each pool downstream of the Lower Reservoir was covered in varying thickness of sediment, only Station 3 (the site nearest the dam, which had the heaviest sediment deposition) exhibited an apparent macroinvertebrate community response in pool habitat.

When comparing fall 2005 with fall 2006 samples collected downstream of the Lower Reservoir, the macroinvertebrate community composition exhibited few differences at Stations 1 (the downstream site nearest Highway 21) and Station 2 (situated approximately midway between Stations 1 and 3). The majority of taxa groups remained unchanged at these two downstream stations, with the exception that midge larvae (Chironomidae) were more diverse and, within some individual habitats, much more abundant. More differences were observed at Station 3 in terms of changing numbers of taxa within specific taxa groups and also changing numbers of individuals within these groups.

Among the five East Fork stations upstream of the Lower Reservoir, only two failed to achieve fully supporting MSCI scores in spring 2006. Station 4, located just upstream of the AmerenUE bin wall achieved partially supporting status and Station 6, which included the reach with the heaviest deposits of sand, achieved the lowest possible non-supporting MSCI score. At the time of spring 2006 sampling, Station 6 had little surface flow and a total of only 41 individuals were collected at this site. The few individuals encountered were likely the result of drift coming downstream during high flow events that occurred during the winter months prior to spring sampling. By fall 2006, scores had improved or remained the same among most of the five East Fork stations upstream of the Lower Reservoir. Only the upstream control, Station 8, experienced a decrease in the MSCI score, likely due in part to low flows during the summer months prior to sampling. Although a more substantial macroinvertebrate community was present at Station 6 in fall 2006, it was dominated by a different suite of taxa than the remaining East Fork stations. Compared to the other stations, chironomids were much more prevalent and made up over three quarters of the sample, whereas mayflies and other EPT Taxa were quite scarce.

As part of the overall biological assessment, samples also were collected at Shut-In Creek and Taum Sauk Creek, two tributaries of the East Fork, beginning in Spring 2006. Each of these stations achieved fully supporting status during the spring season, with Taum Sauk Creek attaining the highest possible score for each of the four biological metrics.

Although the MSCI score for Shut-In Creek was slightly lower, it was sufficient to achieve fully supporting status. MSCI scores for both tributary streams were lower in fall 2006, resulting in the ranking of Shut-In Creek to decrease to partially supporting; the supportability ranking for Taum Sauk Creek did not change despite the lower MSCI score. Each of these tributary stations was relatively small and, as was the case with East Fork Station 8, very little flow was present in riffles and rootmat that had been sampled during the previous spring was no longer submerged. It appears that the quality of the macroinvertebrate community at East Fork Station 8 and the two tributary stations are more affected by reduced flow than the remaining sites, which are able to draw from a larger watershed.

Three Black River stations were sampled to determine whether the potential sediment contribution from the East Fork negatively affected the biota downstream. The upstream control and the downstream station each achieved fully supporting MSCI scores in spring 2006, with the station located between them (which is the first site downstream of the East Fork) having a partially supporting score. All three Black River stations achieved fully supporting scores during the fall 2006 sample season. The East Fork did affect Black River turbidity in spring 2006, with stations downstream of the East Fork confluence having turbidity readings that were roughly six times that of the Black River control station. Despite the elevated turbidity, the Black River did not have the observable layer of sediment present in the East Fork downstream of the Lower Reservoir. During fall 2006, there were no appreciable differences in turbidity among Black River stations.

The change in East Fork turbidity after the release was the most notable water quality difference observed in this study. During fall 2005, turbidity levels in East Fork stations downstream of the Lower Reservoir were between 1 and 2 NTU. Turbidity was consistently higher among affected East Fork stations after the Upper Reservoir failure. In spring 2006, turbidity was fairly consistent among the downstream stations, ranging between 32.3 and 37.9 NTU. By fall 2006 turbidity at the downstream two stations was 4.02 (Station 1) and 6.66 (Station 2) NTU. Station 3 turbidity, however, remained elevated in fall 2006 with a reading of 53.3 NTU. Generally, turbidity in East Fork stations upstream of the Lower Reservoir were lower than the downstream stations during both post-event sample seasons, although turbidity fluctuated depending on the type of rehabilitation activities occurring within JSISP.

After the release, water quality tended to be poorer at Station 6, the former reference station. Turbidity was higher at this site than the remaining stations upstream of the Lower Reservoir and dissolved oxygen was below the 5 mg/L minimum concentration listed in the Missouri Water Quality Standards.

Table of Contents

Section		Page
1.0	Introduction.....	1
2.0	Study Area	1
3.0	Site Descriptions	2
4.0	Methods.....	4
4.1	Macroinvertebrate Collection and Analyses.....	4
4.2	Macroinvertebrate Laboratory Processing.....	5
4.3	Physicochemical Data Collection and Analysis	5
4.4	Quality Assurance/Quality Control (QA/QC)	6
	4.4.1 Field Meters	6
	4.4.2 Biological Samples	6
	4.4.3 Biological Data Entry	6
5.0	Data Results	6
5.1	Physicochemical Data.....	6
5.2	Biological Assessment.....	10
	5.2.1 East Fork Black River Longitudinal Assessment	10
	5.2.1.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir	11
	5.2.1.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir	14
	5.2.2 East Fork Black River Tributaries Biological Assessment....	16
	5.2.3 Black River Biological Assessment.....	17
5.3	Macroinvertebrate Community Composition	18
	5.3.1 East Fork Black River.....	18
	5.3.2 East Fork Black River Tributaries	22
	5.3.3 Black River Sample Stations	24
6.0	Discussion.....	26
7.0	Summary	29
8.0	Recommendations.....	31
9.0	References Cited	32

Tables

Table 1	Percent Land Cover.....	2
Table 2	Fall 2005 Flow and <i>In situ</i> East Fork Black River Water Quality Measurements	7
Table 3	Spring 2006 Flow and <i>In situ</i> Water Quality Measurements.....	7
Table 4	Fall 2006 Flow and <i>In situ</i> Water Quality Measurements	8
Table 5	Fall 2005 East Fork Black River Nutrient Concentrations	9
Table 6	Fall 2006 Black River and East Fork Black River Watershed Nutrient Concentrations.....	10
Table 7	Biological Criteria for Warm Water Reference Streams in the Ozark/Current/Black EDU, Fall Season	10

Table 8	Biological Criteria for Warm Water Reference Streams in the Ozark/Current/Black EDU, Spring Season.....	11
Table 9	Metric Values and Scores for Lower East Fork Black River Stations, Fall 2005 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	11
Table 10	Metric Values and Scores for Lower East Fork Black River, Spring 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	12
Table 11	Lower East Fork Black River Single Habitat Stream Condition Index Scores.....	12
Table 12	Metric Values and Scores for Lower East Fork Black River Stations, Fall 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	12
Table 13	Lower East Fork Black River Level of Effort (As Percent of Sample Sorted) to Reach Sample Target Number	13
Table 14	Metric Values and Scores for East Fork Black River Reference Station, Fall 2005 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	14
Table 15	Ozark/Current/Black EDU Biological Criteria Reference Stream Macroinvertebrate Composition, Fall Season.....	15
Table 16	Metric Values and Scores for Upper East Fork Black River Stations, Spring 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	16
Table 17	Metric Values and Scores for Upper East Fork Black River Stations, Fall 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	16
Table 18	East Fork Black River Tributaries Metric Values and Scores, Spring 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	17
Table 19	East Fork Black River Tributaries Metric Values and Scores, Fall 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	17
Table 20	Black River Coarse Substrate Habitat Metric Values and Scores, Spring 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	18
Table 21	Black River Coarse Substrate Habitat Metric Values and Scores, Fall 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data.....	18
Table 22	Fall 2005 East Fork Black River Macroinvertebrate Composition ...	19
Table 23	Spring 2006 East Fork Black River Macroinvertebrate Composition	20
Table 24	Fall 2006 East Fork Black River Macroinvertebrate Composition ...	22
Table 25	East Fork Black River Tributaries Macroinvertebrate Composition .	23
Table 26	Spring 2006 Black River Macroinvertebrate Composition	25
Table 27	Fall 2006 Black River Macroinvertebrate Composition.....	26

Attachments

- Appendix A Sample Stations Located on the East Fork Black River, Its Tributaries, and the Black River Map
East Fork Black River Study Area Map
- Appendix B Black River, East Fork Black River, Shut-In Creek, and Taum Sauk Creek Macroinvertebrate Taxa Lists
- Appendix C Biological Assessment Report, Effects of the AmerenUE Upper Taum Sauk Reservoir Dam Failure on the Macroinvertebrate Community of East Fork Black River, Reynolds County, December 19-21, 2005

1.0 Introduction

At the request of the Water Protection Program (**WPP**), the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a biological assessment of the East Fork Black River. The original intent of the biological assessment, which began in September 2005, was to provide data to the WPP for use in the relicensing of AmerenUE's Taum Sauk Hydroelectric Plant. The primary focus of the assessment was to determine whether the macroinvertebrate community downstream from Lower Taum Sauk Reservoir was different from that found in the Biological Criteria Reference reach, located on the East Fork Black River within Johnson's Shut-Ins State Park (**JSISP**). During this phase, macroinvertebrate and water quality samples were collected at four stations within the study reach. Three stations were located between the Lower Taum Sauk Reservoir and the Highway 21/49/72 (hereafter referred to as Highway 21) bridge. The upstream reference station was located downstream of State Road N within JSISP. Dave Michaelson, Ken Lister, and Randy Sarver of the WQMS collected samples from these four sites on September 23, 2005 to provide data to the WPP for use in evaluating the biological integrity of this stream.

On December 14, 2005 AmerenUE's Upper Taum Sauk Reservoir failed and the goal of the biological assessment study of East Fork Black River changed to focus on damage assessment. The initial phase of this study effort was conducted on December 19-21, 2005 and was designed to document the reservoir failure's immediate effect on the benthic macroinvertebrate community (Attachment C). Because samples for the December 2005 study were collected outside the time frame described in the department's Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003a), an alternate quantitative macroinvertebrate sampling method was used. By contrast, this report will present findings based on the semi-quantitative method and will focus on the East Fork Black River's macroinvertebrate community in the months prior to the reservoir breach compared to the community composition in the aftermath.

The objectives of this study were to:

- 1) more accurately determine the effects of scour and deposition along a longitudinal gradient of the East Fork Black River upstream of Lower Taum Sauk Reservoir and to determine the length of time the damage remains;
- 2) determine the effects of sediment released from the Lower Reservoir on the East Fork Black River and the mainstem Black River.

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 JSISP and the AmerenUE Lower Taum Sauk Reservoir to its confluence with the Black River near Lesterville, Missouri (see map, 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 2005) as a Class P stream, with designated uses that 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. Maps of the EDU and the local sampling locations can be found in Appendix A. 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. Percent land cover data were derived from Thematic Mapper satellite images 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 (Hwy 21 – Hwy N)	0.0	0.0	4.0	91.0
HUC 14 #11010007030001 (Upstream of Hwy N)	0.0	0.0	4.0	93.0

3.0 Site Descriptions

All of the following sample sites occurred in Reynolds County, Missouri.

East Fork Black River Station #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 bridge at Lesterville, Missouri. Geographic coordinates of the downstream terminus of the sampling reach are Latitude 37.450897, Longitude -90.827831.

East Fork Black River Station #2 (NW ¼ sec. 9, T. 32 N., R. 2 E.) was located in the vicinity of Wicks Cave, north of Lesterville, Missouri. Geographic coordinates collected near the midpoint of the sampling reach are Latitude 37.469833, Longitude -90.838472.

East Fork Black River Station #3 (SW ¼ sec. 33, T. 33 N., R. 2 E.) was located downstream of the Lower Taum Sauk Reservoir spillway. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.494167, Longitude -90.837417.

East Fork Black River Fall 2005 Station #4 (NW ¼ sec. 16, T. 33 N., R. 2 E.) was located within the Johnson's Shut-Ins State Park boundaries downstream of State Road N and is the location of the Biological Criteria Reference reach. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.545990, Longitude -90.842487.

East Fork Black River Spring/Fall 2006 Station #4 (SW ¼ sec. 21, T. 33 N., R. 2 E.) was located upstream of the AmerenUE "bin wall," a water-permeable metal wall that acts as a sieve to prevent bedload material from entering the Lower Reservoir. Geographic coordinates of the downstream terminus of the sampling reach are Latitude 37.526145, Longitude -90.837422.

East Fork Black River Station #5 (SW ¼ sec. 16; T. 33 N., R. 2 E.) was located immediately upstream of the shut-ins at Johnson's Shut-Ins State Park. Geographic coordinates of the downstream terminus of the sampling reach are Latitude 37.539537, Longitude -90.839846.

East Fork Black River Station #6 (NW ¼ sec. 16, T. 33 N., R. 2 E.) was located downstream of the debris dam caused by the Upper Taum Sauk Reservoir failure. This reach is in the same location as that described for Station #4, with the exception that during the time of sampling in spring and fall 2006, the main flow of the East Fork Black River was forced by debris into a high flow channel east of the original channel. This channel (referred to as the "West Channel") was very shallow and mostly filled with sand-sized sediment. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.545990, Longitude -90.842487.

East Fork Black River Station #7 (NW ¼ sec. 16, T. 33 N., R. 2 E.) also was located downstream of the debris dam mentioned above. This station is located in a stream reach referred to as the "East Channel" which, at the time of this writing, is the main conveyance of East Fork Black River flow between the debris dam and the downstream point at which the East Channel and the West Channel converge. Geographic coordinates of the upstream terminus of the sampling reach are Latitude 37.550803, Longitude -90.842357.

East Fork Black River Station #8 (S ½ sec. 4, T. 33 N., R. 2 E.) was located upstream from the Shut-In Creek confluence. This reach was outside the area of influence resulting 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.

Black River Station #1 (N ½ sec. 31, T. 31 N., R. 2 E.) was located upstream from the State Highway K bridge. Geographic coordinates at the upstream terminus of the sampling reach are Latitude 37.327111, Longitude -90.765333.

Black River Station #2 (E ½ sec.28, T. 32 N., R. 2 E.) was located at the Missouri Department of Conservation's Lesterville Access. Geographic coordinates near the midpoint of the reach are Latitude 37.416889, Longitude -90.825667.

Black River Station #3 (Spring 2006) (NE ¼ sec. 20, T. 32 N., R. 2 E.) was located at the Park Bluff Campground, downstream of the Middle Fork Black River confluence and upstream of the East Fork Black River confluence. Geographic coordinates at this sample reach are Latitude 37.442222, Longitude -90.845722.

Black River Station #3 (Fall 2006) (N ½ sec. 21, T. 32 N., R. 2 E.) was accessed via Twin Rivers Landing, with samples collected immediately upstream of the East Fork Black River confluence. Geographic coordinates at the downstream terminus of the sample reach are Latitude 37.440917, Longitude -90.834028.

Taum Sauk Creek #1 (NW ¼ SE ¼ sec. 27, T. 33 N., R. 2 E.) was sampled downstream of the confluence of Little Taum Sauk Creek, near the County Road 204 crossing. Geographic coordinates at the upstream terminus of the sample reach are Latitude 37.508472, Longitude -90.811528.

Shut-In Creek #1 (SW ¼ sec. 5, T. 33 N., R. 2 E.) was sampled within line-of-sight of State Highway MM, near the point where the pavement ends. Geographic coordinates at the midpoint of the sample reach are Latitude 37.577948, Longitude -90.851485.

4.0 Methods

4.1 Macroinvertebrate Collection and Analyses

A standardized sample collection procedure was followed as described in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a). Three standard habitats—flowing water over coarse substrate (riffles), depositional substrate in non-flowing water, and rootmat at the stream edge—were sampled at all East Fork Black River, Taum Sauk Creek, and Shut-In Creek locations. Because the Black River is larger than what is normally considered “wadeable,” non-flow and rootmat habitats could not be sampled consistently or safely. The biological assessment for the Black River is based solely on the macroinvertebrate community present in riffle habitat.

A standardized sample analysis procedure was followed as described in the SMSBPP. The following four metrics were used: 1) Taxa Richness (TR); 2) total number of taxa in the orders Ephemeroptera, Plecoptera, and Trichoptera (EPTT); 3) Biotic Index (BI); and 4) Shannon Diversity Index (SDI). These metrics were scored and combined to form the Macroinvertebrate Stream Condition Index (MSCI). Macroinvertebrate Stream Condition Indices between 20-16 qualify as fully biologically supporting, between 14-10 are partially supporting, and 8-4 are considered non-supporting of aquatic life. The

multi-habitat macroinvertebrate data are presented in Appendix B as laboratory bench sheets.

Although the MSCI score is normally based on multi-habitat data, we have the ability to calculate criteria on an individual habitat basis. Our goals for calculating single-habitat criteria were twofold: 1) to determine whether a differential effect existed among the three habitats sampled in this study; and 2) to conduct a macroinvertebrate investigation based on the single habitat that could be sampled in the Black River. Investigating single-habitat criteria allowed us the ability to make more precise judgements on the effects to the overall community.

Additionally, macroinvertebrate data were analyzed in the following specific ways. First, comparisons were made among reaches longitudinally. This comparison addresses influences that may result from differential sediment deposition and possible scouring effects among sites within the study reach. Stations located in the river reach downstream of the Lower Taum Sauk Reservoir were compared to one another separately from stations located upstream of the Lower Reservoir. Macroinvertebrate community attributes that existed prior to the Upper Reservoir failure were compared with conditions as they exist afterward. Data are summarized and presented in tabular format comparing means of the four standard metrics and other parameters at each of the stations sampled in this project.

4.2 Macroinvertebrate Laboratory Processing

Laboratory processing was consistent with the description in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a). Each sample was processed under 10x magnification to remove a habitat-specific target number of individuals from debris. Individuals were identified to standard taxonomic levels (MDNR 2005d) and enumerated.

4.3 Physicochemical Data Collection and Analysis

During each survey period, *in situ* water quality measurements were collected at all stations. Field measurements included temperature (MDNR 1993), dissolved oxygen (MDNR 2002), conductivity (MDNR 2000), turbidity (MDNR 2005c), and pH (MDNR 2001b). Additionally, water samples were collected by the WQMS and analyzed by ESP's Chemical Analysis Section for chloride, total phosphorus, ammonia-N, nitrite+nitrate-N, and total nitrogen (all parameters reported in mg/L). These latter nutrient parameters were analyzed for fall 2005 and fall 2006 samples, but not for the spring 2006 sample season. Procedures outlined in Field Sheet and Chain of Custody Record (MDNR 2001a) and Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2003c) were followed when collecting water quality samples. Stream velocity was measured at each station where practicable during the study using a Marsh-McBirney Flo-Mate™

Model 2000 flow meter. Discharge was calculated per the methods in the Standard Operating Procedure MDNR-FSS-113, Flow Measurement in Open Channels (MDNR 2003c), with the exception that Black River Station 1 discharge data were obtained using the USGS gaging station at State Road K (Station #07061500). In addition, discharge was assumed to be nearly equal at Black River Station 1 and 2 due to the absence of significant tributaries between the two stations. Black River Station 3 discharge was estimated by subtracting the flow measured at East Fork Black River Station 1 from the aforementioned USGS gaging station data.

Physicochemical data were summarized and presented in tabular form for comparison among stations.

4.4 Quality Assurance/Quality Control (QA/QC)

4.4.1 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 2005b).

4.4.2 Biological Samples

Approximately 16% of macroinvertebrate samples were checked for accuracy of organism removal from sample debris. These tasks were performed consistent with those methods found in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2003a).

4.4.3 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 2003b).

5.0 Data Results

5.1 Physicochemical Data

Flow and non-nutrient pre-event water quality parameters of East Fork Black River sites sampled in fall 2005 are presented in Table 2, with nutrient data presented in Table 3. Discharge from the Lower Reservoir exceeded that of the upstream East Fork Black River reach flowing through Johnson's Shut-Ins at the time of our sampling in fall 2005. Conductivity was slightly higher within JSISP at Station 4 than the remaining stations, with the remaining water quality parameters being similar among stations.

Table 2
 Fall 2005 Flow and *In situ* East Fork Black River Water Quality Measurements

Station	Parameter					
	Flow (cfs)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
1	13.4	26.0	7.24	183	8.3	1.00
2	13.6	26.5	7.85	183	8.3	1.00
3	13.2	27.5	7.34	184	8.2	2.00
4	9.0	25.5	7.57	220	8.4	2.00

Among post-event stations, water quality parameters varied among seasons and according to their position relative to effects resulting from the Upper Reservoir breach. Flow rates were much lower in fall 2006 (Table 4) than either of the two previous sample seasons, with very little water flowing in riffles at the uppermost East Fork Black River site or either of the East Fork tributary stations. Turbidity was consistently higher among all East Fork stations (except control Station 8) following the breach. Whereas turbidity ranged between 1 and 2 NTUs in the East Fork in fall 2005 (Table 2), the range in spring 2006 was 3.14 to 37.9 NTUs (Table 3) and in fall 2006 turbidity readings were between 1 and 53 NTUs (Table 4). Downstream of the reservoir, the highest turbidity readings during both seasons were observed at Station 3, the station nearest the reservoir. Upstream of the reservoir, turbidity was highest at Station 6 (the largely dewatered West Channel).

Table 3
 Spring 2006 Flow and *In situ* Water Quality Measurements

Station	Parameter					
	Flow (cfs)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
BR #1	653	7.9	11.3	219	7.86	5.68
BR #2	653*	8.1	11.2	226	7.92	6.39
BR #3	397	7.9	11.3	281	8.15	1.00
EFBR #1	111	8.2	10.8	102	8.20	32.3
EFBR #2	108	9.1	10.6	99.8	8.10	33.5
EFBR #3	110	9.4	10.9	99.2	8.05	37.9
EFBR #4	164	6.5	11.7	127	7.67	8.81
EFBR #5	170	6.5	11.3	123	7.70	21.0
EFBR #6	2.1	8.7	6.52	168	7.37	35.4
EFBR #7	182	6.5	11.5	116	7.70	6.96
EFBR #8	69.6	6.5	11.8	121	7.77	3.14
SIC #1	84.1	6.4	11.5	94.6	7.76	4.04
TSC #1	16.9	7.80	11.0	76.5	7.92	2.10

*Estimated value

Table 4
 Fall 2006 Flow and *In situ* Water Quality Measurements

Station	Flow (cfs)	Temperature (°C)	Dissolved O ₂ (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
BR #1	126.0	20.5	8.90	327	8.1	1.00
BR #2	126.0*	21.0	9.25	368	8.2	1.00
BR #3	123.0*	21.0	9.12	375	8.1	1.00
EFBR #1	2.9	15.0	7.54	254	7.9	4.02
EFBR #2	3.0	16.5	8.19	268	8.1	6.66
EFBR #3	7.1	16.5	8.30	273	7.7	53.3
EFBR #4	3.6*	20.5	9.80	270	8.2	1.00
EFBR #5	3.6	16.0	8.31	323	7.6	1.57
EFBR #6	0.5	23.0	2.27	355	7.1	22.2
EFBR #7	1.6	17.0	8.33	290	8.0	7.12
EFBR #8	0.6	17.0	7.15	254	8.0	1.19
SIC #1	0.5	22.0	6.69	245	7.8	1.00
TSC #1	0.3	19.0	8.01	225	7.7	1.00

*Estimated value

Conductivity readings were highest in fall 2006 at all sites (Table 4), with those of the lower East Fork (downstream of the dam) being more than twice as high as in the previous spring. Compared to fall 2005, conductivity values in fall 2006 samples also were elevated, but not to the same degree. In fall 2005, conductivity readings among stations downstream of the Lower Reservoir were nearly identical to one another and were lower than the reading observed within JSISP. Although conductivity readings were lower at all sites in spring 2006 (Table 3), a trend similar to the preceding season was observed. Conductivity was consistent among East Fork Black River stations downstream of the Lower Reservoir and lower than the remaining stations farther upstream. The highest spring 2006 conductivity reading among East Fork Black River stations was observed at Station 6. In fall 2006, conductivity was elevated in samples compared to those of fall 2005; however, unlike in the previous sample seasons, there were no trends among East Fork samples. As was the case in spring, conductivity among fall 2006 East Fork samples was highest at Station 6. Conductivity among Black River samples tended to be higher than the East Fork stations, with the exception of Station 6 during fall 2006. Among Black River stations, conductivity was highest for both 2006 sample seasons at Station 3, upstream of the East Fork confluence. Conductivity at the two tributary streams was slightly lower than the remaining stations during both sample seasons in 2006.

With the exception of East Fork Station 6, dissolved oxygen was consistent among stations and varied seasonally. Dissolved oxygen was higher in the spring compared to both fall sample seasons, but there was no difference with respect to pre- versus post-event among most stations. East Fork Station 6 had much lower dissolved oxygen concentrations following the reservoir breach. It had particularly low dissolved oxygen

during the fall 2006 season, and was the only site to fall below the 5 mg/L minimum concentration listed in the Missouri Water Quality Standards for protection of aquatic life (warmwater and coolwater fisheries).

Nutrient concentrations as well as chloride concentrations are presented in Table 5 (fall 2005) and Table 6 (fall 2006). These water quality analytes were not collected during the spring 2006 sampling season. No consistent trends were observed when comparing these parameters before and after the reservoir failure, except that chloride concentrations were only slightly higher among East Fork samples in fall 2006. Despite these minor chloride increases, none among the East Fork sites was present in concentrations higher than the analytical Practical Quantitation Limits (PQL) and were thus estimated values. Compared to East Fork samples, chloride was highest among Black River stations and lowest at the tributary stations. Total nitrogen was present in detectable, although variable, concentrations at all sites during both years and was higher among most stations in fall 2006. The highest total nitrogen levels were observed in fall 2006 at the East Fork stations downstream of the Lower Reservoir, with concentrations being highest at Station 3 and decreasing while progressing downstream. Nitrite+nitrate (NO₂+NO₃-N) was present in detectable levels at all but the biocriteria reference site (fall 2005 Station 4 is in the same location as fall 2006 Station 6) in fall 2006. Although detectable in fall 2006, NO₂+NO₃-N was only present below the PQL at each of the Black River stations as well as East Fork Stations 7 and 8. Ammonia as nitrogen (NH₃-N) was detected at the biocriteria reference site during both years and at East Fork Station 3 in fall 2006.

Table 5
 Fall 2005 East Fork Black River Nutrient Concentrations

Station	Parameter (mg/L)				
	NH ₃ -N	NO ₂ +NO ₃ -N	Total Nitrogen	Total Phosphorus	Chloride
1	*	0.03**	0.09	*	1.57**
2	*	0.02**	0.25	*	1.62**
3	*	0.04**	0.15	*	1.47**
4	0.06	*	0.07	0.77	2.00**

*Below detectable limits

**Estimated value, detected below Practical Quantitation Limits

Table 6
 Fall 2006 Black River and East Fork Black River Watershed Nutrient Concentrations

Station	Parameter (mg/L)				
	NH ₃ -N	NO ₂ +NO ₃ -N	Total Nitrogen	Total Phosphorus	Chloride
BR #1	*	0.05**	0.16	0.02**	4.57**
BR #2	*	0.03**	0.09	*	6.36
BR #3	*	0.04**	0.09	*	6.48
EFBR #1	*	0.20	0.33	*	2.35**
EFBR #2	*	0.25	0.41	*	2.33**
EFBR #3	0.53	0.08	0.84	*	2.43**
EFBR #4	*	0.16	0.26	*	2.24**
EFBR #5	*	0.09	0.14	*	2.31**
EFBR #6	0.19	*	0.20	*	2.35**
EFBR #7	*	0.03**	0.10	*	2.31**
EFBR #8	*	0.01**	0.06	*	2.35**
SIC #1	*	0.05	0.11	*	1.61**
TSC #1	*	0.10	0.16	*	1.23**

*Below detectable limits

**Estimated value, detected below Practical Quantitation Limits

5.2 Biological Assessment

5.2.1 East Fork Black River Longitudinal Assessment

Metrics and scores calculated for the East Fork Black River were compared to biological criteria based on reference sites from the Ozark/Current/Black EDU. Prior to the reservoir failure, East Fork Black River was one of seven reference streams within this EDU. Criteria for fall and spring sample seasons—presented in Tables 7 and 8—were used to assess the overall health of the aquatic communities within the EDU.

Table 7
 Biological Criteria for Warm Water Reference Streams in the Ozark/Current/Black EDU,
 Fall Season

	Score = 5	Score = 3	Score = 1
TR	>84	84-42	<42
EPTT	>25	25-12	<12
BI	<5.16	5.16-7.58	>7.58
SDI	>3.27	3.27-1.64	<1.64

Table 8
 Biological Criteria for Warm Water Reference Streams in the Ozark/Current/Black EDU,
 Spring Season

	Score = 5	Score = 3	Score = 1
TR	>92	92-46	<46
EPTT	>30	30-15	<15
BI	<5.40	5.40-7.70	>7.70
SDI	>3.29	3.29-1.64	<1.64

5.2.1.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir

Downstream of the Lower Reservoir during the fall 2005 sample season, macroinvertebrate biological metrics tended to decline as stations neared the dam (Table 9). Scores for Taxa Richness and Biotic Index were highest at Station 1; scores for individual biological metrics at the remaining stations were variable, but overall were sufficient to yield fully supporting Stream Condition Index scores only at the two downstream stations.

Table 9
 Metric Values and Scores for Lower East Fork Black River Stations, Fall 2005 Season,
 Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	85	27	5.22	3.32		
#1 Score	5	5	5	3	18	Full
#2 Value	83	27	5.58	3.49		
#2 Score	3	5	3	5	16	Full
#3 Value	66	20	5.93	3.20		
#3 Score	3	3	3	3	12	Partial

With the exception of Station 2, the stations downstream of the Lower Reservoir failed to achieve full biological support status during the spring 2006 season (Table 10). Following the December 2005 reservoir failure, sediment-laden water was released through a pipe located at the base of the Lower Reservoir for a period of months which, in addition to increasing the turbidity of the East Fork, allowed a considerable amount of clay-sized sediment to settle in the downstream river reach. We attempted to determine which portion, if any, of the macroinvertebrate community was affected by sedimentation or other habitat alterations downstream of the Lower Reservoir by making habitat-specific biological criteria comparisons of pre- versus post-event metric scores. Scores for spring 2006 coarse substrate samples showed the greatest change of any habitat, being consistently lower than those collected during the previous fall (Table 11). Scores for the remaining habitats were the same or better than the previous fall with the exception that the non-flow score at Station 1 was much lower in spring 2006. By the fall 2006 sample season, scores of most habitats had increased to approach or surpass pre-event scores and

all but Station 3 achieved fully supporting status (Table 12). Exceptions to this trend include the non-flow habitat at Station 3, which declined from spring to fall 2006, and the rootmat habitat of Stations 2 and 3, which was largely unchanged.

Table 10
Metric Values and Scores for Lower East Fork Black River, Spring 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	76	23	6.05	3.22		
#1 Score	3	3	3	3	12	Partial
#2 Value	104	30	5.47	3.53		
#2 Score	5	3	3	5	16	Full
#3 Value	81	21	5.96	3.23		
#3 Score	3	3	3	3	12	Partial

Table 11
Lower East Fork Black River
Single Habitat Stream Condition Index Scores

↓ Station	Sample Year →	Coarse Substrate			Non-Flow			Rootmat		
		F05	S06	F06	F05	S06	F06	F05	S06	F06
EF Black R. #1		20	12	18	16	12	20	14	14	16
EF Black R. #2		18	16	18	18	18	20	12	14	12
EF Black R. #3		14	12	18	18	18	12	12	14	12

Table 12
Metric Values and Scores for Lower East Fork Black River Stations, Fall 2006 Season, Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	91	28	5.42	3.56		
#1 Score	5	5	3	5	18	Full
#2 Value	95	27	5.97	3.47		
#2 Score	5	5	3	5	18	Full
#3 Value	81	20	6.58	3.47		
#3 Score	3	3	3	5	14	Partial

Although the substrate in each pool downstream of the Lower Reservoir was covered in varying thickness of clay-sized particles, only Station 3 (the uppermost site, which had the heaviest sediment deposition) exhibited an apparent macroinvertebrate community response in non-flow habitat. To describe other potential impairment manifestations, we used an estimate of macroinvertebrate density and also compared the community composition that existed prior to the reservoir failure with the community present afterward. We used laboratory effort as a rough estimate of macroinvertebrate density

trends for the lower East Fork Black River (Table 13). Our goal was to compare the level of effort required to reach the target number of organisms (as described in the SMSBPP) before versus after the reservoir breach and also to determine whether areas with the heaviest deposits of sediment (nearest the dam) required more laboratory effort than stations farther downstream.

Table 13
 Lower East Fork Black River
 Level of Effort (As Percent of Sample Sorted) to Reach Sample Target Number

↓Station	Sample Year →	Coarse Substrate			Non-Flow			Rootmat		
		F05	S06	F06	F05	S06	F06	F05	S06	F06
Bioreference Mean		9.65	22.3	9.65	9.61	23.2	9.61	22.5	24.7	22.5
EF Black R. #1		12.5	20.8	10.4	6.3	27.1	6.25	16.7	10.0	14.6
EF Black R. #2		16.7	12.5	10.4	10.0	16.7	8.3	27.1	50.0	22.9
EF Black R. #3		4.2	15.6	10.4	8.3	25.0	18.8	6.2	50.0	22.9

Only Station 3 showed an increase in the level of effort required to reach the target number when comparing fall 2005 to fall 2006 (Table 13). Although an increase in effort was required in each habitat sampled at Station 3, only the nonflow sample exceeded the mean level of effort among biological criteria references. Level of effort for the remaining stations was the same or lower in fall 2006 samples compared to fall 2005. There are no pre-event spring data available for the East Fork below the Lower Reservoir for purposes of comparison; however, the majority of spring 2006 East Fork samples were comparable to or lower than the bioreference mean level of effort. Spring 2006 rootmat habitat was the exception, for which the upstream two stations required sorting 50 percent of the sample (which is usually the maximum level of effort spent sorting a sample).

When comparing fall 2005 with fall 2006 samples, the macroinvertebrate community composition exhibited few changes at Stations 1 and 2. The majority of taxa groups remained unchanged at these two downstream stations; the only exception was that midge larvae (Chironomidae) were more diverse and, within some individual habitats, much more abundant.

More differences were observed at Station 3 in terms of changing numbers of taxa within specific taxa groups and also changing numbers of individuals within these groups. As was the case with the two downstream stations, chironomid taxa also were more diverse and abundant in Station 3 fall 2006 samples, with each habitat increasing by at least six taxa. Mayfly taxa increased from nine to 14 in coarse substrate, but decreased in the remaining habitats. In rootmat, mayfly taxa declined by a single taxon, but the number of individuals fell from 113 in fall 2005 to 37 in fall 2006. In the non-flow sample, mayfly taxa fell from six to one, with the number of individuals falling from 159 to four. The number of caddisfly taxa at Station 3 was unchanged in coarse substrate samples, but the number of individuals decreased from 188 to 32. Although caddisflies were not abundant

in the fall 2005 non-flow sample, there were three taxa present; by comparison, there were no taxa found in the fall 2006 sample. In the rootmat sample, caddisfly taxa decreased from five to one, with the number of individuals decreasing from 29 to one.

5.2.1.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir

During the fall 2005 season Station 4, the biocriteria reference site, achieved its lowest score among three fall sampling events between 1999 and 2005 (Table 15). Taxa Richness and the number of EPT Taxa were lower in fall 2005 compared to previous years, and resulted in a partially supporting score (Table 14).

Table 14
 Metric Values and Scores for East Fork Black River Reference Station, Fall 2005 Season,
 Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	80	24	5.30	3.41		
#4 Score	3	3	3	5	14	Partial

Several sample stations were added to the study for the spring 2006 and subsequent survey seasons to document possible effects and recovery of the macroinvertebrate community. With the exception of Station 4 and Station 6, each of the East Fork Black River stations upstream of the Lower Reservoir were fully supporting in spring 2006. Station 4, located upstream of the impounded area created by AmerenUE's bin wall, achieved partially supporting status in spring 2006 (Table 16). Station 6 (the pre-event biocriteria reference site; post-event West Channel) had very little flow and the substrate was dominated by sand-sized material. Samples collected at this site likely represent macroinvertebrate recolonization that had occurred between the Upper Reservoir failure in December 2005 and the spring sampling season in March 2006. Very few individuals were collected at this site (two insects were present in the coarse substrate sample, five in nonflow, and 35 in rootmat), which resulted in the lowest possible score for each of the biological metrics with an overall score of non-supporting.

Compared to spring 2006, fall 2006 scores improved or remained the same among the upstream East Fork stations (Table 17), with the exception that the MSCI score for control Station 8 declined slightly and resulted in a change from fully supporting to partially supporting. Station 4 improved from partially to fully supporting and the score of Station 6 increased from non-supporting to partially supporting.

Table 15
 Ozark/Current/Black EDU Biological Criteria Reference Stream Macroinvertebrate Composition, Fall Season

	Big Ck.		Blair Ck.			E. Fk. Black R.			Jacks Fork R.		Little Black R.		Sinking Ck.*		Sinking Ck.**
Sample Year	1999	2000	1999	1999	2000	1999	2000	2005	1999	2000	1999	2000	1999	2000	2001
↓Variable Station→	1	1	1	2	1	1	1	4	1	1	1	1	1	1	1
Taxa Richness	93	82	87	97	87	85	90	80	75	87	102	93	97	80	85
Number EPT Taxa	29	26	28	27	28	31	28	24	23	24	27	27	28	20	28
% Ephemeroptera	27.7	29.1	23.4	26.7	29.1	47.3	50.1	40.6	51.4	47.0	53.0	54.2	28.0	32.3	23.1
% Plecoptera	0.3	1.1	1.6	1.5	1.1	0.3	0.3	0.2	0.3	0.0	0.0	0.0	<0.1	0.0	0.1
% Trichoptera	9.2	7.4	9.0	14.0	7.4	7.3	11.0	12.8	2.2	2.9	2.4	7.4	4.5	2.6	4.0
MSCI Score	20	20	20	18	20	18	20	14	16	14	20	20	18	14	18
% Dominant Families															
Elmidae	16.9	15.6	10.7	10.9	11.6	6.8	--	--	15.4	11.5	10.1	12.1	27.2	17.9	36.9
Pleuroceridae	16.0	12.9	19.3	23.0	22.4	--	--	--	--	16.0	--	--	11.7	25.4	10.7
Chironomidae	15.9	14.9	18.7	10.6	9.4	19.1	11.7	18.4	10.4	9.2	20.1	10.8	17.1	12.1	9.2
Caenidae	12.8	10.0	--	--	--	18.8	22.5	14.6	13.2	18.8	--	--	12.5	20.5	--
Hydropsychidae	5.5	--	--	11.9	--	--	--	--	--	--	--	--	--	--	--
Heptageniidae	--	8.8	15.6	11.8	18.4	12.7	15.0	13.3	14.9	14.0	8.2	9.8	9.2	6.4	8.7
Psephenidae	--	--	4.9	--	7.0	--	--	--	--	--	--	--	--	--	--
Isonychiidae	--	--	--	--	--	7.3	9.4	10.4	12.3	--	11.0	--	--	--	6.4
Helicopsychidae	--	--	--	--	--	--	6.2	--	--	--	--	--	--	--	--
Hyaellidae	--	--	--	--	--	--	--	6.3	--	--	--	--	--	--	--
Leptohiphidae	--	--	--	--	--	--	--	--	--	--	18.9	22.6	--	--	--
Baetidae	--	--	--	--	--	--	--	--	--	--	--	8.2	--	--	--

*Sinking Creek, Shannon County

**Sinking Creek, Reynolds County

Table 16
 Metric Values and Scores for Upper East Fork Black River Stations, Spring 2006 Season,
 Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	62	22	5.79	3.48		
#4 Score	3	3	3	5	14	Partial
#5 Value	53	22	5.16	3.48		
#5 Score	3	3	5	5	16	Full
#6 Value	18	8	5.44	2.56		
#6 Score	1	1	1	1	4	Non
#7 Value	54	22	5.23	3.34		
#7 Score	3	3	5	5	16	Full
#8 Value	89	28	4.89	3.65		
#8 Score	3	3	5	5	16	Full

Table 17
 Metric Values and Scores for Upper East Fork Black River Stations, Fall 2006 Season,
 Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	91	25	5.14	3.59		
#4 Score	5	3	5	5	18	Full
#5 Value	90	28	5.34	3.22		
#5 Score	5	5	3	3	16	Full
#6 Value	44	4	7.12	2.41		
#6 Score	3	1	3	3	10	Partial
#7 Value	95	23	5.55	3.55		
#7 Score	5	3	3	5	16	Full
#8 Value	77	20	5.74	3.28		
#8 Score	3	3	3	5	14	Partial

5.2.2 East Fork Black River Tributaries Biological Assessment

In addition to East Fork Black River Station 8, Taum Sauk Creek and Shut-In Creek were added as control sites beginning in spring 2006. Each of these stations achieved fully supporting status during the spring season, with Taum Sauk Creek attaining the highest possible score for each individual metric (Table 18). Shut-In Creek had lower Taxa Richness and fewer EPT Taxa than Taum Sauk Creek, but metric scores were sufficiently high to merit fully supporting status.

Table 18
 East Fork Black River Tributaries Metric Values and Scores, Spring 2006 Season, Using
 Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
Taum Sauk Ck. Value	100	35	5.37	3.62		
Taum Sauk Ck. Score	5	5	5	5	20	Full
Shut-In Ck. Value	78	26	4.65	3.51		
Shut-In Ck. Score	3	3	5	5	16	Full

Although the metric scores for EPT Taxa and Biotic Index at Taum Sauk Creek were lower in fall 2006, the site achieved fully supporting status (Table 19). At Shut-In Creek, the scores for Taxa Richness and EPT Taxa remained the same when comparing the two seasons, but the remaining metrics declined, resulting in a partially supporting score.

Table 19
 East Fork Black River Tributaries Metric Values and Scores, Fall 2006 Season, Using
 Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
Taum Sauk Ck. Value	89	25	5.72	3.50		
Taum Sauk Ck. Score	5	3	3	5	16	Full
Shut-In Ck. Value	65	17	6.12	3.02		
Shut-In Ck. Score	3	3	3	3	12	Partial

5.2.3 Black River Biological Assessment

Coarse substrate habitat was sampled at three sites on the Black River—two downstream of the East Fork Black River confluence and one upstream—to determine 1) whether the macroinvertebrate community was affected by the input of East Fork sediment and 2) if an effect is observed, determine the extent. The Black River was too large for each of the three habitats to be sampled via wading, but we were able to sample coarse substrate during normal flow conditions.

The upstream control as well as the downstream station achieved fully supporting scores during the spring 2006 season, whereas Station 2 was partially supporting (Table 20). Scores among metrics were nearly identical when comparing among sites. The one exception, which resulted in a partially supporting ranking for Station 2, was that there were slightly fewer EPT Taxa present at this station.

Table 20
 Black River Coarse Substrate Habitat Metric Values and Scores, Spring 2006 Season,
 Using Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	49	27	3.23	2.55		
#1 Score	3	5	5	3	16	Full
#2 Value	52	22	3.62	2.97		
#2 Score	3	3	5	3	14	Partial
#3 Value	52	24	3.42	3.01		
#3 Score	3	5	5	3	16	Full

Each of the Black River stations achieved a fully supporting ranking in fall 2006, with the upstream control site attaining the highest possible score (Table 21). As was the case with the spring samples, Station 2 had the lowest score; however, the difference in this case was due to the lack of a single taxon in the Taxa Richness metric. Except for the slightly lower Taxa Richness at Station 2, the two downstream stations were very similar. The upstream control tended to have slightly higher Taxa Richness, more EPT Taxa, and a noticeably lower Biotic Index value. In addition, the Shannon Diversity Index at Station 3 was slightly higher than the remaining sites.

Table 21
 Black River Coarse Substrate Habitat Metric Values and Scores, Fall 2006 Season, Using
 Ozark/Current/Black Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	43	20	4.25	2.62		
#1 Score	5	5	3	5	18	Full
#2 Value	42	19	4.28	2.87		
#2 Score	3	5	3	5	16	Full
#3 Value	46	22	3.91	3.04		
#3 Score	5	5	5	5	20	Full

5.3 Macroinvertebrate Community Composition

5.3.1 East Fork Black River

Macroinvertebrate Taxa Richness, EPT Taxa, and percent EPT are presented in Tables 22, 23, and 24. These tables also provide percent composition data for the five dominant macroinvertebrate families at each East Fork Black River Station. The percent relative abundance data were averaged from the sum of three macroinvertebrate habitats—coarse substrate, nonflow, and rootmat—sampled at each station.

Fall 2005 macroinvertebrate samples from East Fork Black River averaged 79 total taxa (range 66-85) and 25 EPT Taxa (range 20-27) (Table 22). Midge larvae were the dominant taxa group at all but Station 1, where it was fourth in abundance. Mayflies in the family Caenidae were the dominant group at Station 1 and second dominant at the remaining sites. The highest abundance of mayflies occurred at Station 1, where they accounted for nearly half the sample. The lowest percentage of mayflies occurred at Station 3, where they made up slightly more than 30 percent of the sample. Although the genus *Caenis*, including mostly *Caenis latipennis* along with a lesser number of *Caenis anceps*, was the dominant mayfly taxa group among all stations, it was not overwhelmingly dominant. Between 17 and 18 mayfly taxa were present at Stations 1, 2, and 4, with 12 mayfly taxa occurring at Station 3; the genus *Caenis* made up no more than 50 percent of samples at any of the four stations whereas *Isonychia bicolor* and mayflies in the family Heptageniidae also contributed substantially to abundance. Stoneflies were present in low numbers at each site. Each site had two stonefly taxa present in samples with the exception of Station 3, which had a single stonefly taxon. Comparable numbers of caddisfly taxa were present among stations, but made up the highest percentage of samples at Station 3. One genus, *Chimarra*, dominated the caddisfly taxa at Station 3; among the remaining sites, the majority of individuals were distributed among two or three dominant taxa.

Table 22
Fall 2005 East Fork Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3	4
Taxa Richness		85	83	66	80
Number EPT Taxa		27	27	20	24
% Ephemeroptera		48.1	39.1	30.4	40.6
% Plecoptera		0.4	0.9	1.2	0.2
% Trichoptera		5.5	8.8	17.1	12.8
MSCI Score		18	16	12	14
% Dominant Families					
Caenidae		18.5	16.3	15.1	14.6
Elmidae		18.2	13.5	12.2	--
Heptageniidae		14.2	14.3	6.3	13.3
Isonychiidae		11.6	--	--	10.4
Chironomidae		10.8	16.8	26.3	18.4
Arachnoidea		--	5.1	--	--
Philopotamidae		--	--	9.0	--
Hyalellidae		--	--	--	6.3

Spring 2006 macroinvertebrate samples averaged 67 total taxa (range 18-104) and 22 EPT Taxa (range 8-30) (Table 23). Chironomids were the dominant taxa group at all but Station 3, where riffle beetles (Elmidae) were only slightly more abundant. Chironomids, caenid mayflies, and elm mid beetles were among the dominant taxa among all stations

Table 23
 Spring 2006 East Fork Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3	4	5	6	7	8
Taxa Richness		76	104	81	62	53	18	54	89
Number EPT Taxa		23	30	21	22	22	8	22	28
% Ephemeroptera		18.6	13.8	25.9	15.2	15.0	21.4	27.9	27.7
% Plecoptera		2.9	3.0	2.6	4.6	11.8	19.0	4.4	11.7
% Trichoptera		2.1	1.5	5.5	6.8	7.2	2.3	5.2	5.8
MSCI Score		12	16	12	14	16	8	16	16
% Dominant Families									
Chironomidae		31.6	40.1	23.7	53.4	43.1	47.8	49.3	37.3
Elmidae		20.6	4.6	24.0	3.9	--	--	--	--
Caenidae		9.7	6.5	18.6	5.6	--	--	--	--
Tubificidae		7.9	--	--	--	--	--	4.0	--
Asellidae		5.2	--	--	--	--	4.7	--	--
Simuliidae		--	19.7	--	4.1	10.4	--	--	6.0
Ceratopogonidae		--	5.0	6.8	--	--	--	--	--
Heptageniidae		--	--	5.1	--	4.5	--	9.3	9.0
Ephemerebellidae		--	--	--	5.6	--	7.1	10.1	6.3
Nemouridae		--	--	--	--	6.3	16.6	--	--
Leuctridae		--	--	--	--	4.5	--	--	8.0
Leptophlebiidae		--	--	--	--	--	11.9	--	--
Isonychiidae		--	--	--	--	--	--	5.2	--

located downstream of JSISP. Among stations within and upstream of the park, dominant taxa groups were more variable with only chironomids standing out as being consistently abundant. Macroinvertebrates were much less abundant in spring 2006 samples collected from sites affected by the scour resulting from the Upper Reservoir failure. Sites affected by elevated flow and scouring effects include Stations 4, 5, and 7. Station 6 was affected more by deposition. Despite spending the maximum amount of laboratory effort processing samples from these sites (sorting 50 percent of the sample), the target number of organisms was not reached for any habitat. Taxa Richness also was lower among these sites compared to stations downstream of the Lower Reservoir and compared to control Station 8; numbers of EPT Taxa, however, were roughly comparable among all sites except Station 6. Mayfly, stonefly, and caddisfly taxa made up varying percentages of spring samples, with no obvious trends among sites regardless of the degree of scour impact at sites upstream of the Lower Reservoir or sediment deposition in downstream stations. Stoneflies made up the highest percentage of samples at Station 6; however, because this percentage represents eight stoneflies among a total of only 42 individuals, this statistic is not exceptionally meaningful. As was the case with fall 2005 samples, the genus *Caenis* was the most abundant mayfly taxa group among East Fork Black River stations in the spring. Also similar to fall samples, *Caenis latipennis* was not overwhelmingly dominant among all stations; the congeneric *Caenis anceps* was equally

or more abundant at Stations 2 and 3. In addition, other mayfly groups in the families Heptageniidae, Isonychiidae, and Ephemerellidae made a substantial contribution to the overall sample. With the exception of Stations 6 and 8, the number of caddisfly taxa in spring 2006 was similar among sites (ranging between five and seven) and was comparable to the number of taxa observed in fall 2005 samples. Station 6 had one caddisfly taxon represented by only a single individual whereas the control Station 8 had a total of 10 caddisfly taxa.

Fall 2006 macroinvertebrate samples averaged 83 total taxa (range 44-95) and 22 EPT Taxa (range 4-28) (Table 24). Chironomids were the dominant taxa group at the majority of sites, the exceptions being Stations 2, 5, and 8. At Stations 2 and 5, caenid mayflies were more abundant than chironomids and at Station 8, chironomids were outnumbered by riffle beetles (Elmidae). Station 5 had the highest percentage of mayflies, with over half the sample being made up of mayfly taxa, the dominant genera being *Caenis* and *Isonychia*. Stations 3, 6, and 8 had a lower percentage of mayflies in samples than the other five sites (which were largely comparable to one another), with mayfly taxa at Station 6 being represented by a single individual. Stoneflies were present at each site except Station 6 with comparable numbers of taxa and varying numbers of individuals. The highest percentage of stoneflies was found at Station 3; at this site, however, all but one individual was of the genus *Neoperla*. *Neoperla* was also the most abundant taxon at all other stations where stoneflies were present. Caddisflies were slightly less abundant at Stations 2 and 8, whereas the highest percentages occurred at Stations 1 and 7. As was observed in fall 2005 samples, no single caddisfly genus was dominant among stations, rather two or three taxa (e.g. *Chimarra*, *Cheumatopsyche*, *Helicopsyche*) were dominant, depending on the site.

Macroinvertebrates were more abundant in fall 2006 within the scour area compared to the previous spring. In spring, target numbers of organisms were not achieved in the scour area despite having processed 50 percent of samples in the laboratory. In fall, although nearly 50 percent of each sample was processed, target numbers were met for all available habitats. Judging from the distribution of dominant taxa in Table 24, the macroinvertebrate community appears to be fairly consistent among sites with the exception of Stations 6 and 8. The community composition for these two sites was dominated by a different suite of macroinvertebrates than the remaining sites, which were more closely aligned with one another.

Table 24
 Fall 2006 East Fork Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3	4	5	6	7	8
Taxa Richness		91	95	81	91	90	44	95	77
Number EPT Taxa		28	27	20	25	28	4	23	20
% Ephemeroptera		38.7	46.1	16.0	38.0	52.2	<0.1	35.6	10.0
% Plecoptera		0.8	1.1	3.6	1.0	0.7	--	0.6	1.8
% Trichoptera		7.6	1.9	2.6	5.0	3.2	4.6	6.9	1.4
MSCI Score		18	18	14	18	16	10	16	14
% Dominant Families									
Chironomidae		20.5	23.1	38.6	30.9	17.3	76.5	25.4	11.0
Caenidae		15.4	29.3	--	5.2	18.6	--	7.6	--
Elmidae		12.4	7.6	12.9	9.3	14.1	--	14.0	18.5
Heptageniidae		9.3	7.4	8.2	18.8	--	--	9.8	--
Isonychiidae		9.0	5.2	--	8.4	21.5	--	15.7	--
Tubificidae		--	--	7.2	--	--	--	--	--
Coenagrionidae		--	--	5.9	--	--	--	--	--
Baetidae		--	--	--	--	6.7	--	--	--
Ceratopogonidae		--	--	--	--	--	9.2	--	--
Hydroptilidae		--	--	--	--	--	4.2	--	--
Gomphidae		--	--	--	--	--	3.8	--	--
Empididae		--	--	--	--	--	3.6	--	--
Psephenidae		--	--	--	--	--	--	--	12.4
Asellidae		--	--	--	--	--	--	--	9.9
Lumbriculidae		--	--	--	--	--	--	--	7.5

5.3.2 East Fork Black River Tributaries

Taum Sauk Creek spring 2006 Taxa Richness was among the highest in this study (Table 25). Only East Fork Black River Station 2 was higher with a Taxa Richness of 104. The number of Taum Sauk Creek EPT Taxa was five taxa higher than the next highest value at East Fork Black River Station 2. Chironomids were the dominant taxa group, accounting for more than twice the percentage of caenid mayflies. *Caenis latipennis* was the dominant mayfly species, making up 68 percent of mayflies in the spring sample. Heptageniid mayflies were the second most abundant group which, as a family, made up 15 percent of the sample. Stoneflies were more abundant at East Fork Black River Station 8, Taum Sauk Creek, and Shut-In Creek than any of the remaining stations. Among these three sites, stoneflies were present in similar numbers, although they made up a higher percentage of the Shut-In Creek sample. Caddisfly diversity was highest in Taum Sauk Creek spring 2006 samples. A total of 14 caddisfly taxa were found at Taum Sauk Creek, whereas 10 were present at East Fork Black River Station 8, the next

highest. Among the remaining sites, caddisfly taxa richness was half or less than that of Taum Sauk Creek.

Table 25
 East Fork Black River Tributaries Macroinvertebrate Composition

↓Variable	Station→	Taum Sauk Creek		Shut-In Creek	
		Spring 2006	Fall 2006	Spring 2006	Fall 2006
Taxa Richness		100	89	78	65
Number EPT Taxa		35	25	26	17
% Ephemeroptera		24.7	33.3	27.4	27.0
% Plecoptera		13.1	0.1	14.7	0.8
% Trichoptera		7.4	13.6	8.7	4.5
MSCI Score		20	16	16	12
% Dominant Families					
Chironomidae		38.1	26.2	25.2	9.5
Caenidae		17.4	22.4	--	--
Empididae		6.2	--	--	--
Leuctridae		6.0	--	--	--
Heptageniidae		4.1	5.9	7.8	20.1
Ephemerellidae		--	--	11.2	--
Simuliidae		--	--	8.2	--
Perlodidae		--	--	6.8	--
Helicopsychidae		--	5.9	--	--
Arachnoidea		--	5.4	--	--
Psephenidae		--	--	--	14.3
Asellidae		--	--	--	12.1
Hyalellidae		--	--	--	12.0

Spring 2006 Taxa Richness at Shut-In Creek was comparable to some of the lower values among sites for this season. Compared to Taum Sauk Creek, which had one of the most diverse communities in this study, two taxa groups were lacking most prominently in diversity at Shut-In Creek—chironomids and caddisflies. Despite a relative lack of diversity among these two taxa groups, they were still able to contribute sufficient numbers of individuals such that their percentages were similar to the remaining sites, with chironomids being the dominant group. No single species accounted for a large percentage of the mayfly taxa at Shut-In Creek. The most numerous species, *Eurylophella bicolor*, accounted for only 38 percent of mayflies, whereas several other genera contributed lower but comparable percentages. Stoneflies were fairly abundant in samples, but were represented by only four taxa at Shut-In Creek. Two genera, *Amphinemura* and *Isoperla*, were present in nearly equal numbers and accounted for 88 percent of stoneflies at this site. Shut-In Creek had only half the caddisfly diversity of Taum Sauk Creek, but this level of diversity was equal to or better than most of the stations surveyed.

Compared to the spring sample season, Taxa Richness and EPT Taxa were lower in fall 2006 samples at the tributary sites. The MSCI scores also were four points lower in the fall season for both stations. Percentage of mayfly taxa increased in the fall 2006 Taum Sauk Creek sample such that mayflies accounted for one-third of the entire sample. As was the case with the fall samples from several other sites, mayflies in the genus *Caenis* (*C. latipennis* and *C. anceps*) were dominant, accounting for 67 percent of mayfly taxa at this site. Stoneflies were virtually absent from Taum Sauk Creek in the fall, with only two individuals found in samples. Although the fall 2006 caddisfly percentage was nearly twice as high as the spring sample, the fall sample had only eight taxa compared to 14 in spring. The two dominant caddisfly genera in the fall were *Helicopsyche* and *Polycentropus*, which were responsible for 79 percent of caddisflies.

Taxa Richness and the number of EPT Taxa were much lower in fall 2006 Shut-In Creek samples compared to spring samples. In addition, the Stream Condition Index for this site fell from 16 to 12 resulting in a change from fully to partially supporting. Mayflies made up a nearly equal percentage of the fall sample as spring, with the majority of mayflies being in the family Heptageniidae. Two taxa within this family, *Stenonema femoratum* and *Stenacron*, accounted for 73 percent of mayflies. As was observed at Taum Sauk Creek, stoneflies also were much reduced in Shut-In Creek fall samples. Only eight individuals of a single genus (*Acroneturia*) were present in Shut-In Creek samples. Caddisflies were roughly half as abundant in the Shut-In Creek fall sample compared to the spring. The genus *Polycentropus* was the dominant caddisfly taxon in the fall and made up 91 percent of caddisflies. Crustaceans in the orders Amphipoda and Isopoda were also quite abundant in the Shut-In Creek fall sample, with these two groups making up over 24 percent of the overall sample.

5.3.3 Black River Sample Stations

Spring 2006 macroinvertebrate samples averaged 51 total taxa (range 49-52), with Taxa Richness at Stations 2 and 3 being identical (Table 26). The number of EPT Taxa averaged 24, ranging between 22 and 27. Station 1 had the highest number of EPT Taxa and also the highest percentage of mayflies making up the sample. Riffle beetles (Elmidae) were the dominant taxa group at the two upstream stations with mayflies in the family Ephemerellidae being dominant at Station 1. The percentage of mayflies making up the sample tended to decrease while progressing upstream. Conversely, the percentages of stoneflies and caddisflies tended to increase in upstream stations. One mayfly species, *Ephemerella invaria*, accounted for 52 percent of mayflies with the family Heptageniidae making up nearly 23 percent of mayflies at Station 1. These two taxa groups also were the most abundant mayflies at the upstream stations, but Ephemerellidae abundance tended to decrease while progressing upstream. Although the number of stonefly taxa were comparable among sites, the Black River had very few stonefly individuals compared to the East Fork Black River control station and the two tributary stations. The lowest number of caddisfly taxa occurred at Station 2, with the number of taxa present at Stations 1 and 3 being equal. *Cheumatopsyche* was the most

numerous caddisfly genus at Stations 1 and 2, whereas the dominant genus *Helicopsyche* was more than twice as abundant as *Cheumatopsyche* at Station 3.

Table 26
 Spring 2006 Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3
Taxa Richness		49	52	52
Number EPT Taxa		27	22	24
% Ephemeroptera		72.1	48.4	21.8
% Plecoptera		1.6	2.3	2.5
% Trichoptera		6.0	9.4	29.3
MSCI Score		16	14	16
% Dominant Families				
Ephemerellidae		39.3	23.2	10.7
Heptageniidae		19.7	14.5	--
Elmidae		12.2	24.7	20.3
Isonychiidae		5.5	--	--
Chironomidae		3.1	10.4	13.6
Hydropsychidae		--	7.6	7.6
Helicopsychidae		--	--	16.9

Fall 2006 macroinvertebrate samples from the Black River averaged 44 total taxa (range 42-46) and 20 EPT Taxa (range 19-22) (Table 27). Riffle beetles were the dominant taxon at each station with two taxa, *Stenelmis* and *Optioservus sandersoni*, accounting for nearly all riffle beetles in fall samples. Although heptageniid mayflies were second in abundance at each Black River site, no species within this family was consistently dominant; rather, three separate species within the genus *Stenonema* tended to be dominant. Mayflies made up a higher percentage of the sample at Station 3, with nearly half the individuals in this sample being from this group. Stonefly taxa richness was lower in fall samples than spring samples, with no more than three taxa being present among Black River sites. The majority of stonefly individuals were of the genus *Neoperla*, although no more than five specimens of this genus were found in fall samples. The percentage of caddisflies were nearly equal at Stations 1 and 2, but were slightly higher at Station 3. At the two downstream stations two genera, *Chimarra* and *Cheumatopsyche*, were dominant, making up 94 percent of caddisfly taxa at Station 1 and 80 percent at Station 2. At Station 3 *Cheumatopsyche* and *Helicopsyche* were dominant and accounted for 77 percent of caddisfly taxa.

Table 27
 Fall 2006 Black River Macroinvertebrate Composition

↓Variable	Station→	1	2	3
Taxa Richness		43	42	46
Number EPT Taxa		20	19	22
% Ephemeroptera		35.2	38.6	49.8
% Plecoptera		0.6	0.7	1.5
% Trichoptera		8.8	9.1	12.2
MSCI Score		18	16	20
% Dominant Families				
Elmidae		43.4	33.6	21.0
Heptageniidae		12.9	15.3	13.4
Chironomidae		7.8	10.9	10.3
Baetidae		6.9	6.5	--
Philopotamidae		5.6	--	--
Isonychiidae		--	9.7	15.1
Helicopsychidae		--	--	7.4

6.0 Discussion

Most water quality parameters varied little among stations within seasons. Predictably, there were some considerable differences when comparing water quality parameters collected prior to the Upper Reservoir failure with those collected after the breach. Parameters that appeared to be most affected by the release include increased turbidity, generally higher total nitrogen concentrations, and somewhat higher nitrite+nitrate as nitrogen concentrations in spring 2006. The cause for the increased turbidity depended on the station for which this parameter was collected. For stations located downstream of the Lower Reservoir, turbidity was highly dependent on construction activities within and upstream of the reservoir and also whether there was sufficient flow to mobilize sediments that were deposited throughout the reach between the Lower Reservoir and the Black River. The highest turbidity readings after the breach were observed at Station 3, which was immediately below the dam. This station has the heaviest deposits of fine sediments of any of the downstream stations with the most potentially available for mobilization. The increased concentrations of nutrients observed after the release was slight, but consistent among stations. Given that the reservoir failure resulted in the removal of nearly all vegetation within the floodplain of JSISP, any nutrients within the watershed could enter the river since so few plants were available for nutrient uptake or to slow surface water. Flow was extremely reduced during the fall 2006 sample season due to a long-term statewide drought that occurred during the summer of 2006. An empty Upper Taum Sauk Reservoir also may have contributed to lower flows in fall 2006. Historically, since the completion of the Upper Reservoir, water had leaked from this basin into the Taum Sauk Creek and East Fork Black River watersheds. Although the installation of a geotextile liner was completed within the Upper Reservoir in 2004,

the reservoir continued to supplement the flow rates of these two watersheds, although to a diminished degree. These decreased flows also could have contributed to elevated nutrient concentrations as well as the increased conductivity readings observed in fall 2006 by providing less water for the dilution of these constituents.

We observed an exceptionally low dissolved oxygen reading at Station 6 (within the West Channel) during the fall 2006 season. Flow at this station was a fraction of what was present at the remaining sites due to the diversion of the East Fork Black River into the East Channel. Flow within the West Channel (Station 6) consisted of subsurface flow that had percolated through the debris dam as well as some minimal contribution from groundwater seeping in from the western floodplain. In addition to low flows, we also observed a fluffy orange flocculent covering the substrate throughout the Station 6 survey reach, which we assume to be a ferric hydroxide compound precipitating out of solution as a result of soluble ferrous iron (Fe^{2+}) reacting with dissolved oxygen (similar conditions described in Barnden 2005). This oxidation-reduction reaction would remove oxygen from solution to form the flocculent, possibly explaining the reduced oxygen concentrations at this site. Iron flocculents also can result from iron-depositing bacteria which oxidize ferrous iron as an energy source (Barnden 2005). Iron-oxidizing bacteria are more likely to occur in areas where they can compete with oxygen for iron; these areas include iron-bearing rock seeps (Wetzel 1983), such as areas observed at the upstream terminus of Station 6. An abundance of these bacteria also could contribute to hypoxic conditions as they consume dissolved oxygen during the oxidation processes.

Several macroinvertebrate community features downstream of the Lower Reservoir appeared to change in response to effects brought about by the Upper Reservoir failure. Station 2 was anomalous in this regard, being the only station to achieve a fully supporting score for each sampling event and demonstrated no substantial changes in scores among habitat types following the reservoir breach. The stream condition index score for Station 3 consistently was lower than the other stations downstream of the Lower Reservoir, achieving a partially supporting score for each of the three sample seasons. Although MSCI scores at Station 3 were consistently low, there was variability in which habitat type influenced the overall score. In fall 2005 and spring 2006, the coarse substrate and rootmat habitats were responsible for the low score, whereas in fall 2006 nonflow and rootmat were the primary contributors.

Coarse substrate scores declined at each of the lower East Fork stations after the breach, with Station 1 exhibiting the most dramatic decrease. Although we did not observe sediment covering riffle substrates when conducting spring 2006 sampling, a sediment plume of highly turbid water emanated from the collection site when we agitated the substrate to dislodge macroinvertebrates for collection. This phenomenon indicated that fine sediments were present within the subsurface layers of the riffles and may have contributed to the reduced scores for this habitat type. Coarse substrate scores in fall 2006 were comparable to or better than scores prior to the breach. In addition, during sample collection in fall 2006, the sediment plumes described earlier were no longer

observed, indicating that subsurface sediments present in spring had been resuspended and mobilized downstream during high water events or via continuous turbulent flows common in riffles. Nonflow scores at Station 1 also were lower in spring 2006, but were unchanged at the two upstream sites. Given the heavy deposits of sediment in all pools downstream of the Lower Reservoir, it is surprising that the nonflow scores were not consistently lower after the breach. It is possible that macroinvertebrates inhabiting the depositional areas within the stream have evolved a certain tolerance to fine sediments and were relatively unaffected by the additional deposits. The character of the sediment has changed over time since the release, however, with the clays becoming less colloidal and more compacted. Additional surveys will determine whether the low fall 2006 nonflow score at Station 3 (the reach with the heaviest deposition) is due to natural variability or to the fact that the sediment is settling, thus becoming more dense and less suitable for macroinvertebrate inhabitation.

The macroinvertebrate community in the East Fork Black River upstream of the Lower Reservoir was affected by the Upper Reservoir breach in varying degrees, depending on whether the sample site was located in an area affected by scour or deposition. The site designated as Station 4 during the fall 2005 sample season was one of seven biological criteria reference sites for the Ozark/Current/Black EDU. In addition to 2005, this site had been sampled twice during previous fall sample seasons. Of the three sampling events, Taxa Richness, EPT Taxa, as well as the Stream Condition Index score were lowest in 2005. Although the summer of 2005 was unusually hot and dry, flow rates at the reference site seemed adequate to maintain each of the habitats we sampled. Among other reference sites in the EDU, several had individual metric and MSCI scores similar to the low scores observed at this site (as presented in Table 15) and may suggest that natural variability—due to flow, temperature, or some combination of factors—accounted for these scores. As a result of the reservoir breach, the reference reach (designated at this time as Station 6) was covered with several vertical feet of sand-sized sediment, which eliminated virtually the entire macroinvertebrate community, as documented during the spring 2006 season. Based on the extremely low numbers of individuals and the seemingly random composition of the macroinvertebrate community present in spring 2006 samples, it is likely that most or all of the macroinvertebrates collected at this site had drifted into this reach from upstream during the months between the breach and the sample collection season. Although more individuals were collected in fall 2006 and the MSCI score improved from non- to partially supporting, Station 6 remained a highly impacted site. Taxa Richness and EPT Taxa at Station 6 were a fraction of the remaining sites and mayflies were virtually absent. By the fall of 2006, this reach had been colonized by a macroinvertebrate community dominated by midge larvae (Chironomidae), with minor contributions by a few genera of dragonflies (Odonata) and caddisflies (Trichoptera) during the months after the breach. Station 4, located upstream of the AmerenUE bin wall, was the only station other than Station 6 not to achieve fully supporting status in spring 2006. Although this station had been subjected to the scouring flows resulting from the Upper Reservoir failure, Station 5 (just upstream of the shut-ins) experienced similar flows but scored fully supporting. It is

possible, however, that the shut-ins served as a bottleneck and temporarily slowed the floodwater as it flowed downstream, resulting in less intense velocities than would have been experienced downstream at Station 4, thus allowing a higher retention of the macroinvertebrate community at this site.

During the fall 2006 season, metric scores improved or stayed the same for all East Fork sites except Station 8, the upstream control, which dropped from a fully supporting ranking to partially supporting. A similar trend was observed with the two tributary stations—Shut-In Creek and Taum Sauk Creek—which were similar in size to the East Fork Station 8. These stations, located higher in the watershed, were smaller than the remaining downstream sites and appeared to be affected more by drought conditions during the months prior to the fall 2006 sample season. At each of these sites, there was very little surface flow in riffles and much of the rootmat habitat that had been sampled during the previous spring was no longer submerged. This diminished habitat availability likely resulted in these three stations exhibiting lower Taxa Richness in fall 2006. By comparison, each station upstream of the Lower Reservoir within the affected reach had much higher Taxa Richness values in fall compared to spring 2006. It appears that the quality of the macroinvertebrate community at East Fork Station 8 and the two tributary stations are more affected by precipitation than the remaining sites, which are able to draw from a larger watershed.

Three Black River stations were sampled to determine whether the sediment contributed by the East Fork Black River was affecting the biota downstream. The upstream control and downstream stations achieved fully supporting MSCI scores during the spring 2006 season, with Station 2 ranking partially supporting. This reduced score was due to a slightly lower number of EPT Taxa. All three stations achieved fully supporting status during the fall 2006 sample season, but Station 2 once again had the lowest MSCI score (due to the lack of a single taxon, which reduced the Taxa Richness score). The East Fork Black River did affect Black River turbidity in spring 2006; stations downstream of the East Fork confluence had turbidity readings roughly six times that of the Black River station upstream of the confluence. Despite this increased turbidity, there were none of the obvious signs of sedimentation in the Black River riffles that were observed in the East Fork downstream of the Lower Reservoir. During the fall 2006 season, there was no difference in turbidity among Black River stations.

7.0 Summary

1. Flow rates among East Fork Black River sites were lowest in fall 2006, likely due to a combination of continuing drought conditions and lack of supplemental flow leaking from Upper Taum Sauk Reservoir.
2. Conductivity readings during this study were highest in fall 2006 and lowest in spring 2006.

3. Turbidity was consistently higher among affected East Fork stations after the Upper Reservoir failure, with the highest turbidity readings occurring at Station 3 (the site nearest the Lower Reservoir).
4. East Fork Black River Station 6 was the only site to have dissolved oxygen concentrations below the 5 mg/L minimum concentration listed in the Missouri Water Quality Standards.
5. Total nitrogen and $\text{NO}_2+\text{NO}_3\text{-N}$ were slightly but consistently higher in fall 2006 than fall 2005.
6. In fall 2005, macroinvertebrate metrics among sites downstream of the Lower Reservoir tended to decrease from downstream to upstream, with Station 3 achieving only a partially supporting score.
7. Of East Fork sites downstream of the Lower Reservoir, only Station 2 achieved MSCI fully supporting status in spring 2006.
8. When assessing Stream Condition Index values of habitats individually for stations located downstream of the Lower Reservoir, the coarse substrate macroinvertebrate community demonstrated the largest decline from fall 2005 to spring 2006. Scores for coarse substrate returned to near pre-event values in fall 2006.
9. During the fall 2006 season, biological metrics among most East Fork habitats downstream of the Lower Reservoir had improved to approach or surpass pre-event scores. The exception occurred in the nonflow habitat at Station 3, which was much lower in fall 2006 than either of the previous two sample seasons.
10. Macroinvertebrate density, as estimated from the level of laboratory effort spent reaching the target number of organisms, appeared to be lower at Station 3 in fall 2006 compared to fall 2005. The level of effort for the remaining East Fork stations downstream of the Lower Reservoir was the same or lower for fall 2006 samples.
11. Macroinvertebrate community composition was similar among fall samples at Stations 1 and 2. Exceptions were that the family Chironomidae was represented by more taxa and, in some habitats, more individuals.
12. When comparing the macroinvertebrate community of fall 2006 with that of pre-event fall 2005, more differences were observed at Station 3 than the remaining stations located downstream of the Lower Reservoir. These post-event differences include: 1) more diversity and abundance within the family Chironomidae; 2) increased mayfly taxa richness in coarse substrate habitat, with a decrease in the remaining habitats; 3) a dramatic decline of mayfly abundance in rootmat habitat; 4) a decline of mayfly taxa richness and abundance in nonflow habitat; 5) a decreased number of caddisfly

individuals in coarse substrate habitat, with an unchanged caddisfly taxa richness; 6) a decrease in the number of caddisfly taxa and abundance in rootmat habitat.

13. Biological metric scores at the East Fork Black River biological criteria reference site were lower in fall 2005 than either of the two previous fall samples.

14. Among East Fork Black River sites upstream of the Lower Reservoir, Stations 4 and 6 had MSCI scores that were not fully supporting in spring 2006. Stations 5, 7, and 8 had MSCI scores that were fully supporting.

15. Station 6, the former biological criteria reference site, achieved the lowest possible MSCI score in spring 2006, but improved to partially supporting status in fall 2006.

16. Fall 2006 East Fork Black River MSCI scores were similar to or higher than spring 2006 scores among stations within the affected reach. Scores for East Fork Station 8 as well as the two tributary stations—Shut-In Creek and Taum Sauk Creek—were lower in fall 2006, likely due to drought conditions.

17. Among mainstem Black River stations, Station 2 had a lower single habitat MSCI score than the remaining two during both spring 2006 and fall 2006. Only Station 2 scored partially supporting in spring 2006, with the remaining stations approximating fully supporting status. Supportability rankings should be viewed as approximate because status was based on a single habitat method.

18. Each Black River station had single habitat scores that approximated fully supporting status in the fall 2006 sample season. Supportability rankings should be viewed as approximate because status was based on a single habitat method.

8.0 Recommendations

1. Continue monitoring the East Fork Black River upstream of the Lower Taum Sauk Reservoir. The East Fork Black River rehabilitation project within JSISP is currently underway and the new channel will likely be the sole conveyance by the summer of 2007. At least one biological monitoring station should be established within this constructed channel to document macroinvertebrate colonization and to compare the future macroinvertebrate community within this zone with the community that existed in the reference reach prior to the Upper Reservoir failure.

2. Continue monitoring the East Fork Black River downstream of the Lower Reservoir to determine whether sediment abatement activities (plans for which have yet to be finalized) lead to changes in the macroinvertebrate community. Continued monitoring also will determine whether the lower metric score for nonflow habitat at Station 3 was

linked to settling and increasing density of sediment in this reach or if the score was attributable to natural variation.

3. Until plans to address sediment in the lower East Fork are finalized and the implementation complete, sampling in the mainstem Black River should continue. Should some event (natural or human-induced) result in the mobilization of sediment through the East Fork system, potential effects on Black River macroinvertebrates should be documented.

4. Discontinue sampling at East Fork Station 8 as well as Taum Sauk Creek and Shut-In Creek. We have established that these sites are highly variable and are more weather dependent than the remaining study sites and do not provide a great deal of information directly comparable to the remaining stations.

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Biological Assessment Report
Macroinvertebrate Community Assessment of the East Fork Black River and Black River Following the
AmerenUE Upper Taum Sauk Reservoir Failure, Reynolds County, Missouri
April 2007
Page 34

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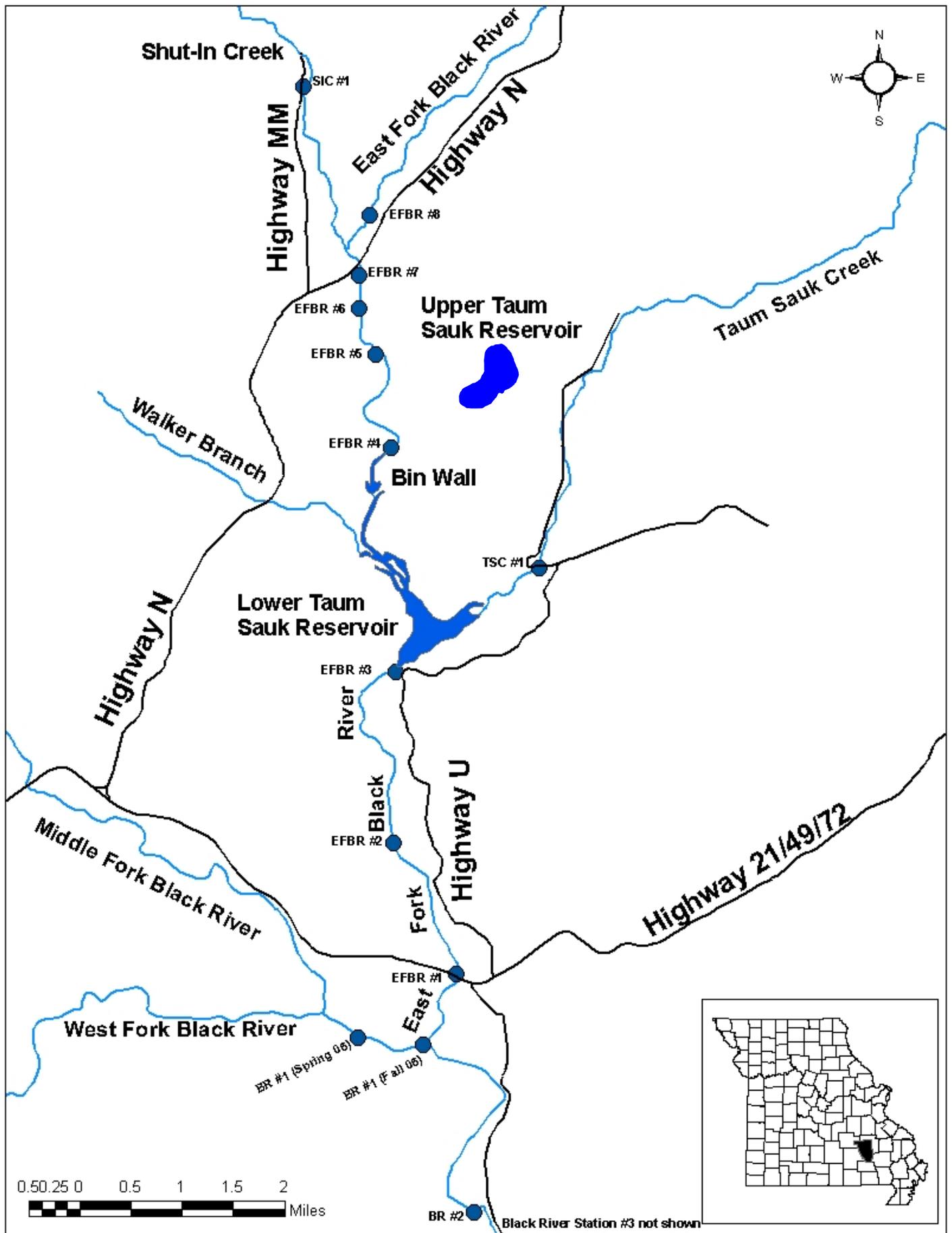
Appendix A

Maps

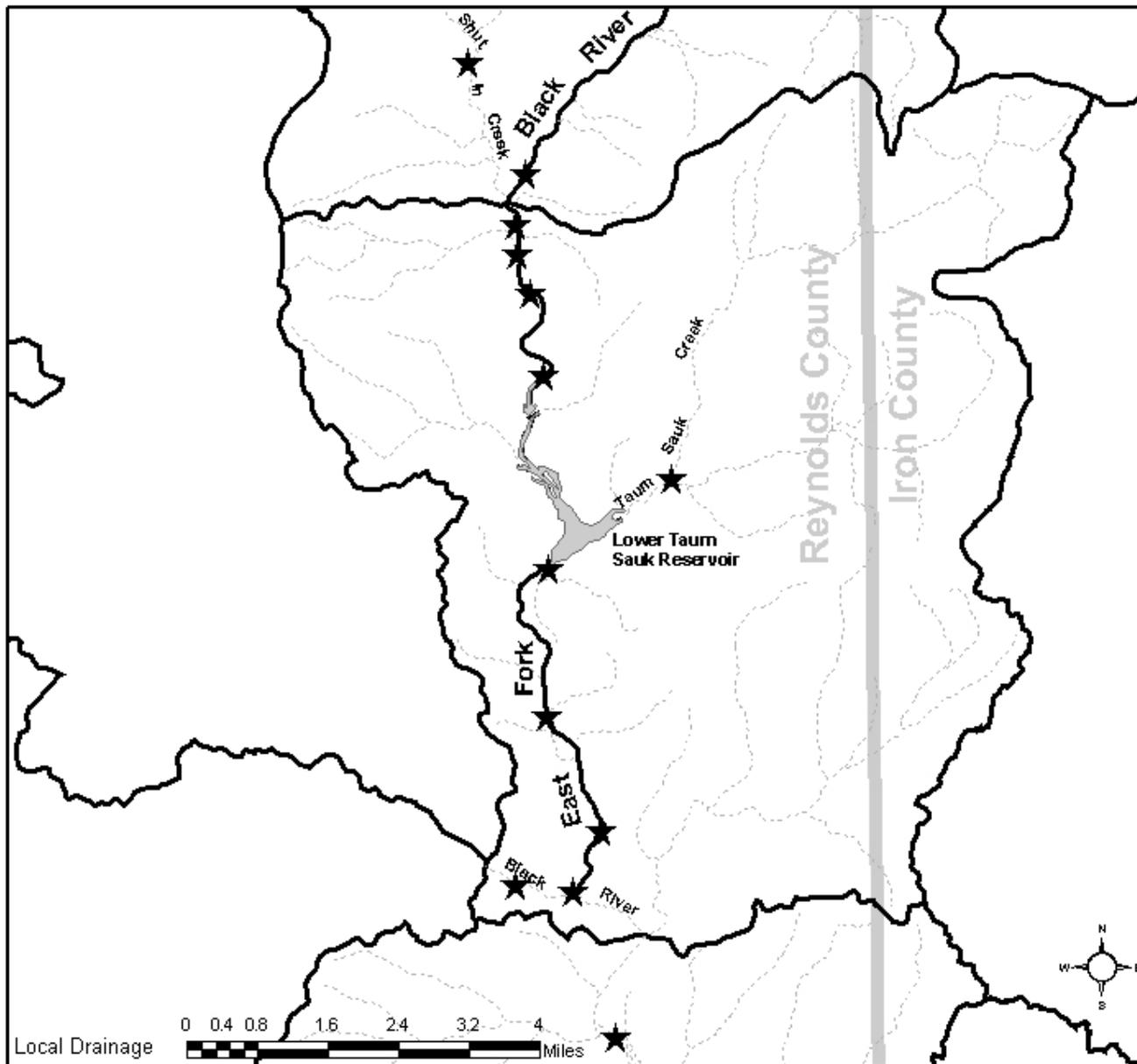
Sample Stations Located on the East Fork Black River, Its Tributaries, and the Black River
Ozark/Current/Black EDU

&

East Fork Black River Study Area
Ozark/Current/Black EDU



East Fork Black River Study Site

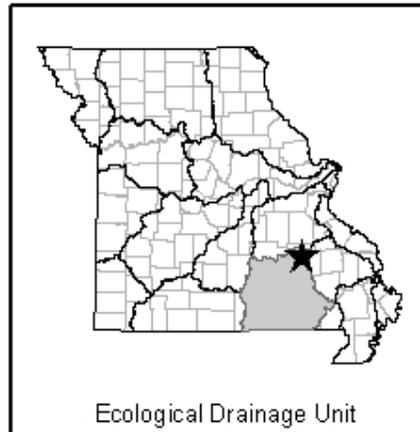


- ★ Sampling Locations
- ▭ County Boundary
- ▭ Local Drainage
- Stream/River

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.



Appendix B

Macroinvertebrate Taxa Lists

Black River

East Fork Black River

Shut-In Creek

Taum Sauk Creek

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0503079], Station #1, Sample Date: 9/23/2005 9:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	4	9
AMPHIPODA			
Hyalella azteca			20
COLEOPTERA			
Ancyronyx variegatus			1
Dubiraphia		6	11
Ectopria nervosa	1		
Macronychus glabratus			12
Microcylloepus pusillus	12		17
Optioservus sandersoni	24	1	
Psephenus herricki	70	1	
Stenelmis	149	29	12
DECAPODA			
Orconectes hylas	-99	-99	-99
DIPTERA			
Ablabesmyia	1	8	5
Anopheles			1
Ceratopogoninae		6	
Corynoneura		2	
Cricotopus/Orthocladius	5	1	5
Cryptochironomus		1	
Dixella			3
Empididae	1		
Epoicocladius		2	
Hexatoma		1	
Labrundinia			4
Nanocladius	1		
Parakiefferiella			1
Paratanytarsus		1	17
Polypedilum convictum grp	27		1
Polypedilum illinoense grp	3		2
Procladius		3	
Rheotanytarsus	13		6
Simulium	4		
Stempellinella		4	1
Stenochironomus	1		1
Tabanus	1		
Tanytarsus	2	19	12
Thienemanniella	1		
Thienemannimyia grp.	2		2
Tribelos		4	3

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0503079], Station #1, Sample Date: 9/23/2005 9:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Xenochironomus			1
EPHEMEROPTERA			
Baetis	9		
Baetiscidae	1		
Caenis anceps	28	53	1
Caenis latipennis	1	4	191
Centroptilum			2
Choroterpes	5	6	
Ephemera simulans		-99	
Heptageniidae	36	9	2
Hexagenia atrocaudata		2	
Isonychia bicolor	173		1
Leptohyphidae		1	3
Leucrocuta	4		
Procloeon		7	7
Stenacron	2	4	
Stenonema bednariki	2		
Stenonema femoratum	19	39	5
Stenonema mediopunctatum	80		
Stenonema pulchellum	11		
Tricorythodes	12		2
HEMIPTERA			
Rhagovelia	1		
ISOPODA			
Lirceus	8		2
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Ancylidae	5	1	
Helisoma			1
Menetus	5		4
LUMBRICINA			
Lumbricina	3	10	
MEGALOPTERA			
Corydalus	4		
Sialis		1	
NEUROPTERA			
Climacia			1
ODONATA			
Argia	19	8	6
Calopteryx			1
Enallagma			10
Gomphidae	1		1
Hagenius brevistylus		1	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503079], Station #1, Sample Date: 9/23/2005 9:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Libellulidae		1	
Stylogomphus albistylus	1		
PLECOPTERA			
Neoperla	5		
Perlesta	2		
TRICHOPTERA			
Cheumatopsyche	15		
Chimarra	62		
Helicopsyche	1		
Nectopsyche			1
Oxyethira			2
Triaenodes			2
TRICLADIDA			
Planariidae	5		
TUBIFICIDA			
Tubificidae	5		1
VENEROIDEA			
Corbicula	5	13	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0503080], Station #2, Sample Date: 9/23/2005 10:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	7	9	52
AMPHIPODA			
Hyaella azteca		3	5
COLEOPTERA			
Dubiraphia		2	14
Ectopria nervosa		5	1
Helichus lithophilus			2
Microcyloepus pusillus	4		3
Optioservus sandersoni	16		
Psephenus herricki	28	9	
Stenelmis	63	65	10
DECAPODA			
Orconectes hylas	-99		
DIPTERA			
Ablabesmyia		11	1
Ceratopogoninae		4	1
Chironomus		1	
Cladopelma		3	
Cladotanytarsus		7	
Corynoneura	1		1
Cricotopus/Orthocladius	12		4
Cryptochironomus		1	
Diptera	1		1
Dixella			3
Labrundinia			3
Nanocladius	1	1	
Pagastiella		1	
Paratanytarsus		3	3
Polypedilum	1		
Polypedilum convictum grp	15		
Polypedilum illinoense grp			2
Rheotanytarsus	77		
Simulium	20		
Stelechomyia			1
Stempellinella		11	1
Stenochironomus			2
Stictochironomus		15	
Tabanus	2		
Tanytarsus	10	14	4
Thienemanniella	2		
Thienemannimyia grp.	5		
Tribelos		7	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0503080], Station #2, Sample Date: 9/23/2005 10:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
EPHEMEROPTERA			
Acentrella	5		
Baetis	10		
Caenis anceps	2	1	
Caenis latipennis	1	83	127
Centroptilum			3
Choroterpes		2	
Ephemerellidae	1		
Heptageniidae	26		1
Isonychia bicolor	48		
Leptophlebiidae		1	
Leucrocuta	3		
Procloeon		7	1
Stenacron	7		
Stenonema femoratum	3	46	2
Stenonema mediopunctatum	52		
Stenonema pulchellum	48		
Tricorythodes	33		
HEMIPTERA			
Trepobates			2
LEPIDOPTERA			
Petrophila	2		
LIMNOPHILA			
Ferrissia			1
Helisoma			3
Laevapex	5		
Menetus		2	13
LUMBRICINA			
Lumbricina	4	4	
LUMBRICULIDA			
Lumbriculidae	8		
ODONATA			
Argia	7	3	16
Didymops		-99	
Enallagma			8
Gomphidae	12	1	
Macromia		1	5
PLECOPTERA			
Neoperla	4		
Perlesta	8		
TRICHOPTERA			
Ceratopsyche morosa grp	5		
Cernotina	3	2	
Cheumatopsyche	45		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503080], Station #2, Sample Date: 9/23/2005 10:45:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Chimarra	45		
Helicopsyche	6		2
Mystacides		3	
Oecetis		2	
Trienodes		1	2
TRICLADIDA			
Planariidae	7		
TUBIFICIDA			
Branchiura sowerbyi		4	
Tubificidae		3	1
VENEROIDEA			
Corbicula	1		
Sphaeriidae		6	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503081], Station #3, Sample Date: 9/23/2005 11:45:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	3	19	5
AMPHIPODA			
Hyaella azteca		2	2
COLEOPTERA			
Microcylloepus pusillus	11		
Optioservus sandersoni	2		
Psephenus herricki	7		
Stenelmis	100	45	1
DECAPODA			
Orconectes virilis			1
DIPTERA			
Ablabesmyia		14	6
Ceratopogoninae		2	
Cricotopus/Orthocladius	6	1	8
Dicrotendipes	1	5	15
Glyptotendipes			1
Hemerodromia	3		
Labrundinia		2	5
Microtendipes		1	
Nanocladius	2		
Nilothauma			2
Paratanytarsus		12	34
Phaenopsectra			2
Polypedilum	3		
Polypedilum convictum grp	58		1
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp		2	
Procladius		4	
Pseudochironomus			1
Rheotanytarsus	3	1	
Simulium	2		
Stictochironomus		2	
Tanytarsus	1	62	72
Thienemannimyia grp.	3		
Tribelos		7	
Zavreliella		3	
EPHEMEROPTERA			
Acentrella	1		
Apobaetis		5	
Baetis	13		
Caenis anceps	25		
Caenis latipennis		66	105

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503081], Station #3, Sample Date: 9/23/2005 11:45:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Choroterpes	33	35	
Isonychia bicolor	20		
Procloeon			4
Stenacron	12	3	
Stenonema femoratum	12	49	2
Stenonema mediopunctatum	4		
Tricorythodes	3	1	2
ISOPODA			
Caecidotea	29		
LIMNOPHILA			
Ancylidae			1
Menetus	1	1	3
LUMBRICINA			
Lumbricina		2	
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Corydalus	-99		
ODONATA			
Argia	7	5	8
Enallagma			17
Hagenius brevistylus			-99
Macromia			-99
PLECOPTERA			
Neoperla	16		
TRICHOPTERA			
Cheumatopsyche	71		
Chimarra	117		
Oecetis		2	1
Orthotrichia			5
Oxyethira			3
Polycentropodidae		1	1
Triaenodes		2	19
TRICLADIDA			
Planariidae	8		
TUBIFICIDA			
Branchiura sowerbyi		4	
Tubificidae	1	2	3
VENEROIDEA			
Sphaeriidae	10	15	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503082], Station #4, Sample Date: 9/23/2005 2:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	16	4	38
AMPHIPODA			
Hyalella azteca			77
COLEOPTERA			
Dubiraphia		4	9
Ectopria nervosa	1		
Hydroporus			1
Macronychus glabratus			2
Optioservus sandersoni	28		
Psephenus herricki	13	1	1
Scirtidae			1
Stenelmis	13	4	1
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia		13	9
Ceratopogoninae		5	12
Cladotanytarsus	1		1
Clinotanypus			2
Cricotopus/Orthocladius	22		3
Cryptochironomus		3	
Dicrotendipes			1
Forcipomyiinae			1
Nanocladius	1		
Parakiefferiella		2	
Paratanytarsus			5
Polypedilum convictum grp	8		
Polypedilum fallax grp			1
Polypedilum illinoense grp			7
Procladius		1	1
Pseudochironomus		4	
Rheotanytarsus	18		9
Simulium	11		
Stempellinella		8	
Stenochironomus	1	1	1
Tabanus	2		
Tanytarsus	9	57	5
Thienemannimyia grp.	4		1
Tribelos	1	21	2
Tvetenia	1		
undescribed Empididae		1	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503082], Station #4, Sample Date: 9/23/2005 2:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Acentrella	8		
Baetis	5		
Caenis anceps	18		3
Caenis latipennis	29	108	20
Centroptilum			1
Eurylophella			1
Heptageniidae	13	1	1
Hexagenia limbata		3	
Isonychia bicolor	127		
Leptophlebiidae			2
Leucrocuta	1		
Procloeon	1	1	2
Stenacron	5		
Stenonema femoratum	5		4
Stenonema mediopunctatum	66		
Stenonema pulchellum	66		
Tricorythodes	2		
ISOPODA			
Lirceus			1
LIMNOPHILA			
Ancylidae			1
Helisoma	-99		-99
Pseudosuccinea			3
LUMBRICINA			
Lumbricina	3	3	
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	9		11
Calopteryx			2
Enallagma			15
Gomphidae		5	1
Hagenius brevistylus		1	
Macromia			2
Progomphus obscurus			-99
Stylogomphus albistylus	12		
PLECOPTERA			
Perlesta	-99		
Zealeuctra	3		
TRICHOPTERA			
Ceratopsyche	4		
Cheumatopsyche	65		1

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0503082], Station #4, Sample Date: 9/23/2005 2:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Helicopsyche	44		2
Oecetis	4	2	1
Triaenodes	1		32
TRICLADIDA			
Planariidae	1	1	4
TUBIFICIDA			
Limnodrilus hoffmeisteri		1	
Tubificidae		5	1
VENEROIDEA			
Sphaeriidae		2	3

Aquid Invertebrate Database Bench Sheet Report**Black R [0602670], Station #1, Sample Date: 3/21/2006 3:00:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
"HYDRACARINA"	
Acarina	9
AMPHIPODA	
Stygobromus	1
COLEOPTERA	
Lutrochus	1
Optioservus sandersoni	20
Stenelmis	62
DIPTERA	
Antocha	1
Cardiocladius	6
Clinocera	8
Cricotopus/Orthocladius	5
Cryptochironomus	1
Dasyheleinae	1
Microtendipes	4
Parametriocnemus	1
Polypedilum convictum grp	1
Tanytarsus	1
Thienemannimyia grp.	2
EPHEMEROPTERA	
Acerpenna	1
Anthopotamus	18
Caenis anceps	21
Caenis latipennis	11
Ephemerella invaria	257
Ephemerella needhami	3
Eurylophella bicolor	3
Heptageniidae	23
Isonychia bicolor	37
Rhithrogena	59
Stenacron	9
Stenonema bednariki	10
Stenonema femoratum	1
Stenonema mediopunctatum	23
Stenonema pulchellum	7
ISOPODA	
Caecidotea (Blind & Unpigmented)	1
LUMBRICINA	
Lumbricina	5
LUMBRICULIDA	
Lumbriculidae	2

Aquid Invertebrate Database Bench Sheet Report**Black R [0602670], Station #1, Sample Date: 3/21/2006 3:00:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
MEGALOPTERA	
Corydalus	-99
PLECOPTERA	
Neoperla	1
Perlesta	8
Perlinella drymo	1
Pteronarcys pictetii	1
TRICHOPTERA	
Ceratopsyche morosa grp	3
Cheumatopsyche	24
Chimarra	4
Nectopsyche	1
Neureclipsis	3
Oecetis	1
Oxyethira	3
Psychomyia	1
TRICLADIDA	
Planariidae	3
TUBIFICIDA	
Tubificidae	1

Aquid Invertebrate Database Bench Sheet Report**Black R [0602672], Station #2, Sample Date: 3/20/2006 1:45:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
"HYDRACARINA"	
Acarina	8
COLEOPTERA	
Optioservus sandersoni	76
Stenelmis	74
DIPTERA	
Ceratopogoninae	1
Cricotopus/Orthocladus	12
Eukiefferiella brevicar grp	6
Hemerodromia	3
Hexatoma	4
Labrundinia	2
Microtendipes	7
Nilotanypus	1
Parametrioconemus	9
Polypedilum convictum grp	2
Polypedilum illinoense grp	1
Potthastia	3
Prosimulium	1
Rheotanytarsus	5
Simulium	5
Stempellinella	1
Sympotthastia	2
Tabanus	1
Tanytarsus	5
Thienemannimyia grp.	7
EPHEMEROPTERA	
Anthopotamus	7
Caenis anceps	4
Caenis latipennis	14
Ephemerella invaria	130
Ephemerella needhami	8
Eurylophella bicolor	3
Heptageniidae	16
Isonychia bicolor	40
Rhithrogena	5
Stenacron	3
Stenonema bednariki	23
Stenonema mediopunctatum	20
Stenonema pulchellum	21
ISOPODA	
Caecidotea (Blind & Unpigmented)	1

Aquid Invertebrate Database Bench Sheet Report**Black R [0602672], Station #2, Sample Date: 3/20/2006 1:45:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
LIMNOPHILA	
Ancyliidae	1
LUMBRICINA	
Lumbricina	-99
LUMBRICULIDA	
Lumbriculidae	1
MEGALOPTERA	
Corydalus	-99
ODONATA	
Argia	1
PLECOPTERA	
Amphinemura	2
Leuctridae	2
Neoperla	2
Perlesta	8
TRICHOPTERA	
Ceratopsyche morosa grp	12
Cheumatopsyche	34
Chimarra	1
Helicopsyche	6
Lepidostoma	4
TRICLADIDA	
Planariidae	3

Aquid Invertebrate Database Bench Sheet Report**Black R [0602671], Station #3, Sample Date: 3/20/2006 3:50:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
"HYDRACARINA"	
Acarina	48
COLEOPTERA	
Optioservus sandersoni	94
Psephenus herricki	3
Stenelmis	47
DIPTERA	
Antocha	2
Ceratopogoninae	2
Clinocera	5
Cricotopus/Orthocladius	10
Cryptochironomus	2
Dasyheleinae	1
Eukiefferiella brevicar grp	2
Hemerodromia	4
Hexatoma	1
Microtendipes	3
Parametriocnemus	14
Polypedilum convictum grp	5
Potthastia	30
Protoplasa fitchii	-99
Simulium	7
Stempellinella	3
Tabanus	1
Tanytarsus	15
Thienemannimyia grp.	10
Tipula	1
EPHEMEROPTERA	
Anthopotamus	2
Caenis anceps	1
Caenis latipennis	18
Ephemerella invaria	65
Ephemerella needhami	1
Eurylophella bicolor	8
Heptageniidae	11
Isonychia bicolor	20
Rhithrogena	10
Stenacron	1
Stenonema bednariki	2
Stenonema mediopunctatum	9
Stenonema pulchellum	3
LUMBRICINA	
Lumbricina	2

Aquid Invertebrate Database Bench Sheet Report**Black R [0602671], Station #3, Sample Date: 3/20/2006 3:50:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
ODONATA	
Gomphidae	4
PLECOPTERA	
Leuctridae	5
Perlesta	9
Pteronarcys pictetii	3
TRICHOPTERA	
Ceratopsyche morosa grp	2
Cheumatopsyche	51
Chimarra	1
Helicopsyche	117
Hydroptila	1
Marilia	2
Neureclipsis	1
Setodes	28
TRICLADIDA	
Planariidae	4
TUBIFICIDA	
Tubificidae	2

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602654], Station #1, Sample Date: 4/12/2006 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8		
AMPHIPODA			
Hyaella azteca		1	1
Stygobromus		1	
BRANCHIOBDELLIDA			
Branchiobdellida	7		1
COLEOPTERA			
Dubiraphia		6	
Microcylloepus pusillus	66		
Optioservus sandersoni	4		
Psephenus herricki	1	1	
Stenelmis	95	84	
DECAPODA			
Orconectes			-99
Orconectes hylas	2	-99	2
DIPTERA			
Ablabesmyia		7	
Cladotanytarsus		1	
Cricotopus bicinctus	1	5	8
Cricotopus/Orthocladius	15	4	6
Dasyheleinae	1		
Dicrotendipes		3	
Djalmabatista		1	
Eukiefferiella brevicar grp	8		
Hemerodromia	9		3
Microtendipes		1	
Nanocladius		1	
Nilotanypus			2
Parakiefferiella		3	
Paratanytarsus		5	3
Polypedilum convictum grp	33	1	3
Polypedilum illinoense grp		1	
Procladius		3	
Rheocricotopus			1
Rheotanytarsus	111	4	100
Simulium	26		21
Stempellinella		2	2
Stenochironomus	1		
Tabanus	1		
Tanytarsus	7	15	18
Thienemanniella	2	1	1
Thienemannimyia grp.	1	3	3

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602654], Station #1, Sample Date: 4/12/2006 11:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tipula	2	1	-99
Tribelos		3	
EPHEMEROPTERA			
Acentrella	5		5
Acerpenna	2		
Caenis anceps	13	15	4
Caenis latipennis	15	11	62
Ephemerella invaria	10		1
Eurylophella bicolor	3		5
Heptageniidae	3		
Isonychia bicolor	14		5
Stenacron		4	
Stenonema femoratum	2	29	1
Stenonema mediopunctatum	3		
Stenonema pulchellum	7		5
Tricorythodes	5		1
ISOPODA			
Lirceus	13		52
LIMNOPHILA			
Helisoma	1		
LUMBRICINA			
Lumbricina	5	20	
LUMBRICULIDA			
Lumbriculidae	2	4	
ODONATA			
Boyeria			1
Enallagma			1
Gomphidae		2	
PLECOPTERA			
Amphinemura	11		6
Isoperla	1		15
Leuctridae		1	
Neoperla	2		
Perlinella drymo	-99		
TRICHOPTERA			
Agapetus	7		
Cheumatopsyche	2		
Chimarra	13		
Hydroptila			1
Oxyethira			4
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Enchytraeidae		1	1

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602654], Station #1, Sample Date: 4/12/2006 11:00:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Limnodrilus claparedianus		2	
Pelosclex ferox		56	
Tubificidae		36	3
Varichaetadrilus angustipenis		1	
VENEROIDEA			
Corbicula	2		

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602655], Station #2, Sample Date: 4/12/2006 11:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
N/A			
Gordiidae		1	
"HYDRACARINA"			
Acarina	5	15	1
AMPHIPODA			
Hyaella azteca			42
COLEOPTERA			
Coleoptera			1
Dubiraphia		5	3
Ectopria nervosa	1		
Optioservus sandersoni	2		
Psephenus herricki	5		
Scirtidae			1
Stenelmis	38	9	
DECAPODA			
Orconectes hylas	2		-99
DIPTERA			
Ablabesmyia		1	1
Ceratopogoninae	2	59	1
Cladotanytarsus		34	
Cricotopus bicinctus			3
Cricotopus/Orthocladius	21	2	4
Cryptochironomus		3	
Cryptotendipes		60	
Demicryptochironomus	1		
Dicrotendipes		1	
Diptera			1
Djalmabatista		5	1
Dolichopodidae		1	
Epoicocladius		1	
Eukiefferiella brevicar grp	5		
Hemerodromia	1		
Labrundinia			2
Micropsectra	3		
Nilotanypus	1		
Pagastiella		41	
Parakiefferiella		52	1
Paralauterborniella		3	
Parametrioctenus	2		
Paratanytarsus			2
Phaenopsectra		1	1
Polypedilum convictum grp	37	2	
Polypedilum halterale grp		8	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602655], Station #2, Sample Date: 4/12/2006 11:50:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polypedilum illinoense grp			14
Polypedilum scalaenum grp		1	
Potthastia	1		
Procladius		19	
Prosimulium	1		
Psectrocladius		1	
Pseudochironomus		1	
Rheotanytarsus	46	1	11
Simulium	237		3
Stempellina		7	
Stempellinella	4	4	1
Stictochironomus		5	
Tabanus	2		
Tanytarsus	12	48	5
Thienemannimyia grp.	3	1	3
Tipula	4		
Tipulidae			1
Tribelos		4	
undescribed Empididae	2		
EPHEMEROPTERA			
Acentrella	3		1
Acerpenna	3		
Baetisca lacustris	1		
Caenis anceps	37	1	
Caenis latipennis	6	5	31
Centroptilum			5
Ephemerella invaria	6		
Eurylophella enoensis			3
Heptageniidae	9		1
Hexagenia limbata		7	
Isonychia bicolor	10		
Leptophlebiidae	2	1	
Stenacron	4	1	
Stenonema femoratum	6		
Stenonema mediopunctatum	7		
Stenonema pulchellum	15		
Tricorythodes	3		1
ISOPODA			
Caecidotea (Blind & Unpigmented)	20		
LIMNOPHILA			
Ancylidae	1		
LUMBRICINA			
Lumbricina	4		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602655], Station #2, Sample Date: 4/12/2006 11:50:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
LUMBRICULIDA			
Lumbriculidae	1		
ODONATA			
Argia	1		
Enallagma			1
Gomphidae	3	2	
Hagenius brevistylus		1	
Hetaerina			1
Macromia			1
Stylogomphus albistylus		1	
PLECOPTERA			
Amphinemura	5		
Chloroperlidae	5		
Isoperla	1		
Leuctridae	21		
Neoperla	3		
Taeniopteryx	2		
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Cernotina		1	
Cheumatopsyche	3		
Chimarra	6		
Glossosomatidae	1		
Oecetis		1	
Polycentropodidae	5		
Rhyacophila	2		
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Branchiura sowerbyi		1	
Limnodrilus hoffmeisteri		2	
Tubificidae		10	
VENEROIDEA			
Corbicula	1	2	
Sphaeriidae		4	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602656], Station #3, Sample Date: 4/12/2006 1:25:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	3	1
AMPHIPODA			
Hyalella azteca			1
COLEOPTERA			
Dubiraphia		1	10
Hydroporus	1		
Psephenus herricki	8		
Scirtidae			1
Stenelmis	206	11	
DECAPODA			
Orconectes			1
Orconectes hylas	1		-99
DIPTERA			
Ablabesmyia			2
Ceratopogoninae		64	
Cladotanytarsus		38	
Clinocera	1		
Coelotanypus		1	
Corynoneura	1		
Cricotopus/Orthocladius	6	5	10
Cryptochironomus	2	2	
Cryptotendipes		8	
Dasyheleinae			1
Dicrotendipes		1	
Djalmabatista		5	
Epoicocladius		1	
Eukiefferiella	1		
Hemerodromia	5	2	
Micropsectra	2		
Nanocladius	2		
Pagastiella		18	
Parakiefferiella		12	
Parametrioconemus		1	
Polypedilum convictum grp	8	1	
Polypedilum halterale grp		17	
Polypedilum illinoense grp			6
Polypedilum scalaenum grp	3	3	1
Procladius		21	2
Pseudochironomus	1	1	
Rheotanytarsus	1		
Simulium	4	2	
Stempellina		5	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602656], Station #3, Sample Date: 4/12/2006 1:25:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stempellinella	1	6	
Stenochironomus	1		
Tanytarsus	4	12	2
Thienemannimyia grp.	4	2	3
Tribelos	1	1	
EPHEMEROPTERA			
Acerpenna	2		
Caenis anceps	134		
Caenis latipennis	10	19	14
Eurylophella bicolor	2	1	1
Eurylophella enoensis			3
Heptageniidae	2		
Hexagenia limbata		4	
Isonychia bicolor	4		
Leptophlebiidae	3		
Leucrocuta	1		
Stenacron	11		
Stenonema femoratum	22		1
Stenonema mediopunctatum	5		
Stenonema pulchellum	7		
HEMIPTERA			
Microvelia			2
ISOPODA			
Caecidotea (Blind & Unpigmented)	19		1
LUMBRICINA			
Lumbricina	1	-99	
LUMBRICULIDA			
Lumbriculidae	2		
MEGALOPTERA			
Corydalus	-99		
ODONATA			
Argia	1		
Enallagma			4
Gomphus		-99	
Hagenius brevistylus		1	
Macromia		1	2
PLECOPTERA			
Neoperla	25		
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Cheumatopsyche	18		
Chimarra	26		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602656], Station #3, Sample Date: 4/12/2006 1:25:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Hydroptila		1	
Neureclipsis			1
Oecetis	1	2	
Triaenodes			4
TRICLADIDA			
Planariidae	12		
TUBIFICIDA			
Branchiura sowerbyi	1	1	
Limnodrilus hoffmeisteri		2	
Tubificidae		14	3
VENEROIDEA			
Corbicula	2	-99	
Sphaeriidae	3	2	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602643], Station #4, Sample Date: 3/21/2006 9:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	1	1
AMPHIPODA			
Crangonyx		1	
Hyaella azteca			1
COLEOPTERA			
Dubiraphia	1	1	1
Helichus lithophilus			1
Sperchopsis		1	
Stenelmis	7	6	
DECAPODA			
Orconectes hylas		-99	1
DIPTERA			
Ablabesmyia	1	2	
Clinocera	4	4	1
Corynoneura		1	9
Cricotopus/Orthocladius	9	2	24
Diptera	1	2	2
Eukiefferiella	2		1
Forcipomyiinae			1
Hydrobaenus		1	
Nanocladius	1		
Orthocladius (Euorthocladius)	3		1
Parametricnemus	3		
Polypedilum convictum grp	29		6
Polypedilum fallax grp			1
Polypedilum scalaenum grp			1
Potthastia	20	3	12
Prosimulium	4		1
Rheocricotopus	8		13
Rheotanytarsus	3		5
Simulium	10		2
Stempellinella	2	2	
Sympotthastia	2		
Tanytarsus	16	2	5
Thienemanniella			3
Thienemannimyia grp.	9	7	7
Tribelos		1	
EPHEMEROPTERA			
Acentrella	2		
Ameletus			1
Caenis anceps		2	1
Caenis latipennis	2	8	10

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602643], Station #4, Sample Date: 3/21/2006 9:50:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Eurylophella bicolor	2	3	16
Eurylophella enoensis		1	1
Heptageniidae	2		
Isonychia bicolor	4		
Leptophlebiidae			2
Leucrocuta	1		
Stenonema femoratum	1		
Stenonema mediopunctatum	1		
Stenonema pulchellum		1	1
LUMBRICINA			
Lumbricina	1	3	
ODONATA			
Calopteryx			1
Gomphidae	2		
Stylogomphus albistylus		1	
PLECOPTERA			
Amphinemura	3		8
Isoperla	3		1
Prostoia			4
TRICHOPTERA			
Agapetus	3		
Cheumatopsyche	5		4
Chimarra	1		
Hydroptila	2		10
Polycentropus	2		
Pycnopsyche			1
TUBIFICIDA			
Branchiura sowerbyi		1	
Limnodrilus hoffmeisteri		1	
Tubificidae	1	8	2

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602644], Station #5, Sample Date: 3/21/2006 11:15:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina			1
AMPHIPODA			
Hyaella azteca			2
COLEOPTERA			
Optioservus sandersoni	1		
Psephenus herricki	2		
Stenelmis	6		1
DECAPODA			
Orconectes hylas			1
DIPTERA			
Antocha	1		
Clinocera	1		1
Corynoneura		3	11
Cricotopus/Orthocladius	1	3	4
Eukiefferiella	2		1
Nilotanypus			1
Orthocladius (Euorthocladius)			2
Parametricnemus	1		1
Polypedilum		1	
Polypedilum convictum grp	5	1	12
Potthastia	1	4	8
Prosimulium	6		9
Rheocricotopus		1	6
Rheotanytarsus	1		1
Simulium			8
Sympotthastia		1	
Tanytarsus		1	6
Thienemanniella			1
Thienemannimyia grp.	1		14
Tipula		1	
EPHEMEROPTERA			
Acentrella			1
Acerpenna			1
Caenis anceps	1		6
Caenis latipennis			2
Dipheter	1		
Eurylophella bicolor		1	5
Isonychia bicolor			2
Leptophlebia			2
Leptophlebiidae			1
Stenacron		-99	1
Stenonema femoratum	2		4

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602644], Station #5, Sample Date: 3/21/2006 11:15:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Stenonema mediopunctatum	1		1
Stenonema pulchellum			1
ISOPODA			
Lirceus			1
LUMBRICINA			
Lumbricina	3	1	
ODONATA			
Helocordulia			1
Stylogomphus albistylus			1
PLECOPTERA			
Amphinemura	3		11
Isoperla			1
Leuctridae	2		8
Neoperla	1		
TRICHOPTERA			
Cheumatopsyche	6		1
Chimarra	1		
Hydroptila		1	5
Ironoquia		1	
Rhyacophila			1
TUBIFICIDA			
Tubificidae		1	1

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602645], Station #6, Sample Date: 3/21/2006 12:30:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
AMPHIPODA			
Stygobromus		1	
DECAPODA			
Orconectes medius	1		
DIPTERA			
Corynoneura			1
Cricotopus/Orthocladius			1
Polypedilum convictum grp			9
Rheocricotopus			3
Sympotthastia		1	3
Thienemanniella	1		
Thienemannimyia grp.		1	
EPHEMEROPTERA			
Eurylophella bicolor			3
Leptophlebia		1	3
Leptophlebiidae			1
Stenonema femoratum			1
ISOPODA			
Lirceus			2
PLECOPTERA			
Amphinemura			6
Isoperla			1
Prostoia			1
TRICHOPTERA			
Hydroptila		1	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602646], Station #7, Sample Date: 3/21/2006 1:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
AMPHIPODA			
Gammarus	1		
Hyaella azteca		1	
COLEOPTERA			
Macronychus glabratus	1		
Optioservus sandersoni	1		
Psephenus herricki	1		
Stenelmis	1		
DECAPODA			
Orconectes hylas			-99
DIPTERA			
Clinocera	1	2	
Corynoneura	1		4
Cricotopus/Orthocladius	3	2	
Eukiefferiella	3		
Orthocladius (Euorthocladius)	2		
Parakiefferiella		1	
Parametriocnemus	3	3	4
Polypedilum convictum grp	31		13
Polypedilum halterale grp	1		
Polypedilum scalaenum grp			2
Potthastia	1	6	
Prosimulium	1		2
Psilometriocnemus	1		
Rheocricotopus	2	2	4
Silvius	1		
Simulium	1		1
Sympotthastia	3		
Tabanus	1		
Tanytarsus	6	1	3
Thienemannimyia grp.	7	4	9
EPHEMEROPTERA			
Acentrella	2		
Baetisca lacustris		2	
Caenis latipennis		1	
Eurylophella bicolor	5	5	8
Eurylophella enoensis			7
Heptageniidae	2		
Isonychia bicolor	12		1
Leptophlebia			2
Leptophlebiidae	1		
Stenonema femoratum	9	1	
Stenonema mediopunctatum	3		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602646], Station #7, Sample Date: 3/21/2006 1:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Stenonema pulchellum	7	1	
ISOPODA			
Lirceus	1	1	
MEGALOPTERA			
Corydalus	3		
ODONATA			
Gomphus		-99	
Stylogomphus albistylus	1		
PLECOPTERA			
Amphinemura			4
Isoperla	3		
Leuctridae			2
Perlesta			1
Zealeuctra	1		
TRICHOPTERA			
Cernotina	1		
Cheumatopsyche	5	1	
Chimarra	2		
Hydroptila			3
Psychomyia	1		
TUBIFICIDA			
Tubificidae	1	2	7

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602647], Station #8, Sample Date: 3/21/2006 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	1	1
AMPHIPODA			
Hyaella azteca			22
COLEOPTERA			
Dubiraphia		9	12
Ectopria nervosa		1	1
Helichus basalis			1
Optioservus sandersoni	3	1	
Paracymus			1
Psephenus herricki	4	2	1
Stenelmis	5	2	2
DECAPODA			
Orconectes hylas	1	-99	
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		16	
Ceratopogoninae	1	2	2
Clinocera	2	2	
Corynoneura		2	10
Cricotopus/Orthocladius	15	6	20
Cryptochironomus		2	
Dasyheleinae		1	
Dicrotendipes		1	
Diptera	1	1	
Eukiefferiella	13	1	2
Hemerodromia	3		
Hydrobaenus	1	7	
Labrundinia			4
Microtendipes			1
Nilotanypus		1	
Orthocladius (Euorthocladius)	1		
Parakiefferiella		15	
Parametrioconemus	3	4	1
Paratanytarsus	1	3	10
Phaenopsectra		6	
Polypedilum			1
Polypedilum convictum grp	82	1	1
Polypedilum illinoense grp			2
Polypedilum scalaenum grp		1	2
Potthastia	29	19	7
Procladius		4	
Prosimulium	45		

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602647], Station #8, Sample Date: 3/21/2006 2:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Pseudochironomus	1		
Rheocricotopus	3	1	7
Rheotanytarsus	11		4
Simulium	26		
Stempellinella	1	8	
Sympotthastia			2
Tabanus		1	
Tanytarsus	14	20	25
Thienemanniella			2
Thienemannimyia grp.	11	17	17
Tipula	1		
Tipulidae		1	
EPHEMEROPTERA			
Acentrella	15		
Baetisca lacustris		2	1
Caenis anceps	4	2	4
Caenis latipennis	9	17	34
Eurylophella bicolor	29	11	33
Eurylophella enoensis			1
Isonychia bicolor	57		
Procloeon		1	
Stenacron	1	6	
Stenonema femoratum	9	10	2
Stenonema mediopunctatum	25		
Stenonema pulchellum	49		4
LIMNOPHILA			
Ancylidae	1		
LUMBRICINA			
Lumbricina	1	1	1
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	1		1
Enallagma			2
Gomphidae	3	3	5
PLECOPTERA			
Acroneuria	2		
Amphinemura	33		2
Isoperla	4	1	
Leuctridae	28	57	9
Prostoia	1		
Strophopteryx	1		
TRICHOPTERA			
Agapetus	2		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602647], Station #8, Sample Date: 3/21/2006 2:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Cheumatopsyche	39		7
Chimarra	4		
Helicopsyche	3		1
Hydroptila	1		5
Oecetis	2		
Polycentropus	1		1
Psychomyia	1		
Pycnopsyche			1
Triaenodes			1
TRICLADIDA			
Planariidae	3	1	
TUBIFICIDA			
Enchytraeidae		1	
Limnodrilus hoffmeisteri		1	
Tubificidae		7	
VENEROIDEA			
Sphaeriidae	1	4	

Aquid Invertebrate Database Bench Sheet Report

Shut-In Ck [0602648], Station #1, Sample Date: 3/21/2006 2:55:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Gammarus		1	
Hyalella azteca			2
Stygobromus	2		
BRANCHIOBDELLIDA			
Branchiobdellida			3
COLEOPTERA			
Dubiraphia		3	
Ectopria nervosa			2
Helichus lithophilus	1		
Hydroporus		2	
Optioservus sandersoni	9	1	
Psephenus herricki	4	1	
DECAPODA			
Orconectes hylas			5
Orconectes punctimanus		1	
DIPTERA			
Ablabesmyia		2	
Ceratopogoninae		1	
Clinocera	18	2	
Corynoneura	1	3	1
Cricotopus/Orthocladius	4	2	6
Diptera	1		
Eukiefferiella	5		
Hemerodromia	1		
Microtendipes		1	
Orthocladius (Euorthocladius)	1		
Parakiefferiella		2	1
Parametrioctenus	1	3	
Paratanytarsus			2
Polypedilum convictum grp	94		1
Polypedilum illinoense grp	1		
Potthastia	3	2	1
Prosimulium	48		1
Pseudolimnophila		2	
Rheocricotopus	4		4
Rheotanytarsus			2
Simulium	22		
Stempellinella	5	5	3
Tanytarsus	22	3	2
Thienemanniella			3

Aquid Invertebrate Database Bench Sheet Report**Shut-In Ck [0602648], Station #1, Sample Date: 3/21/2006 2:55:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.	9	9	3
Tipula	2		
Zavrelimyia		4	1
EPHEMEROPTERA			
Acentrella	18		
Baetidae		1	
Caenis anceps		1	2
Caenis latipennis	7	5	9
Eurylophella bicolor	16	37	37
Eurylophella enoensis			6
Heptageniidae	19		1
Isonychia bicolor	25		
Leptophlebia		1	1
Leptophlebiidae	1	1	
Leucrocuta	3		
Stenacron	3		
Stenonema femoratum	3	3	
Stenonema pulchellum	34		
Stenonema vicarium	1		
ISOPODA			
Lirceus	39	7	3
LUMBRICINA			
Lumbricina	1	1	2
MEGALOPTERA			
Corydalus	1		
Nigronia serricornis	1	1	
ODONATA			
Argia	1		
Boyeria			1
Gomphidae	1		
Gomphus		1	
Helocordulia		1	
Stylogomphus albistylus		2	-99
PLECOPTERA			
Acroneuria	3		
Amphinemura	49	1	2
Isoperla	59		
Leuctridae	5	4	3
TRICHOPTERA			
Agapetus	10		
Cheumatopsyche	10	1	
Chimarra	9		
Helicopsyche	7		
Hydroptila		1	18

Aquid Invertebrate Database Bench Sheet Report**Shut-In Ck [0602648], Station #1, Sample Date: 3/21/2006 2:55:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Polycentropus	11		2
Pycnopsyche		2	4
TRICLADIDA			
Planariidae	1		
TUBIFICIDA			
Tubificidae	3	1	

Aquid Invertebrate Database Bench Sheet Report

Taum Sauk Ck [0602642], Station #1, Sample Date: 3/20/2006 4:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8		1
AMPHIPODA			
Hyaella azteca			1
COLEOPTERA			
Dubiraphia			2
Hydroporus		1	
Optioservus sandersoni	9		
Psephenus herricki		3	
Stenelmis	1		1
DECAPODA			
Orconectes hylas	-99	3	
Orconectes punctimanus			1
DIPTERA			
Ablabesmyia		9	1
Antocha	2	1	
Ceratopogoninae	6	10	
Cladotanytarsus	1	2	
Clinocera	49	9	1
Corynoneura	4	6	1
Cricotopus/Orthocladius	50		21
Cryptochironomus		1	
Dicrotendipes			7
Epoicocladius		1	
Eukiefferiella	8	1	2
Gonomyia		2	
Hemerodromia	6		2
Hexatoma	2		
Labrundinia			1
Larsia		1	
Lauterborniella	1		
Microtendipes		2	
Paracladopelma		1	
Paracricotopus			1
Parakiefferiella		1	
Parametrioctenemus	19	2	
Paratanytarsus		1	14
Paratendipes			1
Polypedilum convictum grp	32		7
Polypedilum scalaenum grp		1	
Potthastia	36	6	21
Procladius		4	
Prosimulium		1	1

Aquid Invertebrate Database Bench Sheet Report**Taum Sauk Ck [0602642], Station #1, Sample Date: 3/20/2006 4:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Rheocricotopus	2	2	15
Rheotanytarsus	3	1	16
Simulium	2		
Stempellina	1		
Stempellinella			1
Stenochironomus	2		
Stilocladius		1	
Sympothastia	10		9
Tabanus	2		
Tanytarsus	7	4	18
Thienemanniella		1	4
Thienemannimyia grp.	12	16	5
Tribelos		11	
Tvetenia	1		
Zavrelimyia		2	
EPHEMEROPTERA			
Acentrella	2		1
Acerpenna	1		1
Ameletus lineatus			1
Caenis anceps		4	2
Caenis latipennis	8	94	80
Centroptilum		1	7
Ephemera		1	
Eurylophella bicolor	1	8	3
Heptageniidae		2	1
Leptophlebiidae	6	1	
Leucrocuta		1	
Stenacron	7	4	
Stenonema femoratum	2	16	1
Stenonema pulchellum	6	1	2
Stenonema vicarium	2		
HEMIPTERA			
Belostoma			-99
ISOPODA			
Lirceus	1	1	
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Helisoma			-99
LUMBRICINA			
Lumbricina	17	4	
MEGALOPTERA			
Nigronia serricornis			-99
ODONATA			

Aquid Invertebrate Database Bench Sheet Report**Taum Sauk Ck [0602642], Station #1, Sample Date: 3/20/2006 4:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Calopteryx			2
PLECOPTERA			
Amphinemura	5		8
Chloroperlidae	19	2	
Isoperla	31	2	
Leuctridae	36	28	1
Perlesta	3		4
Prostoia	3		
TRICHOPTERA			
Agapetus	13	1	
Ceratopsyche	1		
Cheumatopsyche	5	1	11
Cynellus fraternus	2		
Helicopsyche	16	6	3
Hydropsyche	3		
Hydroptila			5
Lepidostoma			3
Mystacides		1	
Oecetis		1	
Polycentropus			2
Pycnopsyche			2
Rhyacophilidae	1		
Triaenodes			3
TRICLADIDA			
Planariidae	2		1
TUBIFICIDA			
Enchytraeidae		1	
Limnodrilus hoffmeisteri	1	1	
Tubificidae	2	12	
VENEROIDEA			
Sphaeriidae		5	

Aquid Invertebrate Database Bench Sheet Report**Black R [0602753], Station #1, Sample Date: 9/19/2006 3:10:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
COLEOPTERA	
Lutrochus	1
Microcylloepus pusillus	1
Optioservus sandersoni	142
Psephenus herricki	-99
Stenelmis	214
DECAPODA	
Orconectes hylas	-99
DIPTERA	
Cricotopus bicinctus	6
Cricotopus/Orthocladius	2
Hemerodromia	1
Microtendipes	4
Polypedilum convictum grp	27
Rheotanytarsus	13
Simulium	6
Stempellinella	3
Sublettea	2
Tabanus	1
Tanytarsus	4
Thienemanniella	2
Thienemannimyia grp.	1
EPHEMEROPTERA	
Acentrella	39
Anthopotamus	3
Baetis	57
Caenis anceps	8
Heptageniidae	46
Isonychia bicolor	58
Leucrocuta	22
Rhithrogena	1
Stenacron	1
Stenonema bednariki	12
Stenonema mediopunctatum	23
Stenonema pulchellum	1
Tricorythodes	18
LUMBRICINA	
Lumbricina	-99
MEGALOPTERA	
Corydalus	4
PLECOPTERA	
Neoperla	5
TRICHOPTERA	

Aquid Invertebrate Database Bench Sheet Report**Black R [0602753], Station #1, Sample Date: 9/19/2006 3:10:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
Ceratopsyche morosa grp	1
Cheumatopsyche	22
Chimarra	46
Helicopsyche	1
Oecetis	1
Setodes	1
TRICLADIDA	
Planariidae	21
VENEROIDEA	
Corbicula	1

Aquid Invertebrate Database Bench Sheet Report**Black R [0602754], Station #2, Sample Date: 9/19/2006 4:35:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
"HYDRACARINA"	
Acarina	15
COLEOPTERA	
Optioservus sandersoni	62
Psephenus herricki	1
Stenelmis	138
DIPTERA	
Antocha	1
Cricotopus bicinctus	1
Cricotopus/Orthocladius	3
Microtendipes	1
Nilotanypus	1
Polypedilum convictum grp	17
Potthastia	3
Rheotanytarsus	13
Stempellinella	3
Sublettea	2
Tabanus	-99
Tanytarsus	13
Thienemanniella	2
Thienemannimyia grp.	5
Tvetenia discoloripes grp	1
EPHEMEROPTERA	
Acentrella	23
Anthopotamus	6
Baetis	16
Caenis anceps	10
Caenis latipennis	-99
Isonychia bicolor	58
Leptophlebiidae	1
Leucrocuta	13
Stenacron	3
Stenonema bednariki	38
Stenonema mediopunctatum	31
Stenonema pulchellum	19
Tricorythodes	12
LUMBRICINA	
Lumbricina	-99
MEGALOPTERA	
Corydalus	4
PLECOPTERA	
Acroneuria	-99
Neoperla	4

Aquid Invertebrate Database Bench Sheet Report

Black R [0602754], Station #2, Sample Date: 9/19/2006 4:35:00 PM

CS = Coarse; -99 = Presence

ORDER: TAXA	CS
TRICHOPTERA	
Cheumatopsyche	22
Chimarra	21
Helicopsyche	2
Oecetis	9
TRICLADIDA	
Planariidae	22
VENEROIDEA	
Corbicula	-99

Aquid Invertebrate Database Bench Sheet Report**Black R [0602755], Station #3, Sample Date: 9/19/2006 5:50:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
"HYDRACARINA"	
Acarina	7
COLEOPTERA	
Optioservus sandersoni	65
Psephenus herricki	2
Stenelmis	45
DECAPODA	
Orconectes hylas	-99
DIPTERA	
Cricotopus bicinctus	2
Cricotopus/Orthocladius	7
Dicrotendipes	1
Microtendipes	2
Nilotanypus	2
Parametrioconemus	1
Pentaneura	1
Polypedilum convictum grp	12
Rheotanytarsus	11
Simulium	1
Stempellinella	2
Tabanus	4
Tanytarsus	8
Thienemanniella	2
Thienemannimyia grp.	3
EPHEMEROPTERA	
Acentrella	15
Anthopotamus	1
Baetis	19
Caenis anceps	27
Ephemerella	2
Isonychia bicolor	79
Leucocuta	8
Stenacron	6
Stenonema bednariki	24
Stenonema mediopunctatum	24
Stenonema pulchellum	16
Tricorythodes	40
LUMBRICINA	
Lumbricina	1
MEGALOPTERA	
Corydalus	-99
ODONATA	
Ischnura	1

Aquid Invertebrate Database Bench Sheet Report**Black R [0602755], Station #3, Sample Date: 9/19/2006 5:50:00 PM****CS = Coarse; -99 = Presence**

ORDER: TAXA	CS
PLECOPTERA	
Neoperla	4
Perlesta	2
Perlinella ephyre	2
TRICHOPTERA	
Ceratopsyche	1
Cheumatopsyche	10
Chimarra	1
Helicopsyche	39
Hydroptila	2
Marilia	7
Oecetis	4
TRICLADIDA	
Planariidae	11

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602756], Station #1, Sample Date: 9/20/2006 10:10:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	7	21
AMPHIPODA			
Hyaella azteca			3
COLEOPTERA			
Dubiraphia	45		10
Ectopria nervosa			2
Macronychus glabratus			2
Microcylloepus pusillus			13
Optioservus sandersoni	13		1
Psephenus herricki	15		
Stenelmis	51	7	5
DECAPODA			
Orconectes hylas	-99	-99	-99
DIPTERA			
Ablabesmyia		9	3
Anopheles			1
Ceratopogoninae		18	1
Chrysops			1
Cladopelma		2	
Cladotanytarsus		11	
Clinotanypus			1
Corynoneura	1		
Cricotopus/Orthocladus	1		4
Cryptochironomus		5	
Cryptotendipes		15	
Dicrotendipes			1
Diptera			1
Hexatoma		3	
Labrundinia			2
Nanocladius			1
Nilotanypus	2		
Pagastiella		8	
Parakiefferiella	2	6	8
Paralauterborniella		16	1
Paratanytarsus		2	8
Polypedilum convictum grp	13		
Polypedilum halterale grp		1	
Polypedilum illinoense grp	5	1	2
Procladius		3	1
Pseudochironomus	1		
Rheocricotopus	1		
Rheotanytarsus	16		

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602756], Station #1, Sample Date: 9/20/2006 10:10:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Simulium	1		
Stempellinella	3	12	1
Stenochironomus	2	2	1
Tanytarsus	14	22	31
Thienemanniella	2		
Xenochironomus			1
EPHEMEROPTERA			
Acerpenna	1		
Anthopotamus	1		
Baetis	9		
Caenis anceps	64	34	
Caenis latipennis		8	77
Callibaetis			1
Choroterpes	1	2	
Ephemera simulans		3	
Eurylophella			1
Heptageniidae	38	3	1
Hexagenia limbata		5	
Isonychia bicolor	107		
Leucrocuta	1		
Paraleptophlebia		1	
Procloeon		14	4
Stenacron	2	1	
Stenonema bednariki	2		
Stenonema femoratum	1	7	
Stenonema mediopunctatum	55		
Tricorythodes	13	1	1
LIMNOPHILA			
Ancylidae	3		
Ferrissia	1		
Menetus		2	9
LUMBRICINA			
Lumbricina	1	1	-99
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	10	2	4
Boyeria			1
Enallagma			6
Gomphus		1	1
Hetaerina	1		
Libellulidae			2
Macromia			-99
Stylogomphus albistylus	1		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602756], Station #1, Sample Date: 9/20/2006 10:10:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
PLECOPTERA			
Neoperla	8		
Perlesta	2		
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Ceratomyza		1	1
Cheumatopsyche	3		
Chimarra	57	2	
Oecetis	1		5
Oxyethira		2	
Trienodes			19
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Branchiura sowerbyi			1
Quistradrilus multisetosus		1	
Tubificidae		14	
VENEROIDEA			
Corbicula	58	31	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602757], Station #2, Sample Date: 9/20/2006 12:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
N/A			
Gordiidae	1		
"HYDRACARINA"			
Acarina	22	2	15
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia		1	9
Microcylloepus pusillus			6
Optioservus sandersoni	9		
Psephenus herricki	17		
Stenelmis	70	3	8
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia	1	5	4
Ceratopogonidae	1	15	
Chironomus		7	
Cladopelma		42	1
Cladotanytarsus	1	7	1
Cricotopus/Orthocladius	5		
Cryptochironomus	3	1	
Cryptotendipes		26	
Demicryptochironomus		1	
Dicrotendipes		1	
Harnischia		2	
Labrundinia			4
Nanocladius	1		
Pagastiella		12	
Paracricotopus	1		
Parakiefferiella	5	4	
Paralauterborniella		10	
Paratanytarsus			3
Polypedilum convictum grp	6		
Polypedilum halterale grp		3	
Polypedilum illinoense grp			1
Polypedilum scalaenum grp	2		
Procladius		15	1
Rheocricotopus	1		
Rheotanytarsus	14		
Simulium	1		
Stempellina		7	
Stempellinella	11	17	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602757], Station #2, Sample Date: 9/20/2006 12:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Stenochironomus		6	
Stictochironomus		4	
Tabanus	3		
Tanypus		2	
Tanytarsus	30	24	20
Thienemanniella	2		
Thienemannimyia grp.	4	1	
EPHEMEROPTERA			
Acerpenna	1		
Anthopotamus	1	1	
Caenis	5		
Caenis anceps	152	7	2
Caenis latipennis	12	1	226
Choroterpes	3	4	1
Ephemera simulans		-99	
Eurylophella	1		
Heptageniidae	31	2	
Hexagenia	1	6	
Isonychia bicolor	73		
Procloeon	2	4	1
Stenacron	3		
Stenonema bednariki	7		
Stenonema femoratum	1	2	2
Stenonema mediopunctatum	45		
Stenonema pulchellum	10		
Tricorythodes	29		1
HEMIPTERA			
Corixidae		12	
Rhagovelia	1		
Trichocorixa		-99	
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Ancylidae	2		
Fossaria			1
Helisoma			3
Menetus			9
LUMBRICINA			
Lumbricina	5	-99	
MEGALOPTERA			
Corydalus	2		
Nigronia serricornis	2		
Sialis		-99	
ODONATA			

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602757], Station #2, Sample Date: 9/20/2006 12:00:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Argia	21		3
Basiaeschna janata			-99
Enallagma			12
Gomphidae	4		
Macromia		-99	1
PLECOPTERA			
Neoperla	14		
Perlinella ephyre	1		
Zealeuctra	1		
TRICHOPTERA			
Cernotina		1	
Chimarra	2		
Helicopsyche	4		
Hydroptila	1		
Oecetis	1		2
Triaenodes			16
TRICLADIDA			
Planariidae	4		
TUBIFICIDA			
Aulodrilus		1	
Branchiura sowerbyi		10	
Limnodrilus hoffmeisteri		2	
Tubificidae	2	21	1
VENEROIDEA			
Corbicula	17		
Sphaeriidae	29	29	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602758], Station #3, Sample Date: 9/26/2006 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	5		
COLEOPTERA			
Dubiraphia			3
Psephenus herricki	5		
Stenelmis	151		13
DECAPODA			
Orconectes hylas	1		1
DIPTERA			
Ablabesmyia	1	1	2
Ceratopogoninae	4	35	14
Chironomus	11	17	8
Cladopelma		27	1
Cladotanytarsus		5	3
Cricotopus/Orthocladius	7		5
Cryptochironomus		2	
Cryptotendipes		12	1
Dicrotendipes		1	6
Forcipomyiinae	1		
Glyptotendipes	1		
Goeldichironomus			26
Harnischia		2	
Hemerodromia	10		1
Labrundinia			2
Microchironomus		8	
Micropsectra		3	
Microtendipes		1	
Nanocladius	4		
Parakiefferiella		2	1
Paralauterborniella	2		
Polypedilum		1	1
Polypedilum convictum grp	15	1	1
Polypedilum fallax grp	1		
Polypedilum halterale grp		12	4
Polypedilum illinoense grp	3		7
Polypedilum scalaenum grp		1	
Procladius	1	72	20
Rheocricotopus	1		
Rheotanytarsus	23		1
Simulium	5		
Tabanus	1		1
Tanytarsus	31	46	68
Thienemannimyia grp.	18	2	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602758], Station #3, Sample Date: 9/26/2006 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tribelos	1		
Zavreliomyia		3	1
EPHEMEROPTERA			
Baetidae	1		
Baetis	21		
Caenis anceps	26		2
Caenis latipennis	1		34
Choroterpes	2		
Ephemera	1		
Heptageniidae	26		
Hexagenia limbata		4	
Isonychia	2		
Procloeon	2		
Stenacron	29		
Stenonema femoratum	9		1
Stenonema mediopunctatum	31		
Stenonema pulchellum	10		
Tricorythodes	5		
HEMIPTERA			
Corixidae		1	1
Microvelia		1	
LIMNOPHILA			
Ancylidae	1		2
Lymnaeidae			2
Menetus			3
LUMBRICINA			
Lumbricina		-99	
MEGALOPTERA			
Corydalus	4		
Sialis			2
ODONATA			
Argia	60		7
Calopteryx			1
Coenagrionidae		1	
Enallagma			9
Epicordulia			1
Gomphus		1	
Stylogomphus albistylus	2		
PLECOPTERA			
Acroneuria	1		
Neoperla	46		
TRICHOPTERA			
Ceratopsyche	3		
Cheumatopsyche	29		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602758], Station #3, Sample Date: 9/26/2006 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Triaenodes			2
TRICLADIDA			
Planariidae	22		
TUBIFICIDA			
Branchiura sowerbyi		18	
Spirosperma	1		1
Tubificidae	24	30	19
VENEROIDEA			
Corbicula	11	4	21

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602760], Station #4, Sample Date: 9/26/2006 3:50:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	15	6	10
AMPHIPODA			
Hyalella azteca			2
COLEOPTERA			
Dubiraphia		17	21
Helichus lithophilus			1
Microcylloepus pusillus			25
Optioservus sandersoni	17	1	
Psephenus herricki	44	4	
Stenelmis	11	30	3
DECAPODA			
Orconectes hylas	2	-99	
DIPTERA			
Ablabesmyia		3	6
Anopheles			3
Cardiocladius	2		
Ceratopogoninae		4	
Cladopelma		1	
Cladotanytarsus		38	2
Cricotopus bicinctus			2
Cricotopus/Orthocladius	85		25
Cryptochironomus		4	
Cryptotendipes		3	
Dicrotendipes			5
Hemerodromia	1		
Hexatoma			1
Labrundinia			2
Nanocladius	1		
Nilotanypus	2		
Parakiefferiella			1
Paralauterborniella		3	
Parametrioconemus	1		
Paratanytarsus			50
Polypedilum convictum grp	25		2
Polypedilum halterale grp		78	
Polypedilum illinoense grp			4
Procladius		2	2
Pseudochironomus		1	1
Rheotanytarsus	4		3
Stempellina		3	
Stempellinella		8	1
Tabanus	2	-99	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602760], Station #4, Sample Date: 9/26/2006 3:50:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Tanytarsus	1	9	17
Thienemanniella	6	1	2
Thienemannimyia grp.	2	1	2
Tipulidae		2	
Tribelos		4	
undescribed Empididae		1	
EPHEMEROPTERA			
Acerpenna	4		1
Baetis	9		
Caenis anceps	15	27	
Caenis latipennis	1	8	19
Choroterpes	1	16	
Heptageniidae	9	11	
Isonychia bicolor	113		
Leucrocuta		4	
Procloeon		3	31
Stenacron	6	5	
Stenonema bednariki	1		
Stenonema femoratum	1	81	2
Stenonema mediopunctatum	128	2	
Stenonema pulchellum	3		
Tricorythodes	3		5
HEMIPTERA			
Rhagovelia			2
ISOPODA			
Lirceus	1		
LEPIDOPTERA			
Petrophila	7		1
LIMNOPHILA			
Ancylidae			2
Lymnaeidae			3
Menetus			11
Physella	1	5	5
Planorbidae		1	
LUMBRICINA			
Lumbricina	1	3	
MEGALOPTERA			
Corydalus	1		
Sialis		-99	
ODONATA			
Argia	22	1	4
Boyeria			3
Calopteryx			2
Enallagma			24

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602760], Station #4, Sample Date: 9/26/2006 3:50:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Gomphidae			2
Hagenius brevistylus	1		
Macromia			1
Neurocordulia			1
Progomphus obscurus		-99	
Stylogomphus albistylus		-99	
PLECOPTERA			
Acroneuria		-99	
Neoperla	14		
TRICHOPTERA			
Ceratopsyche morosa grp	3		
Cheumatopsyche	15		1
Chimarra	9		
Helicopsyche	31		
Hydroptila		1	
Nectopsyche			1
Oecetis	4		1
Trienodes			2
TUBIFICIDA			
Tubificidae		5	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602761], Station #5, Sample Date: 9/27/2006 9:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	21	9	2
COLEOPTERA			
Dubiraphia	1	40	66
Ectopria nervosa		3	
Helichus lithophilus			3
Microcylloepus pusillus	1		1
Optioservus sandersoni	22	2	
Psephenus herricki	8	1	
Stenelmis	28	7	3
DECAPODA			
Orconectes hylas	-99		
DIPTERA			
Ablabesmyia		7	1
Cardiocladius	2		
Ceratopogoninae	3	8	1
Chlorotabanus			1
Cladopelma		5	
Cladotanytarsus			1
Cricotopus bicinctus			4
Cricotopus/Orthocladius	7	2	4
Cryptochironomus		3	
Cryptotendipes		1	
Dicrotendipes	1		3
Forcipomyiinae		1	
Hemerodromia	2		
Labrundinia		1	1
Nanocladius	1		
Pagastiella		1	
Paralauterborniella		8	
Parametrioctenemus	1		
Paratanytarsus		2	9
Paratendipes		1	
Polypedilum convictum grp	3		
Polypedilum fallax grp		1	2
Polypedilum halterale grp		4	
Polypedilum illinoense grp			3
Procladius		16	
Pseudochironomus		1	
Rheotanytarsus	12	1	36
Simulium	27		
Stempellinella		22	
Stenochironomus			3

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602761], Station #5, Sample Date: 9/27/2006 9:50:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stictochironomus		3	
Tabanus	7	-99	
Tanytarsus	2	18	9
Thienemannimyia grp.		1	7
EPHEMEROPTERA			
Acentrella	15		1
Apobaetis			1
Baetis	16		
Caenis anceps	22	156	9
Caenis latipennis		25	14
Centroptilum			12
Choroterpes		1	
Ephemera		-99	
Eurylophella	1		
Heptageniidae	12	2	1
Hexagenia limbata		6	
Isonychia bicolor	258		3
Leptophlebiidae			1
Procloeon		7	30
Stenonema femoratum		5	14
Stenonema mediopunctatum	11		
Stenonema pulchellum	4		1
Tricorythodes			4
HEMIPTERA			
Microvelia			1
Rhagovelia			1
Rheumatobates			1
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Helisoma		-99	
Menetus		1	
Physella	-99		4
LUMBRICINA			
Lumbricina	5	4	
MEGALOPTERA			
Corydalus	3		
Nigronia serricornis			2
Sialis		1	
ODONATA			
Argia	4	2	2
Boyeria			6
Didymops		-99	
Enallagma			2

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602761], Station #5, Sample Date: 9/27/2006 9:50:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Gomphidae		2	
Macromia			1
Stylogomphus albistylus	3	-99	
PLECOPTERA			
Acroneuria	-99		
Neoperla	9		
TRICHOPTERA			
Ceratopsyche morosa grp	9		2
Cheumatopsyche	11		
Chimarra	7		
Helicopsyche	1		
Hydroptila		1	1
Oecetis	1		2
Polycentropus	1		
Trienodes			3
TUBIFICIDA			
Tubificidae		4	1

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602763], Station #6, Sample Date: 9/27/2006 1:00:00 PM****CS = Coarse; NF = Nonflow; -99 = Presence**

ORDER: TAXA	CS	NF
"HYDRACARINA"		
Acarina	4	
COLEOPTERA		
Dubiraphia	1	
Stenelmis	1	1
Tropisternus		-99
DIPTERA		
Ablabesmyia		2
Ceratopogoninae	77	20
Chaetocladius	1	
Chironomus	82	135
Cladotanytarsus	1	
Clinocera	1	
Cricotopus bicinctus	4	
Dicrotendipes	20	80
Diptera	1	
Epoicocladius	1	
Hemerodromia	34	2
Natarsia	2	
Nilothauma		1
Parakiefferiella		2
Parametricnemus	4	
Paraphaenocladius	6	
Paratendipes	84	
Polypedilum	1	
Polypedilum convictum grp	1	
Polypedilum illinoense grp	1	
Polypedilum scalaenum grp	27	
Procladius		4
Psectrocladius		1
Pseudochironomus		1
Rheotanytarsus	3	
Tabanus	2	
Tanytarsus	204	59
Thienemannimyia grp.	47	1
Tribelos	32	
undescribed Empididae	1	
EPHEMEROPTERA		
Caenis latipennis	1	
HEMIPTERA		
Microvelia	1	
ISOPODA		
Lirceus	1	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602763], Station #6, Sample Date: 9/27/2006 1:00:00 PM****CS = Coarse; NF = Nonflow; -99 = Presence**

ORDER: TAXA	CS	NF
LIMNOPHILA		
Physella	1	4
LUMBRICINA		
Lumbricina	2	-99
ODONATA		
Hagenius brevistylus	40	1
Libellulidae		2
TRICHOPTERA		
Hydroptila	42	
Oxyethira	3	
Polycentropus	3	1

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602762], Station #7, Sample Date: 9/27/2006 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	39	4	7
AMPHIPODA			
Hyaella azteca			3
COLEOPTERA			
Dubiraphia	2	50	78
Helichus lithophilus	3		5
Hydraena	1		
Microcylloepus pusillus			4
Optioservus sandersoni	38		
Psephenus herricki	2	2	1
Stenelmis	5	2	
DECAPODA			
Orconectes hylas	4		
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia		6	2
Ceratopogoninae	2	26	
Chironomus		70	1
Cladotanytarsus	4	1	
Corynoneura			1
Cricotopus bicinctus	2	3	6
Cricotopus/Orthocladius	9	2	4
Cryptotendipes		2	
Dicrotendipes		13	
Forcipomyiinae	1		
Hemerodromia	4	1	
Labrundinia		2	5
Natarsia	2		
Nilotanypus	2		2
Pagastiella		8	
Parakiefferiella	1	14	
Parametrioconemus	1		
Paratanytarsus		3	3
Phaenopsectra	1		1
Polypedilum convictum grp	7		
Polypedilum fallax grp	2		
Polypedilum halterale grp		2	
Polypedilum illinoense grp	1		3
Procladius		7	2
Rheotanytarsus	7	1	6
Simulium	6		
Stempellinella	1	2	1

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602762], Station #7, Sample Date: 9/27/2006 11:30:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stenochironomus	10	4	1
Tabanus	6		
Tanytarsus	17	28	15
Thienemannimyia grp.	21	1	9
Tribelos		6	
undescribed Empididae			2
EPHEMEROPTERA			
Acentrella	3		
Baetis	7		
Baetiscidae	2		
Caenis anceps	78	2	
Caenis latipennis	6	1	10
Centroptilum			4
Heptageniidae	31	9	6
Isonychia bicolor	199		2
Procloeon		5	8
Stenacron	3		
Stenonema femoratum	16	13	5
Stenonema mediopunctatum	37		
Stenonema pulchellum	6		
Tricorythodes	1		
HEMIPTERA			
Microvelia	1		
Rhagovelia	1		
ISOPODA			
Caecidotea (Blind & Unpigmented)			1
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Ancylidae		4	
Ferrissia			5
Fossaria			4
Helisoma	-99		
Laevapex	1		3
Menetus			1
Physella	1	1	11
LUMBRICINA			
Lumbricina		1	
MEGALOPTERA			
Corydalus	2		
Nigronia serricornis	1		
Sialis		1	
ODONATA			

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602762], Station #7, Sample Date: 9/27/2006 11:30:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Argia	6		6
Boyeria		-99	3
Calopteryx			3
Coenagrionidae	1		2
Enallagma			20
Gomphidae		1	1
Hagenius brevistylus	2		
Helocordulia			-99
Hetaerina			1
Macromia			1
Stylogomphus albistylus	5		-99
PLECOPTERA			
Acroneuria	2		
Neoperla	1		
Zealeuctra	5		
TRICHOPTERA			
Cheumatopsyche	7		
Chimarra	13		
Helicopsyche	2		
Limnephilidae	1		1
Oecetis	3		30
Triaenodes			31
TUBIFICIDA			
Aulodrilus		1	
Tubificidae	1	8	

Aquid Invertebrate Database Bench Sheet Report

East Fk Black R [0602766], Station #8, Sample Date: 9/28/2006 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	14	10	37
AMPHIPODA			
Hyaella azteca			3
Stygobromus	1		
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia		54	1
Ectopria nervosa	2		
Enochrus	1		
Microcylloepus pusillus			1
Optioservus sandersoni	89		1
Psephenus herricki	123		
Scirtidae			3
Stenelmis	27	14	
DECAPODA			
Orconectes hylas	4		
DIPTERA			
Ablabesmyia		13	
Anopheles			2
Ceratopogoninae		2	1
Chironomus		1	1
Cladotanytarsus		8	
Corynoneura			3
Cricotopus/Orthocladius	1		
Cryptochironomus		6	
Dixella			4
Forcipomyiinae	3		
Natarsia		1	
Paracladopelma		1	
Paramerina	1		
Paratanytarsus		1	3
Phaenopsectra		1	2
Polypedilum convictum grp	3		1
Polypedilum illinoense grp		1	1
Polypedilum scalaenum grp		1	
Procladius		8	2
Stempellina		2	
Stempellinella		29	
Stenochironomus	1	4	

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602766], Station #8, Sample Date: 9/28/2006 9:40:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Tanytarsus		8	2
Thienemannimyia grp.	1		1
Tribelos		2	1
undescribed Empididae		2	
EPHEMEROPTERA			
Acentrella	2		
Apobaetis		1	
Caenis anceps	9	47	
Caenis latipennis	1		2
Ephemeridae		1	
Eurylophella	3		
Heptageniidae	5		
Isonychia bicolor	1		
Leptophlebiidae			1
Procloeon		3	
Stenacron	4	3	
Stenonema femoratum	4	13	1
HEMIPTERA			
Ranatra kirkaldyi			1
Rhagovelia	2		
ISOPODA			
Caecidotea (Blind & Unpigmented)	97		
Lirceus	3		
LIMNOPHILA			
Ancylidae		1	
Lymnaeidae			5
LUMBRICINA			
Lumbricina	13		
LUMBRICULIDA			
Lumbriculidae	75	1	
MEGALOPTERA			
Corydalus	-99		
Nigronia serricornis	2		
Sialis		-99	
ODONATA			
Argia	6	19	
Enallagma			4
Gomphidae	56	1	
PLECOPTERA			
Zealeuctra	19		
TRICHOPTERA			
Cheumatopsyche	2		
Helicopsyche	1		

Aquid Invertebrate Database Bench Sheet Report**East Fk Black R [0602766], Station #8, Sample Date: 9/28/2006 9:40:00 AM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Leptoceridae		1	
Nyctiophylax			1
Oecetis			1
Polycentropus	8		
Trienodes			1
TRICLADIDA			
Planariidae	27	4	2
TUBIFICIDA			
Aulodrilus		3	
Limnodrilus hoffmeisteri		4	
Tubificidae		35	

Aquid Invertebrate Database Bench Sheet Report

Shut-In Ck [0602764], Station #1a, Sample Date: 9/27/2006 3:25:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina			1
AMPHIPODA			
Gammarus			6
Hyalella azteca			114
Stygobromus	1		
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia		3	16
Ectopria nervosa		1	
Optioservus sandersoni	22	1	
Psephenus herricki	112	21	1
Stenelmis	3	5	
DECAPODA			
Orconectes hylas	20	-99	
DIPTERA			
Ablabesmyia		3	
Ceratopogoninae		1	
Chironomus		9	
Cricotopus/Orthocladius	10		
Dicrotendipes			5
Dixella			10
Hybomitra	6		
Kiefferulus		1	
Microtendipes		1	
Natarsia			1
Paratendipes		2	
Polypedilum convictum grp	35	1	
Rheotanytarsus	4		
Stempellinella		1	
Tanytarsus	1	1	
Thienemanniella	1		
Thienemannimyia grp.	1	2	
Tribelos		3	
Zavrelimyia		5	3
EPHEMEROPTERA			
Baetis	1		
Caenis anceps	1	21	
Caenis latipennis	1	1	
Eurylophella	3	2	

Aquid Invertebrate Database Bench Sheet Report**Shut-In Ck [0602764], Station #1a, Sample Date: 9/27/2006 3:25:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Isonychia bicolor	4		
Leptophlebiidae	1	26	3
Procloeon			1
Stenacron	33	17	
Stenonema femoratum	1	136	
Stenonema mediopunctatum	1		
Stenonema vicarium	2		
ISOPODA			
Lirceus	96	15	4
LIMNOPHILA			
Ancylidae		5	
LUMBRICINA			
Lumbricina	11	12	
LUMBRICULIDA			
Lumbriculidae	4	1	
MEGALOPTERA			
Corydalus	2		
Nigronia serricornis	4		
Sialis		-99	
ODONATA			
Argia	8	3	
Boyeria			1
Gomphidae	13	2	
Helocordulia		-99	
Libellulidae		1	
Stylogomphus albistylus		1	
PLECOPTERA			
Acroneuria	8		
RHYNCHOBDELLIDA			
Glossiphoniidae	2		
TRICHOPTERA			
Cheumatopsyche	1		
Helicopsyche	1		
Lype diversa			1
Polycentropus	32	3	4
Triaenodes			1
TRICLADIDA			
Planariidae		2	3
TUBIFICIDA			
Aulodrilus		5	
Tubificidae		6	
VENEROIDEA			
Sphaeriidae		1	

Aquid Invertebrate Database Bench Sheet Report

Taum Sauk Ck [0602759], Station #1, Sample Date: 9/26/2006 1:25:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
N/A			
Gordiidae		1	
"HYDRACARINA"			
Acarina	57	1	5
COLEOPTERA			
Dubiraphia			10
Helichus lithophilus	1		
Optioservus sandersoni	23	2	
Psephenus herricki	44	2	
Scirtidae			1
Stenelmis	9		
DECAPODA			
Orconectes hylas	4	1	
DIPTERA			
Ablabesmyia	7	11	
Ceratopogoninae			14
Chironomus		10	
Cladopelma		1	
Cladotanytarsus		1	
Corynoneura			2
Cricotopus/Orthocladius	56		1
Dasyheleinae	6		
Dicrotendipes	1		1
Diptera	1		
Forcipomyiinae	5		2
Hemerodromia			1
Hybomitra	5	1	
Labrundinia			2
Microtendipes	2	1	6
Nilotanypus	3		
Parakiefferiella	5		
Parametrioconemus	1		
Paraphaenocladius	1		
Paratanytarsus	1	1	20
Paratendipes	1	9	
Phaenopsectra		3	3
Polypedilum convictum grp	37		
Polypedilum illinoense grp	1		
Polypedilum scalaenum grp		2	
Procladius		1	2
Pseudochironomus		1	
Rheocricotopus	7		

Aquid Invertebrate Database Bench Sheet Report**Taum Sauk Ck [0602759], Station #1, Sample Date: 9/26/2006 1:25:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Rheotanytarsus	8		
Stempellina		1	
Stempellinella	2	9	
Stenochironomus		1	
Tanytarsus	8	21	32
Thienemanniella	2		
Thienemannimyia grp.	9		1
Tribelos		5	
Zavrelimyia		2	
EPHEMEROPTERA			
Acentrella	1		
Acerpenna	1		
Caenis anceps	17	54	
Caenis latipennis	5	74	108
Choroterpes	6	1	
Ephemera		-99	
Heptageniidae	6		
Isonychia bicolor	2		
Leptophlebiidae		33	1
Leucrocuta	2		
Procloeon			8
Stenacron	23	1	
Stenonema femoratum	4	32	
Stenonema mediopunctatum	1		
Tricorythodes	4		
HEMIPTERA			
Microvelia	1		
Ranatra			1
Rhagovelia	3		
ISOPODA			
Caecidotea (Blind & Unpigmented)	2		
LIMNOPHILA			
Ancylidae			3
Fossaria			1
Menetus		1	2
LUMBRICINA			
Lumbricina	18	-99	
LUMBRICULIDA			
Lumbriculidae	4		
ODONATA			
Argia	6	3	4
Calopteryx			1
Enallagma			5

Aquid Invertebrate Database Bench Sheet Report**Taum Sauk Ck [0602759], Station #1, Sample Date: 9/26/2006 1:25:00 PM****CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence**

ORDER: TAXA	CS	NF	RM
Gomphidae	38		
Hagenius brevistylus	3		
Macromia			1
PLECOPTERA			
Neoperla	1		
Zealeuctra	1		
TRICHOPTERA			
Cernotina	5		
Cheumatopsyche	1		
Helicopsyche	89		
Leptoceridae	2		
Nyctiophylax			5
Oecetis	4		7
Polycentropus	35		
Trienodes			9
TRICLADIDA			
Planariidae	4	1	1
TUBIFICIDA			
Limnodrilus hoffmeisteri		1	
Tubificidae		6	

Appendix C

Biological Assessment Report, Effects of the AmerenUE Upper Taum Sauk Reservoir Dam Failure on the
Macroinvertebrate Community of East Fork Black River, Reynolds County,
December 19-21, 2005

Biological Assessment Report

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

December 19-21, 2005

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program

Prepared by:

Missouri Department of Natural Resources
Field Services Division
Environmental Services Program
Water Quality Monitoring Section

Table of Contents

Section	Page
1.0 Introduction.....	1
1.1 Objective.....	1
1.2 Null Hypothesis	1
2.0 Study Area	1
3.0 Site Descriptions	2
4.0 Methods.....	3
4.1 Macroinvertebrate Collection	3
4.2 Macroinvertebrate Laboratory Processing.....	3
4.3 Statistical Analyses	3
4.4 Water Chemistry	4
4.5 Quality Assurance/Quality Control.....	4
4.5.1 Field Meters	4
4.5.2 Biological Samples	4
4.5.3 Biological Data Entry	5
5.0 Data Results and Analyses.....	5
5.1 Macroinvertebrate Data	5
5.2 Results of Macroinvertebrate Data Statistical Analyses.....	6
5.3 Water Chemistry	9
6.0 Observations and Photo Documentation.....	11
7.0 Discussion.....	13
8.0 Conclusions.....	14
9.0 Literature Cited.....	15

Tables

Table 1	Percent Land Cover.....	2
Table 2	Total Number of Individuals per Hess Sample.....	5
Table 3	Taxa Richness per Hess Sample	6
Table 4	Stations with Significant Difference in Total Number of Individuals.....	7
Table 5	Stations with Significant Difference in Taxa Richness	7
Table 6	Physical and Chemical Water Quality Results	10

Figures

Figure 1	Box Plots of Number of Individuals (Arithmetic Scale)	8
Figure 2	Box Plot of Number of Individuals (Log ₁₀ Scale)	8
Figure 3	Box Plots of Taxa Richness	9

Attachments

Appendix A – Maps

Appendix B – Photograph - Aerial Photograph of Upper Study Site

Appendix C – Descriptive Statistics

Appendix D – Analyses of Variance Results

Appendix E – Macroinvertebrate Bench Sheets

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.

1.2 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

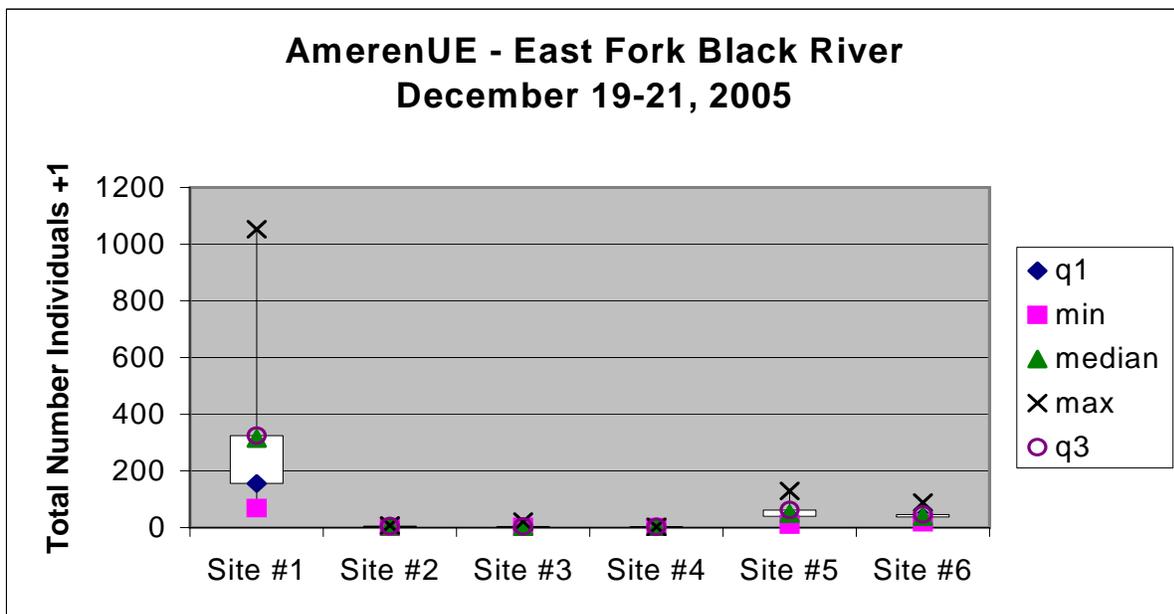
numbers of individuals were significantly reduced at stations 2, 3, and 4. Using the mean value from the control station, the respective number of individuals at these stations was reduced by 93% at station #2, 89% at station #3, and 98% at station #4 (Table 2).

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

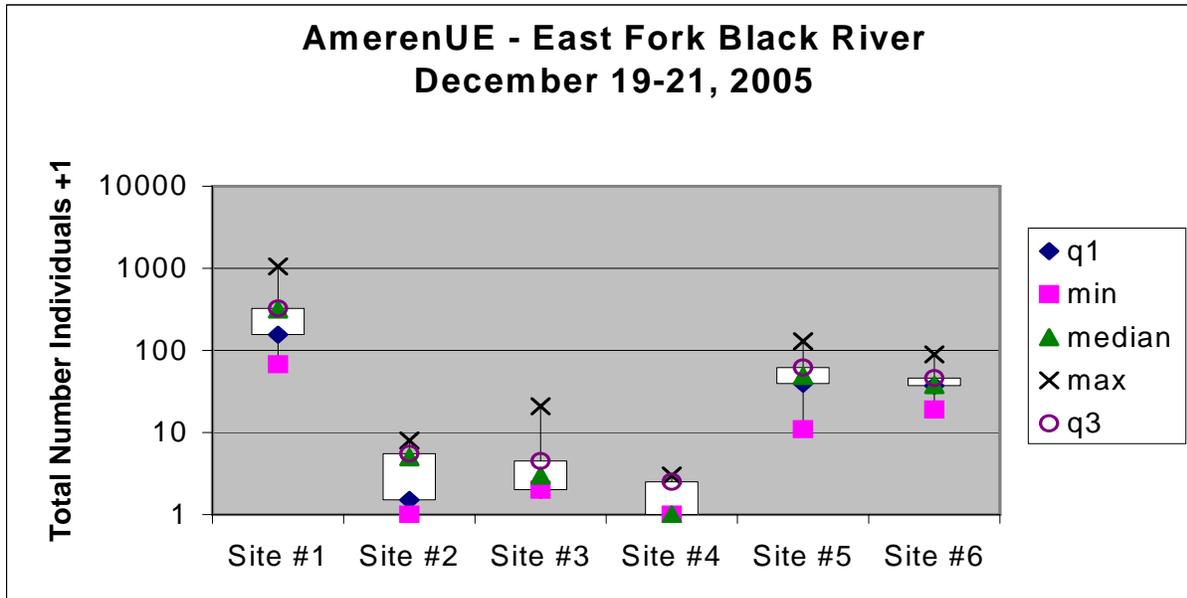
Inspection of the Table 5 grid reveals no significant difference in mean taxa richness between test stations 1 and 5 and control station 6. There were also no significant differences among test stations 2, 3, and 4. However, taxa richness in test stations 2, 3, and 4 were significantly different compared 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)



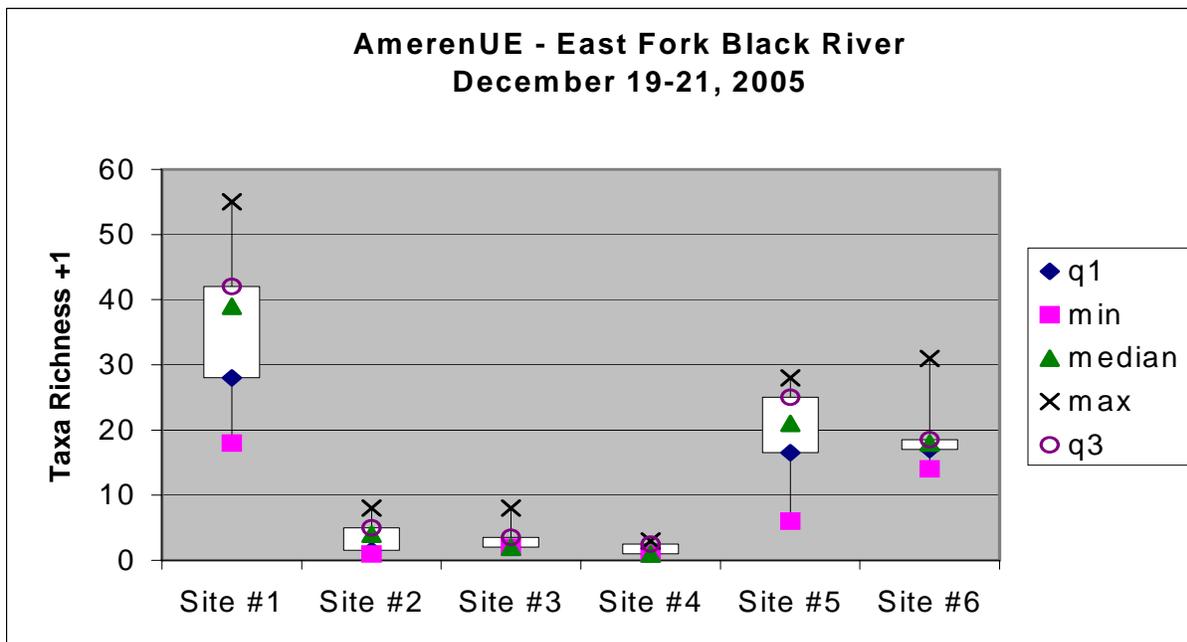
*q1 = 25 percentile and q3 = 75 percentile

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.



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



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



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



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.

9.0 Literature Cited

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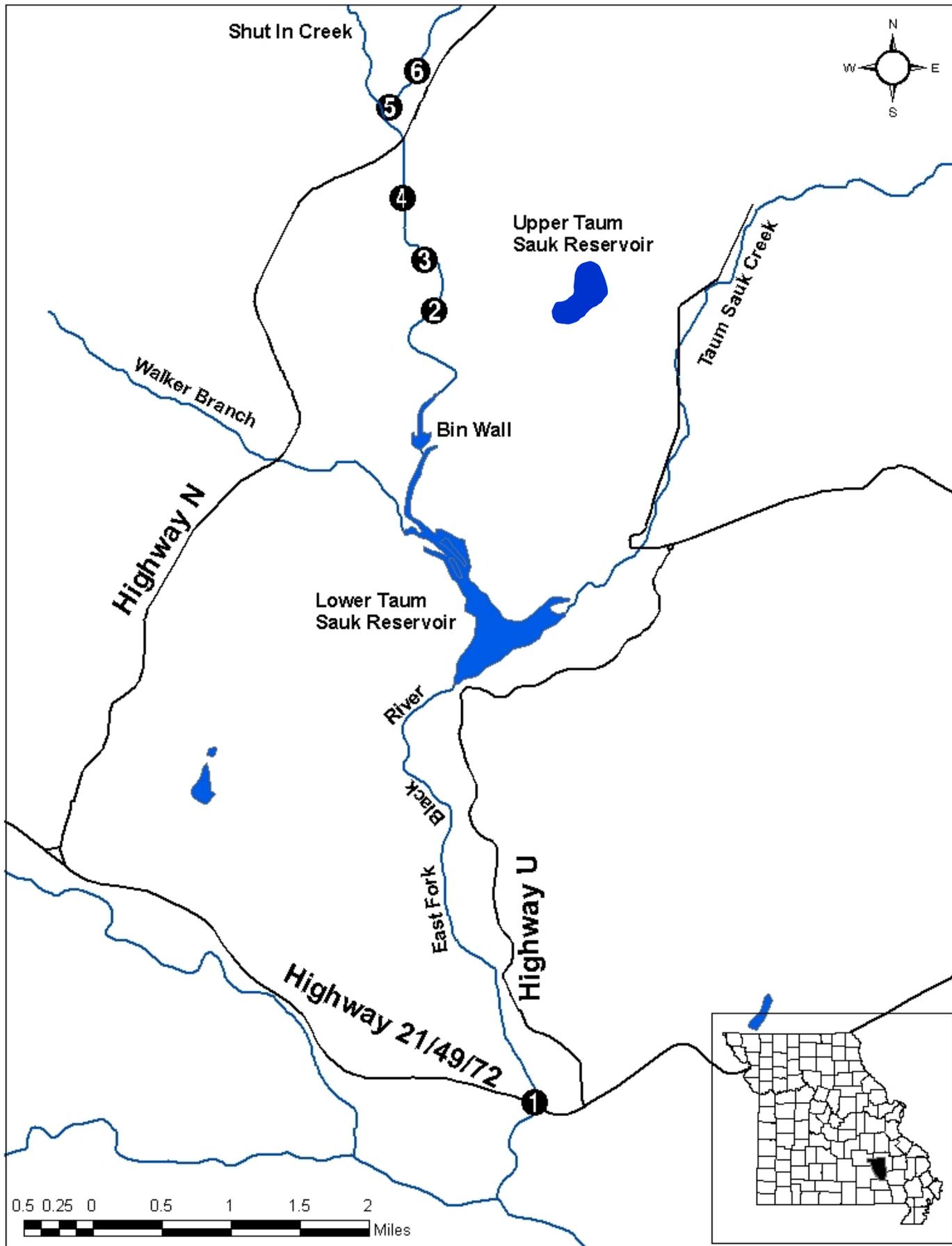
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c: Ed Galbraith, WPP
Leanne Tippett-Mosby, DEQ

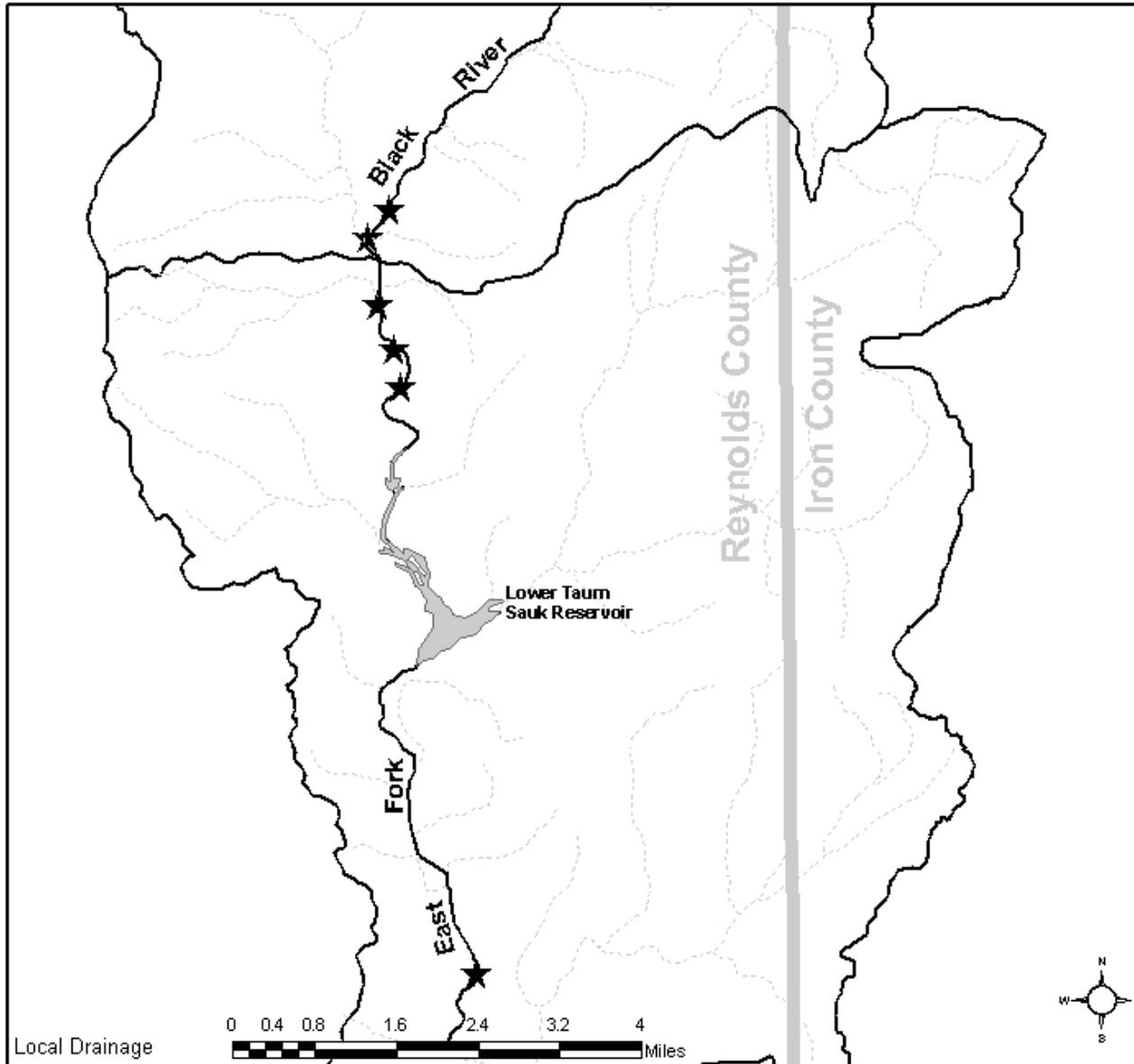
Appendix A

Maps

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



East Fork Black River Study Site

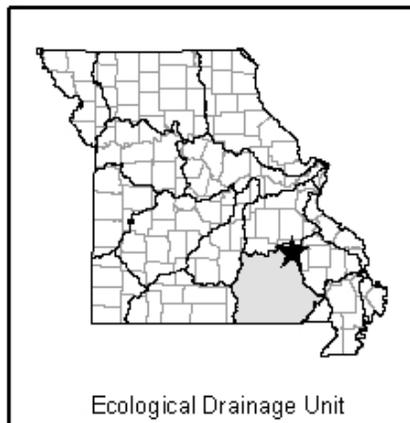


- ★ Sampling Locations
- County Boundary
- Local Drainage
- Stream/River

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.

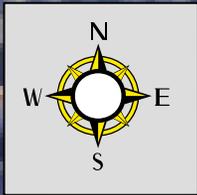


Ecological Drainage Unit

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

	ColumnSize	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

	ColumnSkewness	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

	ColumnSize	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

	ColumnRange	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

	ColumnSkewness	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

	ColumnSize	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

	ColumnSkewness	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

Thursday, March 02, 2006, 08:21:10

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

Data source: Taxa Richness +1

ColumnSize	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

ColumnRange	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

ColumnSkewness	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.

Thursday, March 02, 2006, 08:50:54

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	
Hyaella azteca	1
COLEOPTERA	
Optioservus sandersoni	1
DIPTERA	
Tipula	2
Cricotopus/Orthocladus	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	
Allocaenia	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	
Allocapnia	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	
Pelosclex 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	
Allocapnia	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
Parametrioconemus	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	
Pelosclex ferox	1

Aquatic Invertebrate Database Bench Sheet Report

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

ORDER (Taxa)	CS
COLEOPTERA	
<i>Psephenus herricki</i>	4
<i>Microcyloepus pusillus</i>	1
<i>Optioservus sandersoni</i>	9
DIPTERA	
<i>Prosimulium</i>	1
<i>Eukiefferiella brevicar</i> grp	2
<i>Hemerodromia</i>	3
EPHEMEROPTERA	
<i>Isonychia bicolor</i>	6
<i>Stenonema femoratum</i>	1
<i>Stenonema mediopunctatum</i>	5
<i>Stenonema pulchellum</i>	4
<i>Eurylophella</i>	1
<i>Tricorythodes</i>	1
<i>Caenis anceps</i>	7
<i>Caenis latipennis</i>	1
LUMBRICINA	
Lumbricidae	4
PLECOPTERA	
<i>Allocaenia</i>	24
<i>Amphinemura</i>	1
<i>Strophopteryx</i>	21
<i>Taeniopteryx</i>	1
<i>Hydroperla</i>	1
TRICHOPTERA	
<i>Agapetus</i>	5
TUBIFICIDA	
<i>Pelosclex ferox</i>	1

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	
Allocaenia	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)

CS

"HYDRACARINA"

Acarina

1

Aquatic Invertebrate Database Bench Sheet Report

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

ORDER (Taxa)	CS
DIPTERA	
Georthocladius	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)

CS

TRICLADIDA

Planariidae

1

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528126], Station #3b

ORDER (Taxa)

CS

TRICHOPTERA

Psychomyia

1

Aquatic Invertebrate Database Bench Sheet Report

December 20, 2005 - East Fk Black R [0528127], Station #3c

ORDER (Taxa)

CS

EPHEMEROPTERA

Caenis anceps

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
LUMBRICINA	
Lumbricidae	1
PLECOPTERA	
Allocaenia	1
TUBIFICIDA	
Tubificidae	9

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	
Georthocladius	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

Pseudechironomus

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

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 brevicar 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	
<i>Isonychia bicolor</i>	2
<i>Stenonema pulchellum</i>	2
<i>Caenis latipennis</i>	2
LEPIDOPTERA	
Pyralidae	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	
Pyralidae	1
MEGALOPTERA	
Corydalis	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	
Allocaenia	1
Strophopteryx	1
TRICHOPTERA	
Chimarra	4
Psychomyia	4
Cheumatopsyche	13
TUBIFICIDA	
Enchytraeidae	1

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	
Pyralidae	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