Alabama Department of Environmental Management

303(d)/TMDL Monitoring Site

Rivers and Streams Monitoring Program

2012 Monitoring Summary

Fair™

Locust Fork at an unnamed Etowah County Road near Walnut Grove (34.08444/-86.28917)

BACKGROUND

The Locust Fork drainage encompasses 1,209 mi^2 in north central Alabama, spanning five counties—Blount, Marshall, Etowah, Walker, and Jefferson. The variety of distinct habitats within this river system has produced very diverse biological communities. Several threatened and endangered species inhabit the river, including five species of mussels and four species of fish.

During 2011 and 2012, the Alabama Department of Conservation and Natural Resources (ADCNR) conducted a survey of aquatic snails in the Black Warrior River basin. Thirteen sites were sampled on the Locust Fork, and at least thirteen different species of snails were identified. One of the snail species was *Leptoxis plicata*, a federally endangered species found only in Alabama.

A 75 mile stretch of the Locust Fork, from Alabama Highway 269 near Short Creek in Jefferson County upstream to Blount County Road 30, has been on Alabama's Clean Water Act (CWA) §303(d) list of impaired waters since 1998. It was listed for nutrients and siltation/habitat alteration from agricultural and abandoned surface mining sources.

The Alabama Department of Environmental Management (ADEM) conducted an intensive survey of the Locust Fork watershed in 2012. The objective of the survey was to collect data to develop nutrient and siltation Total Maximum Daily Loads (TMDLs) for the impaired segments. The intensive survey included a total of seven stations on the mainstem of Locust Fork (Figure 1). Macroinvertebrate assessments were conducted at five of these locations. Seventy-two hour surveys of dissolved oxygen, temperature, pH, and conductivity were also conducted at six of the seven sites. Parameters included monthly in-situ measurements, flow, and water samples for lab analysis. The purpose of this report is to summarize the results of the macroinvertebrate assessment conducted at LFKB-15.

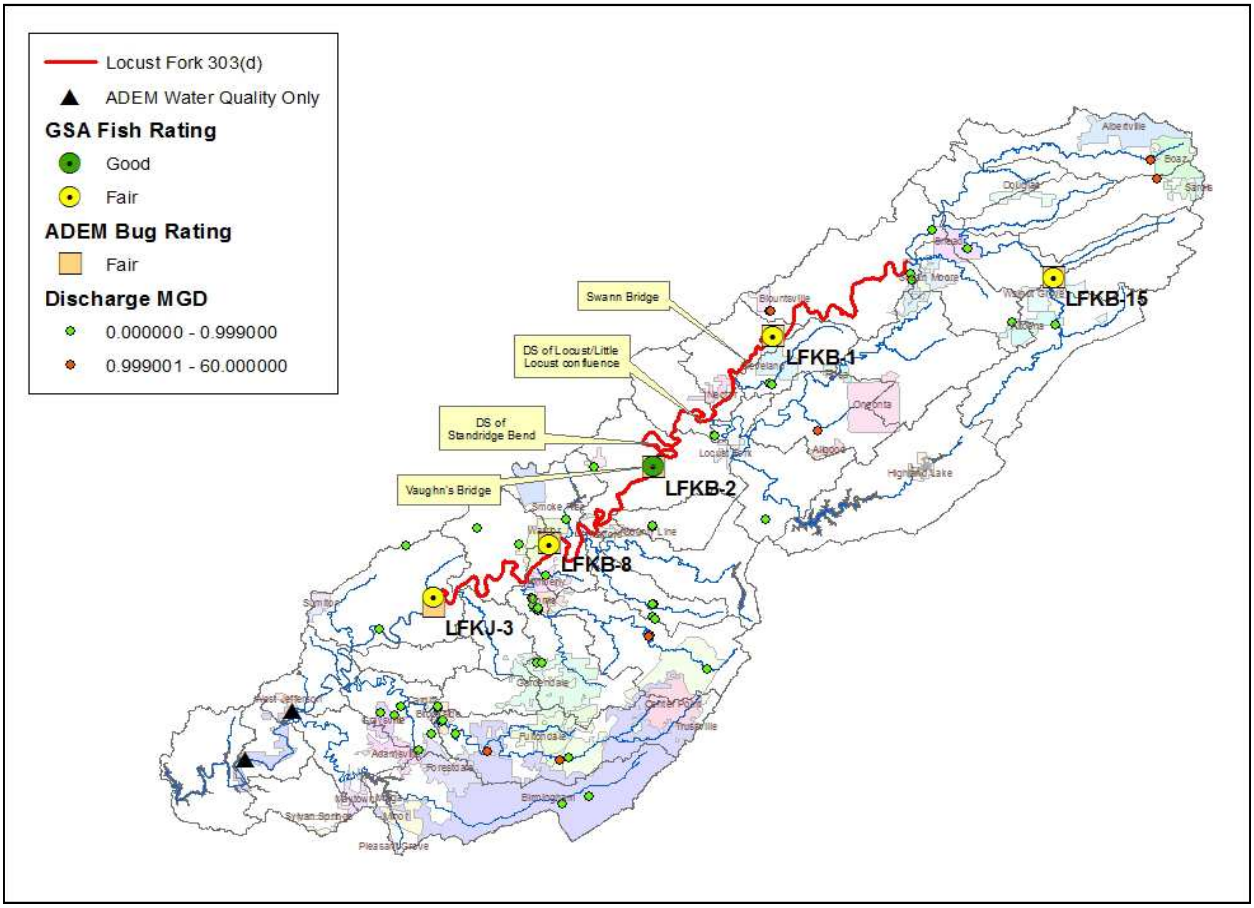

Figure 1. The locations of the five RSMP sampling stations on the mainstem of Locust Fork. The 303(d) listed segments of the Locust Fork are shown in red. Results of fish IBI surveys conducted by the Geological Survey of Alabama (GSA) and macroinvertebrate bioassessments conducted by ADEM are also shown (modified from ADEM Water Quality).

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Locust Fork at LFKB-15 is classified as a *Fish & Wildlife (F&W)* stream located in Etowah County. Based on the 2006 National Land Cover Dataset, landuse within the watershed is predominantly forest (55%) and pasture land (Figure 2). About six percent of the area is developed. As of June 6, 2013, a total of six NPDES permits have been issued in the watershed, most of which are construction stormwater permits.

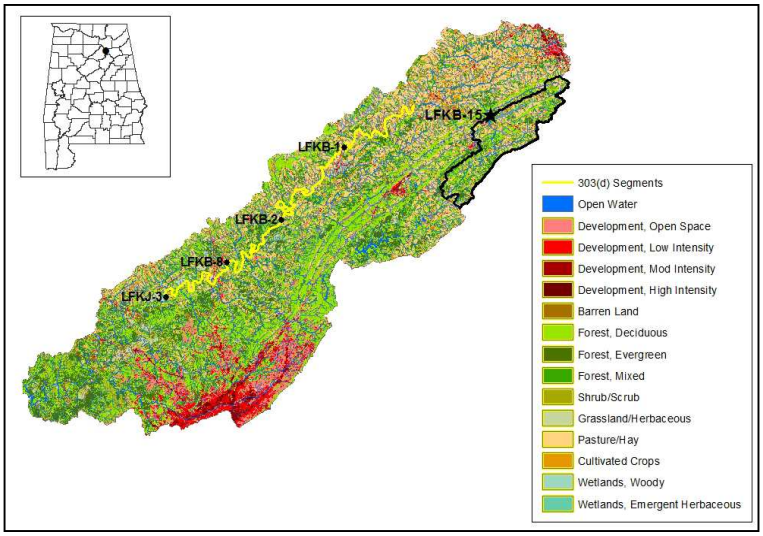

Figure 2. Sampling locations and landuse within the Locust Fork watershed. The 303 (d) listed segments of the Locust Fork are shown in yellow.

REACH CHARACTERISTICS

General observations (Table 2) and a habitat assessment (Table 3) were completed during the macroinvertebrate assessment. In comparison with reference reaches in the same ecoregion, they give an indication of the physical condition of the site and the quality and availability of habitat. Locust Fork at LFKB-15 is a riffle-run stream located in the Southern Limestone Dolomite Valleys and Low Rolling Hills (67f) ecoregion (Figure 3). Benthic substrate consists primarily of gravel. Overall habitat quality was rated as *sub-optimal* for supporting biological communities. However, bank and vegetative stability was *marginal* in the reach due to signs of bank erosion.

Figure 3. Locust Fork at LFKB-15, August 16, 2012.

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Black Warrior River
Drainage Area (mi^2)		73
Ecoregion[a]		67f
Ichthyoregion[b]		PLA
% Landuse		
Open water		1
Wetland	Woody	1
	Emergent herbaceous	<1
Forest	Deciduous	35
	Evergreen	9
	Mixed	11
Shrub/scrub		6
Grassland/herbaceous		3
Pasture/hay		26
Cultivated crops		3
Development	Open space	5
	Low intensity	1
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km^2[c]		21
# NPDES Permits[d]	**TOTAL**	6
Construction Stormwater		5
Mining		1

a. Southern Limestone/Dolomite Valleys and Low Rolling Hills
b. Plateau
c. 2000 US Census
d. #NPDES permits downloaded from ADEM's NPDES Management System database, June 6, 2013.

Table 2. Physical characteristics of Locust Fork at LFKB-15, May 2, 2012.

Physical Characteristics		
Width (ft)		40
Canopy Cover		Mostly Shaded
Depth (ft)		
	Riffle	0.5
	Run	1.0
	Pool	2.0
% of Reach		
	Riffle	5
	Run	85
	Pool	10
% Substrate		
	Cobble	5
	Gravel	78
	Sand	7
	Silt	3
	Organic Matter	7

PERIPHYTON RESULTS

Excessive algal growth can indicate nutrient enrichment. Benthic substrate covered by filamentous algae causes habitat degradation and habitat smothering. Periphyton assessments were conducted in accordance with ADEM's 2005 Revised Periphyton Protocol. Results of periphyton sampling in relation to stream flow are presented in Figure 4. Percent filamentous algae cover was two percent. However, the substrate may have been scoured. Mean daily discharge data from the closest USGS gage station suggest stream flow peaked during the week preceding sampling.

MACROINVERTEBRATE RESULTS

Benthic macroinvertebrate communities were sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). The WMB-I measures taxonomic richness, community composition, and community tolerance to assess the overall health of the macroinvertebrate community. Each score is based on a 100 point scale in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of all individual metric scores. The metric results indicated the macroinvertebrate community to be in *fair* condition (Table 4).

Table 4. Results of the macroinvertebrate bioassessment conducted in Locust Fork at LFKB-15 on May 2, 2012.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness and diversity measures		**(0-100)**
# EPT taxa	18	61
Shannon Diversity	4.09	65
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	21	45
% Non-insect taxa	14	44
Tolerance measures		
% Tolerant taxa	31	53
WMB-I Assessment Score	**---**	**53**
WMB-I Assessment Rating		**Fair (47-69)**

FISH RESULTS

The Geological Survey of Alabama (GSA) conducted fish IBI assessments of the Locust Fork in 2010 and 2011. These data provide information about species richness and diversity, community tolerance, trophic composition, and abundance of the fish community. Each of the 12 metrics is scored 1, 3, or 5, with 1 indicating a poor or least desirable state and 5 a good or most desirable state. The final score is the sum of all metric scores, with a maximum score of 60. Metric results indicated the fish community to be in *fair* condition (Table 5). For additional information, contact the Geological Survey of Alabama, Ecosystems Investigation Program.

Table 3. Results of the habitat assessment conducted in Locust Fork at LFKB-15 on May 2, 2012.

Habitat Assessment	% Maximum Score	Rating
RR		
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	74	Optimal (>70)
Sinuosity	80	Sub-optimal (65-84)
Bank and Vegetative Stability	53	Marginal (35-59)
Riparian Buffer	88	Sub-optimal (70-89)
Habitat Assessment Score	**166**	
% Maximum Score	**69**	**Sub-optimal (59-70)**

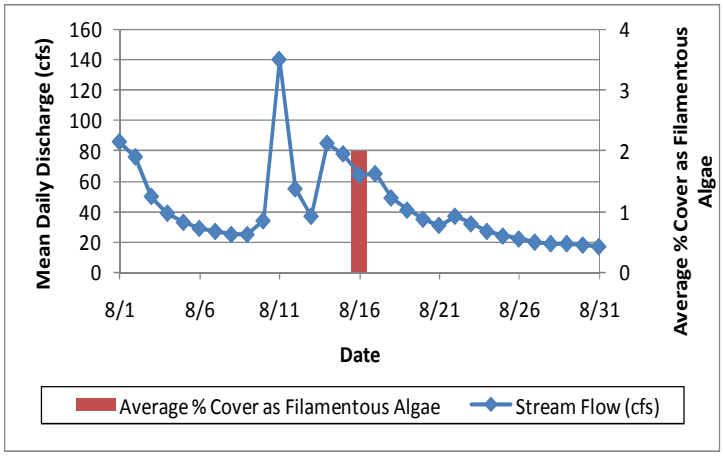

Figure 4. Results of periphyton sampling at LFKB-15 conducted August 16, 2012. The blue line indicates mean daily stream flow at Locust Fork at AL Highway 231 during the month of August 2012.

Table 5. Results of the fish IBI assessment conducted in Locust Fork at LFKB-15 on July 21, 2010 (GSA 2013).

Fish IBI Assessment	Results	Score
Species richness and diversity		
Total native species	17	3
Number cyprinid species	6	3
Number sucker species	1	1
Number *Lepomis* species	5	5
Number darter+madtom species	2	1
Tolerance and intolerance		
Percent dominant species	38	3
Percent of tolerant species	16	3
Percent *Lepomis*	16	3
Trophic Measures		
Percent omnivores	39	1
Percent carnivores	1	3
Abundance, condition, and reproduction		
Percent DELT+hybrids	0	5
Percent simple lithophils	31	3
Total IBI Score		**34**
IBI Assessment Rating		**Fair (33-40)**

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 6. When possible, in situ measurements and water samples were collected monthly during April through November 2012 to help identify any stressors to the biological communities. Turbidity was more than 50 NTU above ecoregional reference reach data on August 14, 2012. Stream flow was not above normal at the time of sampling, but there was heavy rain in the area prior to sample collection, and the stream was characterized as muddy at that time. The median concentration of nitrate-nitrite nitrogen was also higher than expected for streams in the Southern Limestone Dolomite Valleys and Low Rolling Hills ecoregion. Ammonia-nitrogen was above the minimum detection limit in two of eight samples collected. However, the median ammonia-nitrogen concentration was below values expected for the ecoregion.

DISCUSSION

Four segments of the Locust Fork are currently classified as impaired according to §303(d) of the Clean Water Act. The segments are impaired by nutrients, siltation, and other habitat alteration caused by unknown sources.

While overall habitat quality was categorized as *sub-optimal* for supporting macroinvertebrate communities, bank failure due to erosion was noted in the reach. Benthic substrate at LFKB-15 is mostly gravel, but sedimentation issues could lead to the loss of critical habitat in the reach and have significant impacts on the biological communities.

Results of the macroinvertebrate bioassessment conducted at LFKB-15 indicated the aquatic insect community to be in *fair* condition. These results support the findings of a 2010 fish IBI survey conducted by GSA.

Water chemistry analyses showed turbidity above expected values on one sampling date, likely the result of heavy rain in the area prior to sample collection. Concentrations of nitrate-nitrite nitrogen were also elevated as compared to data from ADEM's least-impaired reference reaches in ecoregion 67f.

Table 6. Summary of water quality data collected April-November, 2012. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL) when results were less than this value. Median, average (Avg), and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

Parameter	N		Min	Max	Med	Avg	SD
Physical							
Temperature (°C)	9		10.1	23.2	19.8	18.4	4.5
Turbidity (NTU)	9		6.0	141.0 T	10.0	24.7	43.7
J Total Dissolved Solids (mg/L)	8		80.0	196.0	111.0	116.0	36.6
J Total Suspended Solids (mg/L)	8	<	1.0	20.0	2.8	5.9	7.1
Specific Conductance (µmhos)	9		143.6	202.2	164.6	170.0	19.6
Alkalinity (mg/L)	8		55.3	99.7	72.5	74.2	15.0
Stream Flow (cfs)	9		6.8	32.1	14.2	16.5	8.4
Chemical							
Dissolved Oxygen (mg/L)	9		5.6	8.5	6.4	6.8	1.0
pH (su)	9		6.8	7.6	7.0	7.1	0.3
Ammonia Nitrogen (mg/L)	8	<	0.007	0.069	0.004	0.018	0.027
Nitrate+Nitrite Nitrogen (mg/L)	8		0.138	0.363	0.342 M	0.305	0.078
J Total Kjeldahl Nitrogen (mg/L)	8		0.051	0.401	0.242	0.243	0.105
J Total Nitrogen (mg/L)	8		0.316	0.689	0.594	0.548	0.129
J Dissolved Reactive Phosphorus (mg/L)	8		0.005	0.016	0.007	0.008	0.003
Total Phosphorus (mg/L)	8		0.020	0.079	0.026	0.031	0.020
J CBOD-5 (mg/L)	8	<	2.0	2.8	1.0	1.4	0.7
Chlorides (mg/L)	8		2.2	3.9	2.3	2.7	0.6
Biological							
Chlorophyll a (ug/L)	8	<	0.10	2.14	0.62	0.85	0.76

J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 67f; N= # samples; T=value exceeds 50 NTU above the 90th percentile of all verified ecoregional reference reach data collected in the ecoregion 67f.

FOR MORE INFORMATION, CONTACT:
Ashley Lockwood, ADEM Environmental Indicators Section
1350 Coliseum Boulevard Montgomery, AL 36110
(334) 260-2766 alockwood@adem.state.al.us