Missouri Department of Natural Resources

BIOLOGICAL ASSESSMENT AND HABITAT STUDY

South Fork Blackwater River
Johnson County

2005 - 2006

Prepared for:

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

Prepared by:

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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 South Fork Blackwater River in Johnson County in west central Missouri. Approximately 5 miles of South Fork Blackwater River in Johnson County are included on the 2002 303(d) list for sediment pollution from agricultural nonpoint sources. Although habitat loss is not an impact found on the 303(d) list, there are segments of South Fork Blackwater River that have poor habitat due to channelization, vertical banks, and poor riparian zones. This survey assessed the 5 miles of South Fork Blackwater River in Johnson County from the confluence of the Blackwater River to Section 19, Township 46 North, Range 27 West. The 5 miles of South Fork Blackwater River addressed in this study are listed as Class P waters, water body I.D. #0921 (MDNR 2005c), and constitute the entirety of the listed segment.

1.1 Purpose

The purpose of the study was to determine if the South Fork Blackwater River biological community is impaired and, if so, determine potential causes.

1.2 Objectives

1) Characterize the physicochemical characteristics of South Fork Blackwater River.
2) Characterize the habitat characteristics of South Fork Blackwater River.
3) Determine if the macroinvertebrate community of South Fork Blackwater River is affected by factors related to habitat loss.

1.3 Tasks

1) Conduct physicochemical monitoring of South Fork Blackwater River.
2) Conduct a habitat assessment of South Fork Blackwater River.
3) Conduct a bioassessment of the macroinvertebrate community of South Fork Blackwater River.

1.4 Null Hypotheses

1) Macroinvertebrate assemblages and habitat will not differ among South Fork Blackwater River stream segments.
2) Macroinvertebrate assemblages and habitat will not substantially differ between South Fork Blackwater River and suitable biocriteria reference streams.

2.0 Study Area

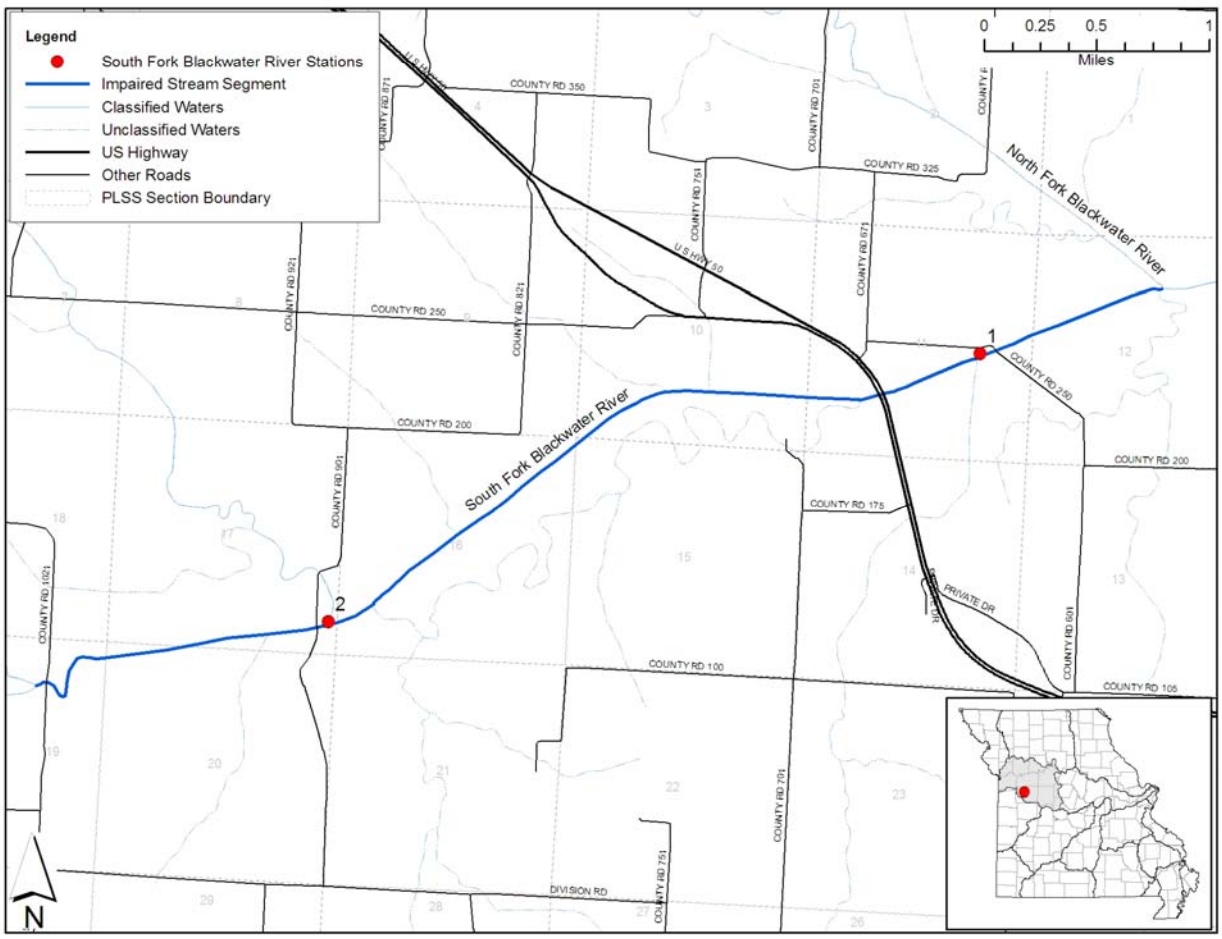
The classified reaches of South Fork Blackwater River begin in western Johnson County approximately 6 miles east of the city of Lone Jack (SW¼ NW¼ NE¼ S30 T47N R28W). The Class C reach of South Fork Blackwater River flows from this point to the southeast for 14 miles. The Class C reach transitions with the Class P reach of South Fork Blackwater River approximately 5 miles north of the city of Holden (SE¼ NW¼ NE¼ S19 T46N R27W). The Class P reach of South Fork Blackwater River flows from this point to the northeast for 5 miles

where it meets the Blackwater River approximately 5 miles northwest of Warrensburg (SW¼ NW¼ NE¼ S12 T46N R27W). The entire drainage of South Fork Blackwater River is approximately 125 square miles.

2.1 Station Descriptions

Two stations were chosen along South Fork Blackwater River. These stations, chosen for accessibility and as representative reaches of stream, are approximately 3.25 miles apart. See Figure 1 for a map of study stations.

Figure 1
Study Locations and Ecological Drainage Unit Map



South Fork Blackwater Station 1 (SW¼ NW¼ NE¼ S11 T46N R27W) is located at Northwest 250th Road in central Johnson County, approximately 0.8 miles upstream of the lower limit of the study reach. The stream is channelized; however, it has a relatively healthy riparian zone. Stream discharge was measured at 0.23 cfs in fall 2005 and 26.79 cfs in spring 2006. Geographic coordinates for this study station are Latitude 38.801782°, Longitude -093.861199°.

South Fork Blackwater Station 2 (NW¼ SW¼ SW¼ S16 T46N R27W) is located at Northwest 901st Road in central Johnson County, approximately 1.5 miles downstream of the upper limit of the study reach. The stream is channelized. While one side of the stream has a healthy riparian zone, the other side lacks any appreciable vegetation in the riparian zone. Stream discharge was measured at 0.30 cfs in fall 2005 and 17.73 cfs in spring 2006. Geographic coordinates for this study station are Latitude 38.783989°, Longitude -093.914710°.

3.0 Methods

Mike Irwin, Carl Wakefield, and other staff of the MDNR, ESP, WQMS conducted this study. Sampling was conducted during the fall of 2005 and the spring of 2006, and samples were collected at sites that provided a variety of habitat characteristics. Fall sampling was conducted on September 12 and 13, 2005 and consisted of macroinvertebrate sampling, water quality sampling, and habitat assessments at two stations on South Fork Blackwater River. Spring sampling was conducted on April 5, 2006 and consisted of macroinvertebrate and water quality sampling.

3.1 Physicochemical Characteristics

Physical and chemical water samples were collected from both 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 Analyses 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 2005b).

3.2 Habitat

South Fork Blackwater River was 303(d) listed for stream habitat degradation through excessive sedimentation. No suspended sediment data exists to directly document sediment as a significant impact to the stream. General fisheries data and the effect of sediment upon fish constituted the original rationale for 303(d) listing South Fork Blackwater River. Sedimentation is one of many instream habitat problems associated with land use. Although instream habitat can be directly measured, the causes of the degradation can range from local scale sources to watershed scale sources. We collected habitat measures at the watershed scale, the reach scale, and the 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). A habitat assessment was conducted on South Fork Blackwater River during the September 2005 sample season. A habitat assessment on Little Drywood Creek (Latitude 37.78580, Longitude -094.39008; SE¼ S30 T35N R31W) completed in September 2004 by Carl Wakefield and Brian Nodine was used for a glide/pool comparison.

3.2.3 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.

3.2.4 Gradient

Utilizing topographic maps and stream coverage in ArcGIS, gradient plots were created for the entirety of South Fork Blackwater River, BIOREF East Fork Crooked River, and BIOREF Little Drywood Creek. Stream distances between contour line intersects were plotted on an x/y graph for each of the streams and study/BIOREF segments within each of the streams. The gradient plot was used to determine general gradient characteristics.

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 September 2005 and April 2006. 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 Plains/Missouri Tributaries between Blue and Lamine Drainages 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 Figure 1 for a map of the EDU's of Missouri.

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
Plains/Lamine/Blackwater EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 28	28 - 57	> 57
EPTT	< 3	3 - 6	> 6
BI	> 8.81	8.81 - 7.61	< 7.61
SDI	< 1.43	1.43 - 2.86	> 2.86

Table 2
Biological Criteria for Glide/Pool-Spring Index Period
Plains/Lamine/Blackwater EDU

Metric	Score = 1	Score = 3	Score = 5
TR	< 25	25 - 50	> 50
EPTT	< 4	4 - 8	> 8
BI	> 8.58	8.58 - 7.16	< 7.16
SDI	< 1.14	1.14 - 2.29	> 2.29

4.0 Results and Analyses

4.1 Physicochemical Parameters

Physicochemical results from the fall 2005 and spring 2006 sampling seasons can be found in Table 3. There were no exceedances of Missouri water quality standards for any parameters. Aside from some slightly elevated nutrient levels at each station for each sampling season, the physicochemical results are unremarkable.

Table 3
Physicochemical Results

Season	Fall 2005		Spring 2006	
Station	1	2	1	2
Date	09/12/2005	09/13/2005	04/05/2006	04/05/2006
Sample Number	0505686	0505687	0603168	0603169
Ammonia as N (mg/L)	<0.03	<0.03	0.04	0.03
Chloride (mg/L)	10.1	10.1	12.4	12.5
DO (mg/L)	7.89	6.74	9.86	10.5
Flow (cfs)	0.24	0.3	26.8	17.7
pH (su)	8.1	8.01	8.17	8.22
SC (µS/cm)	308	324	376	385
Temperature (°C)	26	25	14	14.5
Turbidity (NTU)	11.7	12.9	28.5	28.3
Nitrate + Nitrite as N (mg/L)	<0.01	0.02	0.22	0.27
Total Nitrogen (mg/L)	0.5	0.52	0.71	1.11
Total Phosphorus (mg/L)	0.12	0.11	0.1	0.12

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 South Fork Blackwater River stations with the Plains/Missouri Tributaries between Blue and Lamine Drainages EDU. A refined scale comparing distinct HUs is provided by comparing the 14-digit HU for South Fork Blackwater River stations with the 14-digit HUs of other suitable wadeable/perennial biocriteria reference streams (**BIOREF**). South Fork Blackwater River is associated with the 10300104010002 HU. BIOREF East Fork Crooked River is associated with the 10300101140007 HU. BIOREF Little Drywood Creek is associated with the three following HUs: 10290104060001 (HU 1), 10290104060002 (HU 2), and 10290104060003 (HU 3).

The HU associated with the South Fork Blackwater River study reach is comprised of cool season grassland (~48%), row crops (~25%), and deciduous forest (~18%). In general, this watershed contains considerably more grassland and less row crops than for the Central Plains/Missouri Tributaries between Blue and Lamine Drainages EDU. Urban land use and deciduous forest are similar at this scale. When compared to the BIOREF East Fork Crooked River HU, South Fork Blackwater River is somewhat different. While South Fork Blackwater River is more urbanized, it also has less row crops and more grassland and forest. When the South Fork Blackwater River HU is compared to the BIOREF Little Drywood Creek HUs, there is a great deal of similarity with the South Fork Blackwater River HU generally having slightly less grassland and slightly more forest.

Table 4
Land Use

EDU/HU	% Urban	% Row Crops	% Grassland	% Forest
South Fork Blackwater River HU	5	25	48	18
Plains/Missouri Tributaries between Blue and Lamine Drainages EDU	7	38	31	18
BIOREF East Fork Crooked River HU	1	59	22	10
BIOREF Little Drywood Creek HU 1	1	27	50	13
BIOREF Little Drywood Creek HU 2	2	22	54	12
BIOREF Little Drywood Creek HU 3	7	20	53	10

4.2.2 Habitat Assessment

Scoring results of the habitat assessment are found in Table 5. South Fork Blackwater River Station 1 received a SHAPP score of 96 and South Fork Blackwater River Station 2 received a SHAPP score of 86. In the SHAPP, $\geq$ 75% similarity is the guidance for considering habitats comparable between stations. The stations are approximately 89.6% similar, so the stations are considered comparable to each other.

When comparing the similarity of SHAPP scores between each of the South Fork Blackwater River stations and the BIOREF Little Drywood Creek station, both stations are considered comparable to the reference. South Fork Blackwater River 1 is 85.7% similar to the BIOREF Little Drywood Creek station. At the low end of the acceptable similarity range, South Fork Blackwater River 2 is 76.8% similar to the BIOREF Little Drywood Creek station.

Table 5
Habitat Assessment Scores

Station	Habitat Assessment Score	Similarity to Reference
South Fork Blackwater River 1	96	85.7 %
South Fork Blackwater River 2	86	76.8 %
BIOREF Little Drywood Creek	112	

4.2.3 Sinuosity

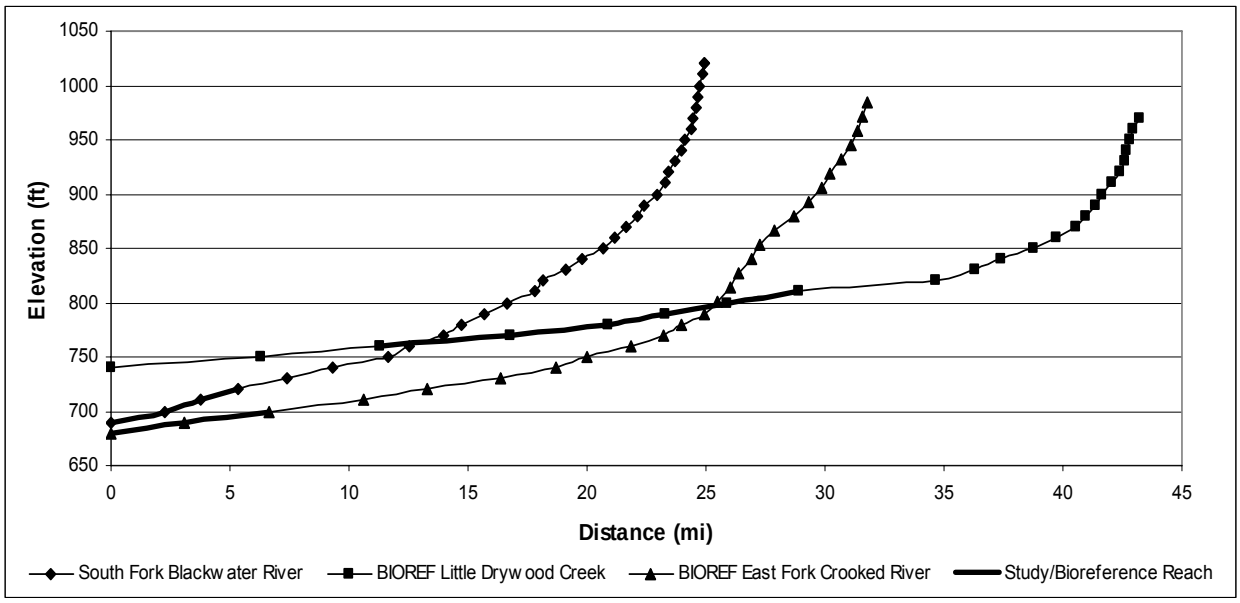
While on-site, the channel at both South Fork Blackwater River stations appeared very straight. In addition, the original meandering channel is noticeable from aerial photos and topographic maps in ArcGIS. This can also be noted from unclassified waters displayed in Figure 1. Due to the proximity of South Fork Blackwater River Station 1 to the mouth of the stream, the reach length used to determine sinuosity was 3000 meters. The reach length to determine sinuosity for South Fork Blackwater River Station 2 was the target 3200 meters. The sinuosity index values for South Fork Blackwater River Station 1 and Station 2 were 1.020 and 1.036 respectively. The uppermost end of Station 2 includes a small portion of unchannelized stream. For this reason the sinuosity is slightly higher than at Station 1. While both stations have been extremely channelized, it is important to note that the channelization likely occurred decades ago.

4.2.4 Gradient

When compared to the BIOREF streams, South Fork Blackwater River has a relatively high gradient. Refer to Figure 2 for gradient plots of South Fork Blackwater River and BIOREF streams.

The overall gradient, mouth to headwaters, of South Fork Blackwater River is 13.23 ft/mi. The overall gradient for BIOREF East Fork Crooked River is 9.58 ft/mi, while the gradient for BIOREF Little Drywood Creek is 5.32 ft/mi. Similarly, the gradient within the South Fork Blackwater River study reach, 3.75 ft/mi, is much higher than the gradients for BIOREF East Fork Crooked River and BIOREF Little Drywood Creek, 3.00 ft/mi and 2.21 ft/mi respectively.

Figure 2
Gradient Plots for South Fork Blackwater River and BIOREF Streams



4.3 Biological Assessment

The South Fork Blackwater River metric results and MSCI scores for fall 2005 and spring 2006 are found in Table 6. MSCI scores are calculated by scoring study station metrics against the appropriate criteria in Table 1 or Table 2.

Table 6
Macroinvertebrate Stream Condition Index Scores

Season	Fall 2005		Spring 2006	
Sampling Station	1	2	1	2
Sample Number	0503391	0503392	0602632	0602633
Taxa Richness (Score)	65 (5)	54 (3)	57 (5)	63 (5)
EPT Taxa (Score)	10 (5)	10 (5)	9 (5)	8 (3)
Biotic Index (Score)	7.39 (5)	7.41 (5)	6.3 (5)	7.2 (3)
Shannon Index (Score)	2.85 (3)	2.61 (3)	2.83 (5)	2.38 (5)
MSCI Score	18	16	20	16
Sustainability	FULL	FULL	FULL	FULL

MSCI scores for both South Fork Blackwater River stations and both seasons were $\geq$ 16, resulting in an assignment of full biological sustainability. For fall samples, SDI scores suggest reduced diversity in both stations, and the TR score was reduced at Station 2. For spring samples, EPT and BI scores were reduced for Station 2.

5.0 Discussion

The Missouri Water Quality Standards numeric criteria were not exceeded in any of the South Fork Blackwater River samples. While the list of physicochemical parameters is not exhaustive,

no inference can be made from these data that the South Fork Blackwater River study reach is impaired for physicochemical reasons. There are, however, some inferences that can be made regarding two of the habitat measures. While land use comparisons provide little insight, SHAPP scores, sinuosity, and gradient are suggestive of some habitat degradation.

According to the SHAPP scores, habitat is biologically comparable throughout the longitudinal segment. While the SHAPP scores for both South Fork Blackwater River stations were within the acceptable limits for biological comparability with BIOREF Little Drywood Creek, South Fork Blackwater River SHAPP values were lower than the reference. In particular, South Fork Blackwater Station 2 barely met the guidance limit for comparability with the reference. This may suggest some habitat degradation.

Sinuosity and gradient measurements indicate that the study reach of South Fork Blackwater River is quite channelized. Since channelization generally causes steeper stream gradients and overall reduction of pool depth (EPA 2006), it is not surprising that high gradient can be paired directly with extensive channelization in the South Fork Blackwater River study reach. It would be interesting to compare the sinuosity and gradient of the modern stream versus the original, unchannelized stream. Even though remnants of the original channel exist, the stream connectivity required to make such measurements and the associated elevation data are simply not available. Hypothetically, the sinuosity would increase significantly and the gradient would decrease markedly.

Habitat issues do not appear to have significant effect on the macroinvertebrate community of South Fork Blackwater River. Although invertebrates are responsive to changes in substrate they may not be responsive to certain habitat problems. The lack of top predator fish has been shown to have good relationship to channelized streams and the resulting lack of pools (MDNR 2005a). Fish surveys may provide more valuable insight than invertebrates regarding habitat problems in extensively channelized streams.

6.0 Conclusions

Two null hypotheses were stated in the introduction: 1) Macroinvertebrate assemblages and habitat will not differ among South Fork Blackwater River stream segments; and 2) macroinvertebrate assemblages and habitat will not substantially differ between South Fork Blackwater River and suitable biocriteria reference streams.

Null hypothesis #1 is accepted. Macroinvertebrate assemblages and habitat did not substantially differ among South Fork Blackwater River stations.

Null hypothesis #2 is accepted. The macroinvertebrate community of South Fork Blackwater River did not substantially differ from the MSCI, which is calculated from biocriteria reference streams. SHAPP scores revealed that the habitat of South Fork Blackwater River was comparable to BIOREF Little Drywood Creek.

The overall bioassessment for South Fork Blackwater River segment covered by this study suggests no biological impairment. Exactly 100% of the MSCI scores are ≥ 16 (full biological sustainability). During the development of biological criteria (MDNR 2002a) it was demonstrated that wadeable perennial reference streams stations scored ≥ 16 about 86% of the time.

7.0 Recommendations

1) Propose South Fork Blackwater River for de-listing from the 303(d) list.

2) Recognize the need for development and incorporation of satisfactory fish bioassessment protocols into the department's aquatic bioassessment program.

3) Conduct fish bioassessments of extensively channelized streams to further evaluate the relationship between the protection of aquatic life designated use, habitat conditions, pool depths, and stream channel characteristics.

8.0 Literature Cited

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APPENDIX A
Fall 2005
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0503091], Station #1, Sample Date: 9/12/2005 11:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	3	1	5
AMPHIPODA			
Hyalella azteca		16	
BRANCHIOBDELLIDA			
Branchiobdellida		9	5
COLEOPTERA			
Berosus	1	5	3
Brachyvatus			1
Dubiraphia	2	26	2
Neoporus		-99	
Scirtidae		3	
Stenelmis	2	7	11
Tropisternus		1	
DECAPODA			
Orconectes virilis	-99	2	1
DIPTERA			
Ablabesmyia	6	4	2
Anopheles		1	
Axarus		1	1
Ceratopogoninae	10	1	
Chironomus	1		
Cladotanytarsus	7		1
Corynoneura		1	
Cricotopus/Orthocladius		3	
Cryptochironomus	16		
Cryptotendipes	5		
Dicrotendipes	14	8	46
Glyptotendipes	2	10	4
Hemerodromia			1
Labrundinia		7	1
Nanocladius		4	
Natarsia	2		
Parachironomus	1	2	
Paratanytarsus		1	
Polypedilum convictum grp		1	
Polypedilum illinoense grp	2	29	4
Polypedilum scalaenum grp	6		
Procladius	2		

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0503091], Station #1, Sample Date: 9/12/2005 11:00:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Rheotanytarsus		4	
Stenochironomus			4
Stictochironomus	28		
Tabanus		1	
Tanypus	1		
Tanytarsus	11	12	2
Thienemanniella	2		
Thienemannimyia grp.		9	2
EPHEMEROPTERA			
Acerpenna		3	
Caenis latipennis	167	72	68
Hexagenia	2		
Leptophlebiidae		3	
Procloeon	4	1	5
Stenacron		1	11
Stenonema femoratum	4	2	45
Tricorythodes			1
HEMIPTERA			
Pelocoris			1
LIMNOPHILA			
Fossaria		1	
Physella		13	2
ODONATA			
Argia		10	5
Enallagma		8	
Erythemis		1	
Gomphus	-99		
Hetaerina		7	
Libellula	-99		
Nasiaeschna pentacantha	-99		
Plathemis		-99	
TRICHOPTERA			
Cheumatopsyche		2	
Hydroptila			1
TUBIFICIDA			
Branchiura sowerbyi	4		
Tubificidae	15	2	
VENEROIDEA			
Sphaeriidae			1

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0503092], Station #2, Sample Date: 9/13/2005 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	6	5	4
AMPHIPODA			
Hyalella azteca		41	
ARHYNCHOBDELLIDA			
Erpobdellidae		1	
BRANCHIOBDELLIDA			
Branchiobdellida	4		1
COLEOPTERA			
Berosus	1	9	
Dubiraphia	3	6	
Scirtidae		2	
Stenelmis	3	19	
DECAPODA			
Orconectes virilis	-99	-99	
DIPTERA			
Ablabesmyia	5	3	6
Anopheles		2	
Axarus			3
Ceratopogonidae	13		
Chironomus	1		
Cladotanytarsus	9		
Corynoneura	2		
Cricotopus/Orthocladius			1
Cryptochironomus	25		
Dicrotendipes	8	18	54
Glyptotendipes	1	1	1
Krenopelopia	1		
Labrundinia	1	2	
Microtendipes	1		
Nanocladius		1	
Nilothauma		1	
Parachironomus		2	
Polypedilum convictum grp			1
Polypedilum illinoense grp	1	17	
Polypedilum scalaenum grp	2		
Pseudochironomus	3		
Stempellinella	2		
Stictochironomus	23		

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0503092], Station #2, Sample Date: 9/13/2005 11:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Tanytarsus	15	10	2
Thienemannimyia grp.		1	1
EPHEMEROPTERA			
Caenis amica		1	
Caenis latipennis	200	96	30
Heptageniidae			1
Hexagenia limbata	1		
Leptophlebiidae		4	
Procloeon	2		1
Stenacron	10	10	6
Stenonema femoratum	12	5	23
HEMIPTERA			
Mesovelia		1	
Trepobates		1	
ISOPODA			
Lirceus		1	
LIMNOPHILA			
Ancylidae		5	
Physella		8	1
ODONATA			
Argia		1	1
Enallagma		5	
TRICHOPTERA			
Cheumatopsyche		1	
Oecetis	1		
TUBIFICIDA			
Branchiura sowerbyi	46		1
Tubificidae	10		1
VENEROIDEA			
Sphaeriidae	3	5	

APPENDIX B
Spring 2006
Macroinvertebrate Bench Sheets

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0602632], Station #1, Sample Date: 4/5/2006 9:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	17		
AMPHIPODA			
Hyalella azteca		1	
ARHYNCHOBDELLIDA			
Erpobdellidae	-99		
BRANCHIOBDELLIDA			
Branchiobdellida		1	
COLEOPTERA			
Berosus	1		
Dubiraphia	1	1	
Dytiscidae			1
Peltodytes	1	1	
Scirtidae		1	
Stenelmis	1	1	1
DECAPODA			
Orconectes virilis	1	1	
DIPTERA			
Ablabesmyia	16	1	1
Ceratopogoninae	32		
Chaoborus	2		2
Chironomus	1		
Cladotanytarsus	19		
Corynoneura	1	1	
Cricotopus bicinctus		1	
Cricotopus/Orthocladius	7	17	67
Cryptochironomus	16		1
Dicrotendipes	2	2	15
Diptera	3		
Eukiefferiella			1
Hemerodromia			1
Hydrobaenus	3	4	1
Labrundinia	2		
Nanocladius	1		
Natarsia		1	
Paralauterborniella	1		
Paratendipes	16	1	1
Phaenopsectra		1	
Polypedilum	1	1	

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0602632], Station #1, Sample Date: 4/5/2006 9:30:00 AM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Polypedilum convictum grp		4	22
Polypedilum halterale grp	5		
Polypedilum illinoense grp		35	1
Polypedilum scalaenum grp	7		
Pseudosmittia	1		
Rheotanytarsus	1	1	2
Simulium		16	59
Stictochironomus	1		
Tanytarsus	56	52	6
Thienemannimyia grp.	3	5	6
EPHEMEROPTERA			
Acerpenna	3	82	63
Caenis latipennis	92	42	39
Leptophlebia		2	
Stenacron	2		2
Stenonema femoratum	1	2	13
ODONATA			
Enallagma	1		
Nasiaeschna pentacantha		-99	
TRICHOPTERA			
Cheumatopsyche			1
Ironoquia		2	
Oecetis	1		
Rhyacophila			1
TUBIFICIDA			
Enchytraeidae	9	1	
Limnodrilus claparedianus	2		
Limnodrilus hoffmeisteri	4		
Tubificidae	19		1

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0602633], Station #2, Sample Date: 4/5/2006 12:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
"HYDRACARINA"			
Acarina	28	10	
ARHYNCHOBDELLIDA			
Erpobdellidae	1	-99	
BRANCHIOBDELLIDA			
Branchiobdellida	5	5	
COLEOPTERA			
Dubiraphia		2	
Hydroporus	1	4	
Peltodytes	1	1	
Stenelmis		1	
Tropisternus		2	
DECAPODA			
Orconectes virilis	-99	-99	-99
DIPTERA			
Ablabesmyia	9	5	6
Ceratopogoninae	5	2	1
Chaoborus	4		
Chironomus	1		
Cladotanytarsus	17	2	
Cricotopus bicinctus			1
Cricotopus/Orthocladius	1	26	24
Cryptochironomus	8	1	
Dicrotendipes	11	2	26
Diptera	5		
Ephydridae			4
Epoicocladius	1		
Forcipomyiinae			1
Glyptotendipes	3	1	31
Hydrobaenus	2	2	4
Labrundinia			1
Nanocladius	2		
Nilotanypus			1
Nilothauma			3
Paralauterborniella	1		
Paraphaenocladius		1	
Paratendipes	1		
Phaenopsectra		1	1
Polypedilum convictum grp		1	1

Aquid Invertebrate Database Bench Sheet Report
South Fk Blackwater R [0602633], Station #2, Sample Date: 4/5/2006 12:30:00 PM
NF = Nonflow; RM = Rootmat; SG = Woody Debris; -99 = Presence

ORDER: TAXA	NF	RM	SG
Polypedilum fallax grp			1
Polypedilum illinoense grp	1	24	9
Polypedilum scalaenum grp	3		1
Procladius	2		
Rheotanytarsus		1	
Simulium		3	
Stenochironomus			1
Tanytarsus	41	55	100
Thienemannimyia grp.	1	8	17
EPHEMEROPTERA			
Acerpenna		17	
Caenis latipennis	112	291	32
Hexagenia limbata	2		
Leptophlebia		-99	
Stenacron	11	1	1
Stenonema femoratum	20	1	9
HEMIPTERA			
Corixidae		1	
LEPIDOPTERA			
Cossidae	1		
LIMNOPHILA			
Fossaria		2	
Physella		16	2
ODONATA			
Argia			1
Ischnura		-99	
Nasiaeschna pentacantha		-99	
TRICHOPTERA			
Cheumatopsyche		1	
Ironoquia		2	
TUBIFICIDA			
Branchiura sowerbyi	1		
Enchytraeidae	1		1
Limnodrilus cervix	1		
Limnodrilus hoffmeisteri	1		
Tubificidae	3		
VENEROIDEA			
Sphaeriidae		1	