Biological Assessment Report

East Fork Black River Macroinvertebrate Community Assessment

2008 Sample Data Annual Report

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1.0 Introduction

As part of a post-settlement agreement between the Missouri Department of Natural Resources and Ameren UE following the December 2005 Upper Taum Sauk Reservoir collapse, the Environmental Services Program's (**ESP**) Water Quality Monitoring Section (**WQMS**) continues to assess water quality and the macroinvertebrate community in the East Fork Black River (**East Fork, EFBR**). As in previous studies (Sarver and Michaelson 2005, Michaelson 2007, 2009), macroinvertebrate and water quality samples were collected in the vicinity of Johnson's Shut-Ins State Park (**JSISP**) and the Lower Taum Sauk Reservoir. Taum Sauk Creek and Imboden Fork, two tributaries of the East Fork, were sampled in spring 2008, but sampling was discontinued at Imboden Fork for fall 2008. Unlike prior biological assessments, the three mainstem Black River stations were not sampled in 2008. These stations were studied following the Upper Reservoir collapse to determine whether sediment and turbidity resulting from the collapse affected water quality and the macroinvertebrates in the Black River. As no appreciable differences between the macroinvertebrate community upstream versus downstream of the East Fork confluence were observed (Michaelson 2009), sampling was discontinued. Dave Michaelson, Carl Wakefield, and Dave Gullic collected spring macroinvertebrate samples from these stations on April 8-9, 2008. Dave Gullic collected all water quality samples from these sites at this time. Dave Michaelson and Brian Nodine collected fall macroinvertebrates on October 7-8, 2008. Dave Gullic collected the water quality samples on October 7, 2008.

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 Imboden Fork 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-mi^2 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 2009d) 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/Black/Current 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/Black/Current EDU and the 14-digit Hydrologic Unit Code (**HUC**) that contain 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/Black/Current 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 were 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 UTME 692107, UTMN 4147245.

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 UTME 691135, UTMN 4149194.

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 UTME 691167, UTMN 4151896.

East Fork Black River 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 UTME 691085, UTMN 4155444.

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 UTME 690836, UTMN 4156925.

East Fork Black River Station #6 (NW ¼ sec. 16, T. 33 N., R. 2 E.) is the restored river reach within Johnson's Shut-Ins State Park, located between Highway N and the Station 5 upstream terminus. Geographic coordinates of the upstream terminus of the sampling reach are UTME 690586, UTMN 4157636.

East Fork Black River Station #8 (S ½ sec. 4, T. 33 N., R. 2 E.) was located upstream from the Imboden Fork 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 UTME 690756, UTMN 4159120.

Taum Sauk Creek #1 (NW ¼ SE ¼ sec. 27, T. 33 N., R. 2 E.) was sampled downstream of the confluence with Little Taum Sauk Creek, near the County Road 204 crossing. Geographic coordinates at the upstream terminus of the sample reach are UTME 693419, UTMN 4153536.

Imboden Fork #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 UTME 689710, UTMN 4161164.

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 (**SMSBPP**) (MDNR 2010h). A total of three standard habitats—flowing water over coarse substrate (riffles and runs), depositional substrate in non-flowing water (pools), and rootmat at the stream edge—were sampled at all East Fork Black River, Taum Sauk Creek, and Imboden Fork locations.

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 goal for calculating single-habitat criteria was to determine whether a differential effect existed among the multiple habitats sampled in this study. Investigating single-habitat criteria allowed us the ability to make more precise judgments 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 grouped for comparison as were

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 2010h). 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 2010e) 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 2010c), dissolved oxygen (MDNR 2009b), conductivity (MDNR 2010f), turbidity (MDNR 2010d), and pH (MDNR 2009c). 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). Procedures outlined in Field Sheet and Chain of Custody Record (MDNR 2010g) and Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2009a) 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-ESP-113, Flow Measurement in Open Channels (MDNR 2003a), with the exception that discharge for East Fork Black River Stations 1, 3, and 6 were based on USGS gaging station data (gaging station #07061300 for EFBR Station 1, #07061290 for EFBR Station 3, and #07061270 for EFBR Station 6).

Physicochemical data were summarized and presented in tabular form for comparison among stations (Table 2, Table3, Table 4, and Table 5).

4.4 Stream Habitat Assessment Project Procedure

Standardized assessment procedures were followed as described for glide/pool prevalent streams in the Stream Habitat Assessment Project Procedure (**SHAPP**) (MDNR 2010a). According to the SHAPP, the aquatic community is influenced by the quality of the stream habitat. Stream habitat quality is scored for each station and the scores are

compared with the SHAPPs conducted at the control stations. If the SHAPP score at a test station is ≥75% of the SHAPP control scores, the stream habitat at the test station is considered to be comparable to the control streams. A single similarly sized stream located within the same EDU was chosen for comparison as the SHAPP control.

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 2010b).

4.5.2 Biological Samples

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (MDNR 2010h).

4.5.3 Biological Data Entry

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

5.0 Data Results

5.1 Physicochemical Data

Flow and non-nutrient water quality parameters of East Fork Black River sites sampled in spring 2008 are presented in Table 2, with fall 2008 data in Table 3. Discharge from the Lower Reservoir exceeded that of the upstream East Fork Black River reach flowing through Johnson's Shut-Ins the spring field season, but discharge was similar among stations in the fall season. Turbidity readings were higher among the lower East Fork stations during the higher spring flows, but with lower flow conditions in the fall, turbidity readings were similar among stations. High flow events during spring 2008 (described below) also may have contributed to decreased turbidity readings among Stations 1-3 by scouring much of the fine event-related sediment in the lower river (Michaelson and Gullic 2008). Although turbidity tended to be higher among the lower East Fork stations in spring, the highest turbidity reading was observed in fall 2008 at Station 6, which was the restored reach upstream of the shut-ins at JSISP. Turbidity at this point was attributable to earth moving equipment working in the channel upstream of the sampling location. Conductivity tended to be slightly higher among East Fork Black River stations upstream of the Lower Reservoir compared to the lower river stations

during both seasons. The remaining non-nutrient water quality parameters were similar among stations.

Spring 2008 sampling was conducted between two extreme flow events. On March 18, 2008, 6 inches of rain resulted in a 15,400 cfs discharge reading at the Highway 21 gage. Macroinvertebrates and water quality samples were collected approximately three weeks later on April 9, 2008. Hours after spring sampling was concluded, a 3.5 inch rain resulted in a flow of 22,800 cfs on April 10, 2008. Each of these discharges was of sufficient magnitude to rank among the top three flow events, based on a period of record at the Highway 21 gage dating back to 1960.

Table 2
Spring 2008 Flow and *In situ* Water Quality Measurements

	Parameter					
Station	Flow (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
EFBR #1	144*	11.6	11.0	67	7.8	7.25
EFBR #2	144*	11.3	10.8	66	7.9	7.27
EFBR #3	144*	11.6	11.4	62	7.8	8.09
EFBR #4	115	11.0	11.2	85	8.0	1.85
EFBR #5	116	11.1	12.3	109	8.1	1.53
EFBR #6	103	10.9	12.7	87	7.9	1.66
EFBR #8	51	11.9	10.4	81	7.8	1.60
IF #1	45	11.9	10.2	70	7.8	1.67
TSC #1	43	12.3	10.3	70	8.0	5.53

*USGS Gaging Station data at Hwy. 21 used for all three downstream EFBR stations.

Table 3
Fall 2008 Flow and *In situ* Water Quality Measurements

Station	Flow (cfs)	Temperature (˚C)	Dissolved O_2 (mg/L)	Conductivity (µS/cm)	pH	Turbidity (NTU)
EFBR #1	6.0*	19.9	8.0	171	7.7	<1.00
EFBR #2	6.0*	19.4	8.4	171	7.7	<1.00
EFBR #3	4.3**	20.1	8.7	164	7.8	2.30
EFBR #4	6.5	18.7	9.1	235	8.1	<1.00
EFBR #5	7.9†	18.2	8.8	235	7.7	<1.00
EFBR #6	7.9†	18.0	8.7	215	7.8	52.2
EFBR #8	7.9	17.9	8.5	215	7.8	<1.00
TSC #1	1.7	18.5	8.3	164	7.3	<1.00

*USGS Gaging Station data at Hwy. 21 used for Station 1 and Station 2.
**USGS Gaging Station data at the Lower Taum Sauk Reservoir dam used for Station 3.
†USGS Gaging Station data at Hwy. N used for Station 5 and Station 6.

Nutrient concentrations and chloride concentrations are presented in Table 4 (spring 2008) and Table 5 (fall 2008). Ammonia as nitrogen and total phosphorus were either

below the detectable limit or below the analytical Practical Quantitation Limit (**PQL**) for all sample stations for both 2008 seasons. Only total nitrogen was consistently present in detectable levels, with the highest reading occurring in spring at Station 6. All chloride concentrations were below the PQL. Among East Fork samples, chloride tended to be lower downstream of the Lower Reservoir. This difference was more pronounced in fall samples. During both 2008 sample seasons, NO_2+NO_3-N concentrations were present in levels either below the PQL or below detectable limits.

Table 4
Spring 2008 East Fork Black River Watershed Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
EFBR #1	*	0.03**	0.12	*	1.36**
EFBR #2	*	0.02**	0.12	*	1.35**
EFBR #3	*	0.03**	0.15	*	1.22**
EFBR #4	*	0.04**	0.11	*	1.73**
EFBR #5	*	0.05**	0.09	*	1.60**
EFBR #6	*	0.04**	0.32	*	1.75**
EFBR #8	*	0.03**	0.09	*	1.98**
IF #1	*	0.04**	0.10	*	1.22**
TSC #1	*	0.01**	0.05	*	1.12**

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

Table 5
Fall 2008 East Fork Black River Watershed Nutrient Concentrations

	Parameter (mg/L)				
Station	NH_3-N	NO_2+NO_3-N	Total Nitrogen	Total Phosphorus	Chloride
EFBR #1	*	0.03**	0.10	*	1.39**
EFBR #2	*	0.03**	0.11	*	1.62**
EFBR #3	*	*	0.16	0.01**	1.68**
EFBR #4	*	*	0.05	*	2.13**
EFBR #5	*	0.03**	0.06	*	2.21**
EFBR #6	*	0.02**	0.04**	*	2.52**
EFBR #8	*	0.01**	0.05	*	2.51**
TSC #1	*	0.01**	0.04**	*	1.56**

*Below detectable limits
**Estimated value, detected below Practical Quantitation Limits

5.2 Stream Habitat Assessment

Scoring results of the habitat assessment are found in Table 6. According to SHAPP guidance, study stations scoring at least 75 percent of the total score of reference/control

stations should support a similar biological community. The SHAPP score for the reference stream used for comparison was 143. Each of the study stations scored >75% of the control stream.

Table 6
Stream Habitat Assessment Scores and Percent Comparison

Stations	SHAPP Scores	Percent of Control Stream Average
EF Black R. #1	167	>100
EF Black R. #2	161	>100
EF Black R. #3	147	>100
EF Black R. #4	150	>100
EF Black R. #5	155	>100
EF Black R. #6	133	93
EF Black R. #8	131	91.6
Control Stream		
Sinking Creek	143	

5.3 Biological Assessment

5.3.1 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/Black/Current EDU. Prior to the reservoir failure, East Fork Black River was one of seven reference streams within this EDU. Criteria for spring and fall 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/Black/Current EDU, Spring Season

	Score = 5	Score = 3	Score = 1
TR	>91	91-45	<45
EPTT	>31	31-15	<15
BI	<5.4	5.4-7.7	>7.7
SDI	>3.29	3.29-1.65	<1.65

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

	Score = 5	Score = 3	Score = 1
TR	>83	83-41	<41
EPTT	>25	25-13	<13
BI	<5.1	5.1-7.5	>7.5
SDI	>3.27	3.27-1.63	<1.63

5.3.1.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir

Downstream of the Lower Reservoir during the spring 2008 sample season, macroinvertebrate biological metrics tended to decline as stations neared the dam (Table 9). Values for Taxa Richness, EPT Taxa, and Shannon Diversity Index were highest at Station 1 and declined in the remaining upstream stations; Biotic Index values among the downstream East Fork stations tended to increase from Station 1 to Station 3, but the difference was insufficient to change the score for this metric. Station 3 exhibited the lowest Taxa Richness and EPT Taxa values among stations downstream of the Lower Reservoir. Macroinvertebrate Stream Condition Index scores were highest at Station 1 and lowest at Station 3. Only Station 3 had MSCI scores sufficiently low to rank partially biologically supporting.

Table 9
Metric Values and Scores for Lower East Fork Black River Stations, Spring 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	116	38	5.5	3.71		
#1 Score	5	5	3	5	18	**Full**
#2 Value	104	35	6.1	3.45		
#2 Score	5	5	3	5	18	**Full**
#3 Value	84	24	6.4	3.19		
#3 Score	3	3	3	3	12	**Partial**
Biocriteria Score = 5	>91	>31	<5.4	>3.29	20-16	**Full**
Biocriteria Score = 3	91-45	31-15	5.4-7.7	3.29-1.65	14-10	**Partial**
Biocriteria Score = 1	<45	<15	>7.7	<1.65	8-4	**Non**

Fall 2008 biological metric values and scores were distributed in a pattern similar to the spring data (Table 10). Taxa Richness, EPT Taxa, and SDI values all were lower at Station 3, with the Biotic Index values being notably higher. Station 2 achieved the highest possible MSCI score and, but for the lack of a single additional taxon, Station 1 also would have attained this score.

Table 10
Metric Values and Scores for Lower East Fork Black River Stations, Fall 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#1 Value	83	27	4.6	3.48		
#1 Score	3	5	5	5	18	**Full**
#2 Value	92	32	4.7	3.64		
#2 Score	5	5	5	5	20	**Full**
#3 Value	70	21	6.0	3.22		
#3 Score	3	3	3	3	12	**Partial**
Biocriteria Score = 5	>83	>25	<5.1	>3.27	20-16	**Full**
Biocriteria Score = 3	83-41	25-13	5.1-7.5	3.27-1.63	14-10	**Partial**
Biocriteria Score = 1	<41	<13	>7.5	<1.63	8-4	**Non**

To assess potential habitat and benthic sediment distribution changes that may occur over time in the lower East Fork, habitat-specific biological criteria comparisons of pre- versus post-event metric scores are presented in Table 11 and Table 12. When comparing single habitat scores over the years, it appears that rootmat at Station 3 continues to be the weakest contributing habitat in the fall, whereas coarse substrate is consistently low in spring samples. Unlike previous years, in which fall MSCI scores for Station 3 were either a combination of two high scoring habitats and one low scoring habitat or a single high-scoring and two low scoring habitats, fall 2008 scores among habitats were similar. Although each individual Station 3 habitat scored higher in fall compared to spring, the overall MSCI score was unchanged. Individual habitat scores at Station 2 also were generally higher in fall, but at Station 1 they were nearly identical among seasons.

Table 11
Lower East Fork Black River
Single Habitat Stream Condition Index Scores--Spring Sample Seasons

Station→	EF Black R. #1			EF Black R. #2			EF Black R. #3		
Habitat ↓ Sample Year→	2006	2007	2008	2006	2007	2008	2006	2007	2008
Coarse Substrate	12	16	18	16	16	14	12	12	12
Non-Flow	12	16	18	18	10	16	18	10	16
Rootmat	14	18	20	14	16	18	14	10	14
MSCI Score	12	18	18	16	16	18	12	12	12

Table 12
Lower East Fork Black River
Single Habitat Stream Condition Index Scores--Fall Sample Seasons

Station→	EF Black R. #1				EF Black R. #2				EF Black R. #3			
Habitat ↓ Sample Year →	2005	2006	2007	2008	2005	2006	2007	2008	2005	2006	2007	2008
Coarse Substrate	20	18	18	18	18	18	18	20	14	18	18	14
Non-Flow	16	20	16	18	18	20	18	20	18	12	18	16
Rootmat	14	16	12	18	12	12	12	18	12	12	12	14
MSCI Score	18	18	18	18	16	18	18	20	12	14	16	12

5.3.1.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir

Only two of the four stations upstream of the Lower Taum Sauk Reservoir—Station 8, the upstream control station, and Station 5, upstream of the shut-ins—attained fully supporting status in spring 2008 (Table 13). The remaining two stations (Stations 4 and 6) scored partially supporting. The two stations with partially supporting scores each had lower Taxa Richness values and higher Biotic Index values compared to those with fully supporting scores. Station 6 had a single taxon less than what was required for a top score in the Taxa Richness metric. This additional taxon would have elevated the Station 6 status to fully supporting.

Table 13
Metric Values and Scores for Upper East Fork Black River Stations, Spring 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	79	26	5.8	3.56		
#4 Score	3	3	3	5	14	**Partial**
#5 Value	85	31	5.3	3.64		
#5 Score	3	3	5	5	16	**Full**
#6 Value	91	29	6.1	3.77		
#6 Score	3	3	3	5	14	**Partial**
#8 Value	108	32	5.2	3.85		
#8 Score	5	5	5	5	20	**Full**
Biocriteria Score = 5	>91	>31	<5.4	>3.29	20-16	**Full**
Biocriteria Score = 3	91-45	31-15	5.4-7.7	3.29-1.65	14-10	**Partial**
Biocriteria Score = 1	<45	<15	>7.7	<1.65	8-4	**Non**

Each of the four stations located upstream of the Lower Reservoir scored fully supporting in fall 2008 (Table 14). Only Station 5 achieved the highest score for each of the biological metrics; the remaining stations had slightly higher Biotic Index scores, which resulted in the difference in MSCI scores. Station 6, the restored reach within JSISP, had

the highest Taxa Richness and EPT Taxa values among the upstream stations in fall 2008.

Table 14
Metric Values and Scores for Upper East Fork Black River Stations, Fall 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
#4 Value	94	30	5.4	3.69		
#4 Score	5	5	3	5	18	**Full**
#5 Value	84	28	4.6	3.57		
#5 Score	5	5	5	5	20	**Full**
#6 Value	97	33	5.8	3.65		
#6 Score	5	5	3	5	18	**Full**
#8 Value	87	31	5.2	3.72		
#8 Score	5	5	3	5	18	**Full**
Biocriteria Score = 5	>83	>25	<5.1	>3.27	20-16	**Full**
Biocriteria Score = 3	83-41	25-13	5.1-7.5	3.27-1.63	14-10	**Partial**
Biocriteria Score = 1	<41	<13	>7.5	<1.63	8-4	**Non**

5.3.2 East Fork Black River Tributaries Biological Assessment

In addition to East Fork Black River Station 8, Taum Sauk Creek and Imboden Fork were added as control sites beginning in spring 2006. Taum Sauk Creek achieved fully supporting status in both 2008 sample seasons (Tables 15 and 16). Imboden Fork, which was sampled only in spring 2008, also was fully supporting. During the spring season Imboden Fork had slightly lower Taxa Richness and Shannon Diversity Index values, but a higher number of EPT Taxa compared to Taum Sauk Creek. Despite these differences in biological metric values, only Imboden Fork Taxa Richness had a lower score.

Table 15
East Fork Black River Tributaries Metric Values and Scores, Spring 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
Taum Sauk Ck. Value	95	23	5.1	3.67		
Taum Sauk Ck. Score	5	3	5	5	18	**Full**
Imboden Fork Value	91	30	5.2	3.48		
Imboden Fork Score	3	3	5	5	16	**Full**
Biocriteria Score = 5	>91	>31	<5.4	>3.29	20-16	**Full**
Biocriteria Score = 3	91-45	31-15	5.4-7.7	3.29-1.65	14-10	**Partial**
Biocriteria Score = 1	<45	<15	>7.7	<1.65	8-4	**Non**

Table 16
East Fork Black River Tributaries Metric Values and Scores, Fall 2008 Season, Using Ozark/Black/Current Biological Criteria Reference Data

Site	TR	EPTT	BI	SDI	MSCI	Support
Taum Sauk Ck. Value	95	33	5.8	3.50		
Taum Sauk Ck. Score	5	5	3	5	18	**Full**
Imboden Fork Value	sampling discontinued					
Imboden Fork Score						
Biocriteria Score = 5	>83	>25	<5.1	>3.27	20-16	**Full**
Biocriteria Score = 3	83-41	25-13	5.1-7.5	3.27-1.63	14-10	**Partial**
Biocriteria Score = 1	<41	<13	>7.5	<1.63	8-4	**Non**

5.4 Macroinvertebrate Community Composition

5.4.1 East Fork Black River

Macroinvertebrate Taxa Richness, EPT Taxa, and percent EPT are presented in Tables 17 and 18. 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.

Spring 2008 Sample Season
Macroinvertebrates were relatively sparse at most of the sample stations in spring 2008. Habitat-specific target numbers of individuals were not reached for at least one habitat at Stations 2, 3, 4, 5, and 6; only Station 1 and Station 8 samples attained target numbers for all three habitats. Coarse substrate habitat seemed particularly depauperate at Stations 4, 5, and 6, where fewer than half of the target number (N=600) was found in subsamples.

Spring 2008 macroinvertebrate samples from East Fork Black River averaged 95 total taxa (range 79-116) and 31 EPT Taxa (range 24-38) (Table 17). Midge larvae (Chironomidae) were the dominant taxa group at all stations except Stations 1 and 2, where squaregill mayflies (Caenidae) were dominant. Chironomids, caenid mayflies, and riffle beetles (Elmidae) accounted for at least half of individuals in the three stations downstream of the Lower Reservoir. Chironomids were the dominant taxa group at each station upstream of the Lower Reservoir. Caenid mayflies were second in abundance at each upstream station except Station 6. The mayfly family Heptageniidae was slightly more numerous than Caenidae at Station 6. Stoneflies in the families Nemouridae and Leuctridae were present among the top five taxa at each of the upstream stations except Station 6. Although these families occurred at Station 6, they were not present in sufficient numbers to rank among the top five.

Station 1 had the highest number of mayfly taxa (N=19), with Station 5 having the fewest (N=13). Of the stations downstream of the Lower Reservoir, Stations 1 and 2 had comparable numbers of mayfly taxa (N=19 and N=17, respectively), whereas Station 3 was lower (N=14). Stations upstream of the Lower Reservoir tended to have lower mayfly taxa richness compared to the lowermost two stations, with the exception of Station 8, which had 17 mayfly taxa. Several mayfly families exhibited patterns of abundance based on their relative position in the watershed, specifically in relation to the Lower Reservoir. Mayflies in the family Caenidae were roughly twice as abundant among stations downstream of the reservoir, whereas the families Baetidae and Ephemerellidae exhibited the opposite trend. Baetid mayflies were not as numerous as caenids throughout the study area but were notably rarer at Stations 1 and 3. Station 2 had more baetid mayflies than the other downstream stations and was roughly comparable to the upstream stations. As with baetids, ephemerellid mayflies also were less abundant than caenids, and the difference between upstream and downstream stations was quite clear. Although Station 5 had the lowest number of ephemerellid individuals among upstream stations (N=49), there were over five times as many present compared to Station 3, which had the most ephemerellids among the downstream stations (N=9). Ephemerellids were present in similar abundance among Stations 1-3 with the number varying only from seven to nine individuals. Despite the low numbers of ephemerellid individuals at Station 1, more ephemerellid taxa were present at this station than any other study site in spring 2008 (eight individuals of five taxa). The remaining stations had only two or three ephemerellid taxa.

Stoneflies were distributed in similar abundance among stations in spring 2008, with the exception of Station 3 and Station 8. Station 3 had the fewest stonefly taxa and individuals of any of the East Fork stations and one genus, *Amphinemura*, was completely lacking. That *Amphineumura* was absent at Station 3 is worth noting because this genus made up over 60 percent of stoneflies at the remaining downstream stations and between 9 and 64 percent at the upstream stations. Station 8 had the highest number of stoneflies of stations sampled in spring 2008, with the majority being immature Leuctridae and *Isoperla*. These two groups accounted for 86 percent of stoneflies at Station 8.

Caddisflies were distributed more evenly among stations than the other previously mentioned EPT groups, with the exception that they were more abundant at Station 3 and less abundant at Station 4 than the remaining sites. Despite having about four times more caddisfly individuals than the next nearest downstream station, caddisfly diversity at Station 3 was about half that of Stations 1 or 2 (but was similar to the type of diversity observed in upstream stations). One genus, *Cheumatopsyche*, accounted for 65 percent of the total caddisfly count at Station 3; this genus was not nearly as abundant among any of the remaining stations.

Riffle beetles (Elmidae) were distributed with no discernible pattern among stations, in terms of abundance or diversity. Station 1 had the most even distribution of elmids

among taxonomic families represented in the sample (4) and had the second highest number of individuals behind Station 3. *Stenelmis* and *Microcylloepus pusillus* were the most abundant elmids at Station 1, with *Dubiraphia* and *Optioservus sandersoni* also present in relatively high numbers compared to the remaining stations. Although Station 3 had the highest number of elmid individuals, this number was represented by only two taxa--*Stenelmis* and *Microcylloepus pusillus*. Of these two taxa, *Stenelmis* accounted for 214 of the 216 (99 percent) elmids in the sample.

Of the remaining taxa groups, few notable patterns were observed. Aquatic worms (Oligochaeta) were present in varying abundance and diversity, with the highest numbers of individuals occurring at Stations 1 and 6. Stations 1, 2, and 8 had a higher number of oligochaete taxa than the remaining stations. Station 3 had the highest number of mollusks present, with the Asian clam *Corbicula* accounting for 76 percent of the mollusks in the sample. *Corbicula* were relatively rare or absent from the remaining samples, with various genera of snails being the only representatives of the phylum Mollusca. The family of true flies that includes midges (Chironomidae) was the most diverse taxonomic group. In spring 2008 Chironomidae comprised 58 genera, species, and species groups. The most abundant of these groups included the genera *Cricotopus/Orthocladius*, *Rheotanytarsus*, and *Tanytarsus*.

Table 17
Spring 2008 East Fork Black River Macroinvertebrate Composition

↓Variable Station→	1	2	3	4	5	6	8
Taxa Richness	116	104	84	79	85	91	108
Number EPT Taxa	38	35	24	26	31	29	32
% Ephemeroptera	31.1	47.3	25.5	44.4	36.2	38.0	33.5
% Plecoptera	4.8	5.8	1.5	9.1	11.1	6.9	10.4
% Trichoptera	3.1	3.7	14.2	4.8	6.1	4.7	4.1
MSCI Score	18	18	12	14	16	14	20
% Dominant Families							
Caenidae	18.8	35.6	20.3	21.1	11.8	13.1	9.8
Elmidae	16.9	4.2	19.0	--	--	--	--
Chironomidae	15.5	19.0	22.7	23.3	22.2	25.4	22.8
Simuliidae	11.5	7.1	--	--	10.6	--	--
Heptageniidae	5.8	4.8	--	4.4	7.4	13.7	9.4
Hydropsychidae	--	--	9.4	--	--	--	--
Corbiculidae	--	--	4.2	--	--	--	--
Ephemerellidae	--	--	--	11.1	--	5.3	9.3
Baetidae	--	--	--	5.6	--	--	--
Nemouridae	--	--	--	5.6	7.0	--	--
Tubificidae	--	--	--	--	--	10.4	--
Leuctridae	--	--	--	--	--	--	7.0

Fall 2008 Sample Season

Fall 2008 macroinvertebrate samples averaged 87 total taxa (range 70-97) and 29 EPT Taxa (range 21-33) (Table 18). Mayflies in the family Isonychiidae were the dominant taxa at Station 1 and Station 2, whereas chironomids were dominant among the remaining stations. Isonychiid mayflies, chironomids, and caenid mayflies were among the dominant taxa at nearly all stations. The composition and relative abundance of the five most abundant taxa were identical at Stations 1 and 2, with more variability occurring among the remaining stations. Mayflies made up similar percentages of samples among all but Stations 3 and 5. Whereas mayflies made up a fairly narrow range of the overall fall samples at six East Fork stations (between 41.6 and 46.5 percent), mayflies accounted for 29.6 percent at Station 3 and 33.6 percent at Station 5. Caddisflies, however, were present in the highest percentage at Station 3 (26.7 percent), with the remaining stations being variable between 7.9 percent (Station 2) and 15.1 percent (Station 4). Stoneflies were present at all stations, but in low numbers and made up no more than 2.1 percent of any sample.

Unlike spring samples, most mayfly families tended not to differ as obviously in abundance between river reaches upstream versus downstream of the Lower Reservoir. Heptageniid mayflies were most abundant at Stations 1, 2, and 8 and least abundant at Station 6. The majority of heptageniids at Stations 1 and 8 were immature larvae that could be identified only to family. Of the seven taxa groupings within the family Heptageniidae, only *Maccaffertium mediopunctatum*, *M. pulchellum*, and *Stenonema femoratum* were present at each station. Mayflies in the family Isonychiidae, represented only by *Isonychia bicolor* in East Fork samples, were present in greatest numbers at Stations 1 and 2 and were least abundant at Station 6. Although *I. bicolor* was common at Station 3, this species was at least 2.5 times more abundant at the remaining downstream stations. The mayfly *Tricorythodes* (family Leptohyphidae) was very rare or present in low to moderate abundance at all but Station 3, where it made up 23 percent of mayflies and 6.8 percent of the entire sample.

As mentioned above, stoneflies were much less abundant in fall samples compared to spring. The number of stonefly individuals ranged from two at Station 3 to 25 at Station 4. With the exception of Station 3, *Neoperla* (family Perlidae) was the most numerous stonefly taxon, making up between 57 and 91 percent of stoneflies. No more than four stonefly taxa were present among any of the fall samples.

Caddisflies were present in comparable numbers among East Fork stations, with the exception of Station 3, where they were roughly twice as abundant compared to the remaining stations. Unlike spring samples, in which Station 3 had greater abundance but fewer taxa than the other two downstream stations, caddisfly taxa richness at Station 3 in the fall sample was similar to the others. The genus *Cheumatopsyche* again accounted for the majority (63 percent) of caddisflies at Station 3, the only station where it had such an overwhelming majority. Among stations upstream of the Lower Reservoir, Station 4 also had more *Cheumatopsyche* than any other caddisfly taxon, making up 51 percent of

the caddisflies in the sample. The pollution-intolerant caddisfly, *Helicopsyche*, was present in much higher numbers among Stations 5, 6, and 8 compared to the remaining downstream stations, making up between 22 and 33 percent of caddisflies in samples. Among Stations 1-4, *Helicopsyche* was either absent (Stations 1 and 3) or rare, making up less than 5 percent of caddisflies.

Similar to spring samples, riffle beetles were present among stations with few notable patterns. Station 1 again exhibited a fairly even distribution of abundance among the four elmid taxa present. Whereas Station 3 had the highest number of elmids among spring samples, it had the fewest in fall 2008. Only two elmid taxa were present at Station 2 (*Stenelmis* and *Dubiraphia*) with the former making up 91 percent of elmids.

Aquatic worms tended to be less abundant in fall samples, with the highest number (N=18) occurring at Station 5. The remaining stations had fewer than 10 oligochaetes per sample. Dragonflies and damselfly larvae (order Odonata) were more abundant in fall samples than spring 2008, although the number of taxa among stations stayed the same or increased only slightly. No single odonate taxon was consistently dominant among all stations, but the damselflies *Argia* and *Enallagma* were more numerous than other odonate taxa at all but Station 1. Slightly fewer chironomid taxa were present in fall samples, but this family remained the most taxa rich group, being made up of 49 genera, species, and species groups. As with spring samples, the genera *Cricotopus/Orthocladius*, *Rheotanytarsus*, and *Tanytarsus* were present in highest abundance.

Table 18
Fall 2008 East Fork Black River Macroinvertebrate Composition

↓Variable Station→	1	2	3	4	5	6	8
Taxa Richness	83	92	70	94	84	97	87
Number EPT Taxa	27	32	21	30	28	33	31
% Ephemeroptera	41.6	42.5	29.6	40.2	33.6	46.5	41.2
% Plecoptera	0.8	1.0	0.1	2.1	1.1	0.4	0.9
% Trichoptera	12.3	7.9	26.7	15.1	14.6	11.1	11.3
MSCI Score	18	20	12	18	20	18	18
% Dominant Families							
Isonychiidae	22.0	17.7	7.3	8.0	11.4	--	9.2
Chironomidae	20.9	15.5	30.1	21.5	15.7	20.3	15.0
Elmidae	8.5	13.2	--	--	8.5	4.1	--
Heptageniidae	8.3	7.9	--	--	--	--	10.2
Caenidae	6.5	6.9	9.1	15.8	10.4	26.8	10.8
Hydropsychidae	--	--	16.9	9.1	--	--	--
Leptohyphidae	--	--	6.8	--	--	--	--
Baetidae	--	--	--	7.9	--	12.9	8.9
Simuliidae	--	--	--	--	8.2	5.3	--

5.4.2 East Fork Black River Tributaries

Spring 2008

As described for several East Fork spring samples, Taum Sauk Creek also failed to attain the target number of subsampled organisms. Although rootmat habitat achieved the desired number of macroinvertebrate individuals, fewer than half the target number was found in either coarse substrate or nonflow habitats. Conversely, Imboden Fork rootmat habitat failed to meet the target number, with the other two habitats reaching their number. Despite the samples from both stations having fewer organisms than desired, each had a fully supporting MSCI score.

Imboden Fork Taxa Richness was one of the highest of spring 2008 samples (Table 19), with only East Fork Black River Stations 1, 2, and 8 being higher. Imboden Fork, like East Fork Black River Station 6, had a single taxon less than what is required for a top score for the Taxa Richness metric. Taum Sauk Creek Taxa Richness was slightly higher than that of Imboden Fork, and achieved the highest possible score for that metric. Chironomids were the dominant taxa group at Taum Sauk Creek during spring, followed by perlodid stoneflies. Perlodids, along with the stonefly family Nemouridae, combined to make up roughly 20 percent of the Taum Sauk Creek sample. Compared to Taum Sauk Creek, chironomids were not as abundant at Imboden Fork but were represented by a similar number of taxa. The aquatic sowbug family Asellidae (made up entirely of *Lirceus*) was the dominant taxon at Imboden Fork, followed by perlodid stoneflies (all *Isoperla*) and heptageniid mayflies. By contrast, heptageniids (as well as mayflies in general) were quite rare at Taum Sauk Creek in spring 2008 compared to Imboden Fork and each of the East Fork stations. Whereas four heptageniid taxa made up 11.6 percent of the Imboden Fork sample, only five individuals of two taxa were present in the Taum Sauk Creek sample.

Although Taum Sauk Creek failed to meet the target number of organisms for two of the three habitats sampled, stoneflies were present at the two tributary stations in nearly equal numbers. Stonefly taxa groups were represented similarly among the two tributary stations, with *Isoperla* and *Amphinemura* being the two dominant genera followed by immature specimens in the families Chloroperlidae and Leuctridae.

Caddisflies were more abundant and slightly more taxa rich in the Imboden Fork sample than Taum Sauk Creek. A total of five caddisfly genera were found in Imboden Fork that were absent from Taum Sauk Creek, whereas two were found only in Taum Sauk Creek.

Few other patterns were observed between the two tributary stations among the remaining taxa groups. Riffle beetles, particularly the genus *Stenelmis*, were more abundant at Imboden Fork compared to Taum Sauk Creek, as were crustaceans (mainly, aquatic sowbugs and crayfish). Oligochaete worms were more numerous and diverse at Taum Sauk Creek as were chironomids, black flies (Simuliidae: *Prosimulium*), and dance flies (Empididae: *Clinocera*).

Fall 2008

Sampling on Imboden Fork was not extended into the fall 2008 sample season.

Taum Sauk Creek had a Taxa Richness of 86 in fall 2008 (Table 19), which was similar to most East Fork stations. The number of EPT Taxa in fall (N=23) was identical to the spring sample and was lower than each of the East Fork stations, except Station 3. Mayflies tended to be much more abundant in the fall sample, whereas stoneflies were much less numerous than in spring. Caddisflies made up a higher percentage of the sample in the fall compared to spring.

Although mayflies were nearly three times as numerous in the fall sample compared to spring, the number of mayfly taxa was identical between the two seasons. The family Caenidae was the dominant mayfly group, made up mostly of *Caenis latipennis* and *C. anceps*. These two species were present in nearly the same ratio to one another in both sample seasons. Caenid mayflies, which more than tripled in abundance, had the largest increase among mayflies from the spring to the fall sample season. This increase occurred mainly with *C. latipennis*, with rootmat habitat providing the greatest contribution. The relative abundance of other mayfly families comprising multiple genera--Baetidae, Heptageniidae, and Ephemerellidae--were largely unchanged between seasons, with the exception that three ephemerellid individuals of two taxa (*Eurylophella bicolor* and *E. enoensis*) were found in spring and none were found in the fall.

Caddisflies made up more of the overall sample in fall. Roughly five times more caddisflies were present in the fall sample than the spring, with caddisfly taxa richness increasing by two in fall. A total of four taxa which were represented by few individuals occurred only in spring samples; however, several taxa that were present only in fall were typically represented by far more individuals. Most notable were two species in the genus *Cheumatopsyche* and the genera *Chimarra* and *Polycentropus*.

Stoneflies, which were quite abundant in the spring Taum Sauk Creek sample, were relatively rare in the fall sample. Although abundance was much lower in fall, the number of stonefly taxa declined by only two between seasons. Despite the relatively small difference in stonefly taxa richness between seasons, there was little overlap in the taxa that occurred. Only one genus, *Zealeuctra*, was common to both seasons.

Chironomids were the dominant taxa group, making up nearly half of the overall sample. Although chironomids in fall were over three times as abundant compared to spring, chironomid taxa richness increased by only one. Although chironomid taxa richness was similar among seasons, a substantial proportion of those taxa occurred only in a single season. That the overall chironomid taxa richness was nearly the same among seasons was due to a similar number of taxa occurring only in one season but not the other. Total chironomid taxa richness, including both seasons, was 45; of that, only 17 taxa were common to both seasons.

A few of the remaining Taum Sauk Creek taxa groups exhibited trends between seasons. Riffle beetles were more abundant in fall and ranked among the five dominant taxa. Of the three elmids present, *Optioservus sandersoni* had the largest increase in numbers between the two sample seasons, whereas the remaining two were present in similar abundance. Among non-chironomid dipterans, the empidid *Clinocera*, which had been somewhat numerous in the spring sample, was absent in fall. Two genera of black flies, *Prosimulium* and *Simulium*, each were present in similar abundance but exclusive of one another by season. *Prosimulium* was present in spring samples but absent in fall, whereas *Simulium* was found only in the fall sample.

Table 19
East Fork Black River Tributaries Macroinvertebrate Composition

Station→	Taum Sauk Creek		Imboden Fork
↓Variable / Season→	Spring 2008	Fall 2008	Spring 2008
Taxa Richness	95	86	91
Number EPT Taxa	23	23	30
% Ephemeroptera	17.6	29.4	28.4
% Plecoptera	28.5	0.7	19.8
% Trichoptera	1.8	5.3	4.4
MSCI Score	18	16	16
% Dominant Families			
Chironomidae	23.8	49.1	9.6
Perlodidae	13.7	--	11.9
Caenidae	11.6	24.9	5.1
Nemouridae	6.7	--	--
Simuliidae	5.8	3.1	--
Asellidae		--	18.6
Heptageniidae		--	11.5
Baetidae		2.5	
Elmidae		3.8	

6.0 Data Trends

This section builds on data trends first presented in the biological assessment of 2007 sample data (Michaelson 2009). Water quality, biological assessment metrics, and macroinvertebrate community composition trends are presented here to show whether changes in these parameters have occurred over time or in response to remediation efforts undertaken in certain reaches of the East Fork Black River.

6.1 Water Quality

Most water quality parameters sampled between fall 2005 and fall 2008 (Table 20) exhibited fluctuations that are typical of seasonal or diel patterns. Changes among years in flow, temperature, dissolved oxygen, and conductivity can be explained by differences in rainfall patterns and, for the lower East Fork Black River, water release cycles from the Lower Taum Sauk Reservoir. During fall low-flow conditions in the lower East Fork, turbidity appears to have returned to levels similar to those observed prior to the 2005 Upper Reservoir breach. Turbidity upstream of the Lower Reservoir continues to be situational. Samples collected within and downstream of construction activities and the JSISP stream restoration project tended to have higher turbidity than the control station (Station 8) or the station located downstream of the park at the AmerenUE property boundary (Station 4).

Nutrient parameters were not collected in the spring 2006 field season. Turbidity and field parameters were measured and are available for comparison in Table 21. Turbidity readings among East Fork stations downstream of the Lower Reservoir were lower in spring 2007 than 2006. Spring turbidity readings consistently increased in slight increments while progressing upstream from Station 1 to Station 3 in 2006 and 2007. Compared to Stations 1 and 2, turbidity was slightly higher at Station 3 in 2008; however, the difference among lower East Fork stations was the lowest since spring samples were first collected in 2006.

For stations located upstream of the Lower Reservoir, turbidity readings were lower in spring 2008 than in previous years, with the exception that the upstream control Station 8 was relatively unchanged. Turbidity at each of the upstream stations was lower than the lower East Fork stations. During the fall sample season, turbidity at each of the East Fork stations was similar, except for a reading of 52.2 NTU at Station 6 that was likely due to construction activity occurring in the upstream portion of the sample reach.

Nutrient parameters were similar among all stations in spring 2007 and 2008 (Table 21). All but a very few analytes were present in concentrations below detectable levels or below the practical quantitation limit for that nutrient. Although nutrient concentrations among East Fork samples were higher in fall samples compared to spring, the majority were below detectable levels or the PQL.

Table 20
Fall Water Quality Parameters

	East Fork Black River																								
Station	1				2				3				4			5			6				8		
Parameter ↓ Year →	05	06	07	08	05	06	07	08	05	06	07	08	06	07	08	06	07	08	05	06	07	08	06	07	08
Flow	13.4	2.9	90.0	6.0	13.6	3.0	54.1	6.0	13.2	7.1	50.3	4.3	3.6	17.9	6.5	3.6	15.2	7.9	9.0	0.5	23.0	7.9	0.6	5.3	7.9
Temp	26.0	15.0	22.9	19.9	26.5	16.5	24.1	19.4	27.5	16.5	21.7	20.1	20.5	22.6	18.7	16.0	25.6	18.2	25.5	23.0	25.4	18.0	17.0	20.0	17.9
D.O.	7.24	7.54	9.06	8.0	7.85	8.19	8.76	8.4	7.34	8.30	8.04	8.7	9.80	9.56	9.1	8.31	8.66	8.8	7.57	2.27	9.24	8.7	7.15	7.27	8.5
Cond.	183	254	136	171	183	268	134	171	184	273	130	164	270	199	235	323	202	235	220	355	187	215	254	183	215
pH	8.3	7.9	7.77	7.7	8.3	8.1	7.91	7.7	8.2	7.7	7.56	7.8	8.2	8.11	8.1	7.6	7.88	7.7	8.4	7.1	7.99	7.8	8.0	7.58	7.8
Turb.	1.00	4.02	5.42	1.00	1.00	6.66	6.01	1.00	2.00	53.3	10.2	2.30	1.00	1.00	1.00	1.57	1.00	1.00	2.00	22.2	1.00	52.2	1.19	1.00	1.00
NH_3-N	†	†	†	†	†	†	†	†	†	0.53	†	†	†	†	†	†	†	†	0.06	0.19	†	†	†	†	†
NO_2+NO_3-N	0.03*	0.20	0.09	0.03*	0.02*	0.25	0.08	0.03*	0.04*	0.08	0.07	†	0.16	0.13	†	0.09	0.14	0.03*	†	†	0.11	0.02*	0.01*	0.15	0.01*
Ttl. Nitrogen	0.09	0.33	0.22	0.10	0.25	0.41	0.22	0.11	0.15	0.84	0.29	0.16	0.26	0.19	0.05	0.14	0.20	0.06	0.07	0.20	0.17	0.04*	0.06	0.20	0.05
Ttl. Phos.	†	†	†	†	†	†	†	†	†	†	†	0.01*	†	†	†	†	†	†	0.77	†	†	†	†	†	†
Chloride	1.57*	2.35*	1.33*	1.39*	1.62*	2.33*	1.38*	1.62*	1.47*	2.43*	1.34*	1.68*	2.24*	2.39*	2.13*	2.31*	2.49*	2.21*	2.00*	2.35*	2.48*	2.52*	2.35*	3.04*	2.51*

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

Table 21
Spring Water Quality Parameters

	East Fork Black River																				
Station	1			2			3			4			5			6			8		
Parameter ↓ Year →	06	07	08	06	07	08	06	07	08	06	07	08	06	07	08	06	07	08	06	07	08
Flow	111	44.0	144	108	42.9	144	110	53.0	144	164	28.3	115	170	25.8	116	2.1	**	103	69.6	13.4	51
Temp	8.2	11.0	11.6	9.1	10.8	11.3	9.4	11.9	11.6	6.5	11.1	11.0	6.5	11.3	11.1	8.7	**	10.9	6.5	11.0	11.9
D.O.	10.8	10.4	11.0	10.6	10.9	10.8	10.9	11.2	11.4	11.7	10.7	11.2	11.3	11.1	12.3	6.52	**	12.7	11.8	11.3	10.4
Cond.	102	143	67	99.8	141	66	99.2	136	62	127	145	85	123	145	109	168	**	87	121	132	81
pH	8.20	7.42	7.8	8.10	7.69	7.9	8.05	7.98	7.8	7.67	7.90	8.0	7.70	7.79	8.1	7.37	**	7.9	7.77	7.93	7.8
Turb.	32.3	6.71	7.25	33.5	7.90	7.27	37.9	8.97	8.09	8.81	5.20	1.85	21.0	14.5	1.53	35.4	**	1.66	3.14	1.00	1.60
NH_3-N	--	†	†	--	†	†	--	†	†	--	†	†	--	†	†	--	**	†	--	†	†
NO_2+NO_3-N	--	0.04*	0.03*	--	0.04*	0.02*	--	0.03*	0.03*	--	0.04*	0.04*	--	0.05	0.05*	--	**	0.04*	--	0.02*	0.03*
Ttl. Nitrogen	--	0.08	0.12	--	0.09	0.12	--	0.08	0.15	--	0.07	0.11	--	0.08	0.09	--	**	0.32	--	0.05	0.09
Ttl. Phos.	--	0.02*	†	--	0.02*	†	--	0.04*	†	--	0.02*	†	--	0.02*	†	--	**	†	--	0.01*	†
Chloride	--	1.88*	1.36*	--	1.85*	1.35*	--	1.92	1.22*	--	2.02	1.73*	--	2.21	1.60*	--	**	1.75*	--	2.16	1.98*

† Below detectable limits
* Estimated value, detected below Practical Quantitation Limits

6.2 Biological Assessment

6.2.1 Biological Metrics

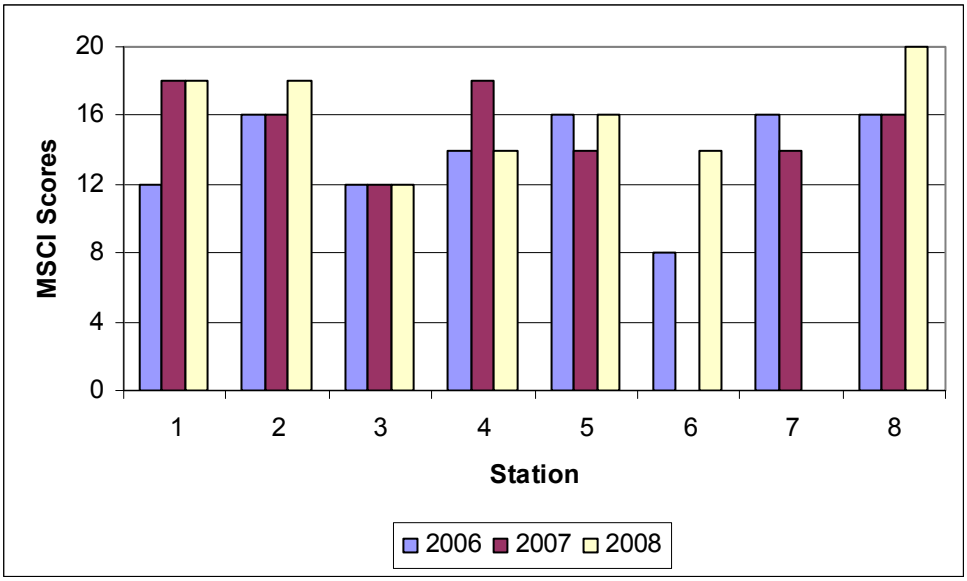
Macroinvertebrate Stream Condition Index (MSCI) scores, which are multi-metric composite scores made up of Taxa Richness, EPT Taxa, Shannon Diversity Index, and Biotic Index, varied seasonally and by station. In the lower East Fork, pre-event conditions are available only for the fall macroinvertebrate community. Fall samples were collected in 2005 prior to the collapse of the Upper Reservoir as part of another study. In the upper East Fork, the site currently referred to as Station 6 within JSISP represents the same East Fork Black River reach that had been a Biological Criteria Reference site. Samples were collected at this station in fall 2005, spring 2000, fall 2000, spring 1999, and fall 1999. Macroinvertebrate data from these samples will serve as a baseline for future assessment of the river restoration project within JSISP.

In this section, each of the four biological metrics that combine to form the MSCI score is presented individually. Although sampling began in fall 2005, biological metrics and the overall MSCI scores are presented with spring followed by fall data for ease of interpretation by season. Biological metrics and MSCI scores are discussed separately by season and graphically presented in Figure 1 through Figure 10.

Spring Macroinvertebrate Stream Condition Index Trends

Spring MSCI scores for stations downstream of the Lower Reservoir were lowest at Station 1 and Station 3 in 2006, where each station achieved an MSCI score of 12 (Figure 1). Although Station 1 achieved only a partially supporting score during the first sample season following the Upper Reservoir breach (spring 2006), it increased to fully supporting status in subsequent years. Spring MSCI scores at Station 3 have remained unchanged among years, with each achieving a partially supporting score of 12. Station 2 had spring MSCI scores of 16 in 2006 and 2007, but increased to 18 in 2008. For stations upstream of the Lower Reservoir (Stations 4-8), MSCI scores were more variable in spring 2008 compared to fall. Stations 5 and 8 each achieved fully supporting scores, with Station 8 attaining the highest possible MSCI score. The remaining upstream stations, 4 and 6, each had partially supporting scores of 14 in spring 2008.

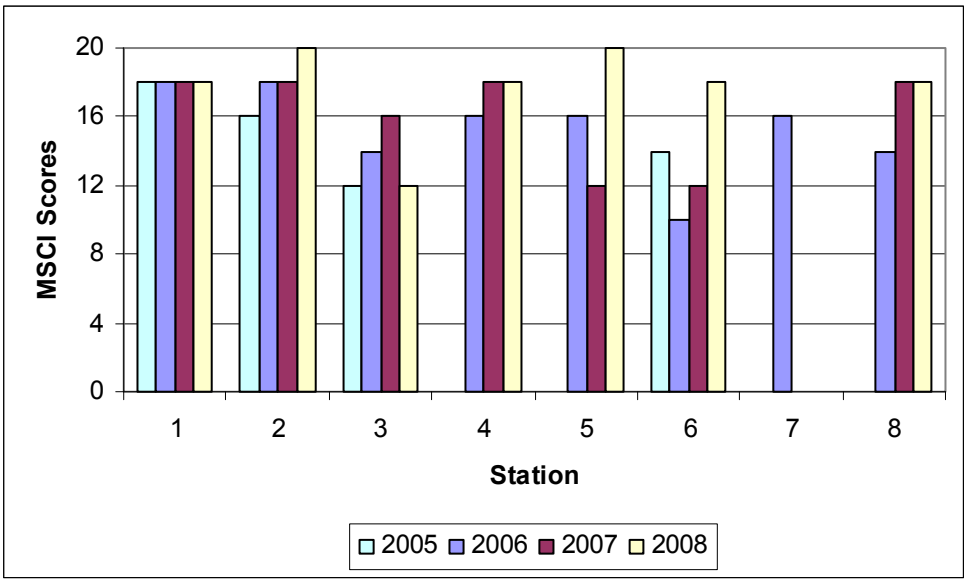
Figure 1
East Fork Black River Spring Macroinvertebrate Stream Condition Index Scores



Fall Macroinvertebrate Stream Condition Index Trends

Among stations downstream of the Lower Reservoir, fall MSCI scores at Stations 1 and 2 were more similar to one another than Station 3 (Figure 2). Station 3 has exhibited more variability over the four fall sample seasons, achieving fully supporting status only once in 2007. With this score, Station 3 appeared to demonstrate incremental improvement since the first samples were collected in 2005. With a fall 2008 MSCI score of 12, however, this trend did not continue. Station 1 fall MSCI scores have remained unchanged over time, with each sample having a score of 18. Station 2 also has achieved a fully supporting score for each of the fall samples, with MSCI scores ranging between 16 in 2005 to 20 in 2008. With the exception of Station 5, which scored 20, all MSCI scores of sites located upstream of the Lower Reservoir (Stations 4-8) were equal to one another in fall 2008, with each station having a fully supporting score of 18. Fall 2008 shows an improvement over previous years for stations located within JSISP, particularly at Station 6. The following fall samples are presented for Station 6: 2005 pre-event data; 2006 "West Channel" data during which time the majority of East Fork flow was directed away from the original channel and into the secondary high flow channel of Station 7; and 2007, which represents macroinvertebrate recolonization that occurred between April (when East Fork flow was directed into the newly-constructed channel) and September 2007. At the time Station 6 was sampled in fall 2008, the restored channel had been in place for approximately 17 months and appears to support an increasingly robust macroinvertebrate community.

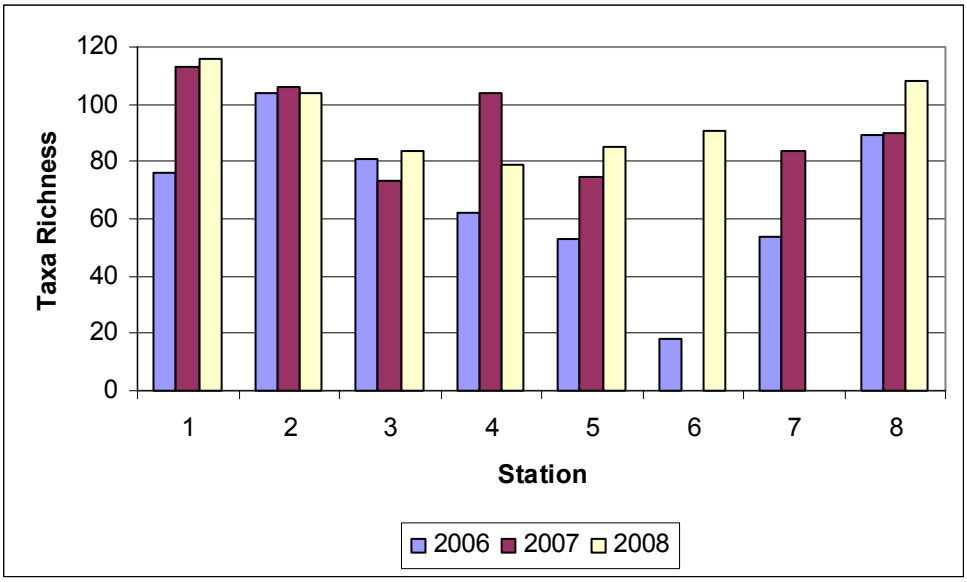
Figure 2
East Fork Black River Fall Macroinvertebrate Stream Condition Index Scores



Spring Taxa Richness Trends

Spring 2008 Taxa Richness followed a pattern similar to that observed in the previous two years among stations downstream of the Lower Reservoir, with fewer taxa occurring in stations nearer the dam. Stations 1 and 3 each had an increase in the number of taxa present from past years, with Station 2 having virtually identical numbers of taxa among years. For stations upstream of the Lower Reservoir, there was considerable variability. Station 4 spring 2008 Taxa Richness was much lower than 2007 (a decrease of 25 taxa), whereas Station 5 increased by 10 and Station 8 increased by 18 taxa. Because Station 6 was under construction in 2007, samples were not collected at that time; however, compared to the Taxa Richness values in the spring of 2006 following the breach, the number of taxa present in 2008 is impressive.

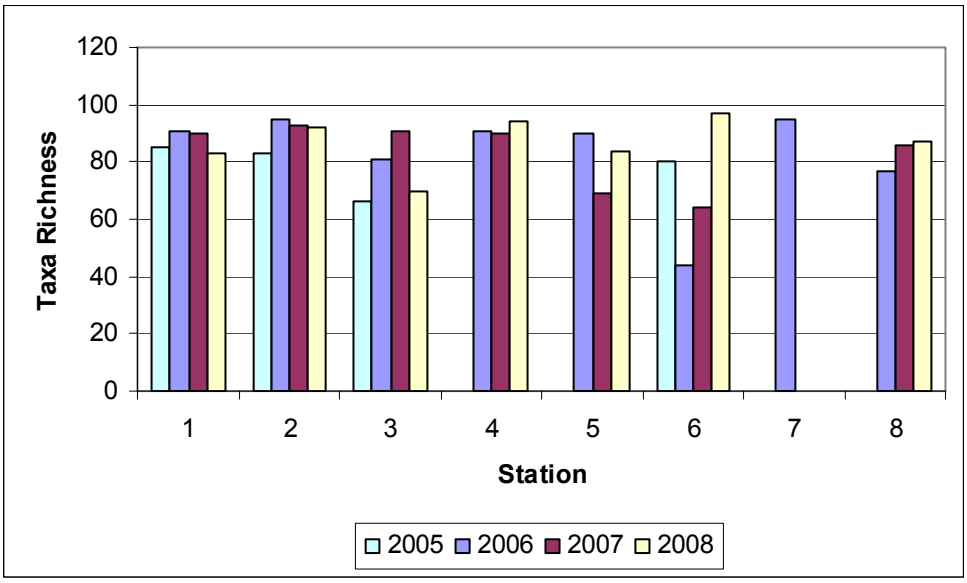
Figure 3
East Fork Black River Spring Taxa Richness Values



Fall Taxa Richness Trends

With a few exceptions, fall Taxa Richness values were comparable among East Fork Black River stations (Figure 4). For stations downstream of the Lower Reservoir, Station 3 exhibited a steady increase from 2005 to 2007, but decreased to near 2005 levels in 2008, mirroring the MSCI score pattern for this site. Taxa Richness for Stations 1 and 2 tended to exhibit less variability among years compared to Station 3. Although fall 2008 Taxa Richness also was lower than 2007 values at Station 1 (decline of seven taxa) and Station 3 (decline of 21 taxa), Station 2 Taxa Richness was nearly unchanged. Among stations upstream of the Lower Reservoir, fall 2008 Taxa Richness values all were at least somewhat higher than 2007. The greatest increases between years occurred at Stations 5 and 6, within JSISP. Station 5 had an increase of 15 taxa over the previous year and Station 6 had 33 more taxa in 2008 than 2007. Station 6 had a greater Taxa Richness in fall 2008 than any of the samples collected previously, including in years prior to the Upper Reservoir breach when it was a biological criteria reference reach.

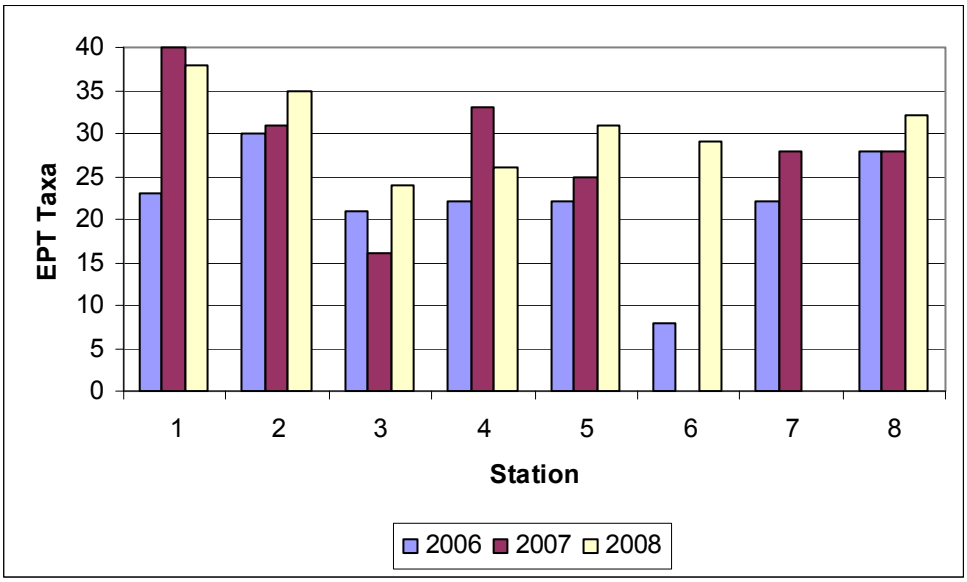
Figure 4
East Fork Black River Fall Taxa Richness Values



Spring EPT Taxa Trends

Patterns of spring EPT Taxa were more variable in 2008 compared to 2007. Among stations downstream of the Lower Reservoir, Stations 2 and 3 each had a higher number of EPT taxa in 2008 than either of the two prior spring sampling events. Although Station 1 had slightly fewer EPT taxa in 2008 than 2007, it continued to have the highest value for this metric of any of the study sites. For stations upstream of the Lower Reservoir, Stations 5, 6, and 8 also had higher numbers of EPT taxa than either of the past spring samples. Station 6 had an equal number of EPT taxa in 2008 (N = 29) as were present in spring 2000 when it was sampled as a biocriteria reference reach.

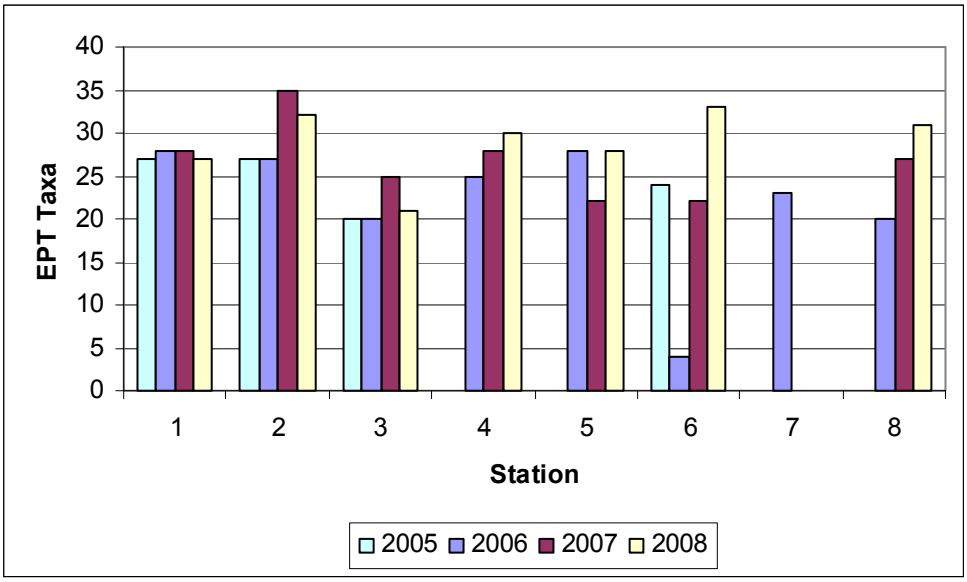
Figure 5
East Fork Black River Spring EPT Taxa Values



Fall EPT Taxa Trends

Each of the stations downstream of the Lower Reservoir had fall EPT Taxa values in 2008 that were slightly lower than 2007. Station 3, which had its highest number of EPT Taxa in 2007, returned to levels similar to past samples in 2008. Station 1 has had very little variability in EPT Taxa; since 2005 the EPT Taxa value has not differed by more than a single taxon. Station 2 had an increase of eight EPT taxa between 2006 and 2007, but decreased slightly by three EPT taxa in 2008. Of the upstream sites, Stations 4, 6, and 8 had EPT Taxa values higher in fall 2008 than any of their respective past fall samples (Figure 6). Stations 4 and 8 each had a pattern of incremental increases in EPT Taxa from 2006 to 2008. Station 6 had more EPT taxa in 2008 than any of the three fall samples collected at this site prior to the Upper Reservoir failure.

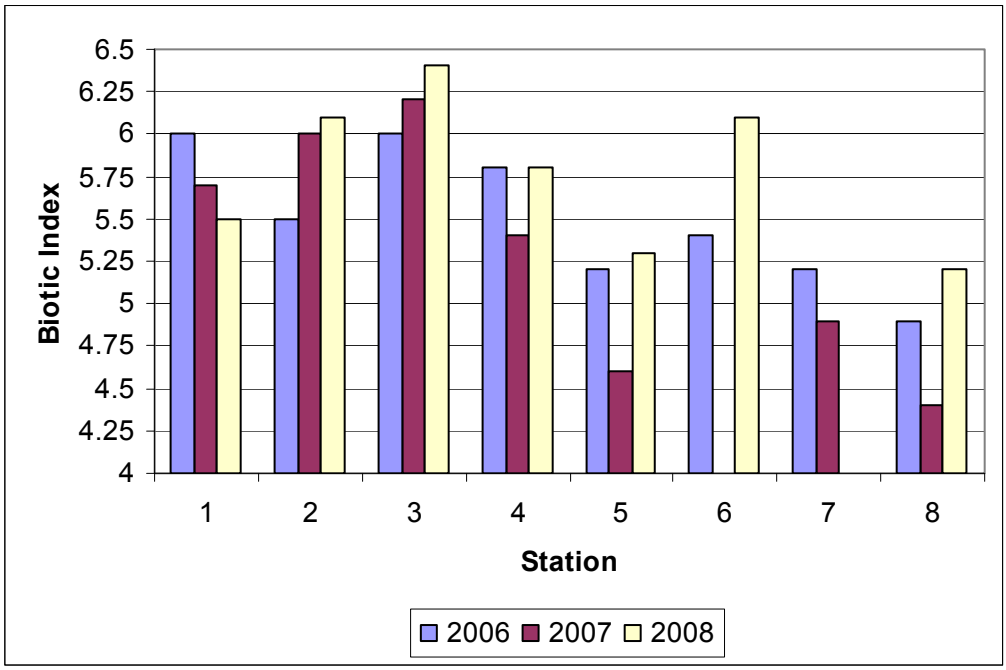
Figure 6
East Fork Black River Fall EPT Taxa Values



Spring Biotic Index Trends

With the exception of Station 1, the Biotic Index for each East Fork sample site was higher in spring 2008 than 2007 (Figure 7). Station 1 Biotic Index values have decreased each year between 2006 and 2008, whereas the remaining stations downstream of the Lower Reservoir have increased each year during the same time period. Within the lower river reach, 2007 and 2008 spring Biotic Index values increased as stations neared the Lower Reservoir. Among the stations upstream of the Lower Reservoir, Biotic Index values also were higher in 2008 compared to 2007, but most were similar to 2006 values. Only Stations 5 and 8 had Biotic Index values that were sufficient to achieve a score of 5.

Figure 7
East Fork Black River Spring Biotic Index Values

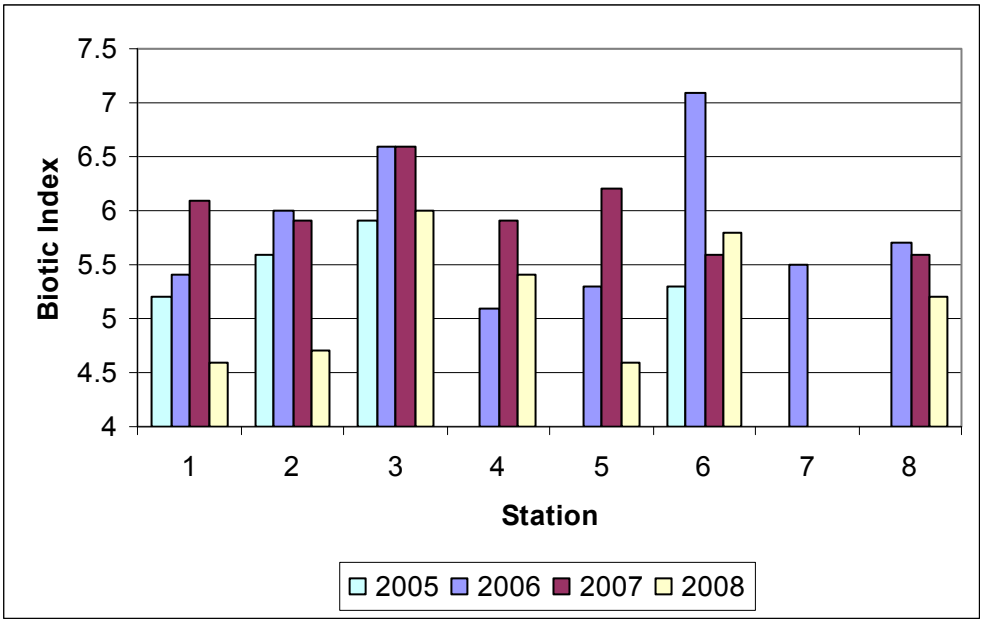


Fall Biotic Index Trends

Despite the differences in fall Biotic Index values shown in Figure 8, all Biotic Index scores between 2005 and 2007 were equal. In 2008, however, Stations 1, 2, and 5 had Biotic Index values that were sufficiently low (BI < 5.1) to attain the highest score of 5 for that metric. Biotic Index values were lower in 2008 than 2007 at all stations except Station 6, which was slightly higher.

Following the Upper Reservoir failure, which occurred after the fall 2005 sample season, Biotic Index values were higher at each of the three lower East Fork stations during fall 2006 and 2007. In the fall of 2008, however, the Biotic Index value at Station 3 was nearly equal to the pre-event value of 2005 and Stations 1 and 2 Biotic Index values were lower than in 2005.

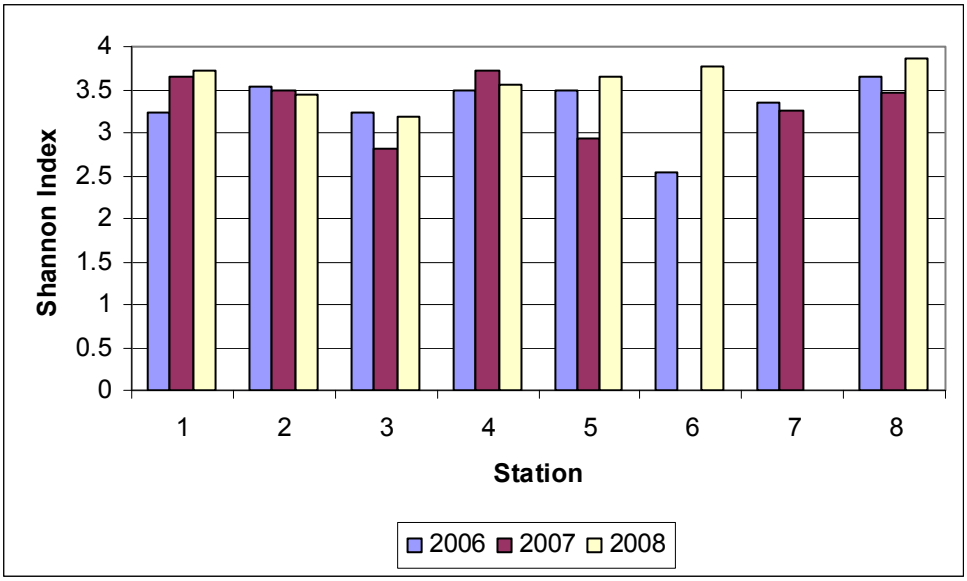
Figure 8
East Fork Black River Fall Biotic Index Values



Spring Shannon Diversity Trends

Spring SDI values were more variable among stations and years compared to the fall (Figure 9). All sites except Station 3 had spring 2008 SDI values sufficient to achieve a score of 5 for that metric. Station 3 spring SDI values for all three years have fallen below the threshold required to reach a score of 5. Spring SDI values tended to decrease among lower river sites as the stations approached the Lower Reservoir dam. Among stations upstream of the Lower Reservoir, SDI values increased slightly with each site while progressing upstream.

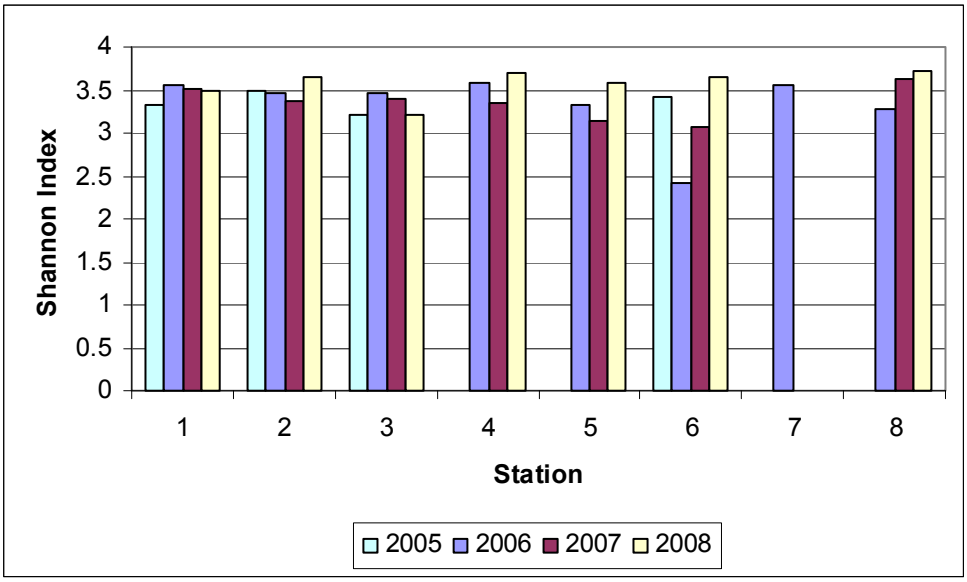
Figure 9
East Fork Black River Spring Shannon Diversity Index Values



Fall Shannon Diversity Trends

Fall Shannon Diversity Index values were fairly consistent among stations and among years (Figure 10). Fall 2008 SDI values were higher at each of the East Fork sites than any of the previous years, except Stations 1 and 3. With the exception of Station 3, which had an SDI score of 3 in 2008, the SDI of each of the East Fork stations achieved a maximum score of 5 for that metric. Although most of the East Fork sites consistently have had SDI scores of 5 between 2005 and 2008, Stations 3, 5, and 6 each have had SDI scores of 3. Low SDI scores at Station 5 (2006) and Station 6 (2006 and 2007) occurred post-event prior to or during East Fork restoration activities. Station 3, however, has had SDI scores of 3 in 2005 and 2008, years in which no major construction activity in the watershed took place.

Figure 10
East Fork Black River Fall Shannon Diversity Index Values



6.2.2 Macroinvertebrate Community Composition Trends

In previous East Fork Black River biological assessment reports (Michaelson 2007, 2009), macroinvertebrate community composition of fall 2005 was compared to the post-event fall community among stations downstream of the Lower Taum Sauk Reservoir dam. In the initial post-event comparison using 2006 data, the report states that the "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." The 2007 report also states that, among East Fork stations downstream of the Lower Reservoir, Station 3 exhibited more differences in the post-event fall 2006 macroinvertebrate community composition than the remaining downstream stations when compared to fall 2005. These differences include:

- more diversity and abundance within the family Chironomidae;
- increased mayfly taxa richness in coarse substrate habitat;
- a dramatic decline of mayfly abundance in rootmat habitat;
- a decline of mayfly taxa richness and abundance in nonflow habitat;
- a decreased number of caddisfly individuals in coarse substrate habitat with an unchanged caddisfly taxa richness; and
- a decrease in the number of caddisfly taxa and abundance in rootmat habitat.

Several trends noted in the preceding paragraph also were observed in 2008 samples; other trends, however, were not. A station-by-station comparison of the fall 2005 versus fall 2008 macroinvertebrate community composition will be presented in later paragraphs and in Tables 22 and 23 following the narrative for each station. In addition, pre-event data from the former Biological Criteria Reference reach (2005 Station 4) will be compared to the restored East Fork reach of Station 6. First, however, the trends noted above for Station 3 will be addressed in a similar format for comparing 2005 with 2008 data:

- fall 2008 chironomid taxa richness and abundance were greater than fall 2005;
- fall 2008 mayfly taxa richness in coarse substrate habitat was equal to 2005;
- Station 3 mayfly abundance in rootmat habitat was less than half in 2008;
- mayfly taxa richness and abundance in Station 3 nonflow habitat was only slightly lower in 2008;
- caddisfly abundance was greater in 2008 and taxa richness increased by a single taxon in Station 3 coarse substrate;
- Station 3 rootmat had greater caddisfly abundance and slightly higher taxa richness in 2008 compared to 2005.

<u>East Fork Black River Station 1</u>
Station 1 had equal numbers of mayfly taxa (18) in fall 2005 and fall 2008 samples, but lower numbers of individuals were observed. Whereas the number of mayflies present in coarse substrate was nearly equal between years, they were much less abundant in nonflow and rootmat habitats. Despite lower numbers of individuals, however, mayflies

accounted for only a slightly lower percentage of the total sample in 2008 (41.6 percent) than 2005 (48.1 percent). Stoneflies were equally rare with comparable numbers of taxa for both sample years. Caddisflies were represented by one more taxon in 2008 than 2005, but nearly twice as many individuals were present in the sample. A notable difference in the overall percent was observed, with caddisflies making up 12.3 percent in 2008 versus 5.5 percent in 2005. The number of taxa as well as abundance of individuals in the family Chironomidae was greater in 2008, with chironomids making up nearly twice as much of the sample (10.8 percent in 2005; 20.9 percent in 2008). Aquatic worms (including the families Tubificidae, Lumbriculidae, and order Lumbricina) were less abundant and made up a lower percentage of the 2008 sample than 2005. In 2005 aquatic worms made up 1.8 percent of the sample, whereas in 2008 they accounted for less than 1 percent. Mollusks (including all bivalves and gastropods) were absent in the coarse substrate habitat sample in 2008, but abundance overall was equal among years. Beetles (Coleoptera) were considerably lower in abundance in the 2008 coarse substrate sample compared to 2005, but roughly similar in the remaining habitats. The total number of beetles in 2008 for all three habitats combined was roughly a third of the 2005 sample, but with only two fewer taxa.

East Fork Black River Station 2

Station 2 had slightly higher mayfly abundance and taxa richness (20 mayfly taxa in 2008 and 17 in 2005), and accounted for 42.5 percent of the 2008 sample. By comparison, in 2005 mayflies made up 39.1 percent. Stoneflies also were present in similarly low numbers in Station 2 fall samples for both years. In 2008, however, stoneflies were found in each of the three habitat samples, compared to 2005 where they were present only in coarse substrate. In 2005 12 stoneflies of two taxa made up 0.9 percent of the sample; in 2008 15 stoneflies of three taxa made up 5.8 percent. Caddisflies were less abundant in 2008 coarse substrate habitat, but the total number of individuals including all habitats was nearly equal to the number in 2005. Caddisflies made up a similar percentage of the 2008 sample (7.9 percent) compared to 2005 (8.8 percent). Although the number of caddisfly individuals was nearly equal between years, taxa richness for this group was slightly higher in 2008 (nine caddisfly taxa in 2008, seven in 2005). Chironomid abundance was much lower in 2008 coarse substrate habitat (57 in 2008, 124 in 2005), but despite the lower abundance, chironomid taxa richness was higher for this habitat. Chironomids were more abundant and diverse in the nonflow and rootmat habitats, with eight more chironomid taxa overall in the 2008 sample than in 2005. Whereas chironomids made up 16.8 percent of the 2005 sample, they accounted for 15.5 percent in 2008. Aquatic worms were much less abundant in 2008 at Station 2 compared to 2005 and had only a single taxon among all three habitats. Although mollusks were present in similar abundance in coarse substrate and nonflow samples, fewer were present in the 2008 rootmat habitat. In addition, only three mollusk taxa were present in 2008, compared to six in 2005.

East Fork Black River Station 3

With all three habitats combined, mayflies were present in nearly equal numbers and made up similar percentages of 2005 (30.4 percent) and 2008 (29.6 percent) samples. In addition, the number of mayfly taxa present in 2008 was nearly equal to 2005. When comparing by habitat, however, there were differences. Mayfly abundance was much higher in coarse substrate but lower in nonflow and rootmat habitats. Despite these differences in mayfly abundance, however, the number of taxa for each habitat was nearly identical in 2005 and 2008. Again, stoneflies were rare in fall samples, with only two individuals present in the 2008 sample. In 2008 caddisflies were more abundant in each habitat, but the number of taxa for each habitat was nearly the same between years. With this increased abundance, caddisflies made up 26.7 percent of the 2008 sample compared to 17.1 percent in 2005. Chironomid abundance in coarse substrate and rootmat habitats was nearly equal in 2008 and 2005, but was slightly higher in 2008 nonflow. Compared to 2005, chironomid taxa richness was higher in each of the three habitats in 2008, but this difference was not overwhelming. As was the case in 2005, chironomids made up the highest percentage of the sample at Station 3 in 2008 (30.1 percent at Station 3, 15.5 percent at Station 2, and 20.9 percent at Station 1). Whereas aquatic worms were more abundant at Station 3 in 2007 compared to 2005 by a factor of 10, this was not the case in fall 2008. Each habitat had the same number of aquatic worms or fewer in 2008, with only four individuals being present among the three samples. Mollusks were present in similar numbers and diversity in 2007 samples but differed between years by habitat. Mollusks were less abundant in 2008 nonflow, but more individuals were present in the rootmat habitat sample. Beetles were much less abundant in the 2008 coarse substrate and nonflow habitat samples. In 2005 45 individuals of a single taxon (*Stenelmis*) were present in the nonflow habitat, but in 2008 only two individuals (of the genera *Stenelmis* and *Dubiraphia*) were collected in this habitat. The number of beetles present in the coarse substrate sample also was much lower in 2008. Whereas 120 individuals of four taxa were present in 2005, 19 individuals of two taxa were present in the 2008 coarse substrate. Only a single beetle was found in the rootmat sample in 2005 and 2008.

East Fork Black River Station 6 (Station 4 during the 2005 sample season)

Mayflies were present in slightly greater abundance and taxa richness, but they made up a similar percentage of the 2008 sample (40.6 percent in 2005, 46.5 percent in 2008) (Table 23). Mayfly taxa richness was higher in 2008 nonflow habitat, but it was equal among years for the remaining habitats. Mayflies were present in much higher numbers in 2008 rootmat habitat. Whereas the rootmat portion of the sample held 6.9 percent of the total mayflies in 2005, it provided 33.6 percent in 2008. A total of three stoneflies of two taxa were present in the 2005 sample and six stoneflies of three taxa in 2008. Interestingly, there were no taxa in common between these two years. Caddisflies were somewhat less abundant in 2008, but they made up a similar percentage of the sample compared to 2005 (12.8 percent in 2005, 11.1 percent in 2008). Despite the lower abundance, overall taxa richness was nearly twice as high in 2008. The number of caddisfly taxa in each habitat was nearly the same between years, suggesting that some degree of partitioning was

taking place. Beetles were approximately one-third as abundant in 2008 coarse substrate habitat, but they were twice as abundant in nonflow. Despite the differences in abundance for these two habitats, taxa richness was similar. In rootmat habitat, however, the number of beetle taxa was much lower despite greater abundance in 2008. For the overall sample, however, only one fewer beetle taxon was present in 2008 compared to 2005. In 2008 chironomid taxa richness and abundance were higher in the coarse substrate and nonflow habitats, but each measure was lower in the rootmat. Overall, chironomid taxa richness was much higher in 2008, but abundance was only slightly higher. Aquatic worms were present in relatively low abundance during both 2005 and 2008; however, taxa richness declined from four in 2005 to one in 2008. Aquatic worms were represented by only a single individual from each habitat in 2008. Mollusks also were present in low numbers during both years but were more abundant in 2008. The coarse substrate habitat sample had the largest increase in mollusks from 2005 to 2008, whereas rootmat had fewer individuals and taxa in 2008.

Table 22
Lower East Fork Black River Taxa Comparison: 2005 Pre-Event versus 2008 Post-Event*
Number of Individuals (Number of Taxa in Parentheses)

	Station 1								Station 2								Station 3							
	Fall 2005				Fall 2008				Fall 2005				Fall 2008				Fall 2005				Fall 2008			
	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total	CS	NF	RM	Total
Ephem	383(14)	125(10)	214(9)	722(18)	384(13)	45(5)	84(12)	513(18)	239(13)	140(6)	134(5)	513(17)	447(12)	58(8)	103(8)	608(20)	123(9)	159(6)	113(4)	395(12)	256(9)	97(5)	49(4)	402(11)
Odonata	21(3)	10(3)	18(4)	49(7)	--	7(4)	8(3)	15(6)	19(2)	5(4)	26(3)	53(5)	12(2)	7(3)	12(4)	31(5)	7(1)	5(1)	25(4)	37(4)	11(1)	5(3)	25(4)	41(4)
Plecop	7(2)	--	--	7(2)	10(2)	--	--	10(2)	12(2)	--	--	12(2)	6(1)	8(3)	1(1)	15(3)	16(1)	--	--	16(1)	1(2)	1(1)	--	2(2)
Trichop	78(3)	--	5(3)	83(6)	97(3)	4(2)	51(5)	152(7)	104(5)	8(4)	4(2)	116(7)	66(6)	7(2)	41(4)	114(9)	188(2)	5(3)	29(5)	222(7)	291(3)	20(3)	52(6)	363(7)
Coleop	256(5)	37(4)	53(5)	346(8)	48(4)	26(3)	44(4)	118(6)	111(4)	81(4)	30(5)	222(7)	100(5)	71(4)	38(4)	209(8)	120(4)	45(1)	1(1)	166(4)	19(2)	2(2)	1(1)	22(3)
Chiro	56(10)	45(10)	61(14)	162(20)	76(9)	106(20)	76(17)	258(26)	124(9)	75(12)	22(10)	221(23)	57(12)	108(23)	57(17)	222(31)	78(9)	116(13)	147(11)	341(22)	77(11)	171(16)	161(15)	409(26)
Worms†	8(2)	10(1)	1(1)	19(2)	5(1)	1(1)	--	6(2)	12(2)	11(3)	1(1)	24(4)	1(1)	1(1)	0(1 L/R)	2(1)	2(2)	8(3)	3(1)	13(4)	2(3)	2(1)	--	4(3)
Mollusca	15(3)	14(2)	5(2)	34(4)	--	21(4)	3(1)	24(4)	6(2)	8(2)	17(3)	31(6)	8(1)	11(2)	6(1)	25(3)	11(2)	16(2)	3(1)	30(2)	8(2)	4(1)	13(1)	25(3)

*excludes Hemiptera, Megaloptera, Lepidoptera, and "Other Diptera"; †"Aquatic worms" includes Tubificidae, Lumbriculidae, and Lumbricina

Table 23
East Fork Black River Station 4/Station 6 Taxa Comparison: 2005 Pre-Event versus 2008 Post-Event*
Number of Individuals (Number of Taxa in Parentheses)

	Fall 2005 (Station 4)				Fall 2008 (Station 6)			
	CS	NF	RM	Total	CS	NF	RM	Total
Ephem.	346(13)	113(4)	34(8)	493(17)	219(13)	162(8)	193(8)	574(20)
Odonata	21(2)	6(2)	31(6)	58(7)	3(2)	10(5)	27(8)	40(9)
Plecop.	3(2)	--	--	3(2)	3(2)	3(2)	--	6(3)
Trichop.	118(5)	2(1)	36(4)	156(5)	106(6)	7(1)	24(4)	137(9)
Coleop.	55(4)	9(3)	15(6)	79(8)	19(4)	18(3)	23(2)	60(7)
Chiro.	66(10)	110(9)	48(14)	224(20)	123(15)	105(17)	23(11)	251(29)
Worms†	4(2)	9(3)	1(1)	14(4)	--	2(1)	--	2(1)
Mollusca	0(1 Large/Rare)	1(1)	7(4)	8(4)	13(2)	4(3)	3(2)	20(4)

*excludes Hemiptera, Megaloptera, Lepidoptera, and "Other Diptera"; †"Aquatic worms" includes Tubificidae, Lumbriculidae, and Lumbricina

6.2.3 Macroinvertebrate Quantitative Similarity Index

The Quantitative Similarity Index (**QSI**) compares two aquatic communities in terms of presence or absence of taxa, also taking relative abundance (percent composition) of each taxon into account (MDNR 2010h). Values range from 0 to 100 percent. Identical communities have a QSI of 100 percent, whereas totally different communities have a value of 0 percent. Although the QSI can be used for several applications where a comparison of overall macroinvertebrate community composition is required, pre-event data from each of the four EFBR samples collected in fall 2005 will be compared to post-event sample data to determine the degree to which the macroinvertebrate community has changed. To provide some perspective, a QSI rating of 70 percent is considered the minimum standard in the SMSBPP when conducting side-by-side duplicative sampling for quality assurance purposes, although other states' biological monitoring programs have an acceptable range of 60 to 85 percent (MDNR 2010h).

Compared to fall 2005, the Quantitative Similarity Index increased from fall 2006 to fall 2007 for all stations, but then decreased sharply in fall 2008 (Table 24). It was expected that the QSI would continue to increase over time as effects of the Upper Reservoir collapse were corrected or allowed to attenuate. A decline such as that shown in 2008 was not anticipated.

Table 24
East Fork Black River Quantitative Similarity Index,
Fall 2005 Data Compared to Fall 2006, Fall 2007, and Fall 2008

Station	Fall 2006	Fall 2007	Fall 2008
1	63.9	68.3	50.0
2	56.2	67.4	52.0
3	44.0	52.9	44.6
4(6)	12.3	55.7	43.8

7.0 Discussion

7.1 Water Quality

Water quality parameters were mostly similar among stations, although there were some differences in turbidity and conductivity between the group of stations upstream versus downstream of Lower Taum Sauk Reservoir. In spring 2008, turbidity was higher among the downstream stations, but conductivity tended to be somewhat lower. In fall 2008, however, there was no notable difference in turbidity among stations (with the exception of higher turbidity at Station 6 due to equipment working in the channel), but conductivity again was lower downstream of the Lower Reservoir. Flow was considerably higher in spring 2008 compared to 2007 but was similar to discharge rates observed in spring 2006.

With the exception of total nitrogen, each of the nutrient parameters analyzed in spring 2008 were present in concentrations either below detectable levels or were detected below the Practical Quantitation Limits. At a concentration of 0.32 mg/L, total nitrogen was highest at Station 6, the restored reach. Among the remaining stations total nitrogen concentrations were similar. Total nitrogen also was the only nutrient present in detectable concentrations during the fall sample season. There was little seasonal difference in this parameter among stations, with the exception that total nitrogen was lower at Station 6 in fall compared to the previous spring.

7.2 Biological Assessment

7.2.1 East Fork Black River

7.2.1.1 East Fork Black River Downstream of Lower Taum Sauk Reservoir

Among stations downstream of the Lower Reservoir, biological metrics tended to be lower as stations approached the dam in spring 2008. Despite this trend and in spite of a significant stormwater event (discussed in the following section), Station 3 was the only lower river station not to achieve fully biologically supporting status. Compared to Stations 1 and 2, lower Taxa Richness and number of EPT Taxa contributed to the partially supporting MSCI score at Station 3.

Benthic event-related fine sediment described in previous reports (McCord 2007, Michaelson 2007) was not present in substantial amounts during the fall 2008 sample season. Two high-flow events in spring 2008 had removed nearly all of the fine clays between the Lower Reservoir dam and the Black River confluence, leaving most of the benthic substrate in this reach similar in appearance to pre-event conditions (Michaelson and Gullic 2008).

The trend of decreasing biological metrics while progressing upstream was not observed during the fall sample season. Biological metrics were higher at Station 2 than either of the other downstream stations and achieved the highest possible MSCI score. Station 3, although achieving fully biologically supporting status in fall 2007 (the first time since macroinvertebrate monitoring began in this system in 2005), failed to meet this goal in the fall 2008 sample season. Once again, Station 3 achieved only a partially supporting MSCI score of 12, with lower Taxa Richness and EPT Taxa (compared to fall 2007 Station 3 metric values) being major contributing factors.

Based on the macroinvertebrate community observed in 2007 samples (Michaelson 2009), it was anticipated that Station 3 biological metrics would continue to exhibit an upward trend as event-related benthic sediment within the reach decreased over time and a steady flow of water was released from the Lower Reservoir dam. Despite the benthic substrate having a pre-event appearance and hydropower operations continuing to be off-line during the summer months of 2008, Station 3 biological metrics actually declined.

Given that none of the water quality parameters analyzed indicated issues with organic pollution, and other stations within the survey reach had adequate MSCI scores (an indication that no acute events occurred in the watershed), other hypotheses to explain the Station 3 fall 2008 MSCI score were considered. These include dissolved oxygen, discharge, and habitat quality. Low dissolved oxygen was considered as a hypothesis because the main source of water at Station 3 originates from a pipe at the base of Lower Taum Sauk Reservoir. During construction of the Upper Reservoir, water was not pumped between the two reservoirs, which allowed the water column in the Lower Reservoir to stratify [Paul Cieslewicz, Missouri Department of Conservation (**MDC**), pers. comm. May 20, 2010]. If water released through the base of the Lower Reservoir was hypolimnetic, the East Fork would be cooler than the upstream stations and possibly hypoxic at least through the river reach including Station 3. Based on dissolved oxygen data loggers deployed downstream of the Lower Reservoir, however, no readings below 5 mg/L occurred during the months preceding fall 2008 sampling (Paul Cieslewicz, Missouri Department of Conservation, pers. comm. May 20, 2010). In addition, seasonal water temperature fluctuations observed at Station 3 during the construction phase of the Upper Reservoir are not consistent with a cold water hypolimnetic release, indicating that water released from the Lower Reservoir originates higher in the water column. The second hypothesis considered, discharge during the summer of 2008 was determined using gaging station data from USGS gage #07061300 at Highway 21 (approximately 3.8 miles downstream of the Lower Reservoir). Although this gaging station's water quality parameters substantiate MDC's dissolved oxygen data loggers deployed upstream, the Highway 21 gage recorded several instances during July and August of 2008 in which the daily *average* discharge rates were <1 cfs. By contrast, the lowest daily average recorded at Highway N (gage #07061270) upstream of JSISP was 3.9 cfs during these months. This difference in flow rates suggests that some issue with the Lower Reservoir (likely to have been renovation work to the dam) restricted flow into the lower East Fork. Low flow conditions documented at Highway 21 may have been more pronounced at Station 3, given a relative scarcity of tributaries and groundwater contributions to flow at the upstream site. The final hypothesis considered, habitat quality, was considered based on discussions with MDC personnel who have conducted instream habitat and flow assessments in the lower East Fork. According to preliminary analysis, a difference in benthic substrate size distribution exists between MDNR Stations 2 and 3. Specifically the Wentworth (1922) size fractions that include small and large gravel (0.079 - 2.5 inches) are relatively rare at Station 3, whereas cobble-sized substrate (2.5 - 10.1 inches) tends to be dominant (Del Lobb, Missouri Department of Conservation, pers. comm. June 11, 2010). This lack of substrate heterogeneity is likely due to the bin wall and Lower Reservoir, which prevent recruitment of fresh (upstream) gravel of varying sizes from replacing gravel displaced by high flow events. Substrate homogeneity can affect the biology of an aquatic system. For example, fewer hornyhead chub (*Nocomis biguttatus*) spawning mounds have been observed in stream reaches lacking gravel-sized substrate (Del Lobb, Missouri Department of Conservation, pers. comm. June 11, 2010). It is probable that benthic substrate homogeneity would have an effect on the macroinvertebrate community as well.

7.2.1.2 East Fork Black River Upstream of Lower Taum Sauk Reservoir

Of the four stations upstream of the Lower Reservoir, only Station 5 and Station 8 achieved fully supporting scores in spring 2008, whereas the remaining sites were partially supporting. Of note was that spring 2008 was the first spring sampling event conducted at the newly-renovated river reach of Station 6. Nearly one year after opening the new channel, Station 6 achieved an MSCI score of 14.

Given observations of past spring sample seasons, it is apparent that the reach of river between the AmerenUE bin wall (Station 4) and the upstream control (Station 8) has exhibited more biological metric variability compared to the reach downstream of the Lower Reservoir. Some of this past variability has been attributed to construction activities in JSISP and East Fork channel restoration efforts. It is also possible, however, that scouring effects of stormwater affect the various river reaches within this study differently. Prior to spring 2008 sampling, a March rain storm resulted in flow events of approximately 8,300 cfs at the Highway N gage and 15,400 cfs at the Highway 21 gage. Of the downstream samples, two of nine habitats failed to reach their respective target number for subsampling, whereas five of 12 upstream habitats did not reach the target number. Since the high flows occurring in the downstream reach had overtopped the Lower Reservoir dam, it is possible that at least some of the stormwater energy had been dissipated by the reservoir and had less erosive force compared to the upstream reach.

Each of the four upstream stations achieved fully supporting scores in fall 2008. Station 5 achieved the highest possible MSCI score of 20, with the remaining upstream stations having MSCI scores of 18 due to slightly higher Biotic Index values resulting in a lower score for this metric. The second post-renovation macroinvertebrate sample was collected at Station 6 in fall 2008. Although Station 6 did not have the highest MSCI score among East Fork stations upstream of the Lower Reservoir, the sample had more taxa and a higher number of EPT taxa than any of the upstream stations. Macroinvertebrate habitat had improved greatly between the fall 2007 and fall 2008 sample seasons, particularly the amount of available rootmat that has become established from the tree plantings and willow (*Salix* sp.) stakes along the stream banks.

7.2.2 East Fork Black River Tributaries

Each of the tributary stations, Taum Sauk Creek and Imboden Fork, achieved fully biologically supporting status in spring 2008. These tributary stations and East Fork Black River Station 8 were established after the Upper Reservoir failure to be used for comparison with the affected reach within JSISP. Given the extreme fluctuations in biological metrics observed in past years, however, it has become apparent that Imboden Fork does not have the consistent flows necessary to make it a good candidate for comparison. When conditions are favorable, Imboden Fork has exhibited exceptional biological metric values, but during other times when flow is lacking in the system, this tributary seems to have been affected more profoundly than the remaining stations. As a

result, it was decided to discontinue sampling Imboden Fork, with spring 2008 being the last sample season for this study.

Taum Sauk Creek also achieved fully supporting status in fall 2008, though with a somewhat lower MSCI score than in 2007. The fall 2008 Taum Sauk Creek biological metric scores were distributed identically compared to the fall 2006 scores.

7.3 Macroinvertebrate Community Composition

7.3.1 East Fork Black River

Despite low macroinvertebrate abundance and difficulty in reaching habitat-specific laboratory subsample target numbers in spring 2008, the majority of stations (four of seven) had fully supporting MSCI scores. A few patterns were observed in spring 2008 macroinvertebrate community composition. First, mayflies tended to be more abundant in the downstream two stations (Stations 1 and 2) compared to the upstream stations, with the exception of the upstream Station 8. Second, certain mayfly families were roughly exclusive of one another, depending on the station's location relative to the Lower Reservoir. In the lower river, the mayfly family Caenidae was relatively abundant, whereas the families Baetidae and Ephemerellidae were sparse. Conversely, upstream of the Lower Reservoir caenids were relatively rare, but baetids and ephemerellids were abundant. This pattern is noteworthy due to the difference in Biotic Index (tolerance to organic pollutants) among these mayfly families. Caenidae has a Biotic Index value of 7; by comparison, the Biotic Index for Baetidae is 4 and Ephemerellidae is particularly sensitive with a Biotic Index of 1. Other community composition trends were observed specifically at Station 3. Of the generally sensitive taxa groups (specifically EPT taxa), Station 3 had fewer stonefly taxa and lower stonefly abundance compared to the remaining stations. Specific to the river reach downstream of the Lower Reservoir, Station 3 also had fewer caddisfly taxa, but the taxa that were present were numerous, as overall caddisfly abundance was much higher at this station compared to the others in spring 2008.

Mayflies were present in similar abundance among East Fork stations in fall 2008, with the exception that they were relatively rare at Stations 3 and 5. Unlike spring samples, however, mayfly taxa were distributed more equally, with no apparent differences in taxa groups relative to the Lower Reservoir. Similar to spring, caddisflies were present in greater abundance at Station 3 compared to the remaining stations. Unlike in spring samples, however, the number of caddisfly taxa was more similar among stations. On a station-by-station basis, chironomids were present in similar percentages during both 2008 sample seasons. Typically, chironomids tend to be more abundant in spring samples and account for a higher percentage of the overall sample compared to fall. In past years, chironomids have made up approximately half of East Fork spring samples, but rarely more than a quarter of fall samples. Although spring 2008 macroinvertebrate abundance was relatively low overall, chironomids appeared to have had a

disproportionately lower contribution compared to previous years and what typically would be expected.

7.3.2 East Fork Black River Tributaries

Similar to the East Fork stations in spring 2008, each of the tributaries had at least one habitat that failed to reach its target number of macroinvertebrate individuals. Taum Sauk Creek failed to reach coarse substrate and non-flow target numbers, whereas at Imboden Fork only the rootmat sample failed to reach the target number. Despite the low macroinvertebrate abundance, each tributary station achieved fully supporting status and Imboden Fork had one of the highest Taxa Richness values of any of the spring 2008 samples. Chironomids were the dominant taxa group in Taum Sauk Creek, followed by perlodid stoneflies. At Imboden Fork, the aquatic sowbug *Lirceus* (Asellidae) was dominant, with perlodid stoneflies second in abundance. Aquatic sowbugs tend to be more common in headwater streams and can make up a dominant percentage of samples collected from these systems. It is probable, then, that Imboden Fork is more similar to a headwater condition, experiencing more frequent cessation of flow compared to the East Fork stations. Heptageniid mayflies were third in abundance at Imboden Fork; however, this mayfly family was quite rare at Taum Sauk Creek and each of the East Fork stations.

As mentioned earlier, sampling at Imboden Fork was discontinued, with spring 2008 being the last sample season for this site. This decision was made mainly due to the large fluctuations in biological metrics experienced over the past years, which has been attributed to the headwater nature of the station and lack of comparability with the East Fork Black River stations, which have larger watershed contributions.

The number of EPT taxa was identical among 2008 sample seasons at Taum Sauk Creek (N = 23). Although the number of mayfly taxa was the same in fall compared to spring, mayfly abundance was nearly three times higher in fall 2008. The number of caddisfly taxa present in the fall Taum Sauk Creek sample increased by two, but the number of individuals was nearly five times as great compared to spring. This increase in fall abundance was not unique to mayflies and caddisflies. With the exception of stoneflies (which are typically rare in fall samples), each of the insect orders collected at Taum Sauk Creek was much more abundant in fall. Chironomidae was the dominant family in both seasons, but it made up nearly half of the Taum Sauk Creek fall sample. Generally chironomids make up a higher percentage of spring samples, and it is unusual for them to dominate a fall sample. In contrast to the seasonal insect trend, crustaceans and aquatic worms were slightly more numerous in spring. It is likely that the scouring flows that occurred prior to spring sampling contributed not only to the low number of macroinvertebrates in samples but also to the unusual proportions observed between seasons.

7.4 Data Trends

7.4.1 Water Quality

Turbidity continues to be the most notable water quality trend over time. Despite much higher flows in spring 2008 compared to 2007, turbidity was roughly the same among lower river stations. With the exception of Station 8 turbidity, which has been largely unchanged throughout this study, stations upstream of the Lower Reservoir exhibited lower turbidity in spring 2008 than any previous spring samples. Flow rates were roughly similar (elevated) in spring 2006 and 2008, but 2008 turbidity was many times lower than in 2006. Among upstream stations, the decrease in turbidity during this time period is likely attributable to cessation of major instream construction activities within JSISP following the opening of the restored channel in April 2007. Other water quality parameters, particularly nutrient concentrations, were unchanged between spring 2007 and 2008 samples.

Two major storms that occurred approximately three weeks apart in spring 2008 produced flows of 15,400 cfs in March and 22,800 cfs in April. A sediment estimation survey conducted in July 2008 (Michaelson and Gullic 2008) noted much less clay-sized benthic sediment in the reach between the Lower Reservoir dam and the mouth of the East Fork compared to the previous year (McCord 2007). The sediment reduction in the lower river appears to have had an effect on turbidity in this reach. Following the Upper Reservoir failure in December 2005, turbidity in the lower river exceeded 1000 NTU. Turbidity levels dropped considerably by spring 2006 but remained elevated compared to pre-event conditions through fall 2007. After the two spring 2008 flood events, however, turbidity among all three downstream stations have returned to levels similar to those measured before the failure in fall 2005. Although fall 2008 had much lower flow rates compared to fall 2007, discharge likely contributed little to decreased turbidity in the lower East Fork. Fall 2006 discharge was similar to or lower than fall 2008, yet turbidity was much higher. In addition to turbidity, total nitrogen and NO_2+NO_3-N concentrations were lower in fall 2008 at each of the East Fork Black River stations, being similar to pre-event levels. Remaining nutrient and other water quality parameters were unremarkable.

7.4.2 Biological Assessment

Despite an extremely high-flow event prior to 2008 spring sampling, which presumably led to difficulty in reaching laboratory target numbers, most East Fork stations had biological metric values and MSCI scores that were comparable to or higher than previous years. Only Station 4, upstream of the AmerenUE bin wall, had a spring 2008 MSCI score that was lower than 2007. The partially supporting score of Station 4 was surprising, given that the MSCI score and the biological metric values were more similar to spring 2006, approximately three months following the Upper Reservoir breach, than to 2007. Macroinvertebrate metric values and scores among stations downstream of the

Lower Reservoir were mostly unchanged. Only Station 2 had a slightly higher spring MSCI score in 2008; the remaining downstream stations were identical to 2007. For the third straight year, Station 3 had a partially supporting MSCI score of 12.

Fall 2008 MSCI scores among all East Fork stations were the same as or higher than any since sampling began in 2005, with the exception that Station 3 returned to partially supporting status. Station 3 had its first recorded fully supporting MSCI score in fall 2007, which was thought perhaps to have been related to more consistent flows being released from the Lower Reservoir dam in the absence of hydroelectric operations (Michaelson 2009). Fall 2008 was the first season that macroinvertebrate samples were collected in which event-related fine sediments were substantially reduced due to two spring flood events described earlier. With benthic substrate free of fine sediments and adequate (but not excessive) flows, it was expected that Station 3 would exhibit higher metric values and have an MSCI score that equaled or surpassed that of fall 2007. Surprisingly, the Station 3 fall 2008 MSCI score was the lowest since pre-event sampling was conducted in 2005, when the Taum Sauk hydroelectric facility was under normal operating conditions. As described in Section 7.2.1.1, reduced flow may have affected Station 3 during the summer months of 2008 more than the remaining downstream stations. During the summer months of 2007, the time frame that preceded the highest MSCI score at Station 3, flow measured at the Highway 21 gage tended to be more consistent with the upstream Highway N gage. In addition, only two days in August 2007 had average daily discharge of <1 cfs at Highway 21, compared with 16 days in July and August 2008. Provided that AmerenUE can maintain adequate flow in the lower river, the question of whether discharge (versus water quality or habitat) is the main contributing factor to lower MSCI scores at Station 3 perhaps can be answered with continued monitoring. Fall 2008 was the second fall sample collected at Station 6 following completion of the restoration of this reach. This station achieved a partially supporting MSCI score of 12 in the first fall sample, but in fall 2008, Station 6 had a fully supporting score of 18. In addition, Taxa Richness and EPT Taxa values observed in fall 2008 exceeded any of the three pre-event fall samples collected at this station when it was a biological criteria reference reach. Monitoring should continue at this site, however, to determine whether the restored reach can sustain this macroinvertebrate community over time.

7.4.3 Macroinvertebrate Quantitative Similarity Index

The Quantitative Similarity Index, in which fall 2005 macroinvertebrate samples were compared with those collected after the Upper Reservoir breach, was higher in 2007 than 2006. This increase was tentatively judged to be a macroinvertebrate community trend toward pre-event conditions. Although it was assumed that this index would continue increasing over time as habitat conditions at these stations improved, clearly this was not the case. One difference that was observed between 2005 and 2008 was a higher number of taxa for several macroinvertebrate groups in 2008. Overall Taxa Richness and EPT Taxa values were higher in 2008 at Stations 2, 3, and 6 compared to 2005. This

difference alone would account for some dissimilarity among years. If habitat and flow conditions become more favorable over time, lower QSI scores should not automatically be viewed as negative.

8.0 Summary

1. Spring 2008 flow rates were much higher than flows noted in spring 2007 but were roughly comparable to 2006.

2. In March and April of 2008, two sizeable high flow events (which ranked as the second and third highest discharges recorded since 1960) occurred in the East Fork Black River. These high flows removed the majority of event-related fine sediment from the East Fork downstream of the Lower Reservoir.

3. Despite the much higher flows in spring 2008, turbidity readings were similar to 2007. Turbidity in fall 2008 was similar to pre-event conditions at all stations, with the exception of the restored reach at Station 6, where machinery was operating in the channel on the day of sampling.

4. Of the nutrient parameters measured, only total nitrogen occurred in detectable concentrations during both sample seasons.

5. Habitat assessment scores among EFBR stations were comparable to or higher than those of a biological criteria reference stream evaluated within the Ozark/Black/Current EDU.

6. Among stations downstream of the Lower Reservoir, biological metrics tended to decline as stations neared the dam in spring 2008. With Station 2 having higher biological metric values than Station 1, this trend was not observed in fall 2008. Station 3, however, had the lowest scores among the lower river stations.

7. Of the three lower river stations, only Station 3 failed to achieve a fully supporting MSCI score during either sample season in 2008.

8. The trend of increasing fall MSCI scores from 2005 to 2007 at Station 3 ended with a partially supporting fall 2008 score of 12.

9. Among stations located upstream of the Lower Reservoir, two of the four (Stations 5 and 8) achieved fully supporting scores in spring 2008; all four upstream stations achieved fully supporting scores in fall 2008.

10. Imboden Fork, which was sampled only in spring 2008, had a fully supporting MSCI score. Taum Sauk Creek, the other East Fork tributary station, achieved fully supporting scores in both seasons.

11. Of the seven East Fork stations, five had at least one habitat in spring samples that failed to reach its target number in laboratory processing. For the fall sample season, three of the seven stations had only one habitat that did not reach its target number.

12. When comparing the macroinvertebrate community of fall 2008 with that of pre-event fall 2005, Station 3 continues to exhibit several differences. These differences include: 1) higher diversity and abundance of chironomids; 2) lower mayfly abundance in rootmat habitat; 3) greater caddisfly abundance in coarse substrate; 4) greater caddisfly abundance in rootmat habitat.

13. The trend of increasing Quantitative Similarity Index scores for each of the four stations for which pre-event data are available also ended with the 2008 fall data. QSI scores for all four stations comparing fall 2005 to fall 2008 were lower than the comparison for 2007.

9.0 Recommendations

1. Continue monitoring the East Fork Black River within JSISP to document whether macroinvertebrate community metrics of the restored reach continue to exceed pre-event levels.

2. Continue macroinvertebrate sampling in the EFBR downstream of the Lower Taum Sauk Reservoir, making note of discharge rates and dissolved oxygen concentrations during summer low flow conditions. These observations may aid in determining whether water quality is a factor contributing to consistently low Station 3 MSCI scores.

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Approved by: _____

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Director
Environmental Services Program

AR:dmt

c: Gary Gaines, Regional Director, SERO
John Ford, QAPP Project Manager, WPP

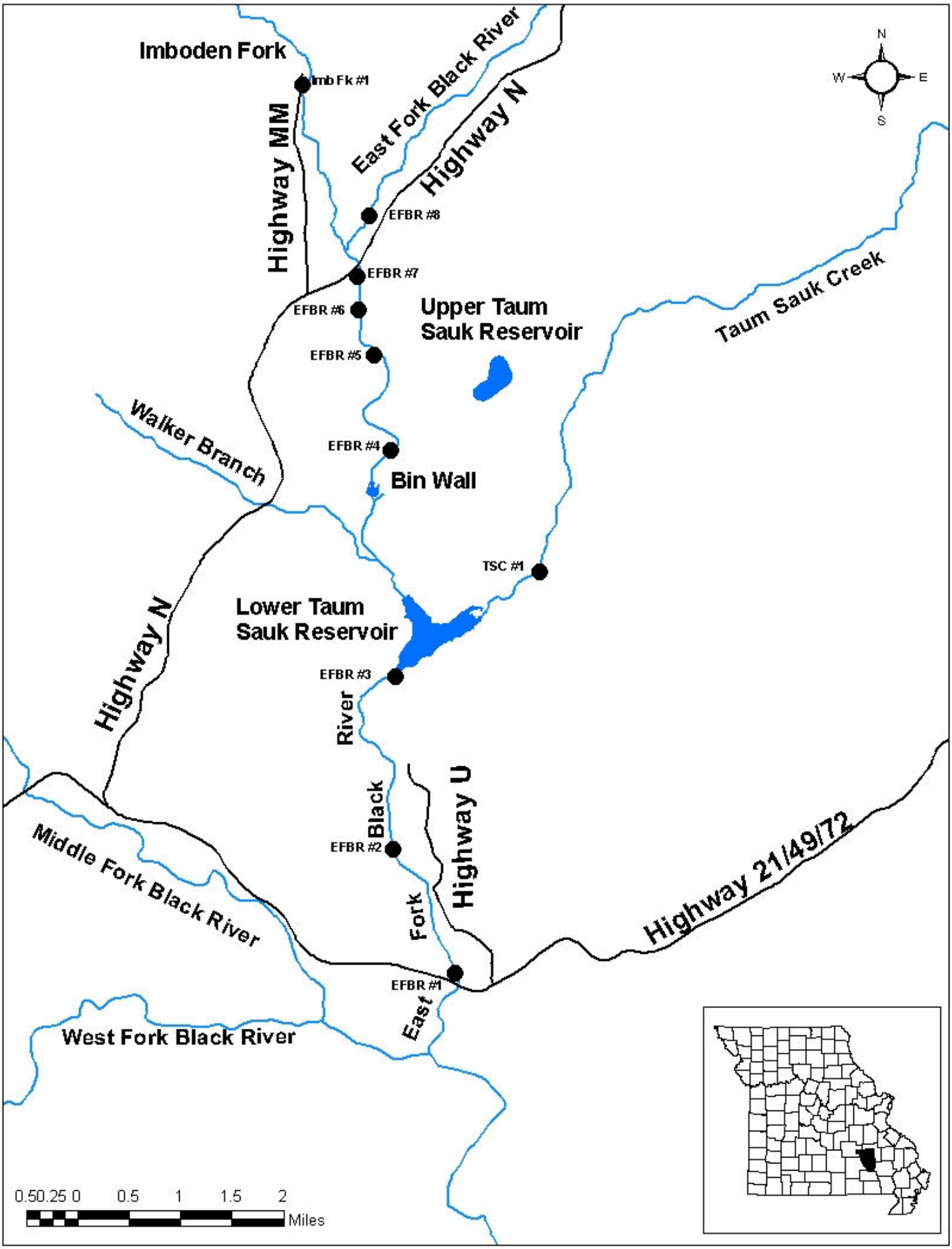
Appendix A

Maps

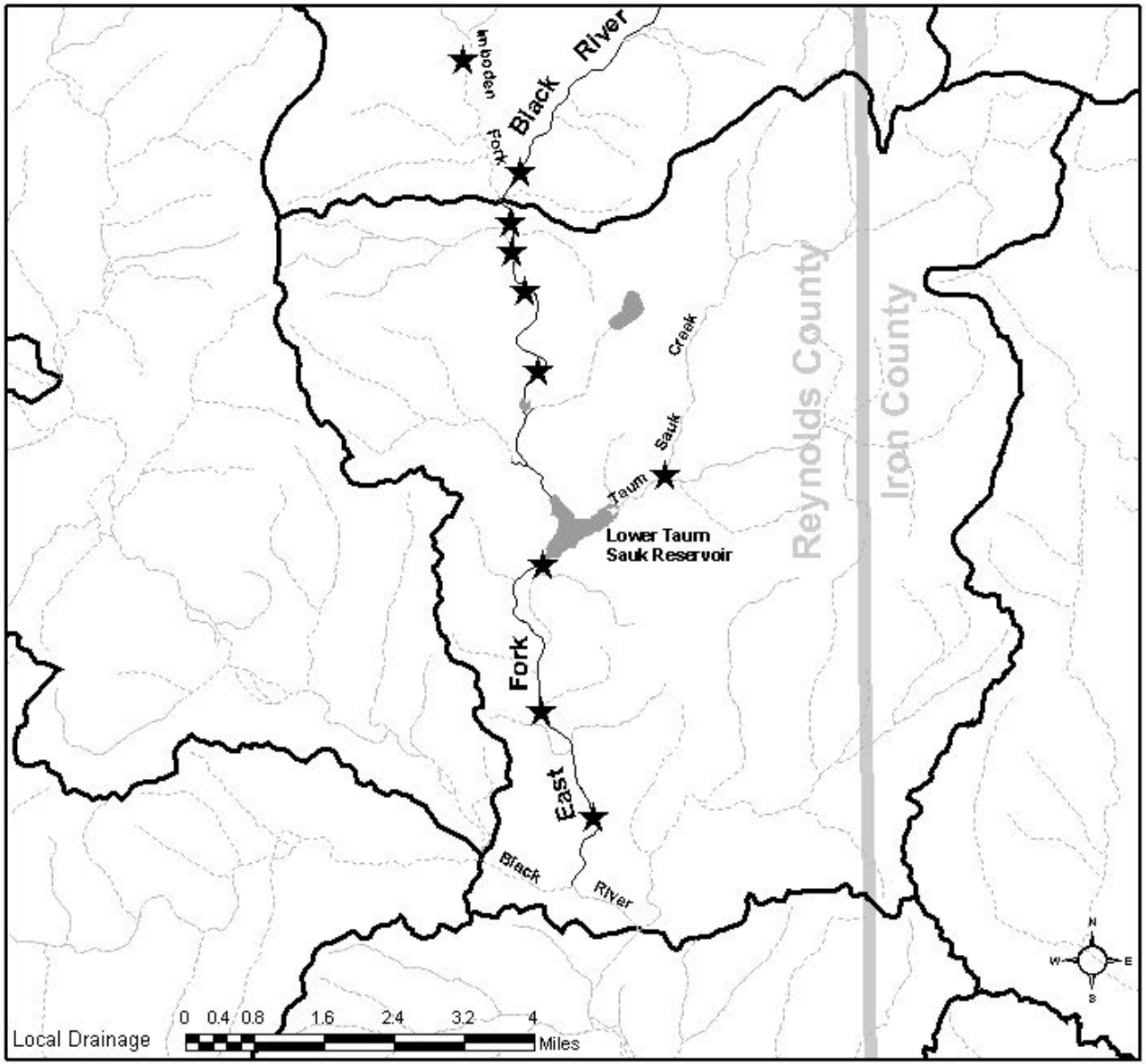
Sample Stations Located on the East Fork Black River and Its Tributaries
Ozark/Black/Current EDU

&

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


Imboden Fork
Imb Fk #1
East Fork Black River
Highway N
Highway MM
N
W
E
S
EFBR #8
EFBR #7
EFBR #6
EFBR #5
Upper Taum
Sauk Reservoir
Taum Sauk Creek
Walker Branch
EFBR #4
Bin Wall
TSC #1
Lower Taum
Sauk Reservoir
Highway N
EFBR #3
East Fork Black River
Highway U
EFBR #2
Middle Fork Black River
Highway 21/49/72
EFBR #1
West Fork Black River
0.50.25 0 0.5 1 1.5 2
Miles

East Fork Black River Study Site



Sampling Locations

County Boundary

Local Drainage

Stream/River

Local Drainage and Biologic Sampling Site Location

Ecolocial 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

Macroinvertebrate Taxa Lists

East Fork Black River

Imboden Fork

Taum Sauk Creek

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804050], Station #1, Sample Date: 4/9/2008 12:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	2	
AMPHIPODA			
Hyalella azteca			1
Stygobromus		1	
COLEOPTERA			
Dubiraphia	2	11	12
Ectopria nervosa	1		
Helichus striatus			-99
Hydrochus			1
Microcylloepus pusillus	36		35
Optioservus sandersoni	20		3
Psephenus herricki	5	2	
Stenelmis	70	4	13
DECAPODA			
Orconectes hylas	-99		5
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		9	1
Ceratopogoninae	1	38	
Chironomidae	1		
Chrysops		4	
Cladotanytarsus		1	
Clinocera	10		
Clinotanypus		2	
Corynoneura	1	4	1
Cricotopus bicinctus	1	1	1
Cricotopus/Orthocladius	13	9	2
Cryptochironomus	1	4	
Dicrotendipes	2	4	1
Diptera	1	4	
Djalmabatista		2	
Eukiefferiella	5		1
Glyptotendipes		1	
Hemerodromia	10	1	
Labrundinia		1	
Microtendipes	9	3	
Nanocladius	1	1	
Nilotanypus		1	1
Pagastiella		3	
Parakiefferiella		1	
Paralauterborniella		1	
Parametriocnemus		3	
Paratanytarsus		3	1
Polypedilum aviceps	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804050], Station #1, Sample Date: 4/9/2008 12:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polypedilum convictum	11		
Polypedilum fallax grp			1
Polypedilum halterale grp	1		
Polypedilum scalaenum grp		1	
Prosimulium	5		16
Pseudorthocladius	1	1	
Rheotanytarsus	8	4	2
Simulium	66		54
Stenochironomus		1	
Sympotthastia	2		
Tabanus	1		
Tanytarsus	27	22	
Thienemannimyia grp.	4	2	3
Tipula	3	1	-99
EPHEMEROPTERA			
Acentrella	9		
Acerpenna	3		2
Baetisca lacustris	1	1	1
Caenis anceps	26	15	6
Caenis latipennis	50	27	17
Caenis punctata	6	15	68
Ephemera simulans	1		
Ephemerella invaria	1		-99
Eurylophella			1
Eurylophella bicolor	1	2	1
Heptageniidae	16	5	1
Hexagenia limbata		1	
Isonychia bicolor	20		13
Maccaffertium mediopunctatum	7	1	
Maccaffertium pulchellum	8		5
Paraleptophlebia	1		
Serratella			1
Stenonema femoratum	12	15	1
Tricorythodes	15		4
ISOPODA			
Caecidotea (Blind & Unpigmented)	1		
Lirceus	2		2
LEPIDOPTERA			
Crambidae			1
Parapoynx	1		
Petrophila	2		
LIMNOPHILA			
Lymnaeidae			1
Menetus			1
LUMBRICINA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804050], Station #1, Sample Date: 4/9/2008 12:50:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Lumbricina	4	1	
LUMBRICULIDA			
Lumbriculidae		1	
MEGALOPTERA			
Corydalus	-99		
Nigronia serricornis			-99
ODONATA			
Argia	3		1
Boyeria			-99
Didymops			-99
Enallagma			2
Hetaerina			5
Stylogomphus albistylus	2		
PLECOPTERA			
Amphinemura	19		20
Isoperla	2		
Leuctridae	7	2	
Neoperla	1	3	
Perlesta	3		1
Zealeuctra		1	
TRICHOPTERA			
Agapetus	3		
Cheumatopsyche	3		
Chimarra	7		1
Helicopsyche	1		
Hydroptila		1	
Oecetis		1	3
Oxyethira		1	4
Polycentropus	1		
Ptilostomis			1
Pycnopsyche			-99
Rhyacophila	2		2
Triaenodes		1	5
Wormaldia	1		
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Branchiura sowerbyi		1	
Enchytraeidae	1	17	
Spirosperma	1		
Tubificidae		49	
VENEROIDA			
Corbicula	4		
Pisidiidae		2	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804048], Station #2, Sample Date: 4/9/2008 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	3	
AMPHIPODA			
Hyalella azteca		2	
BRANCHIOBDELLIDA			
Branchiobdellida	3		
COLEOPTERA			
Berosus			1
Dubiraphia		5	1
Ectopria nervosa		-99	
Lutrochus	2		
Microcylloepus pusillus	6		
Psephenus herricki	6		
Stenelmis	32		
DECAPODA			
Orconectes hylas	5	-99	1
Orconectes virilis			-99
DIPTERA			
Ablabesmyia		17	
Ceratopogoninae		37	
Chironomidae	1	5	1
Clinocera	4		
Clinotanypus		5	
Cricotopus bicinctus		1	8
Cricotopus/Orthocladius	12	10	19
Cryptochironomus		3	
Dicrotendipes		3	
Diptera		2	
Djalmabatista		1	
Eukiefferiella	7		1
Hemerodromia	1		
Hydrobaenus		1	
Micropsectra	1		1
Microtendipes	4		
Nilotanypus	3		1
Orthocladius (Euorthocladius)	1		
Pagastiella		6	
Parakiefferiella		1	
Parametriocnemus	2		
Paratanytarsus		2	
Paratendipes		1	
Phaenopsectra		1	
Polypedilum		1	
Polypedilum convictum	4		
Polypedilum illinoense grp		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804048], Station #2, Sample Date: 4/9/2008 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procladius		2	
Prosimulium	2		2
Psectrocladius		1	
Rheocricotopus			3
Rheotanytarsus	4	5	8
Simulium	46		25
Stempellinella		5	
Sympotthastia			2
Tanytarsus	4	23	5
Thienemanniella	2		
Thienemannimyia grp.	3	2	2
Tipula	-99		1
Tribelos		2	
EPHEMEROPTERA			
Acentrella	13		10
Baetisca lacustris			1
Caenis anceps	24	15	7
Caenis latipennis	48	14	28
Caenis punctata		90	145
Centroptilum		3	1
Ephemera simulans		-99	
Ephemerella invaria	1		1
Ephemerellidae	1		
Eurylophella enoensis			4
Heptageniidae	10	1	
Hexagenia		1	
Isonychia bicolor	12		2
Maccaffertium mediopunctatum	10		
Maccaffertium pulchellum	10		2
Stenacron	4	1	
Stenonema femoratum	8	2	3
Tricorythodes	16		5
HEMIPTERA			
Trichocorixa			1
ISOPODA			
Caecidotea (Blind & Unpigmented)	14	1	
LEPIDOPTERA			
Petrophila	-99		
LIMNOPHILA			
Ancylidae		1	
Helisoma			1
LUMBRICINA			
Lumbricina	4		
LUMBRICULIDA			
Lumbriculidae	2		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804048], Station #2, Sample Date: 4/9/2008 10:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
MEGALOPTERA			
Corydalus	1		
ODONATA			
Calopteryx			1
Enallagma		1	3
Hetaerina			1
Macromia		-99	
PLECOPTERA			
Amphinemura	21		16
Isoperla	1		
Leuctridae	12		1
Neoperla	2		
Perlesta			8
Perlinella drymo		-99	
RHYNCHOBDELLIDA			
Glossiphoniidae	1		
TRICHOPTERA			
Agapetus	6		
Ceratopsyche morosa grp	2		
Cheumatopsyche	11		1
Chimarra			1
Hydroptila			2
Oecetis			1
Oxyethira			1
Polycentropodidae	4		
Polycentropus		5	
Rhyacophila	1		1
Triaenodes		1	2
TUBIFICIDA			
Branchiura sowerbyi	1		
Enchytraeidae	1	5	4
Limnodrilus hoffmeisteri		2	
Tubificidae	1	17	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804049], Station #3, Sample Date: 4/9/2008 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		4	3
AMPHIPODA			
Hyalella azteca		1	
COLEOPTERA			
Berosus	1	-99	
Microcylloepus pusillus	2		
Psephenus herricki	1		
Scirtidae			1
Stenelmis	214		
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia		5	3
Ceratopogoninae	1	11	1
Chaoborus		1	
Chironomidae		2	
Chrysops		-99	
Cladopelma		3	
Cladotanytarsus		1	
Corynoneura		3	2
Cricotopus bicinctus	1		
Cricotopus/Orthocladius	28	4	14
Cryptochironomus		5	
Dicrotendipes	3	3	4
Eukiefferiella	2		
Hemerodromia	11	1	
Labrundinia		1	5
Microtendipes	3		
Nanocladius			3
Paramerina			1
Paraphaenocladius		1	
Paratanytarsus		1	7
Polypedilum halterale grp		3	
Polypedilum illinoense grp		1	3
Procladius		3	
Prosimulium	2		
Psectrocladius			15
Rheotanytarsus	9	2	3
Simulium	2		
Stempellinella		1	
Stenochironomus	1		
Stilocladius		1	
Tabanus	1		
Tanytarsus	1	73	13

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804049], Station #3, Sample Date: 4/9/2008 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.	4	1	15
Tipula	1	-99	
Tribelos		2	1
Zavrelimyia		1	
EPHEMEROPTERA			
Caenis anceps	5	6	
Caenis latipennis	25	105	30
Caenis punctata	7	4	49
Centroptilum			6
Ephemera	1	1	
Eurylophella bicolor	2		3
Eurylophella enoensis			4
Hexagenia limbata		2	
Isonychia bicolor	1		
Maccaffertium mediopunctatum	2	1	
Maccaffertium pulchellum	3		
Stenacron	5	1	
Stenonema femoratum	12	4	1
Tricorythodes	9		
ISOPODA			
Caecidotea	3	1	
LIMNOPHILA			
Ancylidae		1	
Lymnaeidae	1		
Menetus	9	2	
Physella	2		
LUMBRICINA			
Lumbricina	5	-99	
ODONATA			
Argia	1		
Enallagma	1	1	14
Hetaerina			1
Macromia			-99
PLECOPTERA			
Isoperla	4		1
Leuctridae	1		
Neoperla	9		
Perlesta	2		
TRICHOPTERA			
Cheumatopsyche	106	-99	
Hydropsyche	1		
Hydroptila	10		
Oecetis	4	1	6
Polycentropus		1	2
Triaenodes	4	1	26
TRICLADIDA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804049], Station #3, Sample Date: 4/9/2008 11:40:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Planariidae	27	1	
TUBIFICIDA			
Branchiura sowerbyi		3	
Enchytraeidae		3	1
Spirosperma	2	1	
Tubificidae	8	11	
VENEROIDA			
Corbicula	48		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804043], Station #4, Sample Date: 4/8/2008 1:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		4	1
AMPHIPODA			
Crangonyx			1
BRANCHIOBDELLIDA			
Branchiobdellida	1		2
COLEOPTERA			
Dubiraphia		2	5
Dytiscidae		1	
Psephenus herricki	1	2	
Stenelmis	1	6	
DECAPODA			
Orconectes hylas	1	-99	4
DIPTERA			
Ablabesmyia		4	
Ceratopogoninae		1	1
Chironomidae		1	1
Cladotanytarsus			1
Clinocera	5	2	
Corynoneura		5	7
Cricotopus/Orthocladius		1	21
Dicrotendipes		1	
Diptera		1	
Empididae		1	
Eukiefferiella	1	1	
Gonomyia		1	
Hemerodromia	1	2	
Hexatoma	3	2	
Labrundinia			7
Parametriocnemus			1
Paratanytarsus			3
Polypedilum convictum	2		5
Polypedilum fallax grp	1		
Polypedilum illinoense grp			1
Potthastia			1
Prosimulium	7		1
Rheocricotopus			8
Rheotanytarsus	1		20
Simulium	2	1	4
Stempellinella		4	
Sympotthastia			2
Tabanus	-99		
Tanytarsus		1	2
Thienemanniella			4
Thienemannimyia grp.	1	5	6

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804043], Station #4, Sample Date: 4/8/2008 1:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tipula			-99
Zavrelimyia			1
EPHEMEROPTERA			
Acentrella	13		8
Acerpenna	1		3
Baetisca lacustris			1
Caenis anceps	2	15	30
Caenis latipennis		16	46
Centroptilum			4
Eurylophella bicolor	1	7	47
Eurylophella enoensis			2
Isonychia bicolor	4		3
Leptophlebia			-99
Leptophlebiidae		2	
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	2		1
Stenacron	2	7	
Stenonema femoratum	2	3	5
ISOPODA			
Lirceus		1	3
LEPIDOPTERA			
Petrophila		1	
LUMBRICINA			
Lumbricina		-99	
ODONATA			
Argia		1	
Boyeria			-99
Calopteryx			1
Enallagma		1	4
Helocordulia			1
Macromia			1
PLECOPTERA			
Amphinemura	6	1	21
Isoperla	1	1	
Leuctridae	1		2
Perlesta			12
Perlinella ephyre		1	
Prostoia			1
TRICHOPTERA			
Cheumatopsyche	3	2	1
Chimarra	3	2	
Hydroptila		1	11
Limnephilidae			1
Pycnopsyche			1
TUBIFICIDA			
Enchytraeidae	1	3	3

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804043], Station #4, Sample Date: 4/8/2008 1:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Limnodrilus hoffmeisteri		1	
Tubificidae		2	2

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804041], Station #5, Sample Date: 4/8/2008 10:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	2	6	2
AMPHIPODA			
Gammarus			-99
Stygobromus		2	
COLEOPTERA			
Dubiraphia		1	6
Paracymus		1	
Psephenus herricki	1	2	1
Stenelmis	2	1	
DECAPODA			
Orconectes hylas			-99
DIPTERA			
Ablabesmyia		5	
Bittacomorpha		2	
Ceratopogoninae	7	6	1
Chaoborus		2	
Chironomidae		3	3
Cladotanytarsus		1	
Clinocera	3	2	1
Corynoneura		8	3
Cricotopus/Orthocladius	1	5	5
Diptera		1	1
Eukiefferiella	2	1	3
Hemerodromia			1
Labrundinia		1	
Nilotanypus	1		
Ormosia		1	
Orthocladius (Euorthocladius)			4
Paracricotopus		1	1
Parametriocnemus			1
Paratanytarsus			1
Polypedilum aviceps		1	3
Polypedilum convictum	12		7
Polypedilum fallax grp			1
Potthastia	1		
Prosimulium	15	2	27
Rheocricotopus			5
Rheotanytarsus	7		21
Simulium	12		13
Stilocladius			1
Sympotthastia		2	2
Tabanus		1	
Tanytarsus	2	7	3
Thienemanniella	1	1	1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804041], Station #5, Sample Date: 4/8/2008 10:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Thienemannimyia grp.	1	8	6
Tipula			-99
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	24	2	15
Acerpenna	1	1	1
Baetisca lacustris		1	2
Caenis anceps			18
Caenis latipennis	4	29	26
Eurylophella bicolor		17	25
Eurylophella enoensis			3
Isonychia bicolor	6		4
Leptophlebia			2
Leptophlebiidae	1	4	1
Maccaffertium pulchellum	6		8
Stenacron	1	5	
Stenonema femoratum	2	23	3
ISOPODA			
Lirceus		2	3
LIMNOPHILA			
Menetus		1	
MEGALOPTERA			
Nigronia serricornis			1
MESOGASTROPODA			
Hydrobiidae		2	
ODONATA			
Argia		2	
Enallagma			1
Gomphidae		2	
Hagenius brevistylus		1	
Helocordulia		-99	
PLECOPTERA			
Acroneuria			-99
Amphinemura	8		38
Clioperla clio			-99
Isoperla	4		1
Leuctridae		1	2
Neoperla	1		
Perlesta	1		14
Perlinella ephyre		2	
Strophopteryx			-99
TRICHOPTERA			
Agapetus	3	1	
Cheumatopsyche	3		5
Chimarra	2		
Hydroptila			19

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804041], Station #5, Sample Date: 4/8/2008 10:45:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Mystacides		1	
Oecetis		1	
Polycentropodidae	4		1
Ptilostomis			-99
Pycnopsyche			-99
TUBIFICIDA			
Enchytraeidae	3	11	2
Tubificidae		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804042], Station #6, Sample Date: 4/8/2008 11:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	2	4
AMPHIPODA			
Crangonyx		1	4
BRANCHIOBDELLIDA			
Branchiobdellida	7		
COLEOPTERA			
Dubiraphia		4	2
Ectopria nervosa		1	
Heterosternuta		1	
Optioservus sandersoni	4	1	
Psephenus herricki	4	2	
Stenelmis	2		1
DECAPODA			
Orconectes hylas	-99		
DIPTERA			
Ablabesmyia		16	2
Ceratopogonidae	3	8	4
Chironomidae	1	2	2
Cladotanytarsus		8	
Clinocera	4	1	
Corynoneura		4	5
Cricotopus/Orthocladius	2	2	14
Cryptochironomus		1	
Dicrotendipes		1	2
Diplocladius			1
Diptera	1	3	2
Dolichopodidae		2	
Eukiefferiella	1		
Hemerodromia	3		1
Lauterborniella		1	
Microtendipes			1
Monodiamesa		2	
Parametriocnemus	1	1	1
Paratanytarsus			3
Phaenopsectra		6	1
Polypedilum convictum	21		7
Polypedilum fallax grp			3
Potthastia	1		4
Prosimulium	3	2	2
Pseudochironomus		2	
Rheocricotopus	1		1
Rheotanytarsus	1		23
Simulium	5		1
Stempellinella		8	1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804042], Station #6, Sample Date: 4/8/2008 11:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stictochironomus		3	1
Stilocladius			2
Tabanus	2		
Tanytarsus	9	4	16
Thienemanniella	5	1	3
Thienemannimyia grp.	3	13	14
Zavrelimyia		6	1
EPHEMEROPTERA			
Acentrella	17		9
Acerpenna	1	1	5
Caenis anceps		21	12
Caenis latipennis	33	29	26
Centroptilum			1
Eurylophella bicolor	2	10	35
Eurylophella enoensis			2
Heptageniidae	11	9	3
Isonychia bicolor	13		2
Leptophlebiidae	1	1	3
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	17	3	11
Stenacron	4	13	1
Stenonema femoratum	17	34	3
ISOPODA			
Lirceus	1	2	3
LIMNOPHILA			
Physella			1
LUMBRICULIDA			
Lumbriculidae		2	1
MEGALOPTERA			
Corydalus	-99		
Nigronia serricornis			1
Sialis		-99	
ODONATA			
Argia		2	
Corduliidae		1	
Gomphidae	1	3	4
Gomphus		1	
Hagenius brevistylus			2
Stylogomphus albistylus			-99
PLECOPTERA			
Acroneuria	-99	-99	
Amphinemura	11		5
Isoperla	17		14
Leuctridae	4	5	4
Neoperla	2		1
Prostoia			1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804042], Station #6, Sample Date: 4/8/2008 11:30:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
TRICHOPTERA			
Agapetus	2		
Cheumatopsyche	8		
Chimarra	1		
Cyrnellus fraternus	2		
Helicopsyche			1
Hydroptila		1	27
Lepidostoma	1		
Polycentropus	1		
Pycnopsyche			-99
TUBIFICIDA			
Enchytraeidae	3	7	3
Limnodrilus hoffmeisteri		42	4
Tubificidae	2	44	4
VENEROIDA			
Pisidiidae			1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804045], Station #8a, Sample Date: 4/8/2008 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	13	24	6
AMPHIPODA			
Hyalella azteca			1
BRANCHIOBDELLIDA			
Branchiobdellida	38		5
COLEOPTERA			
Dubiraphia		13	5
Dytiscidae		1	
Ectopria nervosa	1		
Heterosternuta			1
Optioservus sandersoni	4	1	1
Paracymus		1	
Psephenus herricki	2	6	1
Stenelmis	41	2	1
Uvarus		1	
DECAPODA			
Orconectes hylas	8		4
DIPTERA			
Ablabesmyia		12	
Ceratopogoninae	6	5	
Chaoborus		1	
Chironomidae	3	1	4
Corynoneura	1	3	1
Cricotopus bicinctus	1	1	6
Cricotopus/Orthocladius	8	7	8
Cryptochironomus		3	
Dicrotendipes		3	
Djalmabatista		3	
Eukiefferiella	1	1	
Hemerodromia	14	7	
Heterotrissocladius		1	
Hydrobaenus		1	
Labrundinia			6
Micropsectra			1
Microtendipes		2	
Orthocladius (Euorthocladius)	1		
Pagastiella		1	
Parakiefferiella		1	1
Parametriocnemus	4	2	
Paratanytarsus	1		
Polypedilum convictum	55		
Polypedilum fallax grp			4
Polypedilum scalaenum grp	1	1	
Prosimulium	7	2	2

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804045], Station #8a, Sample Date: 4/8/2008 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Psectrocladius			1
Pseudochironomus		2	1
Pseudorthocladius	1		
Rheocricotopus			4
Rheotanytarsus	16	12	4
Simulium	5		3
Stempellinella		1	3
Stictochironomus		3	
Stilocladius			2
Sympotthastia	2	4	
Tabanus	-99		
Tanytarsus	4	6	8
Thienemanniella	3	1	3
Thienemannimyia grp.	6	18	13
Tipula	2		
EPHEMEROPTERA			
Acentrella	9	1	4
Acerpenna	1		
Baetisca lacustris		2	1
Caenis anceps	8	27	10
Caenis latipennis	17	32	18
Caenis punctata		1	2
Centroptilum			13
Eurylophella bicolor	14	31	63
Eurylophella enoensis		1	
Heptageniidae	16		3
Isonychia bicolor	20		
Leptophlebia			1
Leptophlebiidae	2	1	3
Maccaffertium mediopunctatum	4		
Maccaffertium pulchellum	38		12
Stenacron	4	4	2
Stenonema femoratum	10	9	9
ISOPODA			
Caecidotea (Blind & Unpigmented)	31		
Lirceus		3	3
LIMNOPHILA			
Ancylidae	1		
Physella	2		
LUMBRICINA			
Lumbricina	6	3	
LUMBRICULIDA			
Lumbriculidae	1		
MEGALOPTERA			
Corydalus	2		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804045], Station #8a, Sample Date: 4/8/2008 5:35:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Sialis		1	
MESOGASTROPODA			
Hydrobiidae	5		1
ODONATA			
Argia		3	
Calopteryx			1
Coenagrionidae		3	
Gomphidae	4	2	1
Helocordulia			3
Libellulidae		2	
Stylogomphus albistylus		6	1
PLECOPTERA			
Acroneuria	-99	1	-99
Amphinemura	11		
Chloroperlidae		3	
Isoperla	8		15
Leuctridae	66	7	9
Strophopteryx	1		
Zealeuctra		1	
TRICHOPTERA			
Cheumatopsyche	13	2	
Chimarra	19		
Cyrnellus fraternus	1		
Hydroptila	1		4
Mystacides		1	
Platycentropus			1
Polycentropus	4	1	1
Triaenodes			1
TRICLADIDA			
Planariidae	2		
TUBIFICIDA			
Enchytraeidae		1	1
Limnodrilus claparedianus		1	
Limnodrilus hoffmeisteri		1	
Tubificidae		13	
VENEROIDA			
Pisidiidae		1	

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804044], Station #1, Sample Date: 4/8/2008 3:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	1	1	
AMPHIPODA			
Hyalella azteca			3
BRANCHIOBDELLIDA			
Branchiobdellida			1
COLEOPTERA			
Dubiraphia			3
Enochrus			4
Limnebius			2
Optioservus sandersoni	1		1
Psephenus herricki			1
Scirtidae			1
Stenelmis	1		2
Tropisternus			-99
DECAPODA			
Orconectes hylas			3
Orconectes virilis			1
DIPTERA			
Ablabesmyia		10	3
Ceratopogoninae	2	2	3
Chironomidae	1	4	3
Chrysops	1	-99	
Cladotanytarsus		2	
Clinocera	20	1	
Corynoneura	1		5
Cricotopus bicinctus			1
Cricotopus/Orthocladius	6	2	5
Diptera		4	4
Djalmabatista		1	
Heterotrissocladius			1
Labrundinia			3
Micropsectra	4		5
Microtendipes		2	
Natarsia		2	
Ormosia	1		
Parametriocnemus	11	5	4
Paraphaenocladius			1
Paratendipes		2	
Pilaria		1	
Polypedilum		1	
Polypedilum aviceps	5		
Polypedilum convictum	2		
Polypedilum illinoense grp			1
Potthastia	1	1	

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804044], Station #1, Sample Date: 4/8/2008 3:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Procladius		4	
Prosimulium	37		4
Rheocricotopus	1	1	22
Rheotanytarsus	1		1
Stictochironomus		1	
Stilocladius			11
Tanytarsus		2	1
Thienemanniella	3		1
Thienemannimyia grp.	2	3	5
Tribelos		2	
undescribed Empididae		1	
Zavreliella		2	
Zavrelimyia	1	4	3
EPHEMEROPTERA			
Acentrella	7		
Ameletus		1	5
Caenis anceps	12	4	3
Caenis latipennis	5	10	47
Centroptilum			9
Eurylophella bicolor			1
Eurylophella enoensis			2
Leptophlebiidae	2	4	6
Stenacron		1	1
Stenonema femoratum	1		2
GORDIOIDEA			
Gordiidae	1		
HEMIPTERA			
Trepobates			1
ISOPODA			
Lirceus	3		6
LIMNOPHILA			
Physella			1
LUMBRICINA			
Lumbricina	10	5	
LUMBRICULIDA			
Lumbriculidae		4	
ODONATA			
Argia			-99
Calopteryx			1
Enallagma			3
Gomphidae	1	1	2
Gomphus			1
Libellula			-99
Stylogomphus albistylus		-99	
PLECOPTERA			
Amphinemura	18		29

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804044], Station #1, Sample Date: 4/8/2008 3:40:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Chloroperlidae	30	2	1
Isoperla	73		23
Leuctridae	1	2	8
Perlesta			6
Strophopteryx	1		1
Zealeuctra	3		1
RHYNCHOBDELLIDA			
Piscicolidae			1
TRICHOPTERA			
Agapetus	1		
Hydroptila	1		5
Lepidostoma			5
Platycentropus			-99
Pycnopsyche			-99
Triaenodes			1
TRICLADIDA			
Planariidae	3		1
TUBIFICIDA			
Enchytraeidae	2	3	9
Limnodrilus claparedianus		1	
Limnodrilus hoffmeisteri		6	
Tubificidae		18	1
VENEROIDA			
Pisidiidae		3	

Aquid Invertebrate Database Bench Sheet Report
Imboden Fk [0804047], Station #1, Sample Date: 4/8/2008 6:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	6	4	2
AMPHIPODA			
Stygobromus		1	
BRANCHIOBDELLIDA			
Branchiobdellida	11		
COLEOPTERA			
Dubiraphia		8	2
Ectopria nervosa		1	
Heterosternuta		2	
Hydraena	1		
Optioservus sandersoni	8		
Paracymus	1	1	
Psephenus herricki	3	8	
Stenelmis	29	1	1
DECAPODA			
Orconectes hylas	3	3	12
DIPTERA			
Ablabesmyia		6	
Anopheles		1	
Ceratopogoninae	11	7	
Chironomidae			2
Cladotanytarsus		2	
Clinocera	4		
Corynoneura		3	1
Cryptochironomus		1	
Dicrotendipes			1
Diptera		5	
Eukiefferiella	3		
Hemerodromia	1		
Labrundinia			1
Micropsectra	1	1	1
Microtendipes		1	
Myxosargus	1		
Natarsia		5	
Nilotanypus	1		
Parametriocnemus	3	1	
Paratanytarsus			1
Polypedilum aviceps	2		
Polypedilum convictum	1		
Potthastia	1		
Procladius		3	
Prosimulium	5	1	
Rheocricotopus		1	2
Rheotanytarsus			1

Aquid Invertebrate Database Bench Sheet Report
Imboden Fk [0804047], Station #1, Sample Date: 4/8/2008 6:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Simulium	8		1
Stempellinella		4	
Stictochironomus		2	
Tanytarsus	1	1	1
Thienemanniella	1	1	2
Thienemannimyia grp.	2	19	8
Tipula	3	1	
Tribelos		7	
Zavreliella		1	
Zavrelimyia		1	
EPHEMEROPTERA			
Acentrella	32		1
Acerpenna	5		2
Ameletus			1
Baetis	1		
Caenis anceps	4	12	5
Caenis latipennis	4	16	11
Centroptilum			1
Ephemera		1	
Eurylophella			2
Eurylophella bicolor	2	13	18
Heptageniidae	9		1
Isonychia bicolor	10		
Leptophlebiidae	12	12	5
Maccaffertium pulchellum	18		2
Stenacron	6	28	1
Stenonema femoratum	1	46	4
ISOPODA			
Caecidotea	1		
Lirceus	114	42	31
LIMNOPHILA			
Physella			1
LUMBRICINA			
Lumbricina	4	1	1
ODONATA			
Argia		4	
Gomphidae	3	2	
Libellula		1	
Stylogomphus albistylus	1	5	
PLECOPTERA			
Amphinemura	46		2
Chloroperlidae	12		
Isoperla	113		7
Leuctridae	5	13	
Zealeuctra	1		1
TRICHOPTERA			

Aquid Invertebrate Database Bench Sheet Report
Imboden Fk [0804047], Station #1, Sample Date: 4/8/2008 6:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Agapetus	11		
Cheumatopsyche	2		
Helicopsyche	2		1
Hydroptila	1		8
Lepidostoma			1
Polycentropus	7	2	
Pycnopsyche		-99	6
Rhyacophila	2		
Wormaldia	2		
TRICLADIDA			
Planariidae	1	1	
TUBIFICIDA			
Enchytraeidae		4	1
Limnodrilus hoffmeisteri		2	
VENEROIDA			
Pisidiidae	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804064], Station #1, Sample Date: 10/7/2008 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	8	6	1
AMPHIPODA			
Hyalella azteca			14
COLEOPTERA			
Dubiraphia		21	10
Gyrinus			1
Microcylloepus pusillus	6		26
Optioservus sandersoni	15		7
Psephenus herricki	11	1	
Stenelmis	16	4	
DECAPODA			
Orconectes hylas	4		
DIPTERA			
Ablabesmyia		6	5
Ceratopogoninae		45	
Cladotanytarsus		1	
Corynoneura		1	1
Cricotopus bicinctus	1		5
Cricotopus/Orthocladius	1		4
Dicrotendipes		4	1
Hemerodromia	1		
Hydrobaenus		6	
Labrundinia			19
Microtendipes		5	1
Nanocladius		5	2
Nilotanypus	3		
Pagastiella		7	
Parakiefferiella		9	
Paratanytarsus		1	2
Phaenopsectra		2	
Polypedilum convictum	13	1	1
Polypedilum illinoense grp		1	2
Pseudochironomus		5	
Rheocricotopus	5	1	1
Rheotanytarsus	47		23
Simulium	27		17
Stempellinella	3	6	3
Stenochironomus		2	
Tabanus	-99		
Tanytarsus	2	28	3
Thienemanniella			2
Thienemannimyia grp.	1	2	1
Tribelos		13	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804064], Station #1, Sample Date: 10/7/2008 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Acentrella	8		
Baetis	26		
Baetiscidae		1	
Caenis anceps	10	14	1
Caenis latipennis	1	10	13
Caenis punctata			32
Centroptilum			1
Ephemerellidae			1
Heptageniidae	56	8	3
Isonychia bicolor	252		20
Leucrocuta	1		
Maccaffertium bednariki	3		
Maccaffertium mediopunctatum	12		1
Maccaffertium pulchellum	3		1
Pseudocloeon			10
Stenacron	1		
Stenonema femoratum	2	12	
Tricorythodes	9		1
ISOPODA			
Caecidotea	5		
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Ancylidae		4	
Helisoma		-99	
Menetus		6	3
LUMBRICINA			
Lumbricina	5		
MEGALOPTERA			
Corydalus	2		-99
Nigronia serricornis	1		
ODONATA			
Argia			3
Enallagma		1	2
Gomphidae		3	
Hagenius brevistylus		2	
Hetaerina			3
Neurocordulia		1	
PLECOPTERA			
Neoperla	9		
Zealeuctra	1		
TRICHOPTERA			
Ceratopsyche morosa grp	7		
Cheumatopsyche	17		
Chimarra	73		1
Oecetis			20

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804064], Station #1, Sample Date: 10/7/2008 11:00:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Oxyethira		3	4
Polycentropus			3
Triaenodes		1	23
TRICLADIDA			
Planariidae	1	1	2
TUBIFICIDA			
Tubificidae		1	
VENEROIDA			
Pisidiidae		11	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804065], Station #2, Sample Date: 10/7/2008 2:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	15	15	29
AMPHIPODA			
Hyalella azteca		1	20
COLEOPTERA			
Berosus		1	
Dubiraphia		16	14
Gyrinus			4
Macronychus glabratus			8
Microcylloepus pusillus	5		12
Optioservus sandersoni	58	5	
Psephenus herricki	14		
Stenelmis	23	49	
DECAPODA			
Orconectes hylas	3	-99	-99
DIPTERA			
Ablabesmyia		8	2
Cardiocladius	2		
Ceratopogoninae		23	1
Chironomidae	1	2	1
Chironomus		2	
Cladopelma		1	
Cladotanytarsus		7	
Corynoneura			3
Cricotopus bicinctus	1		7
Cricotopus/Orthocladius	11	1	4
Cryptochironomus		5	
Dicrotendipes		3	2
Hemerodromia	1		
Labrundinia			8
Microtendipes			1
Nanocladius	1	3	2
Pagastiella		1	
Parakiefferiella		1	1
Parametriocnemus	1		
Paratanytarsus		1	3
Phaenopsectra		5	
Polypedilum convictum	4	1	
Polypedilum halterale grp		1	
Polypedilum illinoense grp		1	3
Psectrocladius		8	
Pseudochironomus		1	
Rheocricotopus	1		
Rheotanytarsus	27	1	12
Simulium	75		3

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804065], Station #2, Sample Date: 10/7/2008 2:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Stempellinella		29	1
Stictochironomus		4	
Tabanus	4		
Tanytarsus	4	20	2
Thienemanniella	1		1
Thienemannimyia grp.	3	2	4
EPHEMEROPTERA			
Acentrella	27	1	1
Baetis	45		9
Baetisca lacustris	1		
Caenis anceps	5	17	
Caenis latipennis		18	4
Caenis punctata			55
Centroptilum			1
Heptageniidae	26		
Hexagenia limbata		5	
Isonychia bicolor	227		26
Leptophlebiidae		2	
Leucrocuta	5		
Maccaffertium mediopunctatum	51		
Maccaffertium pulchellum	16		1
Plauditus	2		
Procloeon		5	
Pseudocloeon			6
Stenacron	4	2	
Stenonema femoratum		8	
Tricorythodes	38		
HEMIPTERA			
Rhagovelia	-99		
LEPIDOPTERA			
Petrophila		1	
LIMNOPHILA			
Menetus		1	6
LUMBRICINA			
Lumbricina	1	1	-99
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	7	3	5
Boyeria			-99
Enallagma			7
Hagenius brevistylus		3	
Macromia		1	-99
Stylogomphus albistylus	5		
PLECOPTERA			
Chloroperlidae		3	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804065], Station #2, Sample Date: 10/7/2008 2:00:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Neoperla	6	4	1
Perlesta		1	
TRICHOPTERA			
Ceratopsyche morosa grp	5		
Cheumatopsyche	15		
Chimarra	42		
Helicopsyche	2		
Hydroptila	1	3	
Oecetis	1		17
Oxyethira			11
Polycentropus		4	2
Triaenodes			11
TRICLADIDA			
Planariidae	5	3	2
VENEROIDA			
Corbicula	8		
Pisidiidae		10	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804066], Station #3, Sample Date: 10/7/2008 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		22	13
AMPHIPODA			
Hyalella azteca		2	
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
COLEOPTERA			
Dubiraphia		1	
Optioservus sandersoni	1		
Stenelmis	18	1	1
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia		9	4
Ceratopogoninae		6	1
Chironomus		5	
Cladotanytarsus		2	
Cricotopus bicinctus			2
Cricotopus/Orthocladius	10		29
Cryptochironomus		18	
Diptera		1	
Eukiefferiella	1		1
Glyptotendipes	1		
Hemerodromia	2		2
Labrundinia			1
Nanocladius	2	2	4
Nilotanypus	2		
Parachironomus			5
Parakiefferiella		1	
Paratanytarsus		4	7
Phaenopsectra	1	2	1
Polypedilum convictum	16		3
Polypedilum illinoense grp	2		7
Pseudochironomus		2	
Rheotanytarsus	38	2	94
Simulium	11		2
Stempellina		1	
Stempellinella		39	
Stenochironomus		2	1
Sympotthastia			1
Tabanus	-99		
Tanytarsus	2	80	1
Thienemanniella		1	
Thienemannimyia grp.	2	1	
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804066], Station #3, Sample Date: 10/7/2008 4:30:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Baetis	2		
Caenis anceps	9	59	
Caenis latipennis	5	15	36
Ephemerellidae			1
Hexagenia limbata		4	
Isonychia bicolor	99		
Maccaffertium mediopunctatum	4		
Maccaffertium pulchellum	16		
Stenacron	34	1	
Stenonema femoratum	5	18	1
Tricorythodes	82		11
HEMIPTERA			
Gelastocoris	-99		
LIMNOPHILA			
Menetus	3		13
LUMBRICINA			
Lumbricina	1		
MEGALOPTERA			
Corydalus	5		
ODONATA			
Argia	11	2	2
Enallagma		2	20
Hetaerina			1
Macromia		1	2
PLECOPTERA			
Acroneuria	-99		
Perlidae	1		
Perlinella ephyre		1	
TRICHOPTERA			
Cheumatopsyche	213		17
Chimarra	75		
Hydroptila			1
Oecetis	3	3	12
Oxyethira			4
Polycentropodidae		14	4
Triaenodes		3	14
TRICLADIDA			
Planariidae	18		1
TUBIFICIDA			
Branchiura sowerbyi	1	2	
VENEROIDA			
Pisidiidae	5	4	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804067], Station #4, Sample Date: 10/8/2008 9:55:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	11	5	1
AMPHIPODA			
Hyalella azteca			1
BRANCHIOBDELLIDA			
Branchiobdellida	2		
COLEOPTERA			
Dubiraphia		7	5
Ectopria nervosa		1	
Helichus			3
Microcylloepus pusillus			4
Optioservus sandersoni	16		3
Psephenus herricki	11	1	-99
Stenelmis	6	22	
DECAPODA			
Orconectes hylas	1		
DIPTERA			
Ablabesmyia		8	2
Apedilum		2	
Cardiocladius	6		
Ceratopogoninae	1	18	2
Chironomidae		3	4
Cladotanytarsus		3	
Corynoneura			1
Cricotopus bicinctus			2
Cricotopus/Orthocladius	19	10	42
Cryptochironomus		4	
Djalmabatista		1	
Forcipomyiinae			1
Hemerodromia	8	1	11
Hexatoma	3		
Labrundinia		1	1
Microtendipes		3	
Nanocladius		1	
Parakiefferiella		1	
Paratanytarsus			4
Phaenopsectra		4	
Polypedilum aviceps	1		
Polypedilum convictum	8		
Polypedilum scalaenum grp		1	
Potthastia			1
Psectrocladius		2	
Pseudochironomus		2	1
Rheocricotopus	1		
Rheotanytarsus	3	1	17

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804067], Station #4, Sample Date: 10/8/2008 9:55:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Robackia	1		
Simulium	26		15
Stempellinella		6	
Stenochironomus			4
Stictochironomus		2	
Tabanus	5		
Tanytarsus	10	20	19
Thienemanniella	4	2	1
Thienemannimyia grp.	2	6	12
EPHEMEROPTERA			
Acentrella	28		14
Baetis	47		2
Baetiscidae		1	
Caenis anceps	7	119	4
Caenis latipennis		13	19
Caenis punctata			21
Choroterpes		3	
Ephemerella	1		
Eurylophella		1	
Heptageniidae	12	3	1
Isonychia bicolor	81		12
Leptophlebiidae		5	
Leucrocuta	3		
Maccaffertium bednariki	5		
Maccaffertium mediopunctatum	19		
Maccaffertium pulchellum	14		8
Procloeon			1
Stenonema femoratum		8	
Tricorythodes	11		2
LIMNOPHILA			
Lymnaeidae			4
Menetus			1
Physella			-99
LUMBRICINA			
Lumbricina		-99	
MEGALOPTERA			
Corydalus	2		
ODONATA			
Argia	2	2	
Boyeria			4
Enallagma			2
Gomphidae		1	
Hagenius brevistylus		3	
Hetaerina			19
Macromia		1	1
Stylogomphus albistylus	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804067], Station #4, Sample Date: 10/8/2008 9:55:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
PLECOPTERA			
Neoperla	22		
Perlinella ephyre	2	1	
TRICHOPTERA			
Ceratopsyche morosa grp	16		1
Cheumatopsyche	86		3
Chimarra	16		
Helicopsyche	2	4	1
Neureclipsis			13
Ochrotrichia			7
Oecetis	4	1	13
Oxyethira			4
Triaenodes			4
TRICLADIDA			
Planariidae	4		
TUBIFICIDA			
Branchiura sowerbyi		1	
Tubificidae		3	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804069], Station #5a, Sample Date: 10/8/2008 2:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	42	18	
COLEOPTERA			
Berosus		1	
Dubiraphia		5	3
Ectopria nervosa	1		
Helichus lithophilus			2
Microcylloepus pusillus			11
Optioservus sandersoni	65	6	1
Psephenus herricki	42	1	
Stenelmis	2	11	
DECAPODA			
Orconectes hylas	-99		-99
DIPTERA			
Ablabesmyia		5	
Ceratopogoninae	4	4	
Cladotanytarsus		2	
Cricotopus bicinctus			1
Cricotopus/Orthocladius	27	10	5
Cryptochironomus		1	
Dicrotendipes		2	
Eukiefferiella	8		
Hemerodromia	24		3
Hexatoma	1		
Microtendipes	1	5	
Nilotanypus	1		
Parametriocnemus	7		1
Polypedilum aviceps			1
Polypedilum convictum	15		3
Polypedilum fallax grp			1
Polypedilum scalaenum grp		1	
Potthastia	3	5	
Psectrocladius		1	
Pseudochironomus		5	
Rheocricotopus	1		
Rheotanytarsus	6		17
Simulium	4		96
Stempellinella	1	9	
Tabanus	11	2	
Tanytarsus	22	9	
Thienemanniella	2		
Thienemannimyia grp.	5	2	
Tipula			2
Tribelos		6	
undescribed Empididae	1		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804069], Station #5a, Sample Date: 10/8/2008 2:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Zavrelimyia			1
EPHEMEROPTERA			
Acentrella	26		3
Acerpenna		1	
Baetis	2		3
Caenis anceps	5	77	2
Caenis latipennis	4	18	19
Caenis punctata			2
Eurylophella		1	
Isonychia bicolor	69		71
Leptophlebiidae	1	21	
Maccaffertium mediopunctatum	15		
Maccaffertium pulchellum	34		3
Plauditus	3		
Procloeon		6	
Stenonema femoratum	3	19	
Tricorythodes	2		
LEPIDOPTERA			
Petrophila	7		
LIMNOPHILA			
Ancylidae		1	
Menetus		1	
Physella	6	3	
LUMBRICINA			
Lumbricina	16		
MEGALOPTERA			
Corydalus	1		-99
ODONATA			
Argia	5	2	1
Calopteryx			2
Gomphidae	6	2	
Hetaerina			4
Stylogomphus albistylus	-99		
PLECOPTERA			
Acroneuria	-99		
Neoperla	6	2	
Perlinella ephyre	2	2	
Zealeuctra	2		
TRICHOPTERA			
Ceratopsyche morosa grp	14		4
Cheumatopsyche	36	1	6
Chimarra	15		
Helicopsyche	36	19	3
Hydropsyche			7
Hydroptila		1	
Oecetis	14	3	7

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804069], Station #5a, Sample Date: 10/8/2008 2:45:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Polycentropus		1	
Triaenodes		1	10
TRICLADIDA			
Planariidae		1	1
TUBIFICIDA			
Enchytraeidae	1		
Tubificidae		1	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804071], Station #6, Sample Date: 10/9/2008 5:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	10	10	4
AMPHIPODA			
Hyalella azteca			28
COLEOPTERA			
Berosus			1
Dubiraphia		8	22
Helichus lithophilus	1		
Microcylloepus pusillus		1	
Optioservus sandersoni	8		
Psephenus herricki	7		
Stenelmis	3	9	
DECAPODA			
Orconectes hylas	-99		
DIPTERA			
Ablabesmyia		4	2
Ceratopogoninae	2	5	
Cladotanytarsus		10	
Corynoneura	1		2
Cricotopus/Orthocladius	27	9	2
Cryptochironomus		8	
Dicrotendipes		5	1
Eukiefferiella	4		
Hemerodromia	1	1	
Hexatoma	3		
Labrundinia			3
Microtendipes		3	5
Nanocladius		1	
Nilotanypus	1		
Pagastiella		1	
Parametriocnemus	3		
Paratanytarsus		1	2
Polypedilum aviceps	23		1
Polypedilum convictum	15	1	
Polypedilum scalaenum grp	2		
Potthastia	2		
Pseudochironomus		4	
Rheocricotopus	5		
Rheotanytarsus	5		
Simulium	66		
Stempellina		1	
Stempellinella	2	14	
Stenochironomus			1
Stictochironomus		4	
Tabanus	4		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804071], Station #6, Sample Date: 10/9/2008 5:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Tanytarsus	10	15	1
Thienemanniella	13		
Thienemannimyia grp.	10	11	3
Tribelos		13	
EPHEMEROPTERA			
Acentrella	80		
Acerpenna	1		
Baetis	64		
Baetisca lacustris		2	
Caenis anceps	10	113	3
Caenis latipennis		30	43
Caenis punctata			132
Centroptilum			5
Ephemera		-99	
Eurylophella		3	2
Heptageniidae	8		
Isonychia bicolor	32		
Leptophlebiidae		2	4
Leucrocuta	4		
Maccaffertium bednariki	1		
Maccaffertium mediopunctatum	1		
Maccaffertium pulchellum	11		
Plauditus	3		
Procloeon		6	1
Stenonema femoratum	3	6	3
Tricorythodes	1		
HEMIPTERA			
Belostoma			-99
ISOPODA			
Lirceus	1		
LEPIDOPTERA			
Petrophila	1		
LIMNOPHILA			
Ancylidae		2	
Lymnaeidae			1
Menetus	1	1	
Physella	12	1	2
MEGALOPTERA			
Corydalus	2		
Nigronia serricornis	1		
ODONATA			
Argia	2	6	2
Boyeria			1
Corduliidae		1	1
Enallagma			17
Gomphus			1

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804071], Station #6, Sample Date: 10/9/2008 5:15:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hagenius brevistylus		1	
Hetaerina			1
Macromia		1	3
Stylogomphus albistylus	1	1	1
PLECOPTERA			
Acroneuria	1		
Neoperla	2	2	
Perlinella ephyre		1	
TRICHOPTERA			
Ceratopsyche morosa grp	7		
Cernotina			1
Cheumatopsyche	34		
Chimarra	18		
Helicopsyche	37		2
Mystacides		7	
Oecetis	9		5
Polycentropus	1		
Triaenodes			16
TRICLADIDA			
Planariidae	2	1	
TUBIFICIDA			
Tubificidae		2	

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804072], Station #8, Sample Date: 10/9/2008 10:50:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina		14	5
AMPHIPODA			
Hyalella azteca			30
COLEOPTERA			
Dubiraphia		7	12
Ectopria nervosa		1	1
Microcylloepus pusillus			6
Optioservus sandersoni	22	5	1
Psephenus herricki	7	2	
Stenelmis	19	9	
DECAPODA			
Orconectes hylas	2		
DIPTERA			
Ablabesmyia		3	2
Ceratopogoninae		5	10
Corynoneura	1	1	5
Cricotopus bicinctus			1
Cricotopus/Orthocladius	8	1	9
Cryptochironomus		1	
Dicrotendipes		2	1
Hemerodromia	9		
Labrundinia			3
Microtendipes		3	5
Nanocladius	3		
Pagastiella		1	
Parametriocnemus	1		
Paratanytarsus			10
Polypedilum aviceps	22	1	
Polypedilum convictum	14		
Polypedilum illinoense grp			1
Potthastia			1
Procladius	2		
Psectrocladius			1
Pseudochironomus			1
Rheocricotopus	13		
Rheotanytarsus	14		1
Simulium	69		
Stempellinella	1		
Tabanus	1		
Tanytarsus	3	2	
Thienemanniella	1	5	2
Thienemannimyia grp.	4	13	10
Tipula	1		
EPHEMEROPTERA			

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804072], Station #8, Sample Date: 10/9/2008 10:50:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Acentrella	22		
Acerpenna	1		
Baetis	64		1
Baetiscidae	1	3	
Caenis anceps	12	3	
Caenis latipennis		37	73
Centroptilum			7
Ephemera simulans		1	
Eurylophella		5	
Heptageniidae	46	12	1
Isonychia bicolor	106		
Leptophlebiidae		7	4
Leucrocuta	1		
Maccaffertium mediopunctatum	14		
Maccaffertium pulchellum	26		
Plauditus	2		
Procloeon		6	
Stenacron	1	3	
Stenonema femoratum	2	10	1
Tricorythodes	1		
ISOPODA			
Lirceus	2		
LEPIDOPTERA			
Petrophila	4		
LIMNOPHILA			
Menetus	2	7	
Physella			1
LUMBRICINA			
Lumbricina	5	1	
LUMBRICULIDA			
Lumbriculidae	2		
MEGALOPTERA			
Corydalus	3		
Nigronia serricornis	1		
ODONATA			
Argia	2	18	2
Boyeria			1
Calopteryx			2
Enallagma		1	23
Gomphidae	9	1	
Gomphus		2	
Macromia		-99	
Stylogomphus albistylus		2	
PLECOPTERA			
Acroneuria	-99		
Neoperla	10		

Aquid Invertebrate Database Bench Sheet Report
East Fk Black R [0804072], Station #8, Sample Date: 10/9/2008 10:50:00 AM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Zealeuctra	1		
TRICHOPTERA			
Ceratopsyche morosa grp	7		
Cheumatopsyche	40	1	
Chimarra	7		
Helicopsyche	21	7	
Oecetis	5	5	10
Oxyethira		1	
Polycentropus	1	1	1
Triaenodes			23
TRICLADIDA			
Planariidae	30		1

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804068], Station #1, Sample Date: 10/8/2008 12:10:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
"HYDRACARINA"			
Acarina	4	8	2
AMPHIPODA			
Hyalella azteca			2
BRANCHIOBDELLIDA			
Branchiobdellida	4		3
COLEOPTERA			
Berosus		1	
Dubiraphia		4	4
Dytiscidae		1	
Optioservus sandersoni	33	1	
Psephenus herricki	4	1	
Scirtidae			6
Stenelmis	3		
DECAPODA			
Orconectes hylas	2		-99
Orconectes punctimanus			-99
DIPTERA			
Ablabesmyia	1	7	1
Anopheles			1
Ceratopogoninae	6	14	
Chironomus		3	3
Cladotanytarsus	2		
Corynoneura	1	1	1
Cricotopus bicinctus	4		2
Cricotopus/Orthocladius	65	5	6
Cryptochironomus		1	
Dicrotendipes		1	1
Dixella			1
Eukiefferiella	1		
Hexatoma	1		
Hydrobaenus		1	
Labrundinia		1	1
Microtendipes	11	79	13
Pagastiella		1	
Paracladopelma		2	
Parakiefferiella	3	8	1
Parametriocnemus	11		
Paratanytarsus	2	2	14
Phaenopsectra	2	42	
Polypedilum aviceps	74		
Polypedilum convictum	43	4	
Polypedilum illinoense grp			1
Procladius		8	1
Psectrocladius	9	15	11

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804068], Station #1, Sample Date: 10/8/2008 12:10:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Rheocricotopus	5		
Rheotanytarsus	6		2
Simulium	36		
Stempellinella	4	6	
Stenochironomus			2
Stictochironomus	1		
Tabanus	-99		
Tanypus		1	
Tanytarsus	19	9	7
Thienemanniella	6	2	1
Thienemannimyia grp.	23	1	10
Tipulidae	2		
EPHEMEROPTERA			
Acentrella	1		
Baetis	17		
Caenis anceps	19	27	9
Caenis latipennis	8	37	152
Caenis punctata		7	31
Centroptilum			12
Isonychia bicolor	5		
Leptophlebiidae	6	1	1
Maccaffertium vicarium	3		
Stenonema femoratum	5		1
HEMIPTERA			
Neoplea			1
LUMBRICINA			
Lumbricina	-99		
ODONATA			
Argia			2
Calopteryx			3
Enallagma			12
Gomphidae	5		
Macromia			-99
PLECOPTERA			
Capniidae	1		
Neoperla	2		
Perlinella ephyre	1		
Taeniopteryx	1		
Zealeuctra	3		1
RHYNCHOBDELLIDA			
Glossiphoniidae			1
TRICHOPTERA			
Ceratopsyche morosa grp	3		
Cheumatopsyche	14		1
Chimarra	16		
Helicopsyche	2		

Aquid Invertebrate Database Bench Sheet Report
Taum Sauk Cr [0804068], Station #1, Sample Date: 10/8/2008 12:10:00 PM
CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

ORDER: TAXA	CS	NF	RM
Hydroptila	2	1	2
Polycentropus	7		4
Ptilostomis			1
Triaenodes			9
TRICLADIDA			
Planariidae			1
TUBIFICIDA			
Limnodrilus hoffmeisteri		1	
Tubificidae		4	
VENEROIDA			
Pisidiidae		3	