Alabama Department of Environmental Management

Ecological Reference Reach

Rivers and Streams Monitoring Program

2016 Monitoring Summary

Excellent-good

Bear Creek on dirt trail off of Escambia County Road 51 (31.03334/-86.70960)

BACKGROUND

Bear Creek is among the least-disturbed watersheds within the Southern Pine Plains and Hills ecoregion, based on landuse, road density, and population density. Since 1991, it has been monitored by the Alabama Department of Environmental Management (ADEM) as a "high quality" reference watershed for comparison with other streams within the ecoregion. Data from reference watersheds are used to characterize natural or background conditions expected in different ecoregions throughout the state. Bear Creek was sampled in 2016 to provide high-quality reference reach data for Southern Pine Plains and Hills streams.

Figure 1. Bear Creek at BRE-1, May 10, 2016.

Table 1. Summary of general watershed characteristics: BRE-1 (2016)

Watershed Characteristics	
Basin	Blackwater
Drainage Area (mi²)	28.2
Ecoregion[o]	65F
Assessment Unit	AL03140104-0103-100
Use Class	F&W
AU Category	1
12-digit Hydrologic Unit Code (HUC)	031401040103
Landuse Categories (2011 National Land Cover Dataset)	
Open Water (%)	0.1
Wetland, Total (%)	0.5
Wetlands, Woody (%)	0.5
Forested, Total (%)	85.3
Forested, Deciduous (%)	1.9
Forested, Evergreen (%)	75.5
Forested, Mixed (%)	7.9
Shrub/Scrub (%)	5.5
Grassland/Herbaceous (%)	1.6
Pasture/Hay (%)	2.6
Crops, Cultivated (%)	3.1
Developed, Total (%)	1.4
Developed, Open Space (%)	1.2
Developed, Low Intensity (%)	0.2
Population/km² (2010 US Census)	1
Roads	
Road Density	0.9

[o] Southern Pine Plains and Hills

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Bear Creek is a *Fish & Wildlife (F&W)* stream located within the Conecuh National Forest in the Blackwater River basin. According to the 2011 National Land Cover Dataset, the watershed is 85% forested. This watershed is sparsely populated, and contains no permitted outfalls. The watershed has a very low road density, with only one small dirt road crossing approximately fives miles upstream of BRE-1.

REACH CHARACTERISTICS

General observations (Figure 1, Table 2) and a habitat survey (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. Like other streams in ecoregion 65F, Bear Creek at BRE-1 is a low gradient, sand-bottomed, tannic stream. Habitat quality was rated as *sub-optimal* for supporting the macroinvertebrate communities, with a large riparian buffer, low sediment deposition, and stable banks.

Table 2. Physical characteristics of Bear Creek at BRE-1, May 10, 2016.

Physical Characteristics	
Width (ft)	25
Canopy Cover	Mostly Shaded
Depth (ft)	
Run	1.5
Pool	4.0
% of Reach	
Run	50
Pool	50
% Substrate	
Gravel	1
Sand	89
Organic Matter	10

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Table 3. Results of the habitat assessment survey conducted on Bear Creek at BRE-1, May 10, 2016.

Habitat Survey	% Max Score	Rating
Instream Habitat Quality	53	Marginal (30-54)
Sediment Deposition	83	Optimal (80-100)
Sinuosity	60	Sub-optimal (55-75)
Bank Vegetative Stability	73	Sub-optimal (58-73)
Riparian Zone Measurements	83	Sub-optimal (60-84)
Habitat Assessment Score	**122**	
% Maximum Score	**68**	**Sub-optimal (57-74)**

BIOASSESSMENT RESULTS

The benthic macroinvertebrate community was sampled using ADEM's Intensive Multi-habitat Bioassessment methodology (WMB-I). Measures of taxonomic richness, community composition and pollution tolerance were used to assess the overall health of the macroinvertebrate community in comparison to conditions expected in Coastal Plain streams. Each site is placed in one of six levels ranging from 1, or *natural*, to 6, or *highly altered*. The condition of the macroinvertebrate community was rated as *excellent-good*, identifying Bear Creek at BRE-1 as a level 2, or near natural, site. Taxa richness and diversity are excellent for this stream type, with 56 total taxa and 20 pollution-sensitive taxa collected at the site. Eight of the taxa are only found in the most pristine streams throughout Alabama and the Southeast (Table 4).

Table 4. Results of the Macroinvertebrate assessment conducted on Bear Creek at BRE-1, May 10, 2016.

Macroinvertebrate Assessment	Results
Taxonomic richness and diversity metrics	
Total # taxa	56
# rare and highly sensitive taxa	8
# sensitive taxa	20
# sensitive EPT taxa	12
Percent taxon metrics	
% sensitive EPT taxa	21
% sensitive taxa	36
% rare and highly sensitive taxa	14
% tolerant individuals	1
% tolerant taxa	2
Percent individual metrics	
% rare and highly sensitive individuals	13
% sensitive individuals	25
% sensitive EPT individuals	21
WMB-I Survey Score	**2.25**
WMB-I Survey Rating	**Excellent-good (2.10-2.25)**

WATER CHEMISTRY

Results of water chemistry analyses are summarized in Table 5. In situ measurements and water samples were collected monthly and semi-monthly (metals), from March through October, 2016, to help characterize the reach. Water temperatures ranged from 17.2 to 23.9 degrees Celsius. Turbidity was very low, ranging from 1.4 to 2.7 NTU. Although low, stream pH was typical of tannic streams in ecoregion 65F. Dissolved nickel exceeded the aquatic life use criterion during the May station visit.

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Table 5. Summary of water quality data collected March-October, 2016. 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	17.2	23.9	20.2	21.1	2.3	
Turbidity (NTU)	9	1.4	2.7	2.0	2.1	0.4	
Total Dissolved Solids (mg/L)	8	< 1.0	29.0	17.5	16.1	10.8	
J Total Suspended Solids (mg/L)	8	1.0	3.0	2.0	2.0	0.9	
Specific Conductance (µmhos/cm)	9	18.7	21.9	19.3	19.6	1.0	
Hardness (mg/L)	4	3.2	4.3	3.4	3.6	0.5	
Alkalinity (mg/L)	8	< 0.8	1.5	0.4	0.4	0.1	
Monthly Stream Flow (cfs)	8	11.1	46.1	19.4	24.6	13.6	
Measured Stream Flow (cfs)	8	11.1	46.1	19.4	24.6	13.6	
Chemical							
Dissolved Oxygen (mg/L)	9	6.9	8.3	7.9	7.8	0.4	
pH (SU)	9	4.3 C	5.2	4.8	4.8	0.3	9
J Ammonia Nitrogen (mg/L)	8	< 0.007	0.049	0.014	0.016	0.015	
Nitrate+Nitrite Nitrogen (mg/L)	8	0.103	0.347	0.228	0.224	0.090	
Total Kjeldahl Nitrogen (mg/L)	8	< 0.050	0.333	0.200	0.202	0.088	
J Dis Reactive Phosphorus (mg/L)	8	< 0.002	0.004	0.002	0.002	0.001	
J Total Phosphorus (mg/L)	8	0.005	0.010	0.008	0.007	0.002	
CBOD-5 (mg/L)	8	< 2.0	< 2.0	1.0	1.0	0.0	
COD (mg/L)	8	< 3.0	17.9	8.2	9.1	5.4	
J TOC (mg/L)	8	2.6	8.9	4.4	4.7	1.9	
Chlorides (mg/L)	8	2.5	3.1	3.0	2.9	0.2	
Sulfate (mg/L)	8	0.87	1.04	0.95	0.95	0.06	
Total Metals							
J Aluminum (mg/L)	4	< 0.106	0.147	0.134	0.117	0.043	
Iron (mg/L)	4	0.214	0.284	0.246	0.248	0.030	
J Manganese (mg/L)	4	< 0.004	0.026	0.002	0.008	0.012	
Dissolved Metals							
J Aluminum (mg/L)	4	< 0.106	0.138	0.053	0.074	0.042	
Antimony (µg/L)	4	< 0.342	< 0.383	0.192	0.186	0.010	
Arsenic (µg/L)	4	< 0.276	< 0.415	0.208	0.190	0.035	
Cadmium (µg/L)	4	< 0.311	< 0.385	0.192	0.183	0.018	
J Chromium (µg/L)	4	< 0.445	0.463	0.454	0.398	0.117	
Copper (µg/L)	4	< 0.218	< 0.454	0.227	0.198	0.059	
J Iron (mg/L)	4	0.142	0.170	0.158	0.157	0.014	
Lead (µg/L)	4	< 0.362	< 0.428	0.181	0.189	0.016	
J Manganese (mg/L)	4	< 0.004	0.025	0.002	0.008	0.012	
Nickel (µg/L)	4	< 0.705	10.298 S	0.352	2.839	4.973	1
Selenium (µg/L)	4	< 0.395	< 0.505	0.252	0.239	0.028	
Silver (µg/L)	4	< 0.365	< 0.478	0.239	0.225	0.028	
Thallium (µg/L)	4	< 0.348	< 0.514	0.174	0.195	0.042	
J Zinc (µg/L)	4	1.594	2.419	1.818	1.912	0.362	
Biological							
Chlorophyll a (mg/m³)	8	< 0.10	0.89	0.53	0.43	0.33	
J E. coli (MPN/DL)	8	16.0	275.5	29.2	61.6	87.3	

C= *F&W* criterion violated; E=# samples that exceeded criteria; J=estimate; N=# samples; S= *F&W* hardness-adjusted aquatic life use criteria exceeded

SUMMARY

The ADEM monitors Bear Creek at BRE-1 as a "high-quality" reference reach for comparison with other streams in the Southern Pine and Hills ecoregion. Bear Creek at BRE-1 is a low-gradient, sand-bottomed, tannic stream typical of streams in the ecoregion. Conditions within this watershed, which is located in the Conecuh National Forest and contains no permitted outfalls, are among the best in Alabama.

Results of the macroinvertebrate survey indicated the community to be in *excellent-good* condition. This stream exhibited low water temperatures, and low concentrations of sediment and nutrients. Habitat quality was rated as *sub-optimal*.