Missouri Department of Natural Resources

BIOLOGICAL ASSESSMENT AND HABITAT STUDY

West Fork Locust Creek
Linn and Sullivan Counties

September 2007 – April 2008

Prepared for:

Missouri Department of Natural Resources
Division of Environmental Quality
Water Protection Program
Water Pollution Control Branch

Prepared by:

Missouri Department of Natural Resources
Field Services Division
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1.0 Introduction

At the request of the Missouri Department of Natural Resources (**MDNR**), Water Protection Program (**WPP**), the Environmental Services Program (**ESP**), Water Quality Monitoring Section (**WQMS**) conducted a macroinvertebrate bioassessment and habitat study of West Fork Locust Creek in Linn and Sullivan counties in north central Missouri. A 34-mile length of West Fork Locust Creek in Linn and Sullivan counties was placed on the 2002 303(d) list by the U. S. Environmental Protection Agency (**EPA**) for unknown pollutants. While no numeric data were used, EPA listed West Fork Locust Creek and nine other streams citing a MDNR revised "Monitoring Report of 26 Waters" and visual/benthic surveys. Specific reasons for the listing of all ten waters included the presence of algae, manganese staining as an indication of dissolved oxygen sag, the presence of pollution tolerant organisms, anoxic sediments, reduced biodiversity, and increased specific conductivity. This survey assessed the entire length of the listed segment of West Fork Locust Creek in Linn and Sullivan counties. This 34-mile length includes a 17-mile Class P segment, water body I.D. #612 and a 17-mile Class C segment, water body I.D. #613 (MDNR 2005b).

1.1 Purpose

The purpose of the study was to determine if the West Fork Locust Creek biological community is impaired and, if so, determine potential causes.

1.2 Objectives

1) Characterize the physicochemical characteristics of West Fork Locust Creek.
2) Characterize the habitat characteristics of West Fork Locust Creek.
3) Determine if the macroinvertebrate community of West Fork Locust Creek is impaired.

1.3 Tasks

1) Conduct physicochemical monitoring of West Fork Locust Creek.
2) Conduct a habitat assessment of West Fork Locust Creek.
3) Conduct a bioassessment of the macroinvertebrate community of West Fork Locust Creek.

1.4 Null Hypotheses

1) Habitat will not differ substantially among West Fork Locust Creek stream segments.
2) Habitat will not differ between West Fork Locust Creek and biological criteria reference streams in the Central Plains/Grand/Chariton Drainages EDU.
3) Macroinvertebrate assemblages will not differ substantially among West Fork Locust Creek stream segments.
4) Macroinvertebrate assemblages will not differ substantially between West Fork Locust Creek and biological criteria reference streams in the Central Plains/Grand/Chariton Drainages EDU.

2.0 Study Area

The Class C segment of West Fork Locust Creek begins in Sullivan County approximately four miles east of Harris, Missouri, immediately upstream of Highway ZZ (UTM 477251 East;

4461712 North). The Class C segment flows south to the beginning of the Class P segment approximately five miles east of Humphreys, Missouri, immediately upstream of Missouri Highway 6 (UTM 481541 East; 4443329 North). The Class P segment continues south to its confluence with Locust Creek northwest of Purdin, Missouri (UTM 481653 East; 4423872 North).

2.1 Station Descriptions

Eight stations were chosen along West Fork Locust Creek, four stations in each stream class. These stations, chosen for accessibility and as representative reaches of stream, average about four miles apart. See Figure 1 for a map of study stations.

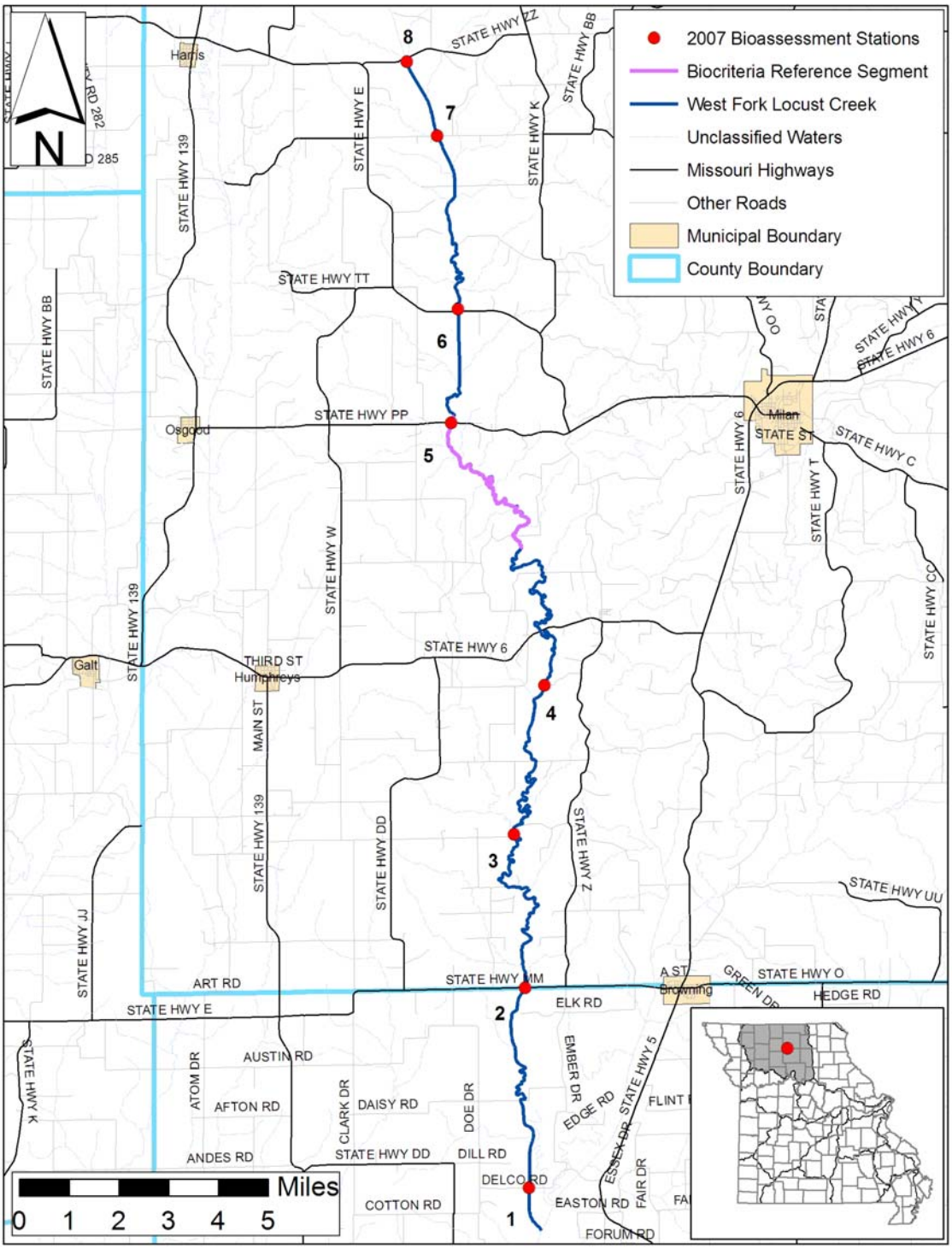
West Fork Locust Creek station 1 (UTM 481234 East; 4425253 North) is located downstream of Delco Road in northern Linn County, approximately 0.9 miles upstream of the confluence with Locust Creek. In fall 2007, there was an active beaver dam with a height of nearly 18 inches on the downstream end of this sample reach, but it was washed away prior to spring 2008 sampling. This portion of the stream is channelized and bounded by levees. Riparian vegetation zone width on the left and right descending banks is typically good. Stream discharge was measured at <0.5 cubic feet per second (**cfs**) in fall 2007 and 31.1 cfs in spring 2008. This length is designated as a Class P stream.

West Fork Locust Creek station 2 (UTM 481113 East; 4431710 North) is located upstream of Highway MM in southwestern Sullivan County, approximately 4.9 miles upstream of West Fork Locust Creek station 1. There is little evidence of stream channelization. Riparian vegetation zone width on the left descending bank is typically excellent, while riparian vegetation zone width on the right descending bank is typically poor. Stream discharge was too low to be measured in fall 2007 and was measured at 28.7 cfs in spring 2008. This length is designated as a Class P stream.

West Fork Locust Creek station 3 (UTM 480714 East; 4436640 North) is located upstream of Violet Road in southwestern Sullivan County, approximately 4.8 miles upstream of West Fork Locust Creek station 2. There was an active beaver dam with a height of less than 12 inches at the downstream end of this location, but it had little effect in the sample reach. This dam was washed away prior to spring 2008 sampling. There is some evidence of minor channelization. Riparian vegetation zone width on the left and right descending banks is typically excellent. Stream discharge was too low to be measured in fall 2007 and was measured at 32.0 cfs in spring 2008. This length is designated as a Class P stream.

West Fork Locust Creek station 4 (UTM 481736 East; 4441467 North) is located upstream of the terminus of Sunridge Road in southwestern Sullivan County, approximately 4.6 miles upstream of West Fork Locust Creek station 3. There is little evidence of stream channelization. Riparian vegetation zone width on the left descending bank is typically excellent, while riparian vegetation zone width on the right descending bank is typically fair. Stream discharge was measured at <0.5 cfs in fall 2007 and 18.0 cfs in spring 2008. This length is designated as a Class P stream.

Figure 1
Study Locations Map with Ecological Drainage Unit Inset



West Fork Locust Creek station 5 (UTM 478719 East; 4449915 North) is located downstream of Highway PP in western Sullivan County, approximately 10.3 miles upstream of West Fork Locust Creek station 4. The increase in relative distance is due to relatively high stream meander and difficulties with landowner permission. There was an active beaver dam with a height of nearly 24 inches at this location that had pooled up a significant portion of the sample reach. This dam was also washed away prior to spring 2008 sampling. There is some evidence of channelization. Riparian vegetation zone width is typically excellent on the left descending bank and typically good on the right descending bank. Stream discharge was too low to be measured in fall 2007 and was measured at 14.4 cfs in spring 2008. This length is designated as a Class C stream and is within a wadeable/perennial biological criteria reference stream (**BIOREF)** reach.

West Fork Locust Creek station 6 (UTM 478938 East; 4453499 North) is located downstream of Highway E in western Sullivan County, approximately 2.6 miles upstream of West Fork Locust Creek station 5. There is evidence of channelization. Riparian vegetation zone width is typically excellent on the left descending bank and typically poor on the right descending bank. Stream discharge was too low to be measured in fall 2007 and was measured at 20.1 cfs in spring 2008. This length is designated as a Class C stream.

West Fork Locust Creek station 7 (UTM 478269 East; 4459182 North) is located downstream of Maple Road in western Sullivan County, approximately 4.4 miles upstream of West Fork Locust Creek station 6. There is some evidence of channelization. Riparian vegetation zone width is typically fair on the left descending bank and typically poor on the right descending bank. Stream discharge was measured at <0.5 cfs in fall 2007 and 16.0 cfs in spring 2008. This length is designated as a Class C stream.

West Fork Locust Creek station 8 (UTM 477274 East; 4461571 North) is located downstream of Highway ZZ in western Sullivan County, approximately 1.7 miles upstream of West Fork Locust Creek station 7. There is some evidence of channelization. Riparian vegetation zone width is typically poor on the left and right descending banks. Stream discharge was measured at <0.5 cfs in fall 2007 and 12.6 cfs in spring 2008. This length is designated as a Class C stream.

For comparison, a habitat assessment was performed for a station on Locust Creek, a neighboring BIOREF station. BIOREF Locust Creek (UTM 488365 East; 4486602 North) is located upstream of 140th Street in central Putnam County. The stream is not channelized. Riparian vegetation zone width on the left descending bank and right descending bank is typically good. This length is designated as a Class P stream.

3.0 Methods

Mike Irwin and Brian Nodine of the MDNR, ESP, WQMS conducted this study. Sampling was conducted during the fall of 2007 and the spring of 2008. Samples were collected at sites that provided a variety of habitat characteristics, were accessible, and had landowner approval. Fall sampling was conducted on September 18-20, 2007, and consisted of macroinvertebrate sampling, water quality sampling, habitat assessments, and stream dimension measurements.

Spring sampling was conducted on March 25-26 and April 1, 2008, and consisted of macroinvertebrate and water quality sampling.

3.1 Physicochemical Characteristics

Physical and chemical water samples were collected from all West Fork Locust Creek stations during both fall and spring. Parameters collected were total nitrogen, nitrate+nitrite as nitrogen, ammonia as nitrogen, total phosphorus, chloride, turbidity, temperature, conductivity, dissolved oxygen, pH, and discharge. WQMS personnel analyzed temperature, conductivity, dissolved oxygen, pH, and discharge in the field and turbidity in the biology laboratory. All other parameters were delivered to the ESP, Chemical Analysis Section for analyses. All samples were collected according to the standard operating procedure MDNR-FSS-001: Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations (MDNR 2003a) and were recorded on an MDNR chain-of-custody (MDNR 2005a).

3.2 Habitat

Although instream habitat can be directly measured, the causes of possible habitat degradation can range from local scale sources to watershed scale sources. We collected habitat measures at the watershed scale, the reach scale, and the in-stream habitat scale to better allow us to evaluate the causes of poor habitat conditions.

3.2.1 Land Use

The land use conditions were summarized from land cover GIS files. Percent land cover data were derived from Thematic Mapper (TM) satellite data collected between 2000 and 2004 and interpreted by the Missouri Resource Assessment Partnership (**MoRAP**). USGS aerial photographs taken within the past 10 years were also used to estimate riparian health of the sampling reach.

3.2.2 Habitat Assessment

Standardized assessment procedures were followed as described for glide/pool habitats in the Stream Habitat Assessment Project Procedure (SHAPP) (MDNR 2003c). Habitat assessments were conducted on West Fork Locust Creek and BIOREF Locust Creek during the fall 2007 sample season.

3.2.3 Width and Depth Measurements

At each sampling station a series of 10 bank to bank transects were established. Each transect was equally spaced within the sampling reach, which is 20 times the average width. Measurements taken at each transect included lower bank width (see the Stream Habitat Assessment Project Procedure for a definition of lower bank), wetted width, and water depth at 25%, 50%, and 75% of the distance across the wetted width. In order to document critical habitat conditions, measurements were collected during the fall low flow period.

3.2.4 Watershed Area

Watershed area is a relative indicator of water availability and aquatic habitat. Watershed area can be used to illustrate differences in stream size, and this measure correlates very well with stream classification. Watershed area was measured using ArcGIS stream coverages.

3.2.5 Sinuosity

Sinuosity was used as an indicator of the amount of channelization that has taken place. Sinuosity was measured using ArcGIS stream coverages, including digital aerial photos, and is represented as a ratio of the actual stream length between two points on the stream to the straight line distance between the two points. Numbers close to 1.0 are considered to be extremely channelized. The target reach length to measure sinuosity was 3200 meters (+/- 200 meters) with the sampling station centered in the middle of the reach.

3.3 Biological Assessment

The biological assessment was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**) (MDNR 2003b). All stations were sampled in fall 2007 and spring 2008. Three standard habitats of glide/pool streams (e.g. depositional substrate in non-flowing water, large woody debris substrate, and rootmat substrate) were sampled at all locations.

Macroinvertebrate data were evaluated by comparison to Biological Criteria for Perennial/Wadeable streams of the Central Plains/Grand/Chariton Ecological Drainage Unit (**EDU**). An EDU is an ecological area in which the aquatic biological communities and stream habitat can be expected to be similar. See the inset in Figure 1 for general stream location and a highlighted Central Plains/Grand/Chariton EDU.

Biological criteria are calculated separately for the fall (mid-September through mid-October) and spring (mid-March through mid-April) index periods. The SMSBPP provides details on the calculation of metrics and scoring of the multi-metric Macroinvertebrate Stream Condition Index (**MSCI**). The four core metrics of the MSCI are: Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered as full biological sustainability, 10-14 as partial biological sustainability, and 4-8 as non-biological sustainability. Table 1 provides scoring criteria for the fall index period and Table 2 for the spring index period.

Table 1
Biological Criteria for Glide/Pool-Fall Index Period
Central Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	<27	27 - 53	>53
EPT	<5	5 - 9	>9
BI	>8.6	8.6 - 7.2	<7.2
SDI	<1.35	1.35 - 2.69	>2.69

Table 2
Biological Criteria for Glide/Pool-Spring Index Period
Central Plains/Grand/Chariton EDU

Metric	Score = 1	Score = 3	Score = 5
TR	<25	25 - 51	>51
EPT	<4	4 - 8	>8
BI	>8.7	8.7 - 7.3	<7.3
SDI	<1.27	1.27 - 2.53	>2.53

4.0 Results and Analyses

4.1 Physicochemical Parameters

Physicochemical results from the fall 2007 and spring 2008 sampling seasons can be found in Table 3. Unusual or notable values are in bold text. There were no violations of Missouri water quality standards for any parameters; however, nutrient values were elevated in the Class C portion of West Fork Locust Creek in both sampling seasons. Due to persistent drought, fall 2007 discharge was minimal, but this trend was reversed for the spring 2008 samples. Wet weather resulted in higher flows in the spring 2008 sampling season, and rains during sampling likely led to higher turbidity values in the Class C segment of West Fork Locust Creek. This is illustrated by a hydrograph of Locust Creek from the U. S. Geological Service stream gage at Linneus, Missouri, shown in Figure 2. This gage is downstream of the mouth of West Locust Creek. Other than these anomalies, there are no notable results for physicochemical parameters. For fall 2007 samples, duplicates were collected at station 4. For spring 2008 samples, duplicates were collected at station 1.

Figure 2
Spring 2008 Stream Discharge in Locust Creek

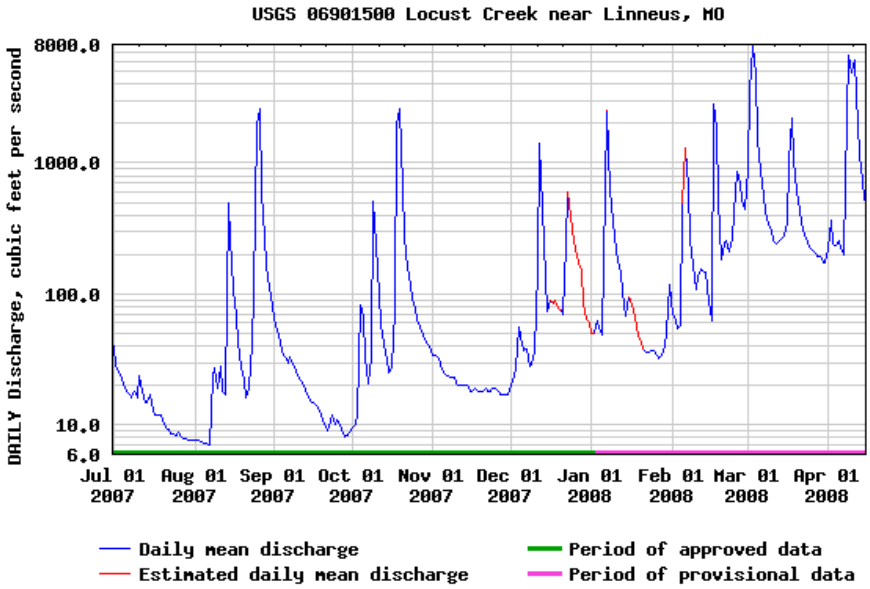


Table 3
Physicochemical Results

Sample #	Date	Time	Station	Flow (cfs) (cfs)	Dissolved Oxygen (mg/L)	pH (pH Units)	Specific Conductivity (umhos/cm)	Temperature (C)	Turbidity (NTU)	Total Nitrogen (mg/L)	NO2+NO3N (mg/L)	NH3 N (mg/L)	Total Phosphorus (mg/L)	Chloride (mg/L)
Fall 2007														
0710273	09/18/2007	9:25	1	**<0.5**	8.6	7.60	332	19.0	18.7	0.37	<0.01	<0.03	0.04	7.7
0710274	09/18/2007	12:30	2		8.2	7.70	291	21.5	13.2	0.52	<0.01	<0.03	0.02	7.4
0710275	09/18/2007	15:25	3		11.4	8.40	273	27.0	28.3	0.62	<0.01	<0.03	0.04	8.5
0710276	09/19/2007	9:15	4a	**<0.5**	6.0	7.60	481	19.5	4.7	0.49	0.02	<0.03	0.03	11.5
0710277	09/19/2007	9:20	4b		6.0	7.60	481	19.5	4.7	0.50	0.01	<0.03	0.04	11.6
0710278	09/19/2007	12:45	5		5.1	7.70	345	19.5	18.6	**2.64**	**0.33**	**1.04**	0.10	11.8
0710280	09/20/2007	10:40	6		6.3	7.80	368	20.0	11.1	0.50	0.02	<0.03	0.03	9.6
0710281	09/20/2007	11:15	7	**<0.5**	5.1	7.70	375	19.0	5.2	0.45	<0.01	<0.03	0.10	10.9
0710279	09/19/2007	16:00	8	**<0.5**	5.8	7.70	332	22.0	22.8	0.41	<0.01	<0.03	0.13	9.6
Spring 2008														
0803433	03/26/2008	9:15	1a	31.1	12.6	8.04	311	7.0	12.2	0.68	0.30	<0.03	0.02	11.9
0803434	03/26/2008	9:20	1b		12.6	8.04	311	7.0	14.3	0.64	0.32	0.03	0.01	11.9
0803431	03/25/2008	12:45	2	28.7	12.4	7.62	309	7.5	11.3	0.78	0.32	<0.03	0.03	11.9
0803432	03/25/2008	14:25	3	32.0	12.5	7.97	324	7.5	10.4	0.80	0.33	0.04	0.04	12.4
0803435	03/26/2008	12:55	4	18.0	12.0	7.96	328	9.0	7.9	0.70	0.31	<0.03	0.02	12.7
0803436	03/26/2008	14:35	5	14.4	10.6	7.80	335	12.0	14.0	0.72	0.30	0.04	0.03	13.4
0803439	04/01/2008	14:45	6	20.1	11.9	8.08	307	8.0	**63.8**	**1.04**	0.24	<0.03	**0.15**	16.4
0803437	04/01/2008	11:15	7	16.0	12.2	7.42	311	7.0	**44.8**	0.79	0.33	<0.03	0.07	16.9
0803438	04/01/2008	13:10	8	12.6	12.3	8.22	316	7.0	**68.9**	**1.14**	0.35	<0.03	**0.12**	18.1

4.2 Habitat

4.2.1 Land Use

The land use data in Table 4 is provided in two scales. A broad scale comparison is provided by comparing the 14-digit hydrologic unit (**HU**) for West Fork Locust Creek stations with the Central Plains/Grand/Chariton EDU. A refined scale comparing distinct HUs is provided by comparing the 14-digit HU for West Fork Locust Creek stations with the 14-digit HUs of BIOREF streams in the Central Plains/Grand/Chariton EDU.

In regard to land use, there is an appreciable difference between the West Fork Locust Creek HUs associated with stations 3 - 8 and the average for the Central Plains/Grand/Chariton EDU. While the percentage of forest differs by less than 5%, there is less cropland and more grassland.

Comparing land use percentages for HUs associated with West Fork Locust Creek and the HUs associated with individual BIOREF streams within the Central Plains/Grand/Chariton EDU provides some insight as well. There are some slight differences in percentage urban land use, but these differences are quite variable. There are some trends associated with land use percentages for cropland and grassland. The HU associated with West Fork Locust Creek stations 1 and 2 contained a higher percentage of cropland than six of the seven BIOREF HUs, but this HU also contains a higher percentage of grassland than five of the seven BIOREF HUs. In contrast, the HUs associated with West Fork Locust Creek stations 3 - 8 contained a lower percentage of cropland than five of the seven BIOREF HUs, and this HU also contains a higher percentage of grassland than five of the seven BIOREF HUs. All but two West Fork Locust Creek and BIOREF HUs had similar percentages of forest.

Table 4
Land Use

Stream	HU	Urban (%)	Crop (%)	Grass (%)	Forest (%)
West Fork Locust Creek (1 & 2)	10290103090010	2	24	54	15
West Fork Locust Creek (3 & 4)	10290103090009	1	11	60	21
West Fork Locust Creek (5 - 8)	10290103090007	1	10	67	15
Central Plains/Grand/Chariton Average		2	28	45	18
East Fork Grand River	10280101060008	0	22	53	19
Locust Creek	10280103090004	2	10	62	20
Locust Creek	10280103090001	0	13	63	15
Marrowbone Creek	10280101170001	2	21	53	19
No Creek	10280102180005	3	51	33	6
Spring Creek	10280202010002	1	10	28	55
West Fork Big Creek	10280101150003	1	23	49	21

4.2.2 Habitat Assessment

Scoring results of the habitat assessment are found in Table 5. West Fork Locust Creek station 8 is ranked lowest (78) and stations 2 - 4 the highest (115). In the SHAPP, $\geq$ 75% similarity is the guidance for considering habitats comparable between stations. Comparable habitats should be able to support comparable biological communities. When comparing West Fork Locust Creek SHAPP scores to each other, all West Fork Locust Creek stations except station 8 had $\geq$ 75% similarity to each other. When comparing West Fork Locust Creek SHAPP scores to BIOREF Locust Creek, all scores except for West Fork Locust Creek station 8 scored $\geq$ 75% similarity.

While West Fork Locust Creek is nearly comparable to BIOREF Locust Creek, this station is not comparable to other stations in West Fork Locust Creek. While there were several factors contributing to the low SHAPP score for this station, pool variability scored several points lower than all other West Fork Locust Creek stations. This is likely due to the extremely small size of the stream at this most upstream station.

Since it appears that stream size has an effect on SHAPP scores, comparison of SHAPP scores according to stream classification provides additional insight. While West Fork Locust Creek station 8 is not comparable to the highest score when Class P and C segments are both used (115), station 8 is comparable to the highest score when scores associated only with Class C segments are used (104). This demonstrates the benefit of comparing Class P and C stream segments as individual streams.

Table 5
Habitat Assessment Scores

Station	SHAPP Score	% of Reference	% of Highest (All Classes)	% of Highest (Within Class)
West Fork Locust Creek 1	99	92.5	86.1	86.1
West Fork Locust Creek 2	115	107.5	100.0	100.0
West Fork Locust Creek 3	115	107.5	100.0	100.0
West Fork Locust Creek 4	115	107.5	100.0	100.0
West Fork Locust Creek 5	104	97.2	90.4	100.0
West Fork Locust Creek 6	104	97.2	90.4	100.0
West Fork Locust Creek 7	88	82.2	76.5	84.6
West Fork Locust Creek 8	78	72.9	67.8	75.0
BIOREF Locust Creek	107	100.0		

4.2.3 Width and Depth Measurements

Station transect measurements for lower bank channel width, wetted width, and depth are provided in Appendix A. A summary of stream width and depth measurement data is available in Table 6.

Some general trends are relatively obvious in Table 6, such as the differences between West Fork Locust Creek and BIOREF stations for average channel width, average wetted width, average depth, maximum depth, standard deviations of average depth, sinuosity, and watershed area. In order to do comparisons of stream stations, however, it is sometimes necessary to incorporate ratios of measurements. Ratios can standardize measurements so that data such as channel width can be used in a manner that allows comparison of study stations regardless of their longitudinal placement or relation to watershed area. For this reason, the ratios of average channel width/average wetted width and average wetted width/average depth are also given in Table 6.

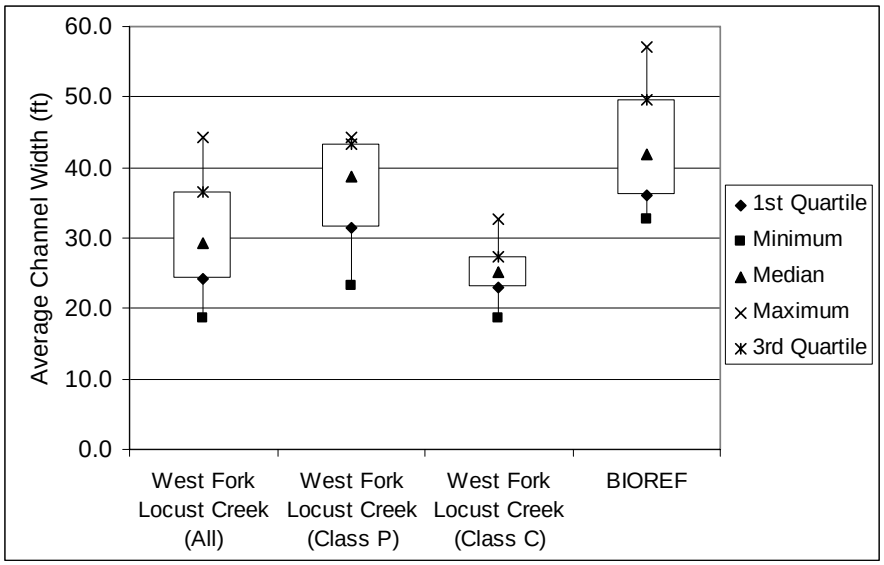
Table 6
Stream Width and Depth Measurement Summary

Station	Stream Class Designation	Average Channel Width (ft)	Average Wetted Width (ft)	Channel Width/ Wetted Width	Average Depth of Stream (ft)	Maximum Depth (ft)	Average Depth Standard Deviation	Wetted Width/ Depth	Watershed Area (sq mi)	Sinuosity (mi/mi)
West Fork Locust Creek 1	P	34.3	21.2	1.6	0.5	1.5	0.5	44.8	132	1.05
West Fork Locust Creek 2	P	42.9	42.0	1.0	1.4	3.1	0.8	30.4	121	1.08
West Fork Locust Creek 3	P	44.2	43.9	1.0	2.4	5.5	1.0	18.6	109	1.73
West Fork Locust Creek 4	P	23.2	11.2	2.1	0.5	1.3	0.4	22.1	83	1.09
West Fork Locust Creek 5	C	32.7	22.4	1.5	1.0	4.5	1.4	23.2	63	1.30
West Fork Locust Creek 6	C	25.7	25.5	1.0	1.1	2.1	0.5	23.1	54	1.21
West Fork Locust Creek 7	C	24.4	8.0	3.1	0.3	0.9	0.3	29.9	33	1.02
West Fork Locust Creek 8	C	18.7	8.7	2.2	0.2	0.6	0.1	48.3	28	1.01
BIOREF East Fork Grand River	P	57.0	40.3	1.4	0.7	2.0	0.5	58.0	228	1.48
BIOREF Locust Creek	P	36.5	26.6	1.4	1.1	2.8	0.6	24.9	64	1.04
BIOREF Marrowbone Creek	P	56.9	33.5	1.7	1.0	2.7	0.6	34.1	66	1.58
BIOREF No Creek	P	32.8	19.6	1.7	1.1	4.3	1.2	17.6	64	1.24
BIOREF Spring Creek	P	47.2	25.1	1.9	0.8	2.9	0.7	33.1	84	1.26
BIOREF West Fork Big Creek	C	34.9	22.5	1.6	0.9	2.2	0.5	25.0	91	1.73
BIOREF West Fork Locust Creek 1	C	40.8	23.3	1.8	1.4	3.7	1.2	16.5	88	1.43
BIOREF West Fork Locust Creek 2	C	42.8	26.7	1.6	1.1	3.3	0.9	25.2	82	2.33

To further demonstrate differences and general trends between West Fork Locust Creek and BIOREF stations, box plots were generated for the parameters in Table 6. Minimums, first quartiles, medians, third quartiles, and maximums were generated for the following primary groupings: West Locust Creek (All), West Fork Locust Creek (Class P), West Fork Locust Creek (Class C), and BIOREF stations. Each of these plots will be discussed independently.

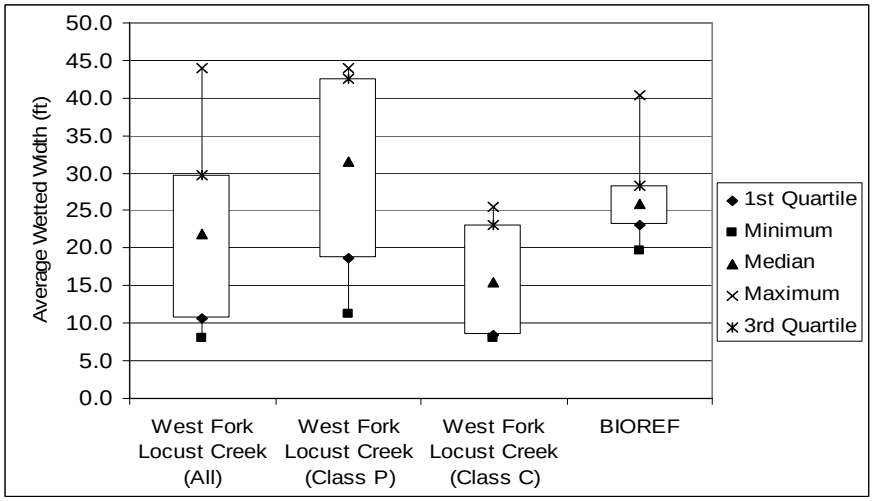
As shown in Figure 3, the average channel widths of all West Fork Locust Creek stations combined are typically lower than those of BIOREF stations. However, the average channel widths for Class P stations are more similar to BIOREF stations than Class C stations or all stations combined. This is another measure that shows difference in stream size in relation to reference.

Figure 3
Average Channel Width



Another illustration of size difference is shown in Figure 4. The average wetted width for all West Fork Locust Creek stations combined has more variability than BIOREF stations, but they are still comparable. However, plotting Class P and Class C average wetted widths demonstrates that the Class C segment is less comparable to reference conditions than the Class P segment.

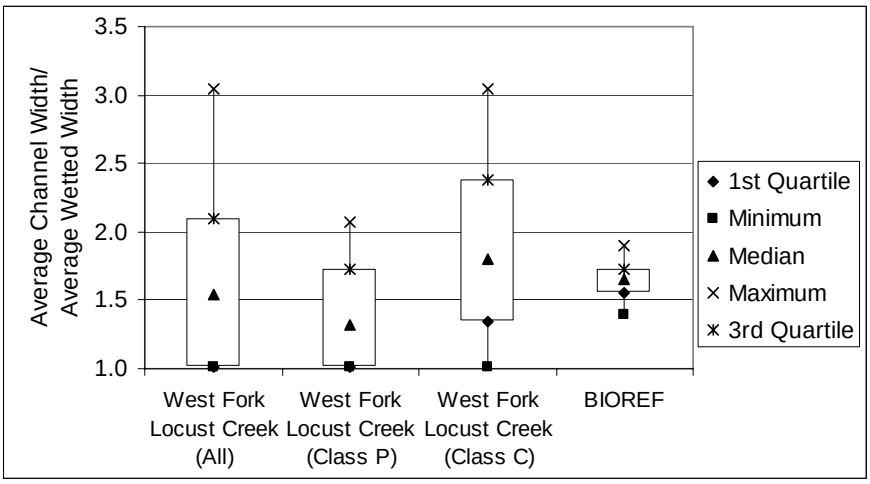
Figure 4
Average Wetted Width



As shown in Figure 5, the average channel width to average wetted width ratios of West Fork Locust Creek stations are more variable than BIOREF stations. Other than this, there are no noteworthy differences. The first quartile, median, and third quartile value for the BIOREFs are

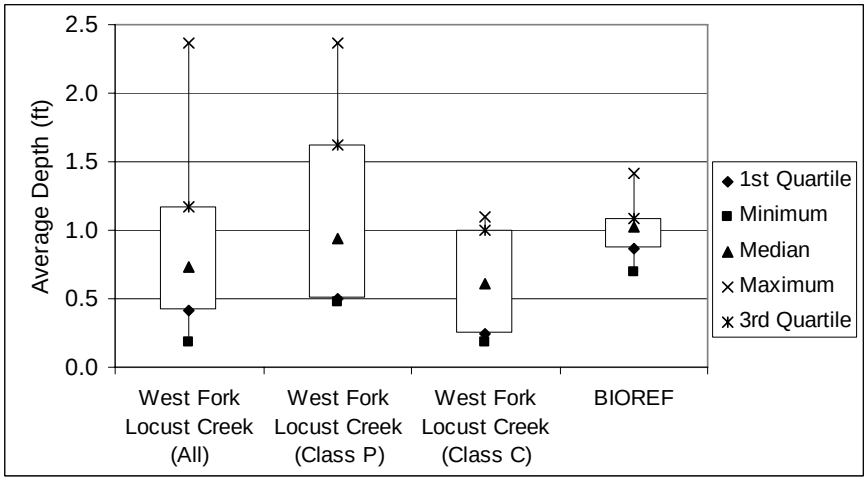
all within the first and third quartile ranges of the West Fork Locust Creek measurements, regardless of class grouping.

Figure 5
Average Channel Width/Average Wetted Width



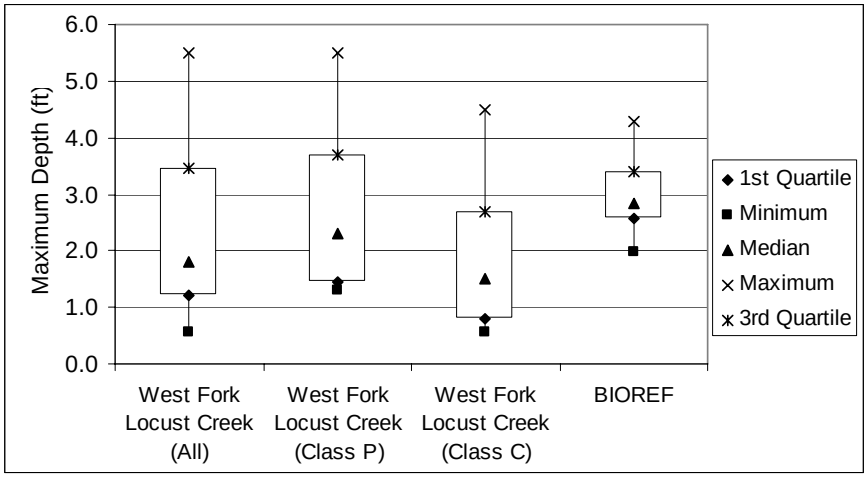
As shown in Figure 6, the range of average depths is wider for the Class P segment of West Fork Locust Creek and the median of the average depths is similar to the BIOREF streams. However, the median average depth for the BIOREF streams is nearly equal to the third quartile for the Class C segment of West Fork Locust Creek.

Figure 6
Average Depth



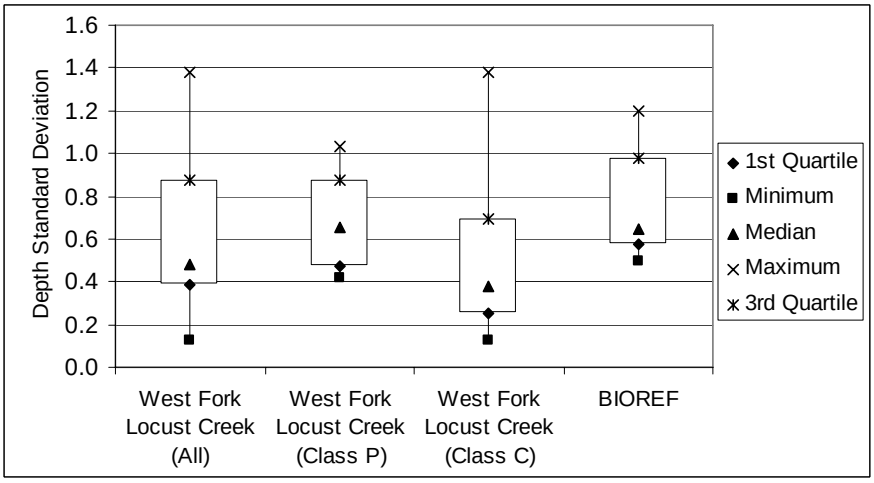
As shown in Figure 7, the range of maximum depths is wider regardless of class for West Fork Locust Creek segments. The median of the maximum depths for the Class P segment is more similar to the BIOREF streams. The median maximum depth for the BIOREF streams is nearly equal to the third quartile for the Class C segment of West Fork Locust Creek.

Figure 7
Maximum Depth



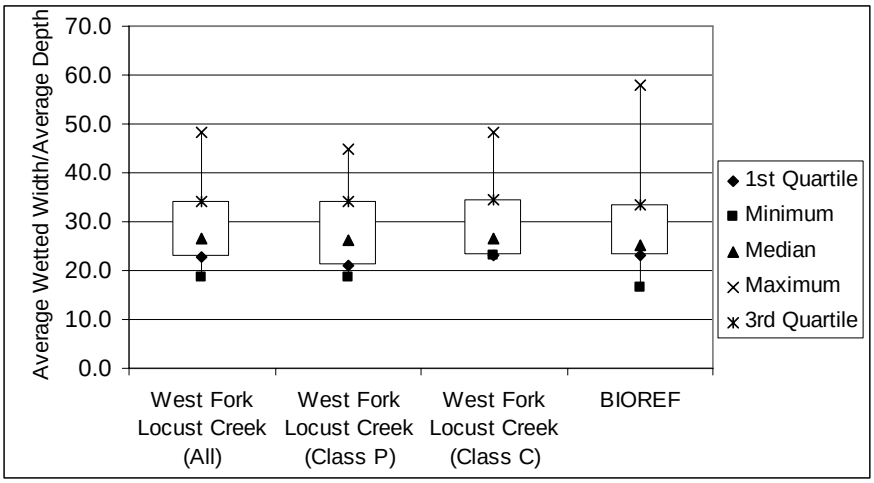
The variability of stream depths within a particular length of stream is another measure of habitat variability. As shown in Figure 8, the standard deviation of the depth for the Class P segment of West Fork Locust Creek more closely resembles the BIOREF streams than does the Class C segment.

Figure 8
Depth Standard Deviation



Calculating a ratio using average wetted width and average depth measurements provides additional insight in the potential wide shallow nature of Northern Missouri channelized streams. But as shown in Figure 9, there is little difference among the BIOREF streams and the West Fork Locust Creek segments regardless of stream class.

Figure 9
Average Wetted Width to Average Depth

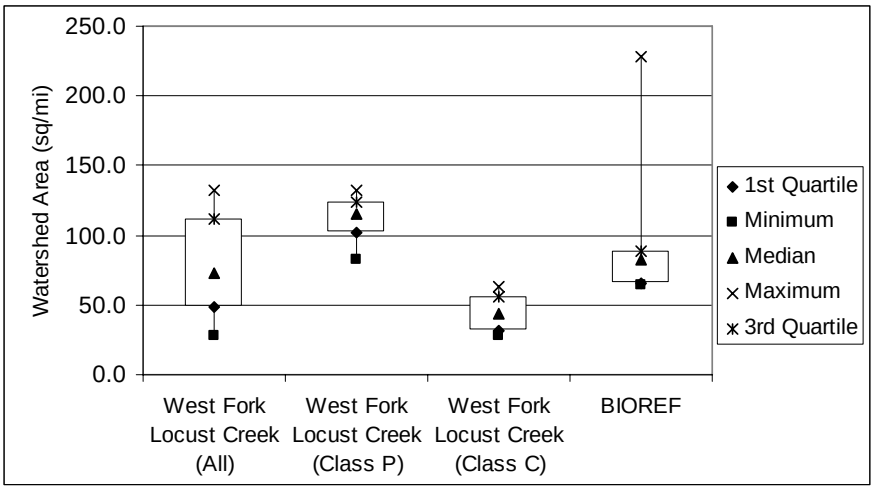


In summary, width and depth measurements illustrate a notable difference between Class P and Class C segments of West Fork Locust Creek in regard to comparability with BIOREF streams in the Central Plains/Grand/Chariton EDU.

4.2.4 Watershed area

As shown in Figure 10, when combined, all West Fork Locust Creek segments correlate relatively well to BIOREF streams. However, when split out, West Fork Locust Creek Class P segments are a better fit than Class C segments when relating to the watershed areas of BIOREF streams. West Fork Locust Creek Class P segments have a larger watershed area but are within the full range of BIOREF streams. In contrast, the maximum watershed area for Class C segments falls below the minimum for BIOREF streams. It is important to note that five out of eight of the listed BIOREF stations were designated as Class P. The other three are designated Class C, and this includes two West Fork Locust BIOREF stations. Additionally, the watershed areas for all three BIOREF stations are larger than West Fork Locust Creek station 5, the most downstream station in the Class P segment.

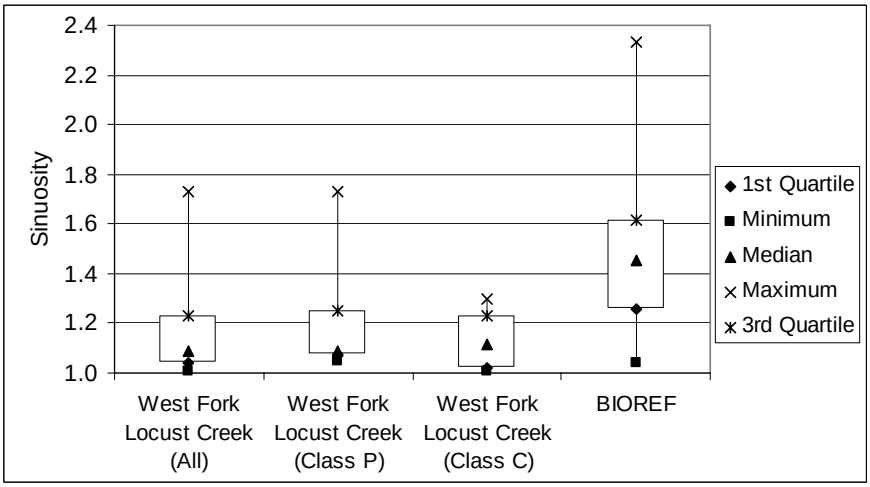
Figure 10
Watershed Area



4.2.5 Sinuosity

The sinuosity index values for West Fork Locust Creek and BIOREF stations are listed in Table 6. With a sinuosity index value of 1.01, West Fork Locust Creek station 8 is the most channelized station in the study reach. West Fork Locust Creek station 3, with a sinuosity index value of 1.73, is the least channelized. A box plot (Figure 11) was generated from sinuosity index values to further demonstrate differences and general trends between West Fork Locust Creek and BIOREF stations. Regardless of whether the data are split by stream classification or pooled, sinuosity index values are generally higher for BIOREF streams.

Figure 11
Sinuosity



4.3 Biological Assessment

Macroinvertebrate bench sheets for fall 2007 and spring 2008 are provided in Appendices B and C respectively. The West Fork Locust Creek metric results and MSCI scores for fall 2007 and spring 2008 are found in Table 7 and 8 respectively. MSCI scores are calculated by scoring study station metrics against the appropriate criteria in Table 1 or Table 2.

In fall 2007 samples, West Fork Locust Creek station 7, yielding an MSCI score of 14, was the only station that was not assigned full biological sustainability. Scores for the Class P segment were quite good. However, in the Class C segment, BI scores were reduced in 75% of stations, SDI scores were reduced in 50% of stations, and TR and EPTT scores were reduced in 25% of stations. In short, while 75% of stations in the Class C segment showed full biological sustainability, there was evidence of a shift toward tolerant taxa and reduced diversity.

Table 7
Fall 2007 Macroinvertebrate Stream Condition Index Scores

Station	Sample #	Score	Sustainability	TR (Score)	EPTT (Score)	BI (Score)	SDI (Score)
West Fork Locust Creek 1	0703277	20	Full	79 (5)	17 (5)	6.8 (5)	3.09 (5)
West Fork Locust Creek 2	0703278	20	Full	66 (5)	12 (5)	6.9 (5)	3.26 (5)
West Fork Locust Creek 3	0703279	20	Full	60 (5)	11 (5)	7.0 (5)	3.13 (5)
West Fork Locust Creek 4a	0703280	20	Full	63 (5)	12 (5)	6.5 (5)	2.97 (5)
West Fork Locust Creek 4b	0703281	20	Full	61 (5)	14 (5)	6.0 (5)	3.03 (5)
West Fork Locust Creek 5	0703282	18	Full	56 (5)	10 (5)	6.6 (5)	2.69 (3)
West Fork Locust Creek 6	0703284	16	Full	60 (5)	10 (5)	7.2 (3)	2.50 (3)
West Fork Locust Creek 7	0703285	14	Partial	53 (3)	9 (3)	7.4 (3)	2.75 (5)
West Fork Locust Creek 8	0703283	18	Full	65 (5)	11 (5)	7.3 (3)	3.01 (5)

In spring 2008, stations 1 - 4 were assigned full biological sustainability; however, stations 5 - 8 were assigned partial biological sustainability. In scores for the Class P segment, TR and SDI scores were reduced in 50% of stations. In the Class C segment, EPTT and SDI scores were reduced in 100% of stations, TR scores were reduced in 75% of stations, and BI scores were reduced in 25% of stations. In the Class P segment, there was some evidence of reduced diversity, but this was not enough to assign lower biological sustainability. However, there was enough evidence of reduced diversity and a shift toward tolerant taxa to assign partial biological sustainability in the Class C segment.

Table 8
Spring 2008 Macroinvertebrate Stream Condition Index Scores

Station	Sample #	Score	Sustainability	TR (Score)	EPTT (Score)	BI (Score)	SDI (Score)
West Fork Locust Creek 1a	0804013	18	Full	65 (5)	16 (5)	7.0 (5)	2.26 (3)
West Fork Locust Creek 1b	0804014	16	Full	50 (3)	13 (5)	7.0 (5)	2.02 (3)
West Fork Locust Creek 2	0804011	20	Full	71 (5)	11 (5)	7.2 (5)	2.69 (5)
West Fork Locust Creek 3	0804012	20	Full	66 (5)	14 (5)	7.2 (5)	2.76 (5)
West Fork Locust Creek 4	0804015	16	Full	51 (3)	9 (5)	7.2 (5)	2.18 (3)
West Fork Locust Creek 5	0804016	14	Partial	56 (5)	8 (3)	7.3 (3)	2.30 (3)
West Fork Locust Creek 6	0804019	14	Partial	47 (3)	8 (3)	6.6 (5)	2.07 (3)
West Fork Locust Creek 7	0804017	14	Partial	43 (3)	7 (3)	6.8 (5)	2.22 (3)
West Fork Locust Creek 8	0804018	12	Partial	33 (3)	7 (3)	7.4 (3)	1.90 (3)

Summaries regarding macroinvertebrate community structure for each West Fork Locust Creek station are available in Tables 9 and 10.

In fall 2007, Chironomidae was the most dominant macroinvertebrate family for West Fork Locust Creek stations 1 - 4 and 7 - 8, and Caenidae was the dominant family for stations 5 and 6. Ephemeroptera and Trichoptera were found, but Plecoptera were not. TR was lowest at stations 5 and 6. EPTT was lowest at station 7 and was also notably low at stations 5 and 6. Diptera were rather abundant in all samples and most abundant at station 5.

In spring 2008, Caenidae was the most dominant macroinvertebrate family for West Fork Locust Creek stations 1, 2, and 4, while Chironomidae was the dominant family for stations 3 and 5 - 8. All three orders of EPT were found at each of the stations, and Perlidae was a dominant taxon at stations 4 and 7. However, TR trended lower in an upstream direction, markedly in the Class C segment, and EPTT followed a similar trend. Diptera were rather abundant in all samples and most abundant at station 7.

Table 9
Fall 2007 Macroinvertebrate Summary

Station	1	2	3	4a	4b	5	6	7	8
Taxa Richness	79	66	60	63	61	56	50	63	65
Number EPT Taxa	17	12	11	12	14	10	10	9	11
% Ephemeroptera	15.2	9.1	10.0	11.1	11.5	12.5	16.0	11.1	12.3
% Plecoptera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
% Trichoptera	6.3	9.1	8.3	7.9	11.5	5.4	4.0	3.2	4.6
Total EPT %	21.5	18.2	18.3	19.0	23.0	17.9	20.0	14.3	16.9
% Diptera	45.6	43.9	46.7	46.0	44.3	42.9	58.0	42.9	49.2
Top Five Dominant Families (%)									
Chironomidae	33.1	26.2	22.8	38.1	36.9	28.5	24.0	59.2	45.3
Caenidae	26.4	14.2	14.7	22.3	19.8	32.0	44.6	22.8	21.3
Elmidae	5.4	8.8	6.3	3.4					
Leptophlebiidae	4.6			10.0	17.7	16.8	4.3	2.5	
Leptoceridae	4.2								
Hyalellidae		14.1	17.6	7.8	4.3	4.4	6.2		
Coenagrionidae		7.1	7.5		3.4				
Tubificidae						2.7			
Scirtidae							4.4	1.9	
Physidae								5.1	6.8
Ceratopogonidae									5.3
Baetidae									5.1
Culicidae									5.1

Table 10
Spring 2008 Macroinvertebrate Summary

Station	1a	1b	2	3	4	5	6	7	8
Taxa Richness	65	50	71	66	51	56	47	43	33
Number EPT Taxa	16	13	11	14	9	8	8	7	7
% Ephemeroptera	12.3	10.0	7.0	9.1	11.8	7.1	8.5	9.3	9.1
% Plecoptera	1.5	2.0	1.4	3.0	2.0	1.8	2.1	2.3	3.0
% Trichoptera	10.8	14.0	7.0	9.1	3.9	5.4	6.4	4.7	9.1
Total EPT %	24.6	26.0	15.5	21.2	17.6	14.3	17.0	16.3	21.2
% Diptera	43.1	42.0	50.7	45.5	47.1	51.8	53.2	58.1	54.5
Top Five Dominant Families (%)									
Caenidae	46.7	52.5	37.8	13.6	47.1	38.3	20.5	27.5	17.5
Chironomidae	20.2	13.5	22.0	39.0	32.6	39.2	35.3	42.0	64.6
Simuliidae	12.5	11.8	11.0	15.2	6.5	3.0	33.6	14.9	8.6
Elmidae	6.0	7.3	4.2						
Hyalellidae	4.6	4.3		5.7					
Tubificidae			4.9	6.8		5.3	2.3	3.2	1.4
Enchytraeidae				5.7		2.8	1.9		
Perlidae					1.9			2.7	
Heptageniidae					1.9				
Limnephilidae									1.9

4.4 Biological Assessment QA/QC

The Quantitative Similarity Index for Taxa (QSIT), a sampling protocol quality control measure, expresses taxa similarity as a percentage. Duplicate samples are expected to have a score of 70% or greater (Rabeni et al. 1999). The fall 2007 QSIT for duplicate samples at station 4 was 79.9%. The spring 2008 QSIT for duplicate samples at station 1 was 83.1%.

5.0 Discussion

The Missouri Water Quality Standards numeric criteria were not violated in any of the West Fork Locust Creek water samples. Fall 2007 sampling was likely affected by extreme drought, but spring 2008 sampling was affected by unusually high rainfall amounts. Some of this rain occurred during sampling of the Class C segment. In fall 2007, nutrient values were high in the Class C segment at station 5. Considering the lack of discharge during fall 2007 and the presence of a relatively large beaver dam, determining the source of increased nutrients would be difficult at best. The increase in nutrient values associated with the Class C segment during spring 2008, along with increased stream discharge and turbidity, could indicate a flushing effect associated with the abnormally wet conditions. While the list of physicochemical parameters is not exhaustive, no clear inference can be made from these data that the West Fork Locust Creek study reach is impaired for physicochemical reasons. There are, however, some habitat quality conclusions that can be made from land use, SHAPP scores, width and depth measurements, watershed area, and sinuosity.

Regarding land use, most West Fork Locust Creek sampling stations have less row crop agriculture and more grassland than streams within the Central Plains/Grand/Chariton Drainages

EDU. All SHAPP scores associated with West Fork Locust Creek, with the exception of station 8, are comparable to BIOREF Locust. Likewise, when comparing SHAPP scores within West Fork Locust Creek, the only station that is not comparable is station 8. There is a sharp contrast, however, if the stream is divided into separate Class P and Class C segments. All Class P segment SHAPP scores are comparable to each other. All Class C segment SHAPP scores are comparable, with station 8 being 75% comparable. For the above reasons, it was decided that it may be useful to look at West Fork Locust as two independent streams, a Class P stream and a Class C stream. Unfortunately, this team did not perform a habitat assessment on a Class C BIOREF, so additional SHAPP analysis is not possible.

When width and depth data are compared between West Fork Locust Creek stations and BIOREF stations within the Central Plains/Grand/Chariton Drainages EDU, treating the study stream as independent stream segments based on classification provides valuable insight. When average channel width, average wetted width, average depth, maximum depth, and standard deviation of depth are analyzed; the Class P segment of West Fork Locust Creek is more comparable to BIOREF stations in the Central Plains/Grand/Chariton EDU than the Class C segment. All of these characteristics are indicative of larger streams, so this can be expected. Interestingly, however, the Class C segment is more comparable to the same BIOREF stations for the average channel width/average wetted width ratio than the Class P segment. The ratio of average wetted width/average depth provides little insight.

When comparing watershed area, a measure that correlates nicely to stream size, neither the Class P segment nor the Class C segment is comparable to other stations in the Central Plains/Grand/Chariton EDU. The watershed areas associated with the Class P segment are much larger than the BIOREF stations, and the watershed areas associated with the Class C segment are much smaller. Watershed area is most comparable when Class P and Class C segments are pooled.

While some portions of West Fork Locust Creek exhibit high sinuosity, the stream appears deficient in this measure overall. In addition, sinuosity was poor when comparing the sinuosity of stations in the Class P and Class C segments independently against the BIOREF stations.

According to the biological assessment, the Class P segment, water body I.D. #612, is assigned full biological sustainability; and the Class C segment, water body I.D. #613, is assigned partial biological sustainability. Considering the 2007 drought that extended into the fall sampling season and the extremely wet spring 2008 season, illustrated by Figure 2, reasons regarding water quantity rather than water quality may have contributed more significantly to low macroinvertebrate numbers in the Class C segment. Low macroinvertebrate numbers at station 7 may have resulted from too little water. Low macroinvertebrate numbers in spring 2008 may have been the result of scour. A landowner along the Class C segment, showing surprise that we had an interest in his stream, mentioned that the stream is either dry or flooded with few days in between. It may also be that the Class C segment is not comparable physically, chemically, or biologically to the BIOREF streams within the Central Plains/Grand/Chariton EDU.

6.0 Conclusions

Four null hypotheses were stated in the introduction: 1) Habitat will not differ substantially among West Fork Locust Creek stream segments; 2) Habitat will not differ between West Fork Locust Creek and biological criteria reference streams in the Central Plains/Grand/Chariton Drainages EDU; 3) Macroinvertebrate assemblages will not differ substantially among West Fork Locust Creek stream segments; 4) Macroinvertebrate assemblages will not differ substantially between West Fork Locust Creek and biological criteria reference streams in the Central Plains/Grand/Chariton Drainages EDU.

Null hypothesis #1 is rejected. SHAPP scores along with width and depth analyses revealed that the habitat of West Fork Locust Creek stations were not comparable. All stations in the Class P segment are comparable with each other, and all stations in the Class C segment are comparable with each other.

Null hypothesis #2 is rejected. SHAPP scores, width and depth analyses, and sinuosity index values revealed that the habitat of West Fork Locust Creek stations was not comparable to BIOREF stream stations within the Central Plains/Grand/Chariton Drainages EDU. Stations in the Class P segment were comparable to BIOREF streams, but stations in the Class C segment were not.

Null hypothesis #3 is rejected. The macroinvertebrate community of all West Fork Locust Creek stations in both seasons received substantially different MSCI scores and exhibited different dominant taxa. All stations in the Class P segment received similar MSCI scores in both seasons, but all stations in the Class C segment received substantially different MSCI scores in both seasons.

Null hypothesis #4 is rejected. The macroinvertebrate community of some West Fork Locust Creek stations differed substantially from the MSCI, which is calculated from biological criteria reference streams within the same EDU. All stations in the Class P segment received a designation of full biological sustainability in both seasons. For the Class C segment, one of four received a designation of partial biological sustainability in fall 2007 samples, and all four stations received a designation of partial biological sustainability in spring 2008 samples.

The bioassessment for the Class P segment of West Fork Locust Creek suggests no biological impairment. Exactly 100% of the MSCI scores are $\geq$ 16 (full biological sustainability). The bioassessment for the Class C segment of West Fork Locust Creek suggests partial biological impairment. Only 37.5% of the MSCI scores are $\geq$ 16, and 62.5% of the MSCI scores were 12 or 14. During the development of biological criteria (MDNR 2002a) it was demonstrated that individual wadeable perennial reference streams stations scored $\geq$ 16 about 86% of the time.

While a specific reason for the relative difference in MSCI scores between Class P and Class C segments is difficult to determine, SHAPP scores along with width and depth analyses strongly suggest this difference may be due to stream size. Considering the size of the watershed, the classification of West Fork Locust Creek at station 8 as a Class C could be marginal or

erroneous. In addition, the effects of a prolonged drought extending into fall 2007 immediately followed by an unusually wet spring 2008 are unknown.

7.0 Recommendations

1) Propose the Class P segment of West Fork Locust Creek for de-listing from the 303(d) list for unknown impairment.
2) Propose the retention of Class C segment of West Fork Locust Creek on the 303(d) list for unknown impairment.
3) Continue study on the Class C segment of West Fork Locust Creek to determine potential source/s of impairment or if drought followed by unusually wet conditions caused an anomalous macroinvertebrate community.
4) Determine if stream class designations for the entirety of West Fork Locust Creek are appropriate.
5) Develop biological criteria designed for specific stream classifications.

8.0 Literature Cited

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APPENDIX A
Fall 2007
Width and Depth Data

West Fork Locust Creek 1					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	42	6	0.1	0.1	0.1
2	32	10	0.1	0.1	0.2
3	34	12	0.1	0.1	0.2
4	33	12	0.3	0.2	0.1
5	20	7	0.1	0.1	0.1
6	29	16	0.1	0.2	0.2
7	32	31	1.0	1.4	1.0
8	44	43	0.5	0.8	1.4
9	42	41	0.5	0.9	0.7
10	35	34	1.5	1.4	1.0

West Fork Locust Creek 2					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	40	40	1.7	1.6	1.3
2	47	47	1.5	1.8	1.5
3	50	50	1.1	1.0	0.7
4	46	45	0.8	1.5	1.5
5	41	41	2.2	3.1	2.9
6	44	37	1.5	3.0	3.1
7	42	42	0.9	0.6	1.5
8	41	41	0.4	0.2	0.5
9	43	42	0.4	0.5	0.5
10	35	35	1.1	1.6	1.5

West Fork Locust Creek 3					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	31	29	1.5	2.3	2.1
2	49	49	2.2	1.4	1.5
3	54	53	1.9	1.3	2.1
4	41	41	3.2	3.5	3.0
5	34	34	4.0	4.0	5.5
6	47	47	1.2	1.9	1.4
7	42	42	4.5	2.5	2.0
8	39	39	2.6	1.9	2.2
9	49	49	1.5	1.5	1.8
10	56	56	2.0	2.4	2.1

West Fork Locust Creek 4					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	32	32	1.2	0.9	1.2
2	13	12	0.3	0.3	0.3
3	15	15	0.4	0.4	0.4
4	20	4.5	0.1	0.1	0.1
5	5	3	0.1	0.2	0.1
6	31	10	1.0	0.8	0.5
7	36	2.5	0.1	0.1	0.1
8	33	12	1.2	1.3	0.8
9	18	15	0.6	1.0	1.0
10	29	6	0.3	0.3	0.3

West Fork Locust Creek 5					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	16	16	0.4	0.5	0.6
2	11	11	0.6	0.4	0.4
3	9	9	0.2	0.1	0.2
4	38	9	0.1	0.1	0.2
5	35	8	0.2	0.1	0.1
6	17	4	0.1	0.1	0.1
7	52	18	0.2	0.1	0.1
8	43	43	1.3	0.9	0.8
9	53	53	3.0	2.6	2.5
10	53	53	4.5	4.5	4.0

West Fork Locust Creek 6					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	32	32	0.8	1.0	0.9
2	25	25	0.8	1.3	2.1
3	24	24	0.9	0.7	0.9
4	27	27	0.4	1.0	1.5
5	15	15	0.7	1.0	1.1
6	30	30	0.4	0.3	0.6
7	28	28	0.8	0.9	1.6
8	23	21	1.1	1.1	0.9
9	28	28	1.8	1.8	1.7
10	25	25	1.6	1.7	1.7

West Fork Locust Creek 7					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	37	10	0.1	0.1	0.1
2	30	6	0.4	0.3	0.3
3	30	6	0.1	0.1	0.1
4	13	12	0.9	0.6	0.4
5	12	12	0.9	0.9	0.9
6	20	9	0.3	0.3	0.3
7	19	6	0.1	0.1	0.0
8	20	6	0.1	0.1	0.2
9	31	5	0.3	0.2	0.1
10	32	8	0.1	0.0	0.0

West Fork Locust Creek 8					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	16	10	0.5	0.3	0.4
2	19	12	0.2	0.2	0.1
3	17	6	0.1	0.1	0.1
4	17	5	0.2	0.1	0.1
5	24	8	0.1	0.1	0.1
6	23	9.5	0.2	0.2	0.4
7	17	17	0.2	0.3	0.6
8	13	4	0.1	0.2	0.2
9	12	9.5	0.1	0.1	0.2
10	29	6	0.1	0.2	0.1

BIOREF Locust Creek					
Transect	Channel Width (ft)	Wetted Width (ft)	Depth of Stream at % Wetted Width (ft)		
			25%	50%	75%
1	31	22	1.2	2.0	2.1
2	30	22	0.4	0.5	0.8
3	38	21	0.2	0.3	0.6
4	26	22	1.5	1.1	0.9
5	34	28	0.4	0.5	0.7
6	28	20	1.2	1.6	1.1
7	48	7	0.2	0.3	0.3
8	28	10	0.3	0.4	0.3
9	28	5	0.2	0.5	0.8
10	28	21	0.2	0.2	0.1

APPENDIX B
Fall 2007
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703277], Station #1, Sample Date: 9/18/2007 10:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1	2	1
AMPHIPODA			
Hyalella azteca		11	29
COLEOPTERA			
Berosus	3	4	13
Dubiraphia	20	32	1
Helichus lithophilus		9	-99
Neoporus		1	
Peltodytes			-99
Scirtidae		4	1
Tropisternus		-99	
DIPTERA			
Ablabesmyia	6	5	6
Ceratopogonidae		1	
Ceratopogoninae	4		3
Chironomus	2		
Cladotanytarsus	21	1	2
Cryptochironomus	7		
Cryptotendipes	12		1
Dicrotendipes	4	4	28
Empididae		1	
Endochironomus		1	
Ephydridae	1		
Forcipomyiinae			23
Glyptotendipes			1
Labrundinia		1	3
Limonia			1
Nanocladius		6	
Nilotanypus		1	
Nilothauma			1
Paralauterborniella	2		
Parametriocnemus			2
Paratanytarsus		1	
Pericoma			1
Polypedilum	2		
Polypedilum halterale grp	3		
Polypedilum illinoense grp		2	7
Polypedilum scalaenum grp	5		1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703277], Station #1, Sample Date: 9/18/2007 10:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Procladius	19	1	2
Pseudosmittia			1
Rheotanytarsus		10	7
Stempellinella	4		
Stratiomys			-99
Tabanus		-99	
Tanytarsus	29	30	74
Thienemannimyia grp.		2	3
Tribelos			1
Zavrelimyia		2	
EPHEMEROPTERA			
Acerpenna	1	4	
Brachycercus	4		
Caenis hilaris	2		5
Caenis latipennis	120	81	45
Hexagenia limbata	6	1	1
Isonychia		1	
Leptophlebiidae		45	
Maccaffertium terminatum			1
Paracloeodes			1
Procloeon	4	2	2
Stenacron	1	1	3
Tricorythodes		2	1
HEMIPTERA			
Corixidae	2	4	1
Neoplea			1
Pelocoris			1
LIMNOPHILA			
Physella	4	15	11
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		15	4
Enallagma		6	3
Erythemis		-99	
Gomphus	2	1	
Hetaerina		2	
Libellula		-99	
Libellulidae	1	1	1
Macromia	-99	-99	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703277], Station #1, Sample Date: 9/18/2007 10:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Progomphus obscurus	-99	-99	
TRICHOPTERA			
Cheumatopsyche		8	11
Hydroptila			3
Nectopsyche	7	31	
Oecetis	-99		1
Triaenodes		2	
TUBIFICIDA			
Branchiura sowerbyi	-99		
Tubificidae	2	1	2
VENEROIDEA			
Sphaeriidae	4	1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703278], Station #2, Sample Date: 9/18/2007 1:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	8	4	9
AMPHIPODA			
Hyalella azteca		72	51
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Berosus		2	2
Dubiraphia	33	41	3
Helichus lithophilus		3	-99
Scirtidae		8	2
DECAPODA			
Orconectes virilis		1	
Palaemonetes kadiakensis		-99	
DIPTERA			
Ablabesmyia	5	4	8
Anopheles			1
Ceratopogoninae	17	3	1
Chaoborus	5		
Cladopelma	2		
Cladotanytarsus	2		1
Cryptochironomus	4		
Cryptotendipes	5		1
Culex		1	
Dicrotendipes	2	5	19
Endochironomus			1
Forcipomyiinae			1
Glyptotendipes	1	7	5
Labrundinia	1	4	2
Microchironomus	1		
Nanocladius	1		
Nilothauma			5
Parachironomus		6	
Parakiefferiella	13	1	1
Polypedilum halterale grp	3		
Polypedilum illinoense grp		3	3
Procladius	31	1	3
Pseudochironomus			10
Stictochironomus	4		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703278], Station #2, Sample Date: 9/18/2007 1:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tanypus	6		
Tanytarsus	4	9	33
Thienemannimyia grp.			1
Tribelos			8
Xenochironomus		2	
EPHEMEROPTERA			
Caenis latipennis	58	22	44
Callibaetis		1	
Hexagenia limbata	14		1
Leptophlebiidae	1	42	3
Procloeon	1		2
Stenacron		2	3
HEMIPTERA			
Belostoma		-99	
Corixidae	2		3
Neoplea		8	1
Palmacorixa		1	
LIMNOPHILA			
Ancylidae			3
Menetus		1	2
Physella		5	3
MEGALOPTERA			
Sialis	-99	-99	
ODONATA			
Argia		27	8
Enallagma		27	
Gomphus	1		
Macromia	-99	-99	
Nasiaeschna pentacantha	-99	-99	
TRICHOPTERA			
Hydroptila			1
Nectopsyche		5	1
Nyctiophylax			9
Oecetis	1	17	1
Polycentropodidae		3	
Triaenodes		8	
TUBIFICIDA			
Branchiura sowerbyi	2	1	
Tubificidae	29	3	2
VENEROIDEA			

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703278], Station #2, Sample Date: 9/18/2007 1:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Sphaeriidae	3	1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703279], Station #3, Sample Date: 9/18/2007 3:45:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	21	6	1
AMPHIPODA			
Hyalella azteca	9	52	99
COLEOPTERA			
Berosus		3	
Dubiraphia	29	27	
Scirtidae	2	4	7
Stenelmis		1	1
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	12	8	10
Ceratopogoninae	17	5	3
Chaoborus	45	1	
Chironomus	2		
Clinotanypus		1	
Cryptochironomus	4		3
Cryptotendipes	2		
Dicrotendipes	2		15
Diptera		1	
Endochironomus		2	6
Forcipomyiinae			4
Glyptotendipes	4	8	4
Labrundinia	3	12	2
Larsia		1	
Nanocladius		2	
Parachironomus	1	8	1
Parakiefferiella	1	1	
Polypedilum illinoense grp	2	1	3
Procladius	21		1
Pseudochironomus	1		17
Stempellina	1		
Stenochironomus	1		
Tanypus	4		
Tanytarsus	7	5	12
Thienemannimyia grp.			4
Tribelos		3	5
Xenochironomus		3	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703279], Station #3, Sample Date: 9/18/2007 3:45:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Zavreliella	1		
EPHEMEROPTERA			
Caenis latipennis	70	29	35
Callibaetis		1	1
Hexagenia limbata	18		1
Leptophlebiidae	9	44	4
Procloeon			3
Stenacron	2	2	1
HEMIPTERA			
Neoplea		2	
LIMNOPHILA			
Ancylidae		1	
Physella		1	4
MEGALOPTERA			
Sialis	1	-99	
NEUROPTERA			
Sisyra		1	
ODONATA			
Argia	13	24	7
Enallagma		22	3
Libellula		-99	
Macromia	-99		
Nasiaeschna pentacantha		1	
TRICHOPTERA			
Hydroptila		1	
Nyctiophylax	2		4
Oecetis	5	7	
Polycentropodidae	1		
Triaenodes		9	
TRICLADIDA			
Planariidae		1	
TUBIFICIDA			
Branchiura sowerbyi	2	1	
Tubificidae	25	2	1
VENEROIDEA			
Sphaeriidae	1	-99	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703280], Station #4a, Sample Date: 9/19/2007 9:45:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	18	2	3
AMPHIPODA			
Hyalella azteca	1	56	24
COLEOPTERA			
Berosus			1
Dubiraphia	32	2	2
Helichus lithophilus			3
Scirtidae		8	2
DIPTERA			
Ablabesmyia	13	2	8
Anopheles	1		
Ceratopogoninae	14		1
Cladopelma	1		
Cladotanytarsus	9		3
Corynoneura	1		
Cryptochironomus	12		
Cryptotendipes	8	1	1
Dicrotendipes	12	13	47
Forcipomyiinae			2
Glyptotendipes		2	
Labrundinia	3	10	2
Nanocladius	3		
Parachironomus		2	
Parakiefferiella			1
Paralauterborniella	3		
Paratanytarsus	1	2	
Polypedilum		1	
Polypedilum halterale grp	3	1	
Polypedilum illinoense grp	2	2	3
Procladius	7		
Pseudochironomus			25
Stempellinella	27		1
Stenochironomus		1	13
Stictochironomus	3		
Tanytarsus	37	38	59
Thienemannimyia grp.		2	
Tribelos	4		3
Xenochironomus		1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703280], Station #4a, Sample Date: 9/19/2007 9:45:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
EPHEMEROPTERA			
Brachycercus	1		1
Caenis latipennis	110	38	80
Hexagenia limbata	9		
Leptophlebiidae	1	99	4
Procloeon	8		7
Stenacron		3	13
Stenonema femoratum		1	
HEMIPTERA			
Belostoma		-99	-99
Corixidae	1		
Neoplea		2	
LIMNOPHILA			
Physella		3	6
LUMBRICINA			
Lumbricina		-99	
LUMBRICULIDA			
Lumbriculidae	3		
ODONATA			
Argia	1	17	3
Calopteryx			1
Enallagma		13	
Gomphus	1		-99
Libellula	1		
Libellulidae	1		
Nasiaeschna pentacantha		-99	
TRICHOPTERA			
Nectopsyche		2	
Nyctiophylax	1	1	5
Oecetis	3		
Polycentropus		1	
Triaenodes		2	
TRICLADIDA			
Planariidae		2	
TUBIFICIDA			
Tubificidae	17		4
VENEROIDEA			
Sphaeriidae	-99	-99	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703281], Station #4b, Sample Date: 9/19/2007 9:45:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	6	2	1
AMPHIPODA			
Hyalella azteca		35	9
COLEOPTERA			
Dubiraphia	7	6	1
Helichus lithophilus		4	3
Scirtidae		10	
DIPTERA			
Ablabesmyia	5	2	8
Anopheles			1
Ceratopogoninae	10	2	
Chironomus	1		
Cladotanytarsus	17	1	2
Cryptochironomus	10		
Cryptotendipes	18		
Dicrotendipes	12	3	34
Forcipomyiinae			1
Glyptotendipes		1	9
Labrundinia	1	7	4
Nanocladius	4		1
Nilothauma			2
Parachironomus		1	
Paracladopelma	1		1
Parakiefferiella	1		
Paratanytarsus		2	
Polypedilum halterale grp	7		
Polypedilum scalaenum grp		1	
Procladius	4	1	1
Pseudochironomus		3	24
Stempellinella	30		1
Stenochironomus			38
Stictochironomus	3		
Tanytarsus	31	18	54
Thienemannimyia grp.		2	1
Tribelos	1		2
EPHEMEROPTERA			
Brachycercus	2		
Caenis latipennis	109	31	57

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703281], Station #4b, Sample Date: 9/19/2007 9:45:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Hexagenia limbata	6		
Leptophlebiidae	1	157	20
Procloeon	9		7
Stenacron	5	5	17
Stenonema femoratum		2	2
HEMIPTERA			
Corixidae	2		
Rheumatobates		1	
LIMNOPHILA			
Physella	1	5	2
LUMBRICULIDA			
Lumbriculidae	4	1	
ODONATA			
Argia		13	5
Boyeria		-99	
Enallagma		14	
Ischnura		3	
Macromia	1		
Nasiaeschna pentacantha		1	
Progomphus obscurus	-99		
TRICHOPTERA			
Hydroptila			3
Ironoquia		-99	1
Nectopsyche	3	2	
Neureclipsis		1	
Nyctiophylax	1		9
Oecetis	1	1	1
Triaenodes		9	
TRICLADIDA			
Planariidae		4	
TUBIFICIDA			
Tubificidae	10		
UNIONIDA			
Unionidae	1		
VENEROIDEA			
Sphaeriidae	4		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703282], Station #5, Sample Date: 9/19/2007 1:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	6		
AMPHIPODA			
Hyalella azteca	2	33	4
COLEOPTERA			
Berosus		1	
Dubiraphia	5	2	
Enochrus	1		
Helichus lithophilus		1	
Neoporus		1	
Scirtidae		2	21
DIPTERA			
Ablabesmyia	3	3	5
Anopheles		3	
Ceratopogoninae	12		
Chaoborus	2		
Chironomus	15		4
Cladotanytarsus	6		
Cryptochironomus	1		2
Cryptotendipes	9		
Dicrotendipes	8	2	33
Diptera			1
Forcipomyiinae			9
Glyptotendipes		9	4
Labrundinia	1	1	
Parakiefferiella	1		
Paratanytarsus	1	1	
Polypedilum halterale grp	7		
Polypedilum illinoense grp	8	12	15
Procladius	39		4
Stempellina	1		
Stempellinella	9		2
Stictochironomus	1		
Tanytarsus	18	4	14
Thienemannimyia grp.		1	
Tribelos		1	6
EPHEMEROPTERA			
Caenis latipennis	113	49	120
Callibaetis		1	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703282], Station #5, Sample Date: 9/19/2007 1:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Hexagenia limbata	10	1	
Leptophlebiidae		142	6
Paracloeodes	1		1
Procloeon	1		1
Stenacron		3	2
HEMIPTERA			
Corixidae	1		1
LIMNOPHILA			
Physella	1	1	10
LUMBRICINA			
Lumbricina			1
LUMBRICULIDA			
Lumbriculidae	3	2	
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		1	
Enallagma		4	
Libellula		-99	
Pachydiplax longipennis		1	
RHYNCHOBDELLIDA			
Glossiphoniidae		1	
TRICHOPTERA			
Oecetis		2	
Phryganeidae		1	
Triaenodes		2	
TUBIFICIDA			
Limnodrilus hoffmeisteri	1		1
Tubificidae	22		
UNIONIDA			
Unionidae	1		
VENEROIDEA			
Sphaeriidae	12		1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703283], Station #8, Sample Date: 9/19/2007 4:15:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
N/A			
Chordodidae		-99	
AMPHIPODA			
Hyalella azteca		3	
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Dubiraphia	1	2	
Helichus lithophilus		3	1
Hydroporus	1	1	
Paracymus			2
Scirtidae	2	8	5
DIPTERA			
Ablabesmyia	24	34	25
Allognosta		1	
Anopheles	11	28	6
Ceratopogonidae		2	1
Ceratopogoninae	17	1	4
Cladotanytarsus	18	1	
Cryptochironomus	7		
Culex		6	
Dicrotendipes	17	9	37
Diptera	2		
Forcipomyiinae	2		26
Glyptotendipes		1	4
Labrundinia	3	18	3
Larsia		1	
Nanocladius	1	2	
Paracladopelma	3		
Paratanytarsus	2	13	
Pericoma		1	
Pilaria		1	
Polypedilum	2	3	6
Polypedilum halterale grp	7		2
Polypedilum illinoense grp	19	49	26
Procladius	6		1
Psychoda	1		
Rheotanytarsus		6	
Stempellinella	3		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703283], Station #8, Sample Date: 9/19/2007 4:15:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stenochironomus			7
Tanytarsus	44	25	15
Thienemannimyia grp.			2
Tipulidae	1		
Tribelos	2		1
Undescribed Empididae		1	
EPHEMEROPTERA			
Acerpenna		1	
Brachycercus	2		
Caenis latipennis	87	52	70
Heptagenia	2	6	6
Hexagenia limbata	2		
Leptophlebiidae	1	5	5
Procloeon	24	5	21
Stenacron			1
HEMIPTERA			
Microvelia	1	5	1
Rheumatobates		1	
Trichocorixa	5		1
ISOPODA			
Caecidotea	1	1	
LIMNOPHILA			
Physella	5	52	11
ODONATA			
Boyeria		-99	
Calopteryx			2
Enallagma		1	
Gomphus	-99	-99	
Libellula	1		
Progomphus obscurus	-99		
TRICHOPTERA			
Cheumatopsyche		1	1
Polycentropodidae	1		
Ptilostomis		3	
TUBIFICIDA			
Enchytraeidae		2	1
Tubificidae	3	3	3
VENEROIDEA			
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703284], Station #6, Sample Date: 9/20/2007 9:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Hyalella azteca		46	10
COLEOPTERA			
Berosus		2	
Dubiraphia	3	2	
Enochrus		1	
Helichus lithophilus		1	1
Scirtidae	1	27	12
DIPTERA			
Ablabesmyia	3	3	6
Allognosta		-99	
Anopheles		5	
Ceratopogoninae	11	1	
Chironomus	2		
Cladotanytarsus	7		2
Corynoneura		1	
Cryptochironomus	2		
Cryptotendipes	2		
Dicrotendipes	5	1	27
Forcipomyiinae			14
Glyptotendipes	1	2	3
Labrundinia		7	2
Nanocladius	1	1	2
Nilothauma			1
Parachironomus		1	
Paratanytarsus		3	
Polypedilum		1	1
Polypedilum fallax grp			3
Polypedilum illinoense grp	4	39	3
Procladius	3	1	
Pseudochironomus			1
Stempellina	1		
Stempellinella	6		
Stenochironomus		1	9
Tanytarsus	22	8	10
Thienemannimyia grp.		2	3
Tribelos		4	6

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703284], Station #6, Sample Date: 9/20/2007 9:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Zavrelimyia	1		
EPHEMEROPTERA			
Caenis latipennis	166	77	152
Caenis punctata			2
Callibaetis		6	
Hexagenia limbata	6		1
Leptophlebiidae	2	29	8
Paracloeodes		1	
Procloeon	3		2
Stenacron			6
HEMIPTERA			
Belostoma	-99	1	
Corixidae	1		
Hebrus		1	
Neoplea		1	
Ranatra fusca		-99	
Ranatra nigra		1	
LIMNOPHILA			
Physella		15	2
ODONATA			
Argia		3	1
Enallagma		9	
Gomphus	-99		
Ischnura		5	
Libellula	-99		
Progomphus obscurus	-99		
TRICHOPTERA			
Nectopsyche		1	
Oecetis	2		
TUBIFICIDA			
Tubificidae	32	1	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703285], Station #7, Sample Date: 9/20/2007 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina		1	
BRANCHIOBDELLIDA			
Branchiobdellida	1		
COLEOPTERA			
Dubiraphia	1	1	
Helichus basalis		1	
Helichus lithophilus		2	
Scirtidae		14	2
DECAPODA			
Orconectes virilis	-99		
DIPTERA			
Ablabesmyia	31	24	12
Anopheles		5	
Ceratopogoninae		3	
Chironomus	13		1
Cladotanytarsus	5	1	
Cryptochironomus	3		
Cryptotendipes	2		
Culex		2	
Dicrotendipes	10	7	96
Diptera			1
Forcipomyiinae	1		3
Glyptotendipes	3	6	11
Labrundinia		7	2
Nanocladius	2	2	
Paracladopelma	3		
Paratanytarsus	2	9	3
Polypedilum halterale grp	10		1
Polypedilum illinoense grp	52	24	11
Polypedilum scalaenum grp	2		2
Procladius	9	3	2
Rheotanytarsus	1	1	1
Stempellinella	9	11	
Tanytarsus	36	33	19
Thienemanniella		1	
Tipula	1	3	
Tribelos			1
Zavrelimyia		1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0703285], Station #7, Sample Date: 9/20/2007 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	40	64	83
Callibaetis		4	1
Leptophlebiidae	2	19	
Procloeon	4	1	2
Stenacron		5	2
Stenonema femoratum			1
HEMIPTERA			
Corixidae		6	1
LIMNOPHILA			
Helisoma	-99		
Physella	7	32	3
ODONATA			
Boyeria		1	
Gomphus	1		
Ischnura		1	
Libellula		-99	
Progomphus obscurus	1	-99	
TRICHOPTERA			
Oecetis	1	1	
Ptilostomis		1	
TUBIFICIDA			
Tubificidae	1	2	1
VENEROIDEA			
Sphaeriidae	1	2	

APPENDIX C
Spring 2008
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804011], Station #2, Sample Date: 3/25/2008 11:50:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	12		2
AMPHIPODA			
Hyalella azteca	1	23	11
COLEOPTERA			
Dubiraphia	6	24	7
Helichus lithophilus		1	
Neoporus	1	1	
Paracymus	2		
Peltodytes	3		
Scirtidae		3	
DIPTERA			
Ablabesmyia	2	1	
Ceratopogoninae	18	4	
Chaoborus	1		
Chironomidae	7	5	10
Chrysops	1		
Cladotanytarsus	1		
Cnephia			2
Corynoneura	1		
Cricotopus bicinctus		1	3
Cricotopus/Orthocladius	4	10	29
Cryptochironomus	2		
Dasyheleinae		1	
Dicrotendipes	1		2
Diptera	1		1
Dolichopodidae		1	
Eukiefferiella			1
Glyptotendipes		1	6
Hydrobaenus	12	13	28
Labrundinia		3	
Nanocladius		8	
Ormosia	3	2	
Paracladopelma	2		
Paraphaenocladius		1	2
Paratanytarsus			3
Paratendipes		1	
Phaenopsectra		1	3
Procladius	6	2	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804011], Station #2, Sample Date: 3/25/2008 11:50:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Simulium	4		91
Stenochironomus			1
Stictochironomus	1		
Tabanus		-99	
Tanytarsus		2	2
Thienemanniella	1	1	3
Thienemannimyia grp.	1	6	
Tribelos			2
Zavrelimyia		1	
EPHEMEROPTERA			
Caenis latipennis	130	140	61
Hexagenia limbata	4		
Paraleptophlebia	1		
Stenacron	3	7	1
Stenonema femoratum	1		8
HEMIPTERA			
Corixidae	3		
Ranatra nigra	1		
Sigara	1		
Trichocorixa	1		
MEGALOPTERA			
Sialis	1	1	
ODONATA			
Argia	1	1	
Basiaeschna janata		-99	
Boyeria		-99	
Enallagma		3	1
Progomphus obscurus	2		
PLECOPTERA			
Perlesta	1		2
TRICHOPTERA			
Nectopsyche			1
Neureclipsis		2	
Nyctiophylax			2
Ptilostomis		-99	
Triaenodes		6	
TUBIFICIDA			
Branchiura sowerbyi	1		
Enchytraeidae	15	6	1
Limnodrilus claparedianus	1		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804011], Station #2, Sample Date: 3/25/2008 11:50:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Limnodrilus hoffmeisteri	5		
Tubificidae	33	1	2
VENEROIDEA			
Sphaeriidae	2	1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804012], Station #3, Sample Date: 3/25/2008 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Hyalella azteca		33	3
COLEOPTERA			
Dubiraphia	7	4	1
Gymnochthebius		1	
Laccophilus		1	
Neoporus		1	
Scirtidae		6	
Tropisternus		-99	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia			1
Ceratopogoninae	5		
Chironomidae	1	3	3
Chrysops		1	
Cladotanytarsus	2		
Cnephia	1		
Cricotopus/Orthocladius	2	19	54
Cryptochironomus	2		
Culex	1		
Dicrotendipes			3
Diplocladius		5	2
Diptera	3		
Glyptotendipes		1	3
Gonomyia	4	2	1
Hydrobaenus	8	54	62
Ormosia	2		
Paracladopelma	1		
Paraphaenocladius		1	1
Paratanytarsus	1	2	
Phaenopsectra	1		
Pilaria		1	
Procladius	1		
Pseudochironomus	1		2
Simulium		92	3
Smittia		1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804012], Station #3, Sample Date: 3/25/2008 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stictochironomus	1		
Tanytarsus	1		
Thienemanniella		3	1
Thienemannimyia grp.		1	
Tribelos			2
EPHEMEROPTERA			
Acerpenna		5	
Caenis latipennis	27	39	20
Centroptilum		1	
Heptageniidae	1		
Leptophlebia		-99	
Stenonema femoratum	1	2	1
LIMNOPHILA			
Lymnaeidae	1		
ODONATA			
Argia		3	
Dromogomphus	1		
Enallagma		2	
Gomphus	1		
Libellula		-99	
Libellulidae	1		
Nasiaeschna pentacantha		1	
Tetragoneuria		-99	
PLECOPTERA			
Allocapnia		1	
Perlesta		13	
TRICHOPTERA			
Cheumatopsyche		1	
Limnephilidae	1	1	2
Polycentropodidae		1	
Ptilostomis		-99	
Pycnopsyche		-99	
Triaenodes		4	
TUBIFICIDA			
Branchiura sowerbyi	2	2	
Enchytraeidae	29	7	
Limnodrilus hoffmeisteri	1		
Tubificidae	33	4	1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804013], Station #1a, Sample Date: 3/26/2008 10:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	11	2	3
AMPHIPODA			
Hyalella azteca	3	37	1
COLEOPTERA			
Berosus			1
Dineutus		-99	
Dubiraphia	30	19	5
Helichus lithophilus		1	
Neoporus	2	1	
Peltodytes	4	1	
Scirtidae			1
DECAPODA			
Palaemonetes kadiakensis		-99	
DIPTERA			
Ablabesmyia		1	1
Ceratopogoninae	1	1	
Chironomidae	3		4
Cladotanytarsus	1		
Cnephia	1		24
Corynoneura		3	
Cricotopus/Orthocladius	9	3	35
Dicrotendipes			3
Diptera		1	
Eukiefferiella			5
Glyptotendipes			3
Hydrobaenus	23	15	25
Labrundinia		1	1
Mesosmittia		1	
Nanocladius		2	
Nilothauma			1
Ormosia		1	
Paracladopelma	2		
Paraphaenocladius	1		2
Paratanytarsus	1		1
Polypedilum illinoense grp	1		
Rheotanytarsus		1	1
Simulium	1		85
Stenochironomus			1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804013], Station #1a, Sample Date: 3/26/2008 10:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tanytarsus	3	2	3
Thienemanniella		4	10
Thienemannimyia grp.		4	3
undescribed Empididae		1	
EPHEMEROPTERA			
Acerpenna			1
Baetisca lacustris	1		
Caenis latipennis	207	152	56
Hexagenia limbata	1	-99	
Leptophlebia		2	
Stenacron	1		1
Stenonema femoratum	2	3	1
Tricorythodes			1
HEMIPTERA			
Ranatra nigra		-99	
MEGALOPTERA			
Sialis		-99	
ODONATA			
Argia		5	
Dromogomphus	1		
Enallagma	2	7	
Libellula		1	
Macromia	1	-99	
Progomphus obscurus	1		
PLECOPTERA			
Perlesta	1		6
RHYNCHOBDELLIDA			
Piscicolidae	2		
TRICHOPTERA			
Cheumatopsyche			1
Limnephilidae	1		
Nectopsyche	2	5	
Nyctiophylax			1
Polycentropus		-99	
Ptilostomis		-99	
Pycnopsyche		-99	
TUBIFICIDA			
Enchytraeidae		1	
Tubificidae	1		1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804014], Station #1b, Sample Date: 3/26/2008 10:35:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	2	1	
AMPHIPODA			
Hyalella azteca	5	28	5
COLEOPTERA			
Berosus			1
Dubiraphia	33	23	9
Helichus lithophilus		3	
Neoporus			1
Peltodytes	2		
DECAPODA			
Palaemonetes kadiakensis	-99	1	
DIPTERA			
Ablabesmyia	1	4	
Ceratopogoninae	15	2	
Chironomidae	1	2	4
Cladotanytarsus	6		
Cricotopus/Orthocladius	5	6	19
Cryptochironomus	1		
Dicrotendipes	1	1	1
Eukiefferiella			5
Glyptotendipes	1		1
Hydrobaenus	11	10	9
Labrundinia	1	4	
Nanocladius		4	
Ormosia	1		
Paratanytarsus	2	3	
Polypedilum halterale grp	1	1	
Polypedilum scalaenum grp	2		
Simulium			105
Tanytarsus	4	2	1
Thienemanniella		1	
Thienemannimyia grp.	2	3	
Tipula		-99	
EPHEMEROPTERA			
Acerpenna		1	4
Caenis latipennis	165	178	121
Hexagenia limbata	1	1	
Stenacron	8	2	4

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804014], Station #1b, Sample Date: 3/26/2008 10:35:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stenonema femoratum	3		8
ODONATA			
Argia		6	
Dromogomphus	-99	-99	
Enallagma		7	
Gomphus	1		
Libellula		1	
Macromia	-99		
Progomphus obscurus	-99		
PLECOPTERA			
Perlesta	1		3
TRICHOPTERA			
Cernotina		1	
Cheumatopsyche			1
Limnephilidae	1		
Nectopsyche		1	
Nyctiophylax	1		
Pycnopsyche		-99	
Triaenodes		1	
TUBIFICIDA			
Tubificidae	1	4	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804015], Station #4, Sample Date: 3/26/2008 1:15:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina		1	2
AMPHIPODA			
Hyalella azteca		9	
COLEOPTERA			
Dubiraphia	2	4	1
Helichus lithophilus		2	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia		1	
Ceratopogoninae	4	7	
Chaoborus			1
Chironomidae	1	2	9
Chrysops	2	-99	
Cricotopus/Orthocladius	7	14	71
Dicrotendipes		1	1
Diplocladius			1
Eukiefferiella			1
Glyptotendipes			3
Hydrobaenus	30	21	30
Nanocladius		3	
Ormosia		1	
Paralauterborniella		1	
Paraphaenocladius	2	1	3
Paratanytarsus	3	9	7
Polypedilum scalaenum grp	1	2	
Pseudochironomus			1
Rheotanytarsus		1	1
Simulium	8	14	31
Stenochironomus			2
Tanytarsus	2	12	8
Thienemanniella	2	3	1
Thienemannimyia grp.		3	4
EPHEMEROPTERA			
Acerpenna	2	5	
Caenis latipennis	139	168	75
Hexagenia limbata	1		
Leptophlebia	2	1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804015], Station #4, Sample Date: 3/26/2008 1:15:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stenacron	1	6	6
Stenonema femoratum		1	2
HEMIPTERA			
Ranatra fusca		-99	
MEGALOPTERA			
Sialis		-99	
ODONATA			
Calopteryx		1	
Dromogomphus	2		
Enallagma	2	1	
Gomphus	1		
Macromia	1		
Nasiaeschna pentacantha		-99	
Progomphus obscurus	4		
PLECOPTERA			
Perlesta	2	10	4
TRICHOPTERA			
Oecetis		1	1
Pycnopsyche		-99	
TUBIFICIDA			
Branchiura sowerbyi	1		
Enchytraeidae	5	2	
Limnodrilus hoffmeisteri	1		
Tubificidae	5	2	2

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804016], Station #5, Sample Date: 3/26/2008 2:55:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	3		1
AMPHIPODA			
Hyalella azteca	1	3	
COLEOPTERA			
Dubiraphia	2		
Helichus lithophilus		1	
Scirtidae		1	
Tropisternus		-99	
DECAPODA			
Orconectes virilis		-99	
DIPTERA			
Ablabesmyia	2		
Ceratopogoninae	10		
Chironomidae	3	1	1
Chrysops	3		
Cladotanytarsus	26		
Cricotopus/Orthocladius	52	51	48
Cryptochironomus	1	2	
Dicrotendipes		1	
Diplocladius	2		
Diptera	3		
Erioptera	1		
Glyptotendipes		1	1
Gonomyia	2	1	
Hydrobaenus	49	20	24
Ormosia	8		
Paraphaenocladius	3		
Paratanytarsus	1	1	2
Pericoma	1		
Phaenopsectra	3		
Polypedilum halterale grp	4		
Polypedilum scalaenum grp	2		
Pseudosmittia	2		
Simulium	4	11	9
Stenochironomus			1
Tanypus	1		
Tanytarsus	1	1	1
Thienemanniella	1	1	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804016], Station #5, Sample Date: 3/26/2008 2:55:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Thienemannimyia grp.		2	
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna		2	
Caenis latipennis	55	180	71
Maccaffertium terminatum		1	
Stenacron		5	
LUMBRICINA			
Lumbricina	-99		
ODONATA			
Coenagrionidae	1		
Dromogomphus	1		
Enallagma		1	
Gomphus	1		
Libellulidae	1	1	
Progomphus obscurus	10		
PLECOPTERA			
Perlesta	2	10	1
TRICHOPTERA			
Cheumatopsyche	1		1
Limnephilidae	2	2	
Triaenodes		3	
TRICLADIDA			
Planariidae	1		
TUBIFICIDA			
Enchytraeidae	16	3	4
Limnodrilus hoffmeisteri	1		
Tubificidae	36	2	4
VENEROIDEA			
Sphaeriidae	7		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804017], Station #7, Sample Date: 4/1/2008 12:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Hyalella azteca		4	1
COLEOPTERA			
Agabus		-99	
Dubiraphia		5	
Helichus lithophilus		3	
Scirtidae		4	
DIPTERA			
Chaoborus	2		2
Chironomidae	1	2	1
Chrysops		1	
Cricotopus/Orthocladius	13	65	107
Dicrotendipes		1	
Diplocladius		1	1
Diptera	2		
Dolichopodidae	2		
Erioptera		1	1
Eukiefferiella			2
Glyptotendipes		1	1
Hydrobaenus	14	39	20
Mesosmittia	1		
Ormosia			1
Paraphaenocladius		3	
Paratanytarsus		6	1
Pericoma			1
Polypedilum halterale grp	4		
Polypedilum scalaenum grp	1		
Simulium	1	19	87
Stenochironomus	1		
Thienemanniella		2	
Thienemannimyia grp.		9	4
Tipula		-99	
Zavrelimyia		1	
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	12	172	14
Leptophlebia		2	
Stenacron	2	1	
ODONATA			

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804017], Station #7, Sample Date: 4/1/2008 12:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Calopteryx		1	
Enallagma		1	
Progomphus obscurus	1		
PLECOPTERA			
Perlesta	3	13	4
TRICHOPTERA			
Cheumatopsyche		2	
Ironoquia	5	8	2
TUBIFICIDA			
Enchytraeidae		10	
Tubificidae	13	6	4
VENEROIDEA			
Sphaeriidae	2		

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804018], Station #8, Sample Date: 4/1/2008 1:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
AMPHIPODA			
Crangonyx	-99		
Hyalella azteca		3	
COLEOPTERA			
Helichus lithophilus		1	
Peltodytes	1		
DIPTERA			
Ceratopogoninae			1
Chironomidae	1		
Chrysops	-99		
Cricotopus/Orthocladius	15	79	38
Diplocladius		1	1
Diptera			1
Hydrobaenus	16	66	31
Ormosia			1
Paraphaenocladius			1
Paratanytarsus	1		
Pilaria			1
Polypedilum convictum		1	
Polypedilum halterale grp	5		
Simulium		31	4
Stictochironomus	1		
Tanytarsus	1	1	
Thienemanniella		1	
Thienemannimyia grp.	1		
EPHEMEROPTERA			
Acerpenna		1	
Caenis latipennis	12	52	7
Heptagenia		-99	
ISOPODA			
Lirceus		1	
PLECOPTERA			
Perlesta		5	
TRICHOPTERA			
Cheumatopsyche		3	
Ironoquia		7	1
Triaenodes		2	
TUBIFICIDA			
Enchytraeidae	1		1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804018], Station #8, Sample Date: 4/1/2008 1:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Limnodrilus hoffmeisteri			1
Tubificidae	4		1

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804019], Station #6, Sample Date: 4/1/2008 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	1		
AMPHIPODA			
Crangonyx		-99	
Hyalella azteca	2	1	
COLEOPTERA			
Agabus		-99	
Neoporus	1		
Peltodytes	1		
DIPTERA			
Ablabesmyia	1		
Ceratopogoninae	5	3	
Chironomidae	8	5	4
Chrysops	1		
Cladotanytarsus	3	1	
Cricotopus bicinctus	3	1	
Cricotopus/Orthocladius	28	41	43
Cryptochironomus	1		
Dicrotendipes	1		1
Erioptera		1	
Glyptotendipes	1		
Hydrobaenus	83	50	11
Paraphaenocladius	2	2	1
Paratanytarsus	1	1	
Pericoma	1		
Saetheria	1		
Simulium	31	57	207
Stegopterna	1		
Stenochironomus			2
Stictochironomus	1		
Tanytarsus	2	3	
Thienemanniella	1	1	
Thienemannimyia grp.	2	2	2
Tipula		-99	
Zavrelimyia	1		
EPHEMEROPTERA			
Acerpenna	1		1
Caenis latipennis	79	83	19
Leptophlebia	2	-99	

Aquid Invertebrate Database Bench Sheet Report
West Fork Locust Ck [0804019], Station #6, Sample Date: 4/1/2008 3:00:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Stenacron	3		
HEMIPTERA			
Trichocorixa		1	
ODONATA			
Calopteryx		-99	
Coenagrionidae	1		
Enallagma		-99	
Progomphus obscurus	2		
PLECOPTERA			
Perlesta	3	7	
TRICHOPTERA			
Cheumatopsyche		1	
Ironoquia	3	7	3
Triaenodes		2	
TUBIFICIDA			
Enchytraeidae	13	4	
Limnodrilus hoffmeisteri	4		
Tubificidae	13	4	