

2009 Monitoring Summary



Basin Assessment Site

Browns Creek at Nesmith Road in Blount County (34.22322/-86.43794)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Browns Creek watershed for biological and water quality monitoring as part of the 2009 Assessment of the Tennessee (TN) River Basin. The objectives of this project were to assess the biological integrity of each monitoring site and to estimate overall water quality within the Tennessee River basin.



Figure 1. Browns Creek at BRSB-2, November 12, 2008.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Browns Creek at BRSB-2 is a *Fish & Wildlife (F&W)* stream located in Blount County. Landuse in the watershed is 46% forest and 41% pasture and cropland. Poultry houses were also noted in the watershed. Population density is very low, and less than 6% of the area is developed. As of September 1, 2012, ADEM has issued a total of eight NPDES permits in this watershed.

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. Browns Creek at BRSB-2 is a riffle-run stream located in the Sequatchie Valley ecoregion (Figure 1). The benthic substrate consists primarily of gravel and sand. Although overall habitat quality was categorized as *sub-optimal* for supporting diverse aquatic macroinvertebrate communities, a limited riparian buffer and access of cattle to the stream were noted as issues during assessment.

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 individual metric scores. Results indicated the community to be in *fair* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee R
Drainage Area (mi ²)		10
Ecoregion ^a		68b
% Landuse		
Open water		<1
Wetland	Woody	<1
	Emergent herbaceous	<1
Forest	Deciduous	39
	Evergreen	3
	Mixed	4
Shrub/scrub		6
Grassland/herbaceous		2
Pasture/hay		32
Cultivated crops		9
Development	Open space	3
	Low intensity	<1
	Moderate intensity	<1
	High intensity	<1
Barren		1
Population/km ^{2b}		1
# NPDES Permits ^c	TOTAL	8
	Construction Stormwater	5
	Mining	2
	Industrial General	1

a. Sequatchie Valley

b. 2000 US Census

c. #NPDES permits downloaded from ADEM's NPDES Management System database, September 1, 2012.

Table 2. Physical characteristics of Browns Creek at BRSB-2, June 4, 2009.

Physical Characteristics		
Width (ft)		25
Canopy Cover		Open
Depth (ft)		
	Riffle	0.5
	Run	1.5
	Pool	3.0
% of Reach		
	Riffle	5
	Run	70
	Pool	25
% Substrate		
	Boulder	2
	Clay	5
	Cobble	17
	Gravel	35
	Sand	35
	Silt	3
	Organic Matter	3

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Table 3. Results of the habitat assessment conducted on Browns Creek at BRSB-2, June 4, 2009.

Habitat Assessment	% Maximum Score	Rating
Instream Habitat Quality	73	Optimal >70
Sediment Deposition	63	Sub-optimal (59-70)
Sinuosity	88	Optimal >84
Bank and Vegetative Stability	60	Sub-optimal (60-74)
Riparian Buffer	30	Poor <50
Habitat Assessment Score	151	
% Maximum Score	63	Sub-optimal (59-70)

Table 4. Results of the macroinvertebrate bioassessment of Browns Creek at BRSB-2 conducted on June 4, 2009.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness measures		(0-100)
# EPT taxa	10	26
Taxonomic composition measures		
% Non-insect taxa	19	18
% Dominant taxon	13	98
% EPC taxa	25	60
Functional feeding group measures		
% Predators	3	7
Tolerance measures		
% Taxa as Tolerant	31	52
WMB-I Assessment Score	---	44
WMB-I Assessment Rating		Fair (39-58)

WATER CHEMISTRY

Results of water chemistry are presented in Table 5. In-situ measurements and water samples were collected monthly, semi-monthly (metals), or quarterly (pesticides, semi-volatile organics, and atrazine) during March through October of 2009 to help identify any stressors to the biological communities. Dissolved arsenic exceeded the criterion applicable to its *F&W* use classification in May and July. Turbidity was >50 NTU above background levels during a high flow event in May; flows were too high to obtain a stream flow measurement. Flows measured during 2009 ranged from 3.6 cfs on Sept. 10th to 84.8 cfs on Oct. 14th. Median specific conductance, hardness, total dissolved solids, total suspended solids, alkalinity, nutrients (nitrate+nitrite-nitrogen, total kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, and total phosphorus), and metals (total aluminum and copper) were higher than expected based on comparison with ecoregion reference reach data.

SUMMARY

Bioassessment results indicated the macroinvertebrate community in Browns Creek at BRSB-2 to be in *fair* condition. Results of water chemistry analyses showed concentrations of total dissolved and suspended solids, metals, and nutrients to be elevated as compared to data from ADEM's least-impaired reference reaches in ecoregion 68. Monitoring should continue to ensure that conditions remain stable.

Table 5. Summary of water quality data collected March-October, 2009. Minimum (Min) and maximum (Max) values calculated using minimum detection limits (MDL). 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)	10	15.8	28.1	20.1	20.4	4.0	
Turbidity (NTU)	10	9.6	68.7 ^T	22.2	28.3	17.8	
^J Total Dissolved Solids (mg/L)	8	146.0	1036.0	179.5 ^M	284.9	304.5	
^J Total Suspended Solids (mg/L)	8	12.0	65.0	18.5 ^M	25.9	18.0	
Specific Conductance (µmhos)	10	216.7	360.6	288 ^G	295.7	44.3	
Hardness (mg/L)	4	76.6	170.0	144 ^G	133.6	40.2	
Alkalinity (mg/L)	8	86.0	150.0	121.5 ^M	119.6	19.2	
Stream Flow (cfs)	9	3.6	84.8	11.9	22.6	25.9	
Chemical							
Dissolved Oxygen (mg/L)	11	6.4	10.2	8.3	8.4	1.1	
pH (su)	11	7.4	8.0	7.8	7.7	0.2	
^{BJ} Ammonia Nitrogen (mg/L)	4	< 0.014	0.048	0.035	0.031	0.017	
^{BJ} Nitrate+Nitrite Nitrogen (mg/L)	7	< 0.003	4.723	1.410 ^M	1.677	1.538	
^{BJ} Total Kjeldahl Nitrogen (mg/L)	4	0.232	1.028	0.646	0.638	0.355	
^{BJ} Total Nitrogen (mg/L)	4	0.968	2.741	1.765 ^M	1.810	0.732	
^J Dissolved Reactive Phosphorus (mg/L)	8	0.022	0.389	0.080 ^M	0.136	0.134	
^{BJ} Total Phosphorus (mg/L)	4	0.056	0.481	0.064 ^M	0.166	0.210	
^J CBOD-5 (mg/L)	8	< 1.0	4.3	0.8	1.2	1.3	
Chlorides (mg/L)	8	2.6	15.6	3.8	5.6	4.3	
Atrazine (µg/L)	2	< 0.06	0.06	0.03	0.03	0.00	
Total Metals							
^J Aluminum (mg/L)	4	0.332	2.180	0.804 ^M	1.030	0.799	
Iron (mg/L)	4	0.456	2.300	0.630	1.004	0.869	
^J Manganese (mg/L)	4	0.084	0.174	0.108	0.118	0.039	
Dissolved Metals							
Aluminum (mg/L)	4	< 0.033	0.118	0.030	0.049	0.047	
Antimony (µg/L)	4	< 0.7	6.0	3.0	2.3	1.3	
^J Arsenic (µg/L)	4	< 0.4	1.2 ^H	0.4	0.5	0.4	2
Cadmium (µg/L)	4	< 2.000	3.000	1.000	1.125	0.250	
Chromium (mg/L)	4	< 0.007	0.013	0.004	0.004	0.002	
Copper (mg/L)	4	< 0.013	0.200	0.1 ^M	0.077	0.047	
^J Iron (mg/L)	4	< 0.020	0.111	0.012	0.036	0.050	
Lead (µg/L)	4	< 1.0	1.5	0.8	0.7	0.1	
^J Manganese (mg/L)	4	0.046	0.067	0.048	0.052	0.010	
^{BJ} Mercury (µg/L)	1	<	<	<	0.080		
Nickel (mg/L)	4	< 0.008	0.019	0.004	0.005	0.003	
Selenium (µg/L)	4	< 0.4	0.4	0.2	0.2	0.0	
Silver (µg/L)	4	< 1.000	2.000	0.500	0.625	0.250	
Thallium (µg/L)	4	< 0.4	0.4	0.2	0.2	0.0	
Zinc (mg/L)	4	< 0.003	0.060	0.030	0.023	0.014	
Biological							
Chlorophyll a (ug/L)	8	< 0.10	3.20	1.78	1.79	1.15	
^J Fecal Coliform (col/100 mL)	8	68	967	220	402	341	
^J E. coli (col/100mL)	1				120		

E=# samples that exceeded criteria; G=value higher than median concentration of all verified ecoregional reference reach data collected in the ecoregion 68; H=*F&W* human health criteria exceeded; J=estimate; M=value >90% of all verified ecoregional reference reach data collected in the ecoregion 68; N=# samples; Q= # of uncertain criterion exceedances; T=value exceeds 50 NTU above the 90th percentile of all verified ecoregional reference reach data collected in the ecoregion 68.