

2019 Monitoring Summary

Ecological Reference Reach



Butler Creek at Lauderdale County Road 302 (34.97376/-87.61127)

BACKGROUND

Butler Creek is among the least-disturbed watersheds within the Western Highland Rim ecoregion, based on landuse, road density, and population density. Since 2016, BTLL-1 has been monitored by the Alabama Department of Environmental Management (ADEM) as a candidate “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. Butler Creek was sampled in 2019 to provide high-quality reference reach data for Western Highland Rim streams.

Butler Creek is within one of 50 Strategic Habitat Units (SHU) by the U.S. Fish and Wildlife Service (USFWS) and the Alabama Rivers & Streams Network (ARSN). SHUs are recognized as high quality habitats occupied by federally listed and state imperiled species.



Figure 1. Butler Creek at BTLL-1, June 26, 2019.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Butler Creek is a *Fish and Wildlife (F&W)* stream located within Lauderdale County near the community of Hines. According to the 2016 National Land Cover Dataset, the watershed is 56% forested, 22% pasture and is 6% developed with no permitted outfalls. It is sparsely populated with very few roads. It is located within a Strategic Habitat Unit that supports federally listed threatened or endangered aquatic species and other aquatic species listed to be of the *Highest or High Conservation Concern* by the state of Alabama.

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 71f, Butler Creek at BTLL-1 is a medium-high gradient stream characterized predominantly by a bedrock, cobble and gravel substrates. Overall habitat quality was categorized as *sub-optimal* for supporting the biological communities in this stream type.

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 north Alabama streams and rivers. 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 has been rated as *Good-fair*, identifying Butler Creek at BTLL-1 as a level 3 site or near natural site. Taxa richness and diversity are excellent, with 63 total taxa and 25 pollution-sensitive taxa collected at the site. Six of the taxa are only found in the most pristine streams throughout Alabama and the southeast (Table 4).

Table 1. Summary of general watershed characteristics: BTLL-1

Watershed Characteristics	
Basin	Tennessee
Drainage Area (mi ²)	60.2
Ecoregion ^a	71F
Assessment Unit	AL06030005-0507-100
Use Class	F&W
AU Category	1
12-digit Hydrologic Unit Code (HUC)	060300050507
Conservation Status	
Strategic Habitat Unit	4 Shoal Ck (0603)
Landuse Categories (2011 National Land Cover Dataset)	
Wetland, Total (%)	1.1
Wetlands, Woody (%)	1.1
Forested, Total (%)	55.9
Forested, Deciduous (%)	49.7
Forested, Evergreen (%)	4.1
Forested, Mixed (%)	2.1
Shrub/Scrub (%)	9.6
Grassland/Herbaceous (%)	2.7
Pasture/Hay (%)	22.0
Crops, Cultivated (%)	3.0
Developed, Total (%)	5.7
Developed, Open Space (%)	4.8
Developed, Low Intensity (%)	0.7
Developed, Medium Intensity (%)	0.2
Population/km (2010 US Census)	14
Roads	
Road Density	1.4

^a Western Highland Rim

† 12-digit HUC located in a Strategic Habitat Unit.

± 12-digit HUC identified as Clean Water Partnership priority watershed.

Table 2. Physical characteristics of Butler Creek at BTLL-1, June 26, 2019.

Physical Characteristics	
Width (ft)	65
Canopy Cover	Open
Depth (ft)	
Riffle	1.0
Run	1.5
Pool	3.0
% of Reach	
Riffle	5
Run	45
Pool	50
% Substrate	
Bedrock	25
Boulder	2
Cobble	30
Gravel	25
Sand	3
Silt	10
Organic Matter	5

Table 3. Results of the habitat assessment survey conducted on Butler Creek at BTLL-1, June 26, 2019.

Habitat Survey	% Max Score	Rating
Instream Habitat Quality	74	Sub-optimal (55-74.999)
Sediment Deposition	49	Marginal (30-49.999)
Riffle Frequency	60	Sub-optimal (55-74.999)
Bank Vegetative Stability	80	Optimal (80-100)
Riparian Zone Measurements	55	Sub-optimal (55-74.999)
Habitat Assessment Score	130	
% Maximum Score	65	Sub-optimal (55-69.999)

Table 4. Results of the Macroinvertebrate assessment conducted on Butler Creek at BTLL-1, June 26, 2019.

Macroinvertebrate Assessment	Scores
Taxonomic richness and diversity metrics	
Taxa Count	63
# rare and highly sensitive taxa	6
# sensitive taxa	19
# sensitive EPT taxa	7
Percent taxon metrics	
% rare and highly sensitive taxa	10
% sensitive taxa	30
% sensitive EPT taxa	11
% highly tolerant taxa	11
Percent individual metrics	
% rare and highly sensitive individuals	6
% sensitive individuals	16
% sensitive EPT individuals	12
% tolerant individuals	7
WMB-I Survey Score	3.4
WMB-I Survey Rating	Good-fair (3.15-3.499)

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 2019 to help characterize the reach. In situ parameters were well within *F&W* ranges to protect uses. Individual pH values were slightly higher and lower than expected based off of data collected at reference reaches within the Western Highland Rim ecoregion (71f). Values for water temperature, ammonia and dissolved selenium were >90% of all verified ecoregional reference reach data collected in the ecoregion 71f.

SUMMARY

The ADEM monitored Butler Creek at BTLL-1 as a candidate “high-quality” reference reach for comparison with other Western Highland Rim streams. Butler Creek at BTLL-1 is typical of streams in the region, characterized by moderate to high gradient riffles with bedrock, cobble and gravel substrates. Located within a SHU, the watershed is of exceptional quality, containing no permitted outfalls. Water quality conditions are very high, exhibiting low water temperatures, and low concentrations of nutrients, and metals. Macroinvertebrate diversity and taxa richness are in *good-fair* condition.

Table 5. Summary of water quality data collected March-October, 2019. 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.

BTLL-1 AL06030005-0507-100	N	Min	Max	Med	Avg	SD	E	10thP	90thP
Physical									
Temperature (°C)	9	7.6	23.9 ^D	21.0	18.7	5.5		7.6	23.9
Turbidity (NTU)	9	1.4	3.1	2.3	2.3	0.6		1.4	3.1
Total Dissolved Solids (mg/L)	7	33.0	46.0	38.0	39.0	4.4		33.0	46.0
Total Suspended Solids (mg/L)	7	1.0	5.0	3.0	3.0	1.4		1.0	5.0
Specific Conductance (µmhos/cm)	9	46.0	63.0	57.0	56.6	5.8		46.0	63.0
Hardness (mg/L)	4	18.3	24.9	22.8	22.2	2.9		18.3	24.9
Alkalinity (mg/L)	8	13.2	26.2	22.2	21.5	4.0		13.2	26.2
Measured Stream Flow (cfs)	8	28.1	216.8	75.9	90.0	58.9		28.1	216.8
Chemical									
Dissolved Oxygen (mg/L)	9	7.7	12.3	9.1	9.6	1.6		7.7	12.3
pH (SU)	9	7.0 ^D	7.8 ^D	7.4	7.4	0.3		7.0	7.8
J Ammonia Nitrogen (mg/L)	8	<0.004	0.024 ^D	0.008	0.010	0.009		0.002	0.024
J Nitrate+Nitrite Nitrogen (mg/L)	8	0.146	0.595	0.242	0.290	0.160		0.146	0.595
Total Kjeldahl Nitrogen (mg/L)	8	<0.075	3.220	0.038	0.495	1.106		0.038	3.220
J Total Nitrogen (mg/L)	8	<0.184	3.423	0.477	0.786	1.076		0.184	3.423
J Dis Reactive Phosphorus (mg/L)	8	<0.006	0.021	0.008	0.008	0.006		0.003	0.021
Total Phosphorus (mg/L)	8	0.010	0.061	0.013	0.020	0.017		0.010	0.061
J TOC (mg/L)	8	0.5	1.1	0.9	0.8	0.2		0.5	1.1
CBOD-5 (mg/L)	8	<2.0	<2.0	1.0	1.0	0.0		1.0	1.0
J COD (mg/L)	7	<1.2	6.0	1.8	2.7	2.3		0.6	6.0
J Chlorides (mg/L)	8	<0.6	1.8	1.0	1.0	0.5		0.3	1.8
J Sulfate (mg/L)	8	1.40	3.33	2.34	2.29	0.65		1.40	3.33
Total Metals									
J Aluminum (T) (mg/L)	4	<0.023	0.102	0.058	0.058	0.039		0.012	0.102
Iron (T) (mg/L)	4	<0.063	<0.063	0.032	0.032	0.000		0.032	0.032
Manganese (T) (mg/L)	4	<0.004	<0.004	0.002	0.002	0.000		0.002	0.002
Dissolved Metals									
J Aluminum (mg/L)	4	<0.023	0.072	0.031	0.036	0.026		0.012	0.072
Antimony (µg/L)	4	<1.480	<1.480	0.740	0.740	0.000		0.740	0.740
Arsenic (µg/L)	4	<0.689	<0.689	0.344	0.344	0.000		0.344	0.344
Cadmium (µg/L)	4	<0.726	<0.726	0.363	0.363	0.000		0.363	0.363
Chromium (µg/L)	4	<0.793	<0.793	0.396	0.396	0.000		0.396	0.396
Copper (µg/L)	4	<1.190	<1.190	0.595	0.595	0.000		0.595	0.595
Iron (mg/L)	4	<0.063	<0.063	0.032	0.032	0.000		0.032	0.032
Lead (µg/L)	4	<0.697	<0.697	0.348	0.348	0.000		0.348	0.348
Manganese (mg/L)	4	<0.004	<0.004	0.002	0.002	0.000		0.002	0.002
Nickel (µg/L)	4	<1.960	<1.960	0.980	0.980	0.000		0.980	0.980
J Selenium (µg/L)	4	<1.900	2.290 ^D	0.950	1.285	0.670		0.950	2.290
Silver (µg/L)	4	<1.350	<1.350	0.675	0.675	0.000		0.675	0.675
Thallium (µg/L)	4	<0.641	<0.641	0.320	0.320	0.000		0.320	0.320
Zinc (µg/L)	4	<2.340	<2.340	1.170	1.170	0.000		1.170	1.170
Biological									
Chlorophyll a (mg/m³)	8	<0.27	1.60	0.50	0.61	0.41		0.27	1.60
E. coli (MPN/DL)	8	62.0	290.9	80.2	126.1	93.2		62.0	290.9

D=an individual value >90% of all verified ecoregional reference reach data collected in the ecoregion 71f; E=# samples that exceeded criteria; J=estimate; N=# samples.