Alabama Department of Environmental Management

Ambient Monitoring Site

Rivers and Streams Monitoring Program

2009 Monitoring Summary

Fair

Limestone Creek at Hwy 72 Bridge, Limestone County (34.75210/-86.82320)

BACKGROUND

Limestone Creek at LIML-300 is one of a network of 94 ambient sites monitored annually by the Alabama Department of Environmental Management (ADEM) to identify long-term trends in water quality and to provide data for the development of Total Maximum Daily Loads (TMDLs) and water quality criteria.

Limestone Creek was also selected for biological and water quality monitoring as part of the 2009 Assessment of the Tennessee (TN) River Basin. The objectives of the TN Basin Assessments were to assess the biological integrity of each monitoring site and to estimate overall water quality within the basin.

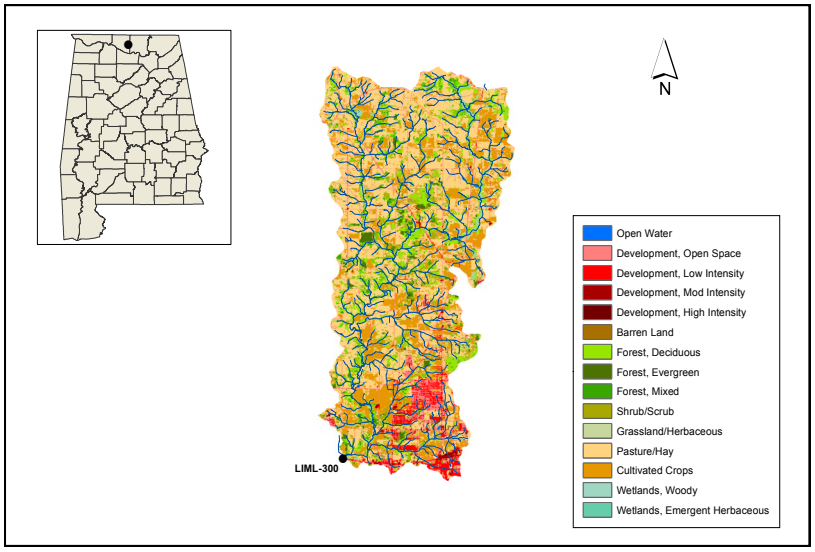

Figure 1. Sampling location and landuse within the Limestone Creek watershed at LIML-300.

WATERSHED CHARACTERISTICS

The Limestone Creek watershed at LIML-300 is a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g) of Limestone County (Table 1). Based on the 2000 Land Cover Dataset, landuse within the watershed is primarily agriculture (62%) with some forested areas (Figure 1). A total of 305 NDPES permits have been issued within the watershed, most of which are construction stormwater permits.

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. Limestone Creek at LIML-300 is a riffle-run stream reach composed mostly of bedrock, gravel, and sand substrates. Overall habitat quality was categorized as *optimal* for supporing macroinvertebrate communities.

BIOASSESSMENT RESULTS

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

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi^2)		121
Ecoregion[a]		71g
% Landuse		
Open water		<1
Wetland	Woody	2
	Emergent herbaceous	<1
Forest	Deciduous	13
	Evergreen	2
	Mixed	3
Shrub/scrub		6
Grassland/herbaceous		1
Pasture/hay		44
Cultivated crops		18
Development	Open space	7
	Low intensity	3
	Moderate intensity	<1
	High intensity	<1
Barren		<1
Population/km^2[b]		564
# NPDES Permits[c]	**TOTAL**	305
401 Water Quality Certification		9
Construction Stormwater		256
Mining		2
Industrial General		4
Municipal Individual		10
Underground Injection Control		24

a. Eastern Highland Rim

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, February 23, 2011

Table 2. Physical characteristics of Limestone Creek at LIML-300, June 10, 2009.

Physical Characteristics		
Width (ft)		60
Canopy Cover		Mostly Open
Depth (ft)		
	Riffle	0.5
	Run	1.5
	Pool	3.5
% of Reach		
	Riffle	5
	Run	65
	Pool	30
% Substrate		
	Bedrock	50
	Cobble	5
	Gravel	20
	Sand	20
	Silt	2
	Organic Matter	3

Table 3. Results of the habitat assessment conducted in Limestone Creek at LIML-300, June 10, 2009.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	68	Sub-optimal (59-70)
Sediment Deposition	75	Optimal (>70)
Sinuosity	55	Marginal (45-64)
Bank and Vegetative Stability	60	Sub-optimal (60-74)
Riparian Buffer	88	Sub-optimal (70-89)
Habitat Assessment Score	**173**	
% Maximum Score	**72**	**Optimal (>70)**

Table 4. Results of the macroinvertebrate bioassessment conducted in Limestone Creek at LIML-300, June 10, 2009.

Macroinvertebrate Assessment		
	Results	**Scores**
Taxa richness and diversity measures		**(0-100)**
# EPT taxa	16	52
Shannon Diversity	4.34	76
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	8	16
% Non-insect taxa	14	44
Functional feeding group		
% Predator Individuals	5	15
Community tolerance		
% Tolerant taxa	32	49
WMB-I Assessment Score	**---**	**42**
WMB-I Assessment Rating		**Fair (29-43)**

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In situ measurements and water samples were collected monthly, semi-monthly, or quarterly during March through October of 2009 to help identify any stressors to the biological communities. Median specific conductance, dissolved reactive phosphorus, total phosphorus, chlorides, total aluminum, and total manganese were above background concentrations based on reference reach data collected in ecoregion 71. Dissolved copper exceeded the aquatic life use criterion applicable to its *F&W* use classification for one out of four samples collected. One fecal coliform sample exceeded the *F&W* use classification criterion of 2000 colonies/100 ml of sample. However, this sample was taken after a rain event and was well within expected limit for streams in the ecoregion.

SUMMARY

While the habitat at LIML-300 was rated as *optimal* for supporting macroinvertebrate communities, bioassessment results indicated the macroinvertebrate community to be in *fair* condition. Concentrations of nutrients (total phosphorus, dissolved reactive phosphorus), specific conductance, chlorides and metals (dissolved copper, total aluminum, and total manganese) were elevated as compared to data from ADEM's least-impaired reference reaches in the same ecoregion. The data presented in this report and all other available data will be reviewed to identify the causes and sources of the degraded biological conditions.

Table 5. Summary of water quality data collected March-October, 2009. 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	E
	Physical									
	Temperature (°C)	9		12.6		23.7	21.4	19.0	4.5	
	Turbidity (NTU)	9		4.1		18.7	6.3	7.8	4.5	
J	Total Dissolved Solids (mg/L)	8	<	1.0		92.0	77.0	67.8	30.7	
	Total Suspended Solids (mg/L)	8	<	1.0		19.0	3.5	4.9	6.0	
	Specific Conductance (µmhos)	9		92.7		136.9	109.4 G	110.8	14.2	
	Hardness (mg/L)	4		31.3		54.8	46.8	44.9	9.8	
	Alkalinity (mg/L)	8		27.7		57.0	39.6	42.1	10.9	
	Stream Flow (cfs)	10		0.0		446.0	99.5	139.3	132.8	
	Chemical									
	Dissolved Oxygen (mg/L)	9		6.8		10.2	8.0	8.3	1.2	
	pH (su)	9		7.1		7.4	7.2	7.2	0.1	
	Ammonia Nitrogen (mg/L)	8	<	0.006		0.014	0.006	0.005	0.002	
	Nitrate+Nitrite Nitrogen (mg/L)	8		0.883		2.809	1.079	1.284	0.637	
	Total Kjeldahl Nitrogen (mg/L)	8	<	0.089		1.498	0.264	0.385	0.476	
	Total Nitrogen (mg/L)	8	<	1.192		4.307	1.300	1.669	1.068	
	Dissolved Reactive Phosphorus (mg/L)	8		0.021		0.248	0.042 M	0.069	0.076	
	Total Phosphorus (mg/L)	8		0.040		0.102	0.060 M	0.065	0.023	
J	CBOD-5 (mg/L)	8	<	1.0		2.0	1.0	0.9	0.2	
	Chlorides (mg/L)	8		3.3		5.1	4.5 M	4.4	0.6	
	Atrazine (µg/L)	2		0.08		0.31	0.20	0.20	0.16	
	Total Metals									
J	Aluminum (mg/L)	4		0.060		0.407	0.152 M	0.193	0.150	
	Iron (mg/L)	4		0.168		0.509	0.266	0.302	0.146	
J	Manganese (mg/L)	4		0.026		0.032	0.028 M	0.029	0.002	
	Dissolved Metals									
J	Aluminum (mg/L)	4	<	0.031		0.095	0.024	0.040	0.038	
	Antimony (µg/L)	4	<	0.7	<	0.7	0.4	0.4	0.0	
	Arsenic (µg/L)	4	<	0.4		1.6	0.2	0.4	0.3	
	Cadmium (mg/L)	4	<	0.003	<	0.003	0.002	0.002	0.000	
	Chromium (mg/L)	4	<	0.013	<	0.013	0.006	0.006	0.000	
	Copper (mg/L)	4	<	0.013		0.023 S	0.006	0.011	0.008	1
J	Iron (mg/L)	4	<	0.026		0.233	0.046	0.085	0.104	
	Lead (µg/L)	4	<	0.6		1.0	0.5	0.5	0.1	
J	Manganese (mg/L)	4	<	0.001		0.019	0.016	0.013	0.009	
	Mercury (µg/L)	4	<	0.1	<	0.1	0.0	0.0	0.0	
	Nickel (mg/L)	4	<	0.004		0.019	0.006	0.006	0.004	
	Selenium (µg/L)	4	<	0.4		1.5	0.2	0.3	0.3	
	Silver (mg/L)	4	<	0.002	<	0.002	0.001	0.001	0.000	
	Thallium (µg/L)	4	<	0.4		0.5	0.2	0.2	0.0	
	Zinc (mg/L)	4	<	0.003		0.030	0.002	0.005	0.007	
	Biological									
	Chlorophyll a (ug/L)	8	<	0.10		17.09	0.53	3.18	5.88	
J	Fecal Coliform (col/100 mL)	8		62		2400 H	125	426	802	1

E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 71; H=*F&W* human health criterion exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 71; N=# samples; S=*F&W* hardness-adjusted aquatic life use criterion exceeded.

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