

2009 Monitoring Summary



Swan Creek at US Highway 31 (Limestone County) (34.68860/-86.95310)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) selected the Swan Creek watershed 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 location and to estimate overall water quality within the TN basin.



Figure 1. Swan Creek at SWNL-390, May 12, 2009.

WATERSHED CHARACTERISTICS

Watershed characteristics are summarized in Table 1. Swan Creek is a *Fish & Wildlife (F&W)* stream located north of the City of Decatur in the Tennessee River basin. Based on the 2006 National Land Cover Dataset, land use within the watershed is primarily agricultural crops (48%), with some forested areas. The presence of agricultural and cultivated crops is characteristic of watersheds in the Eastern Highland Rim ecoregion. As of September 1, 2012, seventy-three NPDES permits have been issued 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. Swan Creek at SWNL-390 is a high gradient, riffle-run stream with a bottom substrate dominated by bedrock (Figure 1). Overall habitat quality was categorized as *optimal* due to little sediment deposition and good bank and vegetative stability.

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 in comparison to least-impaired reference reaches in the same ecoregion. The final score is the average of the score for each metric. Metric results indicated the macroinvertebrate community to be in *poor* condition (Table 4).

Table 1. Summary of watershed characteristics.

Watershed Characteristics		
Basin		Tennessee River
Drainage Area (mi²)		54
Ecoregion^a		71g
% Landuse		
Open water		<1
Wetland	Woody	4
	Emergent herbaceous	<1
Forest	Deciduous	12
	Evergreen	3
	Mixed	5
Shrub/scrub		5
Grassland/herbaceous		2
Pasture/hay		32
Cultivated crops		16
Development	Open space	10
	Low intensity	9
	Moderate intensity	2
	High intensity	<1
Barren		<1
Population/km^{2b}		143
# NPDES Permits^c	TOTAL	73
	Construction Stormwater	67
	Industrial General	3
	Industrial Individual	1
	Municipal Individual	2

a. Eastern Highland Rim

b. 2000 US Census

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

Table 2. Physical characteristics of Swan Creek at SWNL-390, June 3, 2009.

Physical Characteristics		
Width (ft)		50
Canopy Cover		Open
Depth (ft)	Riffle	0.6
	Run	2.5
	Pool	3.0
% of Reach	Riffle	10
	Run	70
	Pool	20
% Substrate	Bedrock	81
	Boulder	3
	Cobble	10
	Gravel	2
	Sand	2
	Organic Matter	2

Table 3. Results of the habitat assessment conducted on Swan Creek at SWNL-390, June 3, 2009.

Habitat Assessment	%Maximum Score	Rating
Instream Habitat Quality	61	Sub-optimal (59-70)
Sediment Deposition	80	Optimal >70
Sinuosity	63	Marginal (45-64)
Bank and Vegetative Stability	76	Optimal >74
Riparian Buffer	88	Sub-optimal (70-89)
Habitat Assessment Score	179	
% Maximum Score	75	Optimal >70

Table 4. Results of the macroinvertebrate bioassessment conducted in Swan Creek at SWNL-390, June 3, 2009.

Macroinvertebrate Assessment		
	Results	Scores
Taxa richness and diversity measures		(0-100)
# EPT taxa	9	22
Shannon Diversity	3.17	22
Taxonomic composition measures		
% EPT minus Baetidae and Hydropsychidae	16	35
% Non-insect taxa	18	25
Functional feeding group		
% Predator Individuals	4	9
Community tolerance		
% Tolerant taxa	36	38
WMB-I Assessment Score	---	25
WMB-I Assessment Rating		Poor (15-28)

WATER CHEMISTRY

Results of water chemistry analyses are presented in Table 5. In situ measurements were collected during monthly water sampling between March and October and during the macroinvertebrate bioassessment in June 2009 to help identify any stressors to the biological communities. Swan Creek at SWNL-390 met *F&W* criteria for temperature, turbidity, and dissolved oxygen. Generally, no metals toxicities were detected, except for dissolved copper, which exceeded the *F&W* aquatic life use criterion one time in October. Organics results were less than the minimum detection limit (MDL), except for atrazine, which was detected in both samples collected. Values for specific conductance, hardness, chlorides and nutrients (nitrate-nitrite nitrogen, total Kjeldahl nitrogen, total nitrogen, dissolved reactive phosphorus, total phosphorus) were all higher than expected for the ecoregion. Three of nine pH measurements were above the 8.5 standard unit criterion for *F&W*, and may be related to enriched nutrient conditions at the site.

SUMMARY

Bioassessment results indicated the macroinvertebrate community to be in *poor* condition. Overall habitat quality was categorized as *optimal* due to low sedimentation, and good bank and vegetative stability. Intensive water chemistry results indicated that high nutrient concentrations may have impacted macroinvertebrate community health and diversity.

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	13.7	29.8	23.6	21.7	6.1	
Turbidity (NTU)	9	2.0	5.2	3.5	3.5	1.2	
↓ Total Dissolved Solids (mg/L)	8	10.0	210.0	129.0	127.2	58.5	
Total Suspended Solids (mg/L)	8	< 1.0	7.0	1.0	1.9	2.2	
Specific Conductance (µmhos)	9	160.0	381.7	229.7 ^G	241.2	82.2	
Hardness (mg/L)	4	71.8	99.0	88.3 ^G	86.8	14.2	
Alkalinity (mg/L)	8	50.3	125.0	67.4	74.1	24.6	
Stream Flow (cfs)	9	11.5	112.9	44.5	53.2	36.6	
Chemical							
Dissolved Oxygen (mg/L)	9	6.8	13.4	10.8	10.4	2.0	
pH (su)	9	7.7	9.0 ^C	8.1	8.2	0.5	3
↓ ^B Ammonia Nitrogen (mg/L)	7	< 0.006	0.370	0.007	0.057	0.138	
Nitrate+Nitrite Nitrogen (mg/L)	8	1.084	7.830	1.644 ^M	2.726	2.381	
↓ ^B Total Kjeldahl Nitrogen (mg/L)	7	0.336	0.790	0.621 ^M	0.573	0.158	
↓ ^B Total Nitrogen (mg/L)	7	1.420	5.099	1.913 ^M	2.570	1.284	
↓ Dissolved Reactive Phosphorus (mg/L)	8	0.088	2.780	0.484 ^M	0.780	0.849	
↓ ^B Total Phosphorus (mg/L)	6	0.112	1.724	0.877 ^M	0.862	0.556	
↓ CBOD-5 (mg/L)	8	< 1.4	4.8	1.0	1.5	1.3	
Chlorides (mg/L)	8	6.8	32.0	12.7 ^M	15.4	9.1	
Atrazine (µg/L)	2	0.11	0.60	0.36	0.36	0.35	
Total Metals							
↓ Aluminum (mg/L)	4	< 0.019	0.258	0.092	0.113	0.105	
Iron (mg/L)	4	< 0.014	0.409	0.200	0.204	0.186	
↓ Manganese (mg/L)	4	< 0.001	0.022	0.020	0.016	0.010	
Dissolved Metals							
↓ Aluminum (mg/L)	4	< 0.019	0.054	0.016	0.024	0.020	
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 (µg/L)	4	< 3.000	< 3.000	1.500	1.500	0.000	
Chromium (mg/L)	4	< 0.013	< 0.013	0.006	0.006	0.000	
↓ Copper (mg/L)	4	< 0.013	0.024 ^S	0.006	0.011	0.009	1
↓ Iron (mg/L)	4	< 0.014	0.114	0.013	0.037	0.052	
Lead (µg/L)	4	< 0.6	1.0	0.5	0.5	0.1	
↓ Manganese (mg/L)	4	< 0.001	0.015	0.012	0.010	0.006	
Mercury (µg/L)	4	< 0.080	< 0.080	0.040	0.040	0.000	
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 (µg/L)	4	< 2.000	< 2.000	1.000	1.000	0.000	
Thallium (µg/L)	4	< 0.4	0.5	0.2	0.2	0.0	
↓ Zinc (mg/L)	4	< 0.003	0.030	0.005	0.006	0.006	
Biological							
Chlorophyll a (ug/L)	8	1.07	4.63	2.27	2.48	1.37	
↓ Fecal Coliform (col/100 mL)	8	9	1400	48	212	480	

B=one or more samples excluded from calculations because they did not meet laboratory QC requirements; C=value exceeds criteria for *F&W* water use classification; E=# samples that exceeded criterion; G=value greater than median concentration of all verified reference data collected in ecoregion 71; J=estimate; M=value exceeds the 90th percentile of all verified reference data collected in ecoregion 71; N=# samples; S=*F&W* hardness-adjusted aquatic life use criterion exceeded.

FOR MORE INFORMATION, CONTACT:

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