

# Biological Assessment of Upper Clearfield Creek Cambria and Clearfield Counties

**Technical Report Provided Through the  
Trout Unlimited AMD Technical Assistance Program**

**June 2010**

## Background

The Clearfield Creek Watershed Association (CCWA) requested a technical assistance grant to evaluate the biological communities in upper Clearfield Creek. Trout Unlimited (TU) worked with the CCWA to select seven sites for habitat and benthic population evaluation and two sites for a fishery evaluation (Table 1, Figure 1). After the scope of work was approved by both TU and the CCWA, Department of Environmental Protection (DEP) Bureau of Abandoned Mine Reclamation (BAMR) personnel expressed interest in the collection of chemical and flow data in concert with the biological data. Thus, the scope of work was expanded, in partnership with DEP BAMR, and water quality samples were analyzed for 14 parameters by the DEP Bureau of Laboratories (Table 2).

*Table 1. Data Collection Sites*

Latitude	Longitude	Site Name	Benthic Macroinvertebrates	Fish	Habitat	Chemistry	Flow	Site Description
40.5362	-78.55946	CC 1	x	x	x	x	x	Above Amsbry Bridge
40.5517	-78.55886	CC 2	x		x	x		Above SR 53 Bridge
40.5756	-78.5287	CC 3	x		x	x	x	Above Little Laurel Run
40.5822	-78.52701	CC 4	x		x	x	x	Below Little Laurel Run
40.6106	-78.51265	CC 5	x		x	x		Above UNT 26497
40.6202	-78.5041	CC 6	x		x	x	x	Above Brubaker Run
40.6262	-78.50321	CC 7	x	x	x	x	x	Below Brubaker Run
TOTAL			7	2	7	7	5	

Figure 1. Data Collection Sites

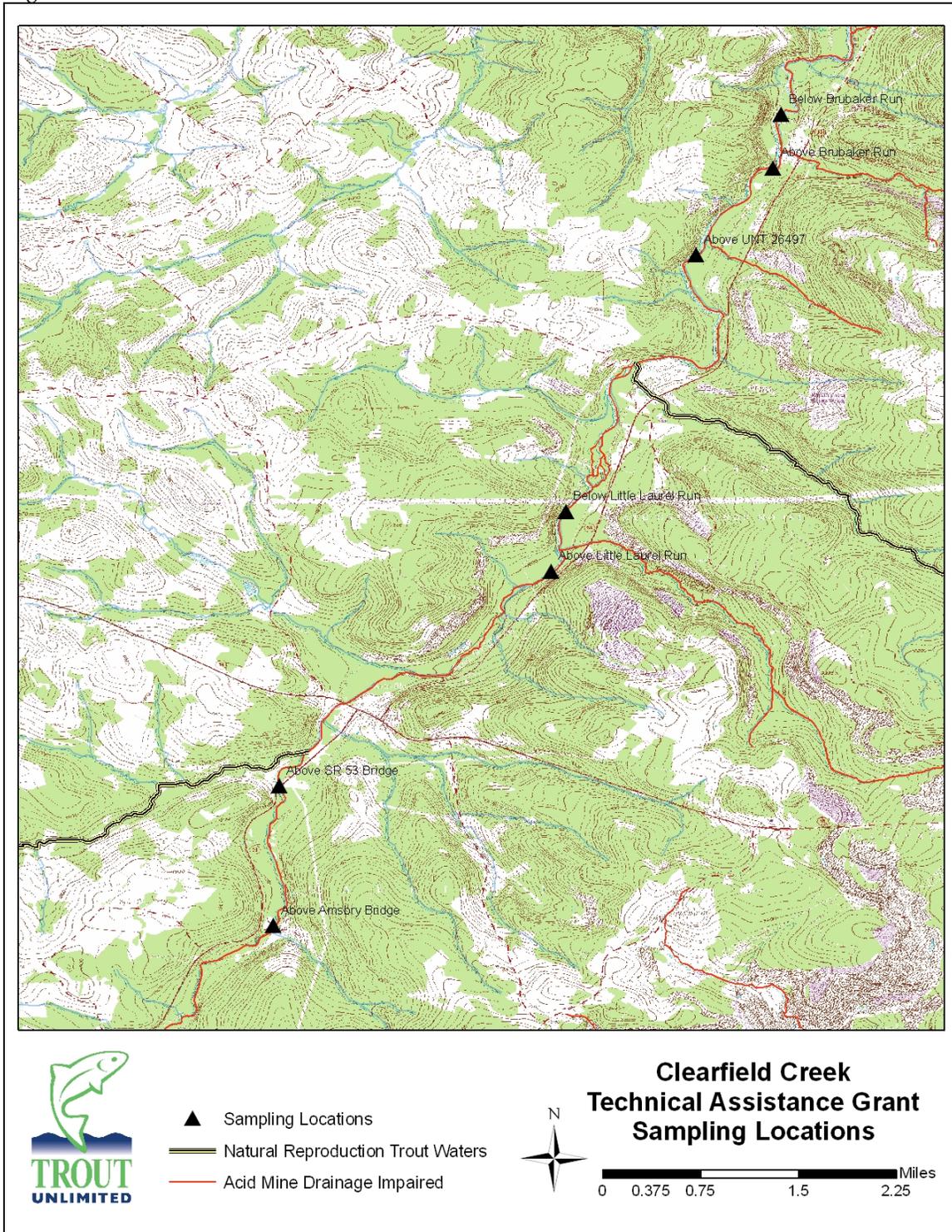


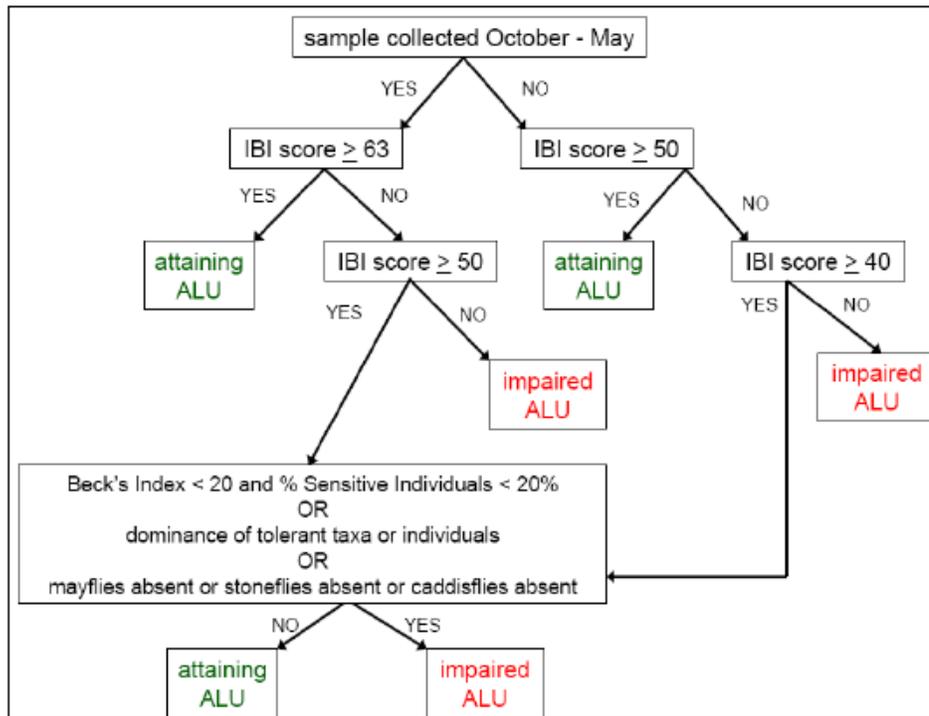
Table 2. Chemistry Parameters

Parameter	Unit	Parameter	Unit
pH	standard units	Fe <sup>+2</sup>	mg/l
Conductivity	umhos/cm	Fe <sup>+3</sup>	mg/l
Total Calculated Acidity	mg/l	Al	mg/l
Hot Acidity	mg/l	Mn	mg/l
Net Acidity	mg/l	Ca	mg/l
Alkalinity	mg/l	Sulfates	mg/l
Fe	mg/l	Solids	mg/l

Benthic macroinvertebrate collections were made on December 18, 2009 and habitat evaluation, flow measurements, and water quality sampling occurred on December 22, 2009. 100 meters of habitat were evaluated at each site using DEP's *Water Quality Network Habitat Assessment* Form, which considers the following twelve parameters: instream cover, epifaunal substrate, embeddedness, velocity/depth regimes, channel alteration, sediment deposition, frequency of riffles, channel flow status, condition of banks, bank vegetative protection, grazing or other disruptive pressure, and riparian vegetation zone width.

Benthic macroinvertebrate collections were made according to DEP's Instream Comprehensive Evaluation (ICE) protocol (specifically section C.1.b. *Antidegradation Surveys*). In short, benthic macroinvertebrate samples consisted of a combination of six D-frame efforts in a 100-meter stream section. These efforts were spread out so as to select the best riffle habitat areas with varying depths. Each effort consisted of an area of 1 m<sup>2</sup> to a depth of at least 4 inches as substrate allowed and was conducted with a 500 micron mesh 12-inch diameter D-frame kick net. The six individual efforts were composited and preserved with ethanol for processing in the lab. No sub-sampling was required for these samples as the individual counts were less than or near 200. Individuals were identified to genus or to the next highest possible taxonomic level. The samples were evaluated according to the six metrics comprising the DEP's Index of Biological Integrity (IBI) (Total Taxa Richness, EPT Taxa Richness, Beck's Index V.3, Shannon Diversity, Hilsenhoff Biotic Index, and Percent Sensitive Individuals). These metrics were standardized and used to determine if the stream met the Aquatic Life Use (ALU) threshold for cold water fishes, warm water fishes, and trout stocked fishes (Figure 2).

Figure 2. ALU Attainment and Impairment Thresholds for Cold Water Fishes (CWF), Warm Water Fishes (WWF), and Trout Stocked Fishes (TSF) Protected Uses (Department of Environmental Protection, 2009)



Stream flow was measured using a Swiffer Current Velocity Meter and according to DEP's *Standardized Biological Field Collection and Laboratory Methods*. Width, velocity at 6/10 depth of the water column, and depth of water were measured at intervals across the stream so as to not capture more than 1/10 of the stream velocity per interval. Stream discharge was later calculated by summing the volume of water moving through each interval. Discharge measurements from Clearfield Creek Above SR 53 and Clearfield Creek Above UNT 26497 were not taken. A water quality grab sample was taken at each site according to directions provided by DEP BAMR personnel.

TU staff attempted to evaluate the fishery of upper Clearfield Creek on July 6, 2010 but the conductivity of the stream was too high, hindering the effectiveness of sampling equipment. As a result, no fish data could be collected as part of this TAG.

### Clearfield Creek - Above Amsbry Bridge (CC 1)

CC 1 is the most upstream site in the study area and is located just below where Unnamed Tributary (UNT) 26554 enters Clearfield Creek and is approximately 8 stream miles above Brubaker Run. According to DEP's 2008 Integrated List, Clearfield Creek at this location is impaired with abandoned mine drainage (AMD) metals. The Sankertown Abandoned Mine Land (AML) Inventory site on the headwaters of UNT 26591 and the Gallitizin North AML on Bradley Run are the most likely sources of AMD to this part of Clearfield Creek (Figure 8).

*Figure 3. Clearfield Creek – Above Amsbry Bridge*



*Habitat* - Habitat at this site was optimal with a total score of 197 out of 240 (Figure 9). Suboptimal rankings were only given for the categories of velocity/depth regime, channel alteration, and riparian vegetative zone width because only 3 of the 4 velocity depth regimes common for good habitat were found, historical channel alteration was present, and a minimal human impact to the riparian zone was present.

*Benthic Macroinvertebrates* – A total of 192 taxa were found at this site (Figure 10). The average of adjusted standardized core metric scores (53.5) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does meet the benchmark for aquatic life use attainment (Table 3, Figure 2).

Table 3. CC 1 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	22	0.667	0.667
EPT Taxa Richness (PTV 0 – 4)	9	0.474	0.474
Beck's Index, version 3	9	0.237	0.237
Hilsenhoff Biotic Index	4.18	0.717	0.717
Shannon Diversity	2.15	0.751	0.751
Percent Sensitive Individuals (PTV 0 – 3)	30.7	0.364	0.364
<b>IBI SCORE =</b>			<b>53.5</b>

*Water Chemistry and Loadings* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 4, Figure 12) and Clearfield Creek was net alkaline at this site.

Table 4. CC 1 Water Chemistry and Loadings

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
13,195 (gpm)	7.2	-16 (mg/L)	29.4 (mg/L)	0.47 (mg/L)	0.223 (mg/L)	0.171 (mg/L)
		-2,537.6 (lbs/day)	4,655.2 (lbs/day)	27.12 (lbs/day)	35.37 (lbs/day)	27.12 (lbs/day)

Despite the listing of this stream section as AMD-impaired and the presence of two AML sites upstream, Clearfield Creek at this location contains a robust population of benthic macroinvertebrates (Figures 10 & 11) and water quality was good during the sampling period (Figures 18, Table 15).

**Clearfield Creek - Above SR 53 Bridge (CC 2)**

CC 2 is located on Clearfield Creek approximately 1 stream mile downstream of CC 1 and approximately 7 stream miles upstream of Brubaker Run. According to DEP’s 2008 Integrated List, Clearfield Creek at this location is impaired with AMD metals. No tributaries enter Clearfield Creek between this site and CC 1, however a notable AMD discharge does enter the stream at the Amsbry bridge downstream of CC 1 (Figure 4).

*Habitat* - Habitat at this site was optimal with a total score of 195 out of 240 (Figure 9). Suboptimal rankings were only given for the categories of velocity/depth regime, channel alteration, and riparian vegetative zone width because only 3 of the 4 velocity depth regimes common for good habitat were found, historical channel alteration was present, and minimal human impact to the riparian zone was present.

*Benthic Macroinvertebrates* – A total of 57 taxa were found at this site (Figure 10). The average of adjusted standardized core metric scores (34.6) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 5, Figure 2).

Table 5. CC 2 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	11	0.333	0.333
EPT Taxa Richness (PTV 0 – 4)	3	0.158	0.158
Beck’s Index, version 3	2	0.053	0.053
Hilsenhoff Biotic Index	5.72	0.528	0.528
Shannon Diversity	1.93	0.675	0.675
Percent Sensitive Individuals (PTV 0 – 3)	28.1	0.332	0.332
<b>IBI SCORE =</b>			<b>34.6</b>

*Water Chemistry* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 6, Figure 12) and Clearfield Creek was still net alkaline at this site.

Table 6. CC 2 - Water Chemistry

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
--	7.3	7.4 (mg/L)	22.4 (mg/L)	0.483 (mg/L)	0.46 (mg/L)	0.186 (mg/L)
		-- (lbs/day)	-- (lbs/day)	-- (lbs/day)	-- (lbs/day)	-- (lbs/day)

Although water chemistry was determined to be in the acceptable range and habitat at this site was similar to habitat found upstream (Figures 9 & 12), there was an observed reduction in benthic macroinvertebrate taxa (Figure 10) and IBI scores (Figure 11). This reduction is believed to be related to a culmination of upstream sewage/organic and AMD input.

Cambria County Conservation District staff have indicated a presence of untreated sewage in this segment of Clearfield Creek (verbal communication). Inputs of sewage would have a predicted detrimental effect on benthic populations however the chemical parameters used to detect sewage were not included in this AMD-based assessment. The AMD discharge entering Clearfield Creek near the Ambsry bridge (Figure 4) may also be contributing to the decreased benthic population, especially in low flow conditions. At the time of sampling, AMD from this site was probably diluted with high flows. However, during summer low flow periods this pollution input may be concentrated enough to have an effect on benthic macroinvertebrate populations downstream. Regardless of the cause, this noted biological change underscores the importance of collecting biological data in concert with the standard suite of AMD-chemistry data when conducting water quality snapshots.

Figure 4. AMD entering Clearfield Creek below CC 1.



### **Clearfield Creek - Above Little Laurel Run (CC 3)**

CC 3 is located on Clearfield Creek approximately 2.4 stream miles downstream of the SR 53 site and approximately 3.4 stream miles above Brubaker Run. According to DEP's 2008 Integrated List, Clearfield Creek at this location is impaired with AMD metals. Six tributaries enter Clearfield Creek between this site and CC 2: Beaverdam Run, UNT 26529, Swartz Run, UNT 26520, UNT 26518, and UNT 26519. Notably, none of these tributaries are listed by the DEP as AMD-impaired. In addition, Beaverdam Run from its headwaters to its mouth is recognized by the PA Fish and Boat Commission as a natural reproduction trout water.

Two existing AMLs presumably have an impact on water chemistry at CC 3: the Ashville AML located near the mouth of Swartz Run, and the Dysart Southwest II AML located on UNT 26519 (Figure 8).

*Habitat* - Habitat at this site was optimal with a total score of 216 out of 240 (Figure 9). Suboptimal rankings were only given for the categories of velocity/depth regime and condition of banks because only 3 of the 4 velocity depth regimes common for good habitat were found and small areas of erosion were noted on the stream banks.

*Benthic Macroinvertebrates* – A total of 114 taxa were found at this location. The average of adjusted standardized core metric scores (46.0) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 7, Figure 2).

Table 7. CC 3 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	17	0.515	0.515
EPT Taxa Richness (PTV 0 – 4)	8	0.421	0.421
Beck's Index, version 3	5	0.132	0.132
Hilsenhoff Biotic Index	4.54	0.673	0.673
Shannon Diversity	2.09	0.729	0.729
Percent Sensitive Individuals (PTV 0 – 3)	24.6	0.291	0.291
		<b>IBI SCORE =</b>	<b>46.0</b>

*Water Chemistry and Loadings* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 8, Figure 12) and Clearfield Creek was still net alkaline at this site.

Table 8. CC 3 Water Chemistry and Loadings

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
26,166 (gpm)	7.4	-15.4 (mg/L)	26.2 (mg/L)	0.372 (mg/L)	0.275 (mg/L)	0.141 (mg/L)
		-4,843.35 (lbs/day)	8,226.59 (lbs/day)	117 (lbs/day)	86.49 (lbs/day)	44.35 (lbs/day)

Habitat at this site was similar to habitat at CC 2 (Figure 9), however the population of benthic macroinvertebrates (Figures 10 & 11) at this location improved slightly. These improvements are corroborated by a reduction in AMD-metal concentrations (Figure 12) and are probably owed to the input of clean water and seed populations from the aforementioned six tributaries that enter Clearfield Creek between the SR 53 site and this location.

Figure 5. Little Laurel Run and Clearfield Creek



**Clearfield Creek - Below Little Laurel Run (CC 4)**

CC 4 is located approximately 0.3 stream miles downstream of Little Laurel Run and approximately 3.7 stream miles above Brubaker Run. According to DEP’s 2008 Integrated List, Clearfield Creek at this location is impaired with AMD metals. Six AML features intersect or presumably drain to Little Laurel Run (State Game Lands #184, Little Laurel Run, Buckhorn North, Buckhorn, Buckhorn West #1, and West Buckhorn #2) (Figure 8) and the DEP lists this stream as impaired with AMD metals and low pH.

*Habitat* - Habitat at this site was optimal with a total score of 223 out of 240 (Figure 9). Suboptimal rankings were only given for the category of velocity/depth regime because only 3 of the 4 velocity depth regimes common for good habitat were found.

*Benthic Macroinvertebrates* – A total of 45 taxa were found at this location. The average of adjusted standardized core metric scores (45.2) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 9, Figure 2).

Table 9. CC 4 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	16	0.485	0.485
EPT Taxa Richness (PTV 0 – 4)	5	0.263	0.263
Beck’s Index, version 3	6	0.158	0.158
Hilsenhoff Biotic Index	4.76	0.647	0.647
Shannon Diversity	2.33	0.816	0.816
Percent Sensitive Individuals (PTV 0 – 3)	28.9	0.342	0.342
<b>IBI SCORE =</b>			<b>45.2</b>

*Water Chemistry and Loadings* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 10, Figure 11) and Clearfield Creek was still net alkaline at this site.

Table 10. CC 4 Water Chemistry and Loadings

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
26,795 (gpm)	7.1	-8.2 (mg/L)	20.6 (mg/L)	0.417 (mg/L)	0.526 (mg/L)	0.59 (mg/L)
		-2,641.02 (lbs/day)	6,623.72 (lbs/day)	134.31 (lbs/day)	169.41 (lbs/day)	190.02 (lbs/day)

Although habitat at CC 4 is similar to that found at CC 3 (Figure 9), total benthic macroinvertebrate taxa (Figure 10) and IBI score (Figure 11) decreased. Furthermore, metals associated with AMD increased (Figure 12). These decreases in macroinvertebrate presence and water quality are more than likely attributed to Little Laurel Run.

**Clearfield Creek – Above UNT 26497 (CC 5)**

CC 5 is located approximately 2.7 stream miles downstream of Little Laurel Run and approximately 1.0 stream mile above Brubaker Run. According to DEP’s 2008 Integrated List, Clearfield Creek at this location is impaired with AMD metals. Six tributaries enter Clearfield Creek between Little Laurel Run and this site: UNT 26515, Indian Run, Laurel Run, UNT 26500, UNT 26499, and UNT 26498. None of these tributaries are AMD-impaired. In addition, Laurel Run from its headwaters to its mouth is recognized by the PA Fish and Boat Commission as a natural reproduction trout water.

Two AML’s exist in proximity to Clearfield Creek between Little Laurel Run and CC 5 (Figure 8): Dysart East, located between Laurel Run and UNT 26500, and Condron which encompasses much of UNT 26498 and Clearfield Creek downstream to well-below CC 6.

*Habitat* - Habitat at this site was optimal with a total score of 218 out of 240 (Figure 9). Suboptimal rankings was only given for the category of velocity/depth regime because only 3 of the 4 velocity depth regimes common for good habitat were found.

*Benthic Macroinvertebrates* – A total of 58 taxa were found at this location (Figure 10). The average of adjusted standardized core metric scores (43.4) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 11, Figure 2).

Table 11 . CC 5 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	17	0.515	0.515
EPT Taxa Richness (PTV 0 – 4)	7	0.368	0.368
Beck’s Index, version 3	5	0.132	0.132
Hilsenhoff Biotic Index	5.62	0.540	0.540
Shannon Diversity	2.12	0.743	0.743
Percent Sensitive Individuals (PTV 0 – 3)	25.9	0.306	0.306
<b>IBI SCORE =</b>			<b>43.4</b>

*Water Chemistry* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 12, Figure 12) and Clearfield Creek was still net alkaline at this site.

Table 12 . CC 5 Water Chemistry

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
--	7.2	-1 (mg/L)	17.2 (mg/L)	0.299 (mg/L)	0.346 (mg/L)	0.424 (mg/L)
		-- (lbs/day)	-- (lbs/day)	-- (lbs/day)	-- (lbs/day)	-- (lbs/day)

Both habitat (Figure 9) and benthic macroinvertebrate IBI values (Figure 11) showed little variation at this location when compared to CC 4. However, the total number of benthic macroinvertebrate taxa found increased (Figure 10) and the concentration of metals associated with AMD decreased (Figure 12). In addition, Clearfield Creek was still net alkaline during the sampling period probably owing to the input of clean water from the aforementioned six tributaries that enter Clearfield Creek between Little Laurel Run and CC 5.

**Clearfield Creek – Above Brubaker Run (CC 6)**

CC 6 is located approximately 0.9 miles downstream of CC 5 and approximately 0.2 stream miles above Brubaker Run. According to DEP’s 2008 Integrated List, Clearfield Creek at this location is impaired with AMD metals. UNT 26497 which is impaired with AMD metals and low pH, and UNT 26496 which is not impaired flow into Clearfield Creek above this sampling location. The Condron AML site exists over much of the upstream site area (Figure 8).

*Habitat* - Habitat at this site was optimal with a total score of 229 out of 240 (Figure 9). No suboptimal rankings were found for any of the twelve parameters assessed.

*Benthic Macroinvertebrates* – A total of 26 taxa were found at this location (Figure 10). The average of adjusted standardized core metric scores (38.2) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 13, Figure 2).

Table 13 . CC 6 Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	8	0.242	0.242
EPT Taxa Richness (PTV 0 – 4)	4	0.211	0.211
Beck’s Index, version 3	1	0.026	0.026
Hilsenhoff Biotic Index	4.65	0.659	0.659
Shannon Diversity	1.86	0.651	0.651
Percent Sensitive Individuals (PTV 0 – 3)	42.3	0.501	0.501
<b>IBI SCORE =</b>			<b>38.2</b>

*Water Chemistry and Loadings* – None of the water quality parameters measured were found to be outside of DEP water quality criteria levels (Table 14, Figure 12) and Clearfield Creek was still net alkaline at this site.

Table 14 . CC 6 Water Chemistry and Loadings

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
34,919 (gpm)	7.3	-10.8 (mg/L)	21 (mg/L)	0.278 (mg/L)	0.335 (mg/L)	0.417 (mg/L)
		-4,533.04 (lbs/day)	8,799.59 (lbs/day)	116.68 (lbs/day)	140.61 (lbs/day)	175.03 (lbs/day)

Although habitat at this site showed little variation when compared to CC 5 (Figure 9), benthic macroinvertebrate taxa (Figure 10) and IBI values (Figure 11) slightly declined. Water chemistry at this site was very similar to the Above UNT 26497 site (Figure 12) suggesting that the impact of the upstream AMD-impaired tributary to Clearfield Creek is more pronounced during low-flow conditions.

**Clearfield Creek – Below Brubaker Run (CC 7)**

CC 7 is located approximately 100 meters downstream of Brubaker Run and also captures the AMD-loading from a discharge entering Clearfield Creek directly above Brubaker Run (Figure 6). According to DEP’s 2008 Integrated List, Clearfield Creek above Brubaker Run is impaired with AMD metals and becomes additionally impaired with low pH below Brubaker Run. Brubaker Run is considered impaired with AMD metals and low pH and has two AML sites (Brubaker Run and Dougherty West) presumably affecting its water quality (Figure 8).

*Habitat* - Habitat at this site was optimal with a total score of 211 out of 240 (Figure 9). Suboptimal rankings were only given for the categories of instream cover and frequency of riffles because there was only a 30-50% mix of boulder, cobble, and other stable habitat and riffle occurrence was infrequent at this location.

*Benthic Macroinvertebrates* – One individual stonefly was found at this site (Figure 10, Table 15). The average of adjusted standardized core metric scores (32.4) included as part of the IBI for benthic macroinvertebrates at this site indicates that the stream at this location does not meet the benchmark for aquatic life use attainment (Table 15, Figure 2).

Table 15 . CC 7 IBI Metrics

METRIC	OBSERVED VALUE	STANDARDIZED METRIC SCORE	ADJUSTED STANDARDIZED METRIC SCORE
Total Taxa Richness	1	0.030	0.030
EPT Taxa Richness (PTV 0 – 4)	1	0.053	0.053
Beck’s Index, version 3	0	0.000	0.000
Hilsenhoff Biotic Index	3.00	0.863	0.863
Shannon Diversity	0.00	0.000	0.000
Percent Sensitive Individuals (PTV 0 – 3)	100.0	1.183	1.000
<b>IBI SCORE =</b>			<b>32.4</b>

*Water Chemistry and Loadings* – Although the pH of Clearfield Creek below Brubaker Run is within the acceptable range for aquatic life, concentrations of iron, aluminum, and manganese are outside of DEP water quality criteria levels (Table 14, Figure 12).

Table 16 . CC 7 Water Chemistry and Loadings

Flow	pH	Total Acidity	Total Alkalinity	Total Fe	Total Al	Total Mn
43,222 (gpm)	6.5	4.6 (mg/L)	8.2 (mg/L)	1.555 (mg/L)	1.305 (mg/L)	1.912 (mg/L)
		2,389.83 (lbs/day)	4,253.05 (lbs/day)	805.27 (lbs/day)	677.98 (lbs/day)	993.34 (lbs/day)

Brubaker Run and the aforementioned discharge have a marked impact to the benthic macroinvertebrate population and chemistry of Clearfield Creek (Figures 10, 11, & 12). The individual stonefly, which is generally regarded as pollution sensitive, found at this site is believed to be an anomaly that perhaps drifted downstream during sampling. The concentrations of AMD metals at this location are very high making it unlikely that any pollution-sensitive macroinvertebrate would be able to inhabit this portion of the stream.

*Figure 6. Discharge above Brubaker Run*



## Summary

The portion of upper Clearfield Creek studied as part of this TAG is considered by the DEP to be impaired with either AMD metals or AMD metals and a low pH. Data collected for this TAG corroborate these findings, but suggest that Clearfield Creek has optimal habitat for aquatic life. The flux of benthic macroinvertebrate populations upstream of Brubaker Run are owed to a combination of AMD inputs and potential organic pollution. Although only the most upstream site is considered to meet the threshold for aquatic life use, the presence of insect families (Ephemeroptera, Plecoptera, Trichoptera) and genera commonly considered pollution sensitive at all of the sites above Brubaker Run indicate that this reach of Clearfield Creek is in recovery and could support a variety of fish species including brook trout.

*Figure 7. Aquatic insects collected from Clearfield Creek above Amsbry Bridge*



Figure 8. Sampling Locations, Stream Names, and AML Inventory Sites

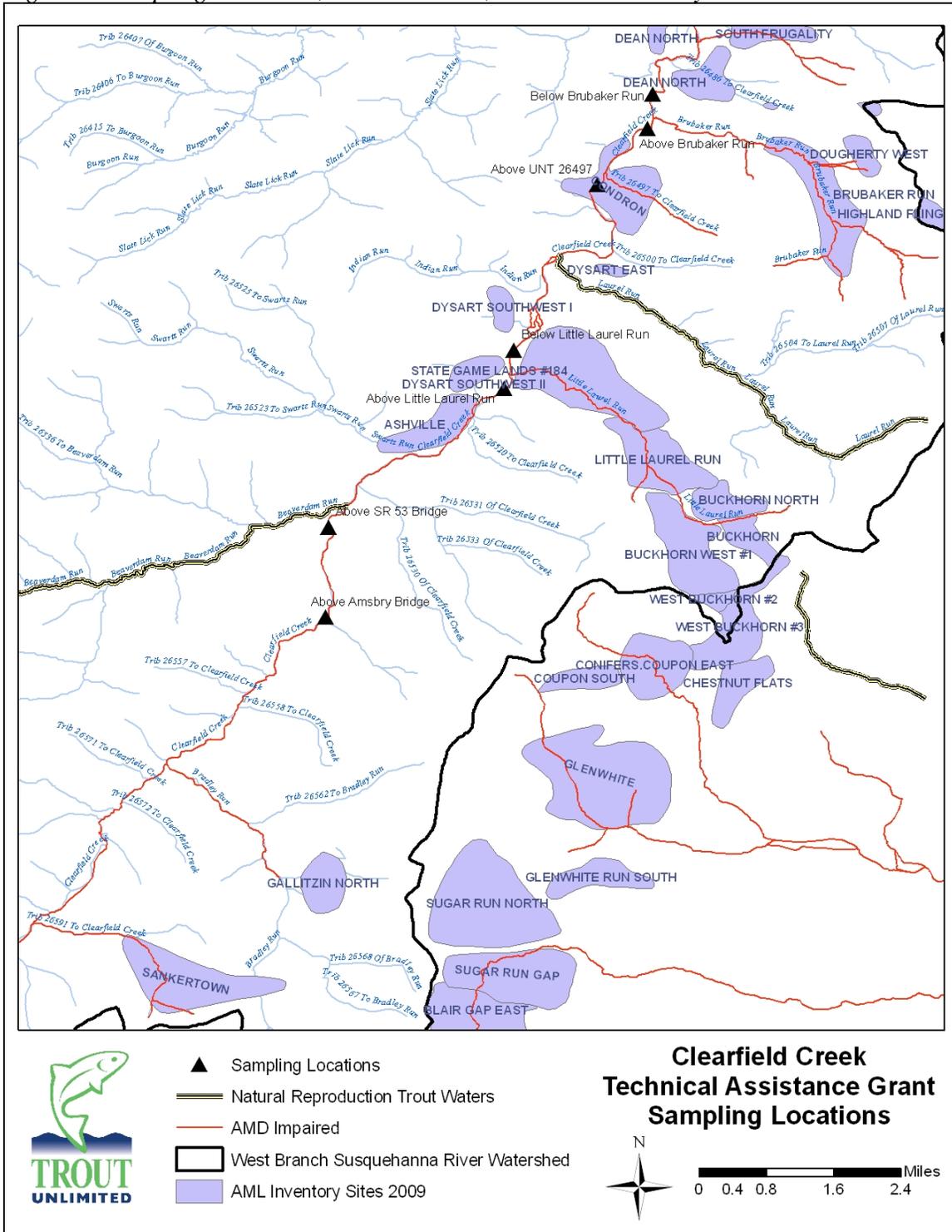


Figure 9. Habitat Evaluation

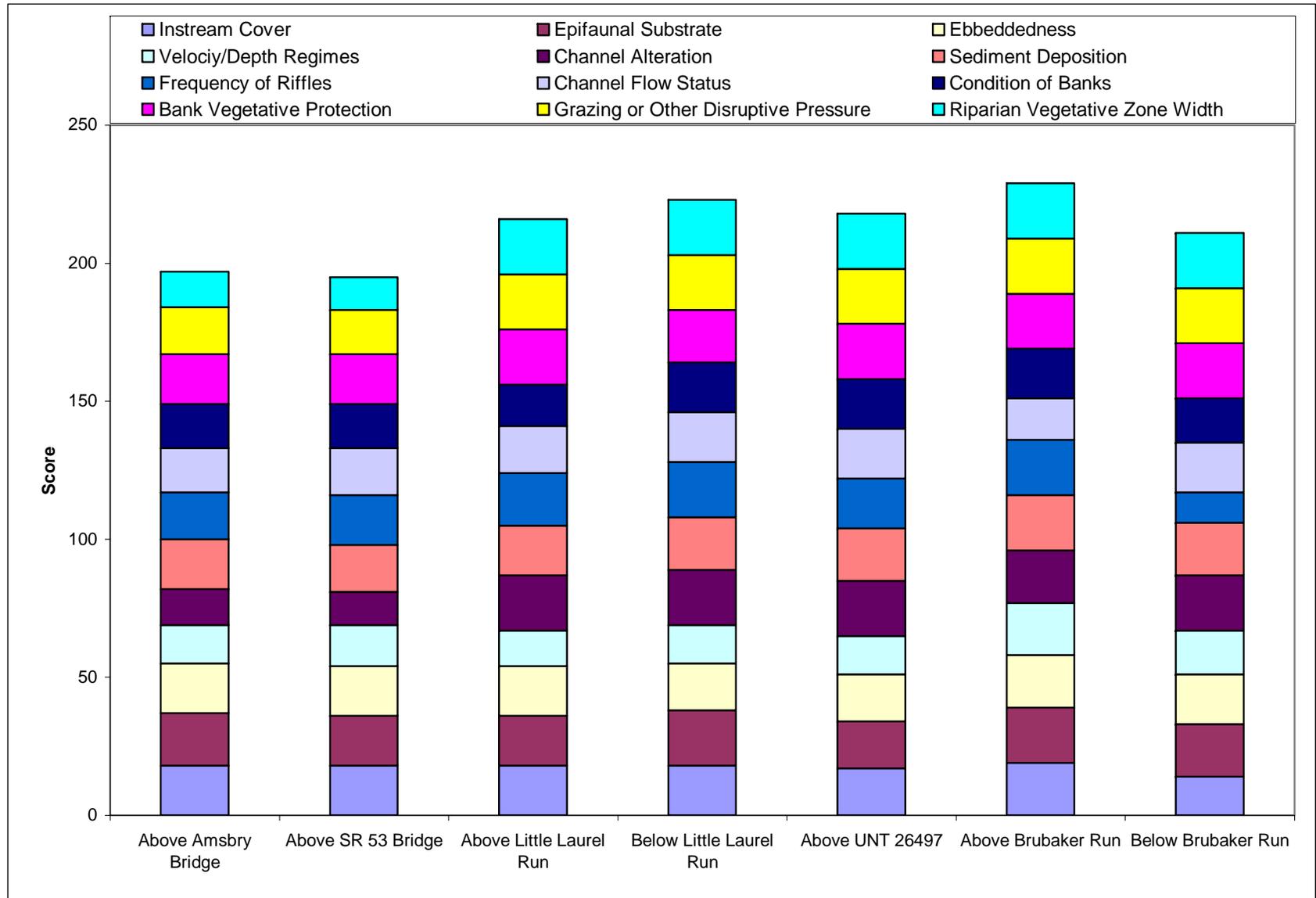


Figure 10. Total Benthic Macroinvertebrate Taxa

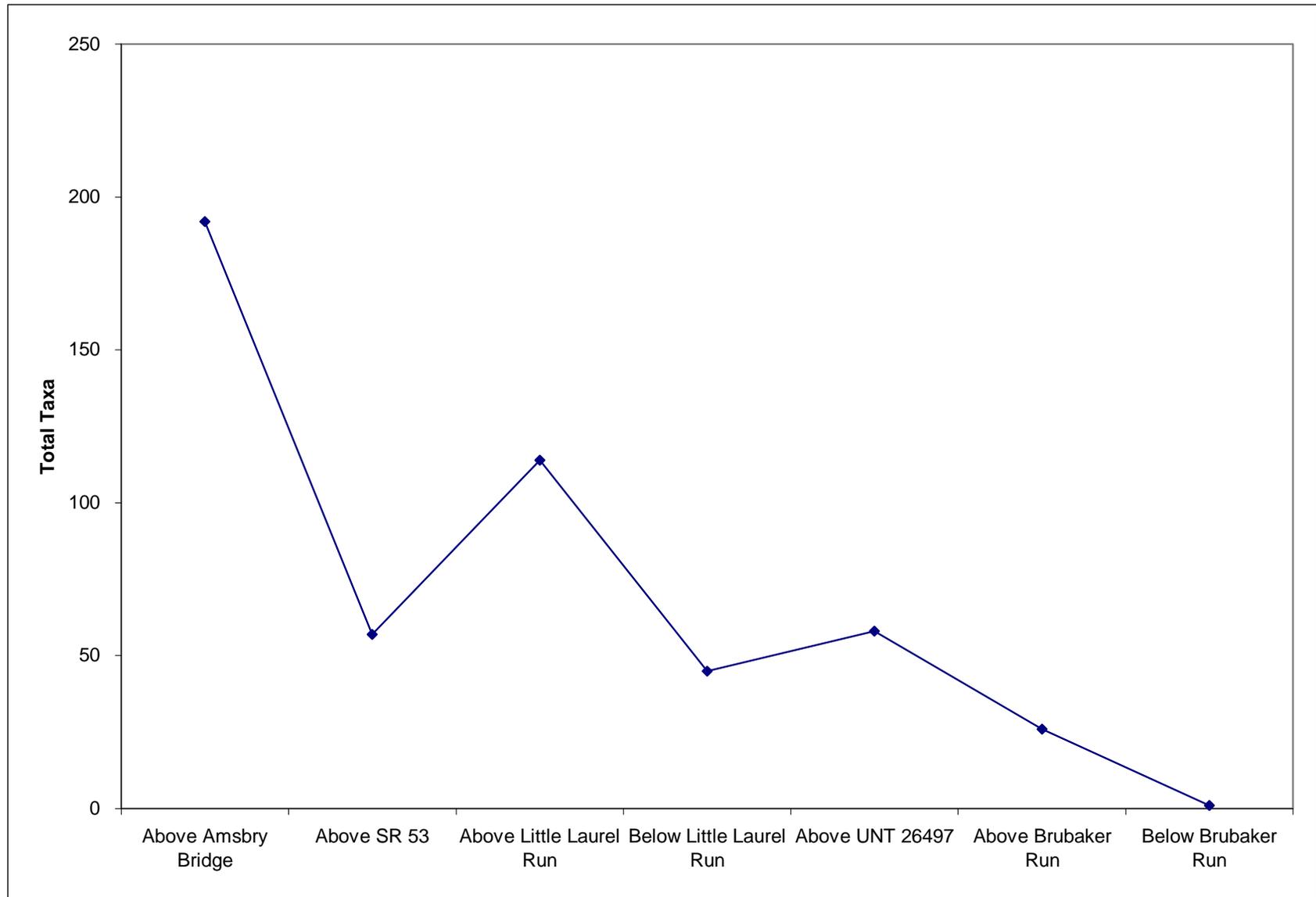


Figure 11. Benthic Macroinvertebrate Index of Biological Integrity Values

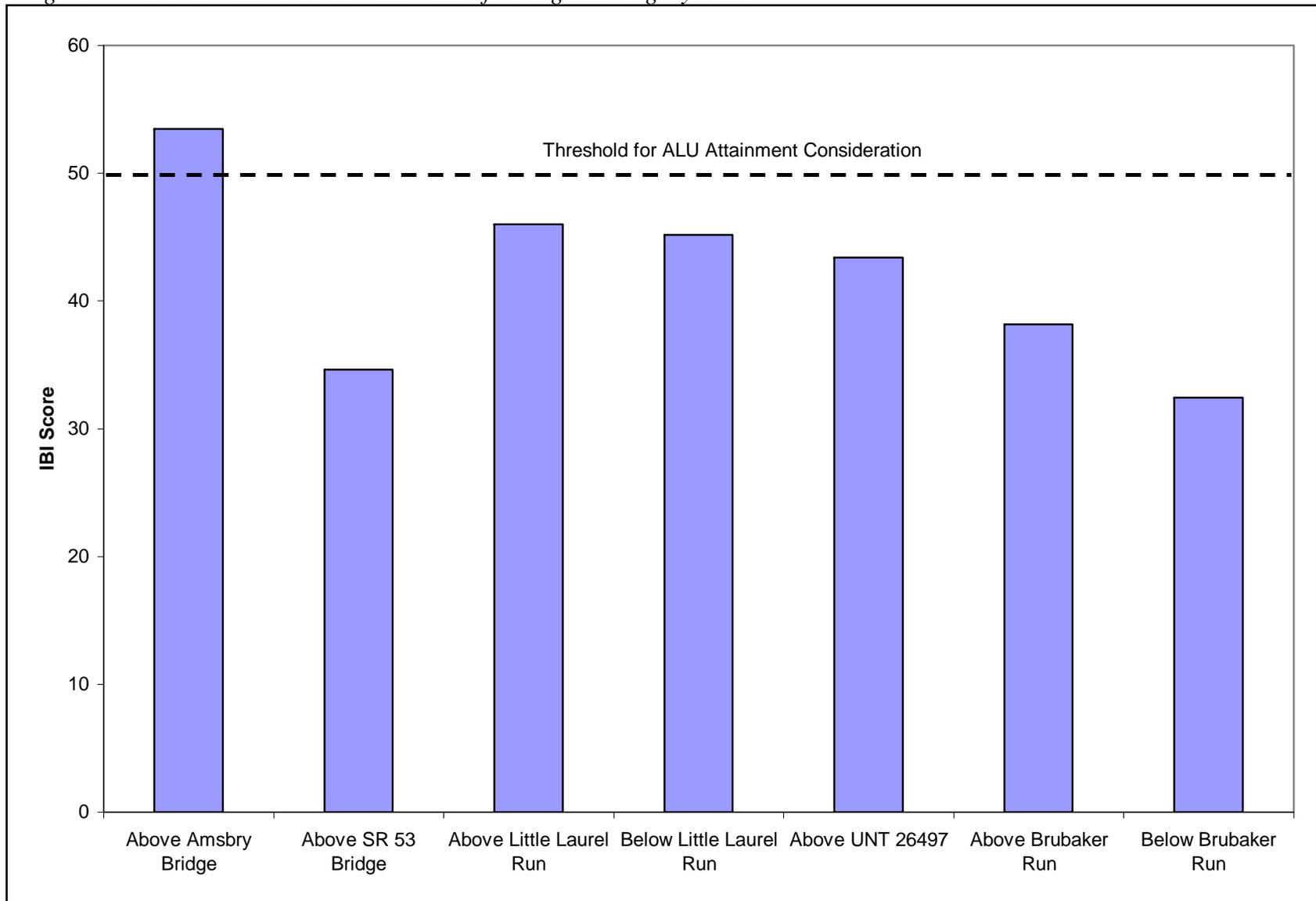


Figure 12. AMD Metals

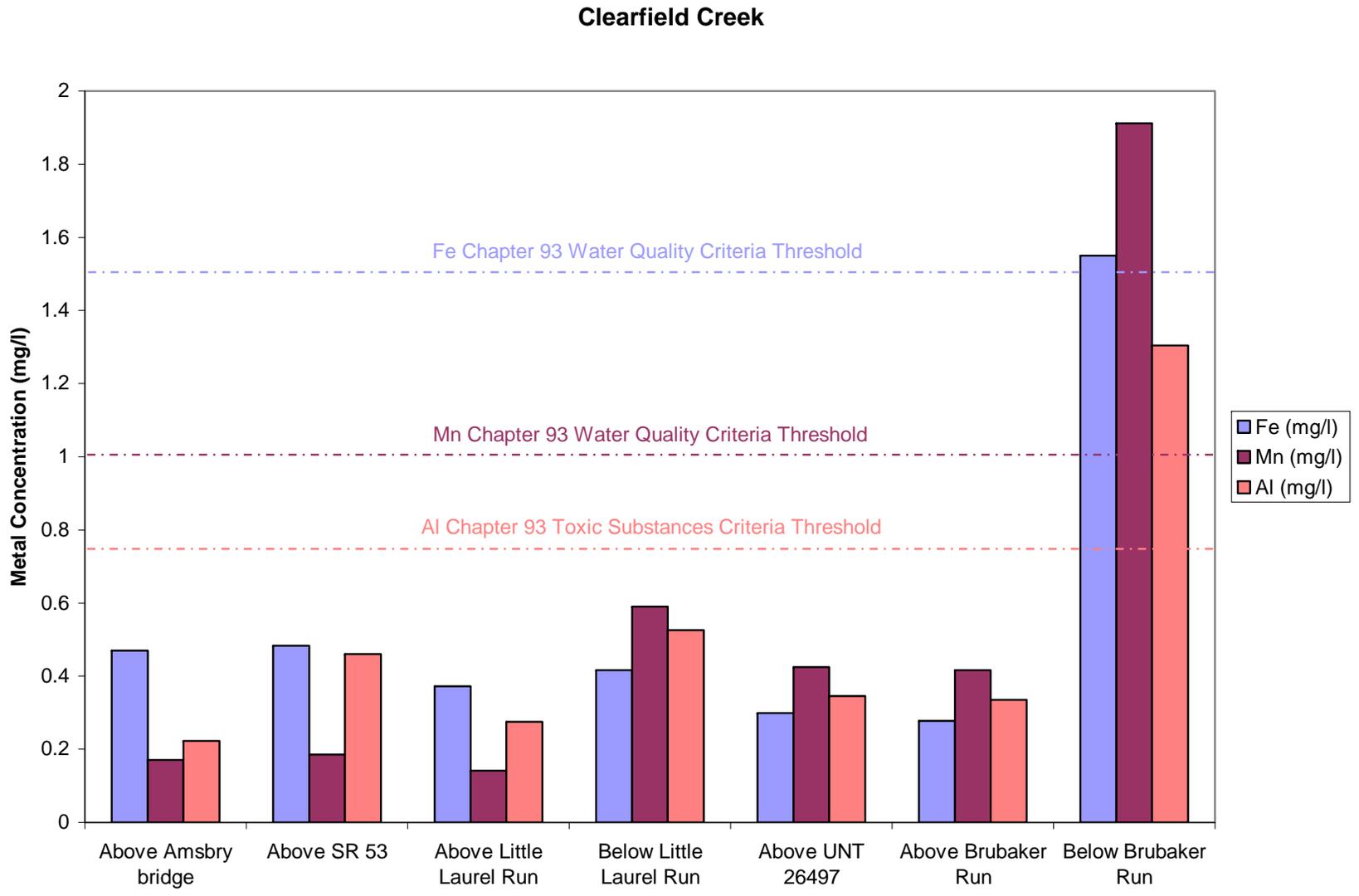


Table 17. Benthic Macroinvertebrate Taxa

Collection Date	Above Amsbry	Above SR 53	Above Little	Below Little	Above UNT 26497	Above Brubaker	Below Brubaker
	Bridge	12-18-2009	Laurel Run	Laurel Run	12-18-2009	Run	Run
Ephemeroptera							
Baetis sp.	9	0	0	0	0	0	0
Caenis sp.	0	0	0	4	25	6	0
Ephemera sp.	2	0	0	0	6	0	0
Ephemerella sp.	41	0	13	3	1	0	0
Eurylophella sp.	5	1	1	0	3	0	0
Heptageniidae	0	0	1	0	0	0	0
Isonychia sp.	0	0	1	0	0	1	0
Leptophlebia sp.	0	0	0	0	1	0	0
Maccaffertium sp.	3	0	2	4	4	5	0
Stenacron sp.	1	0	0	0	0	0	0
Plecoptera							
Allocapnia sp.	0	3	0	1	1	0	1
Capniidae	1	0	0	0	0	0	0
Leuctridae	1	0	0	0	0	0	0
Paracapnia sp.	2	0	0	0	0	0	0
Taenionema sp.	0	0	1	0	0	0	0
Taeniopteryx sp.	7	12	7	1	2	5	0
Coleoptera							
Optioservus sp.	9	1	6	1	0	0	0
Oulimnius sp.	1	3	0	0	1	0	0
Megaloptera							
Nigronia sp.	1	0	1	0	1	0	0
Sialis sp.	0	0	0	1	1	0	0
Diptera-Chironomidae							
Chironomidae	50	3	34	3	1	2	0
Diptera							
Antocha sp.	1	0	1	1	0	0	0
Atherix sp.	0	1	1	1	0	0	0
Bezzia/Palpomyia sp.	0	0	0	0	2	0	0
Hemerodromia sp.	0	0	0	0	1	0	0
Molophilus sp.	0	0	0	1	0	0	0
Simuliidae	1	0	0	0	0	0	0
Tipula sp.	0	0	0	1	0	0	0
Trichoptera							
Cheumatopsyche sp.	2	2	8	3	1	0	0
Hydropsyche sp.	44	12	29	15	2	5	0
Mystacides sp.	0	0	1	0	0	0	0
Pycnopsyche sp.	0	0	0	0	0	1	0
Rhyacophila sp.	0	0	0	2	0	0	0
Gastropoda							
Ferrissia sp.	1	0	0	0	0	0	0
Annelida							
Oligochaeta	3	17	4	3	5	1	0
Crustacea							
Caecidotea sp.	1	0	0	0	0	0	0
Crangonyx sp.	6	2	0	0	0	0	0
Other Organisms							
Nematoda	0	0	3	0	0	0	0
<b>TOTAL</b>	<b>192</b>	<b>57</b>	<b>114</b>	<b>45</b>	<b>58</b>	<b>26</b>	<b>1</b>

Table 18. Water Quality Concentrations and Loadings

		Above Amsbry 12/22/2009	Above SR 53 12/22/2009	Above Little Laurel Run 12/22/2009	Below Little Laurel Run 12/22/2009	Above UNT 26497 12/22/2009	Above Brubaker Run 12/22/2009	Below Brubaker Run 12/22/2009
FLOW	(gpm)	13195		26166	26795		34919	43222
pH	(field)	7.21	7.16	7.22	7.08	7.24	7.1	6.58
pH	(lab)	7.2	7.3	7.4	7.1	7.2	7.3	6.5
SPECIFIC CONDUCTANCE	(umhos/cm)	480	480	370	380	340	340	420
ACIDITY (CALCLATED)	(mg/l)	2.695809909	4.073921881	2.684346236	5.017671136	3.398964671	3.277156008	14.30467502
ACIDITY (HOT)	(mg/l)	-16	7.4	-15.4	-8.2	-1	-10.8	4.6
NET ACIDITY (CALCULATED)	(mg/l)	-45.4	-15	-41.6	-28.8	-18.2	-31.8	-3.6
TOTAL ALKALINITY	(mg/l)	29.4	22.4	26.2	20.6	17.2	21	8.2
TOTAL ALUMINUM	(mg/l)	0.223	0.46	0.275	0.526	0.346	0.335	1.305
TOTAL Fe	(mg/l)	0.47	0.483	0.372	0.417	0.299	0.278	1.55
FERROUS Fe+2	(mg/l)	0.13	0.13	0.11	0.11	0.11	0.1	0.66
FERRIC Fe+3	(mg/l)	0.34	0.353	0.262	0.307	0.189	0.178	0.89
TOTAL Fe+3	(mg/l)	0.34	0.353	0.262	0.307	0.189	0.178	0.89
TOTAL Mn	(mg/l)	0.171	0.186	0.141	0.59	0.424	0.417	1.912
TOTAL Ca	(mg/l)	28.1	28.1	24.8	24.6	21.1	24.1	28.5
TOTAL Sulfates	(mg/l)	63.2	75.9	60.4	69	60.3	67	104.4
SUSPENDE SOLIDS	(mg/l)	6	14	6	14	8	6	12
ACID LOADING	(lbs/day)	-2537.6624	--	-4843.53593	-2641.02238	--	-4533.0449	2389.830824
Fe LOADING	(lbs/day)	74.543833	--	116.999699	134.3056503	--	116.6839336	805.269082
Mn LOADING	(lbs/day)	27.1212669	--	44.34666012	190.024781	--	175.0259005	993.3383773
Al LOADING	(lbs/day)	35.3686697	--	86.491713	169.4119234	--	140.6083373	677.9846142
TDS	(mg/l)	258	246	206	192	100	200	246
HARDNESS	(mg/l)	106	108	95	96	86	95	124
TOTAL Mg	(mg/l)	8.73	9.16	8.12	8.43	7.91	8.43	12.9



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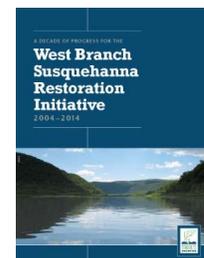
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