Laurel Hill Creek Macroinvertebrate Survey 2008-2009

Prepared by: Somerset Conservation District

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INTRODUCTION

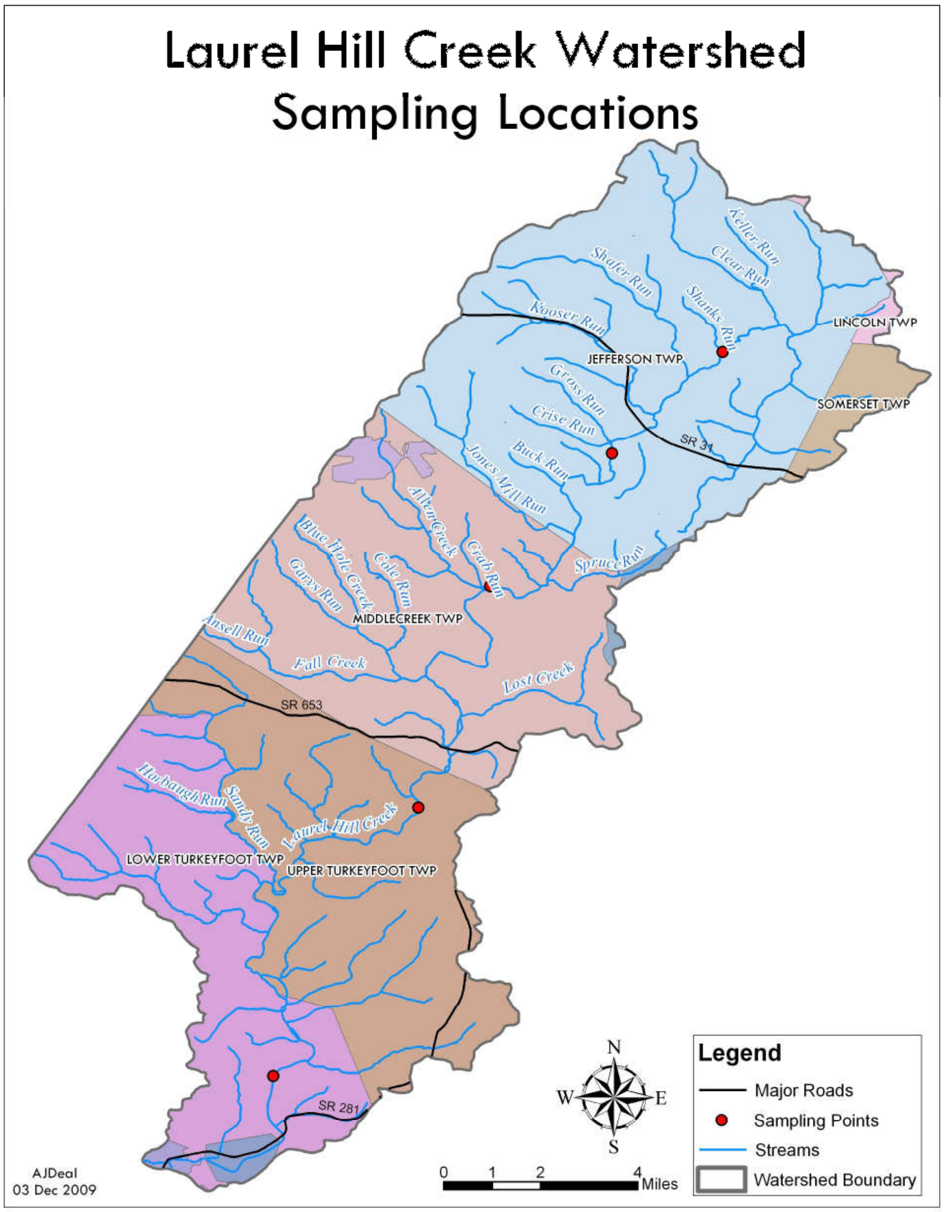
Laurel Hill Creek is a third order tributary of the Casselman River located in Somerset County, Pennsylvania. Laurel Hill Creek originates 3.2 kilometers (2 miles) west of the village of Lavansville, from its origin on the on the Laurel ridge the stream flows 61km (38 miles) south to its confluence with the Casselman River in the town of Confluence, Pennsylvania. Laurel Hill Creek flows through a low gradient meadow like area in its headwaters, then increases gradient as it flows south until it reaches the Whipkey Dam area, where its gradient lessens. The land use around the stream is diverse, form agriculture, stone quarries, and recreational to resort complexes. Somerset Borough receives the majority of its water supply from the stream while two major resorts are located along the stream's upper section, Seven Springs and Hidden Valley. These resorts have a large demand for water not only because of their size and populations, but also to produce snow for the ski season. There are two state parks in the watershed, Kooser and Laurel Hill. Laurel Hill Creek has two special regulation delayed harvest trout project areas and are stocked annually by the Pennsylvania Fish and Boat Commission. Some of the small tributaries in the watershed harbor wild reproducing brook trout populations. Tourism is very popular in the watershed due to resorts, parks, angling, hunting, and proximity to other destination points such as Ohiopyle State Park and well known landmarks such as the Frank Lloyd Wright designed Falling Water.

Recently it has been observed that the volume of water flowing down Laurel Hill Creek has diminished. In its lower reaches large islands of grass have emerged in the last six years. With this concern for the welfare of the watershed Chestnut Ridge Chapter of Trout Unlimited, Pennsylvania Department of Environmental Protection, United States Geological Survey (USGS), and the Somerset Conservation District initiated a Water Resource Management Plan project for the watershed to assess if water withdraw was the cause of the limited flows in the stream and to attain baseline data to monitor the stream's biological and physical condition. USGS surveyed wells, in stream flows, habitat, and withdraws from the watershed to determine if the stream was in jeopardy of major impacts due to dewatering. The Somerset Conservation District performed the task of sampling benthic macroinvertebrates and designing a monitoring protocol sensitive enough to detect macroinvertebrate community changes due to falling water levels.

METHODS

Benthic macroinvertebrates were sampled in the fall of 2007 at three sites and spring of 2008 at five sites. The spring sampling was used to assess summer and fall emerging macroinvertebrates while the fall sampling will assess the winter and early spring emerging macroinvertebrates (Linke et. al. 1999). Macroinvertebrate samples were collected using a 0.30 x 0.30m Suber Sampler (Washington, Knaggs 1996). Five sub samples were taken from across riffle areas within each site. The five sub samples were pooled as one sample. Macroinvertebrates will be preserved in the field with 70% isopropyl alcohol and taken to the Somerset Conservation District Office for enumeration and identification to the lowest taxonomic level practicable (usually genus level) (Klemm et.al. 1990). The macroinvertebrates were identified to the lowest taxonomic level practicable by using identification keys by Merritt, Cummings (1996) and Peckarsky (1990). The data from the sites were assessed using multiple metrics to determine the baseline macroinvertebrate community structure. The Shannon-Weaver (S-W) mean diversity index was used to assess the diversity of taxa in each site. The diversity metric measures the occurrence of total taxa and the distribution of the taxa. When diversity scores are low this indicates that the site in dominated by only a few taxa. The Hilsenhoff Biotic Index (HBI) will assess organic loading impacts by assigning an organic tolerance score to each taxon. The organic tolerance scores will be attained at the genus level from the EPA Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters. Scores were attained by adding tolerance levels for all species listed in each genus the acquiring an average tolerance for the genus. Genuses that were not listed were assumed to have an average tolerance of three. These scores are then multiplied by the total number of taxa found in the site. This number is then divided by the total number of organisms found in the sample. This calculation is carried out for each taxa and the results are added together to obtain the HBI score. HBI scores lower than 1.75 indicate excellent water quality, scores in the 1.76-2.5 range indicate good water quality, scores in the 2.51-3.75 range indicate fair water quality a score above 3.75 indicates substantial organic loading impacts. Percent Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddis flies) (EPT) index was used to detect acidification and organic loading, the lower the percent composition of EPT taxa the more likely the water has sustained a pollution impact. Other metrics that were used are percent dominant taxa, species richness, percent acid tolerant taxa, and total individuals collected per site. The percent dominant taxa measure the percentage composition of the most collected individual taxa in a site. The higher the percent composition of the dominant taxa the lower the site's diversity will fall. Species richness is the number of taxa collected from each site. The more taxa collected the healthier the stream. The percent of acid tolerant taxa assess the percentage of macroinvertebrates in a site that are tolerant to acidic pollution. The percent composition of acid tolerant and acid intolerant individuals was derived from the Kelmm at. al. 1990 by identifying acid tolerant and intolerant individuals that were listed in the manual. Hydropsyche and Cheumatopsyche genus were also included as tolerant taxa because of their use in determining mild acid and organic impacts (Barbour et. al. 1999 and Stribling et. al. 1998). When these taxa dominate the sample it indicates that acidic conditions are present. Benthic macroinvertebrate sampling sites are located in Figure 1.

Figure 1: Laurel Hill Creek Sampling Sites



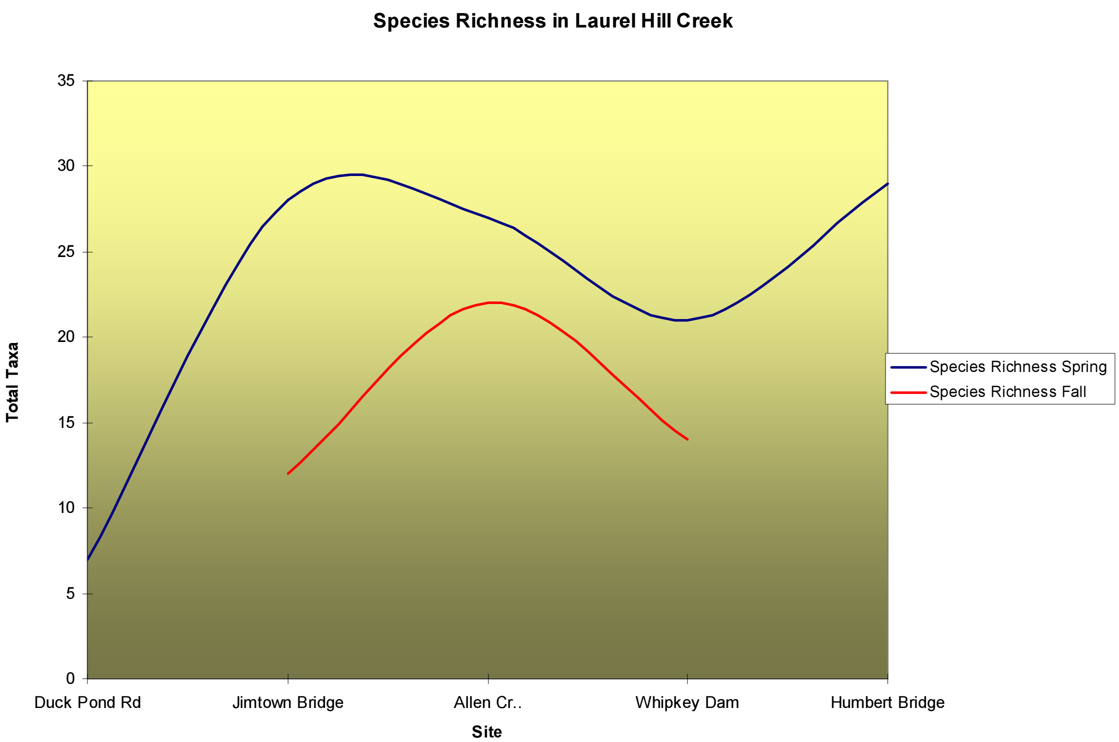
RESULTS

In the spring sampling of Laurel Hill Creek five sites were sampled, but in the fall sampling only three sites were sampled. In addition to the three fall sites; Jim Town Road, below the confluence of Allen Run, and Whipkey Dam were also sampled in the spring sampling. The two sites added in the spring were to extend the survey up and downstream. The two sites added were the Humbert and Duck Pond Road sites. Since all sites were not sampled in the fall the comparisons of data will be made with the spring samples. However, the fall data is included and will be discussed for the three sites sampled. The scores for all metrics are located in Appendix A. A list of all taxa collected is contained in Appendix B.

Species Richness

All sites sampled exhibited excellent species richness in the spring sampling except for the Duck Pond Road site. This site contained only seven taxa and was severely impacted by erosion and siltation. The fall sampling produced fewer taxa but the sites sampled were still taxa rich. The results for all sites sampled in both seasons are located in Figure 1.

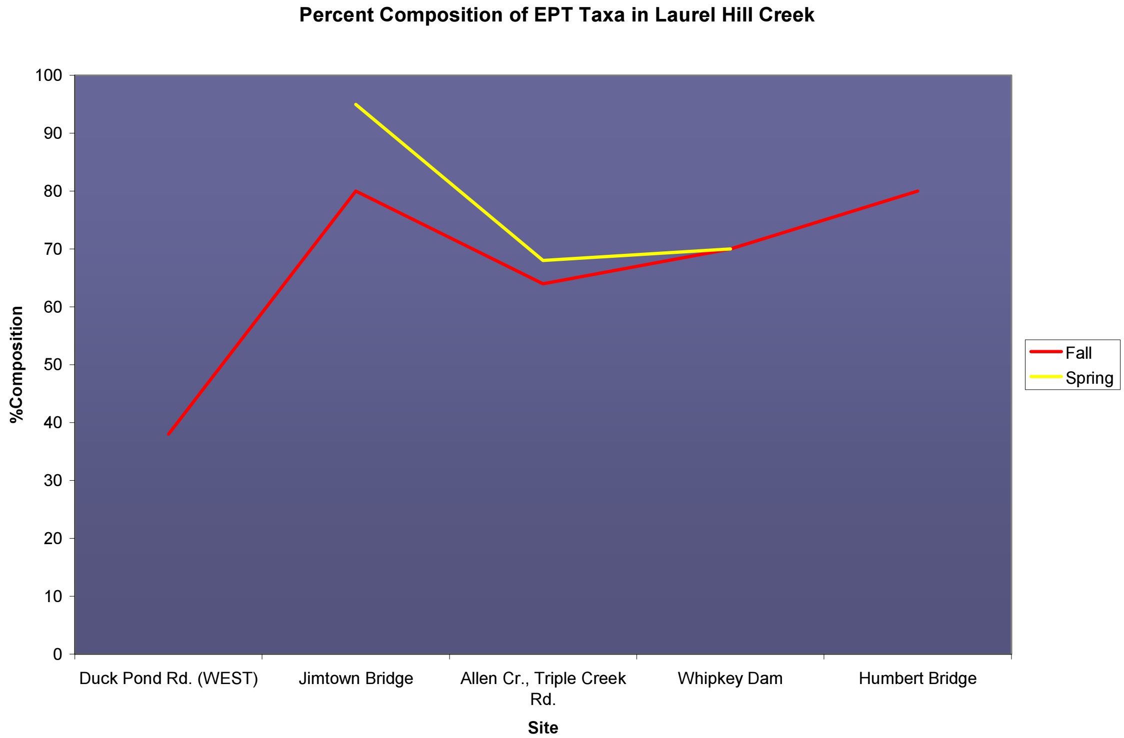
Figure 1: Species Richness of Laurel Hill Creek



Percent EPT Taxa

All sites except for the Duck Pond Road site contained macroinvertebrate communities dominated by EPT taxa in both spring and fall samplings. The results for the percent composition of EPT taxa are located in Figure 2.

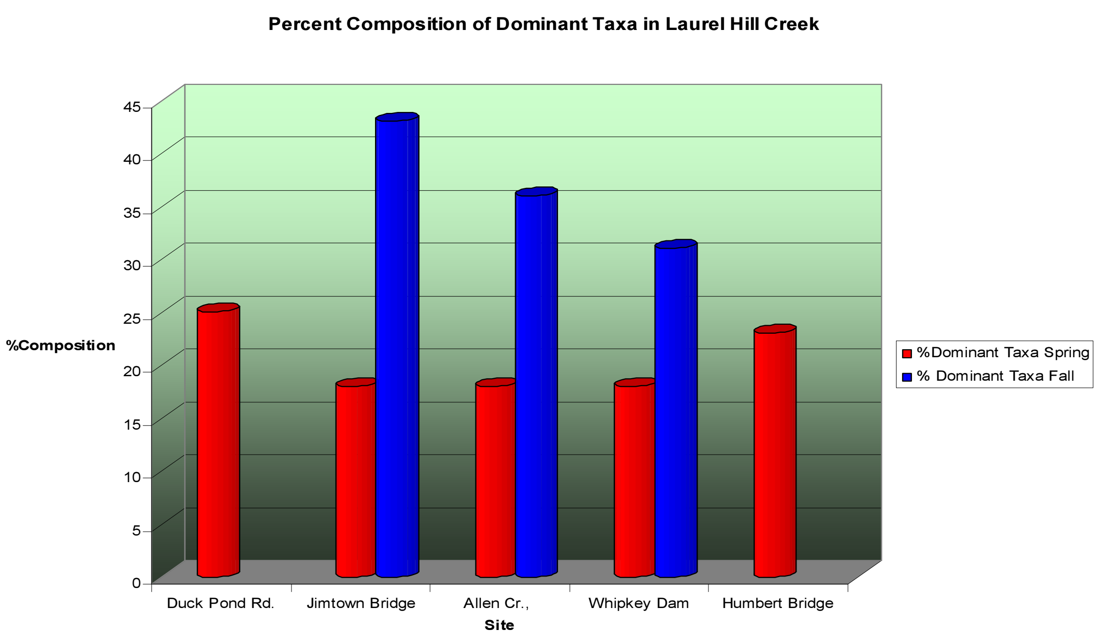
Figure 2: Percent Composition of EPT Taxa in Laurel Hill Creek



Percent Composition of Dominant Taxa

All sites exhibited a balanced diversity between taxa with the exception of the Jim town Road site in the fall sampling due to a large population of *Hydropsyche spp*. The results for the percent composition of the dominant taxa are located in Figure 3.

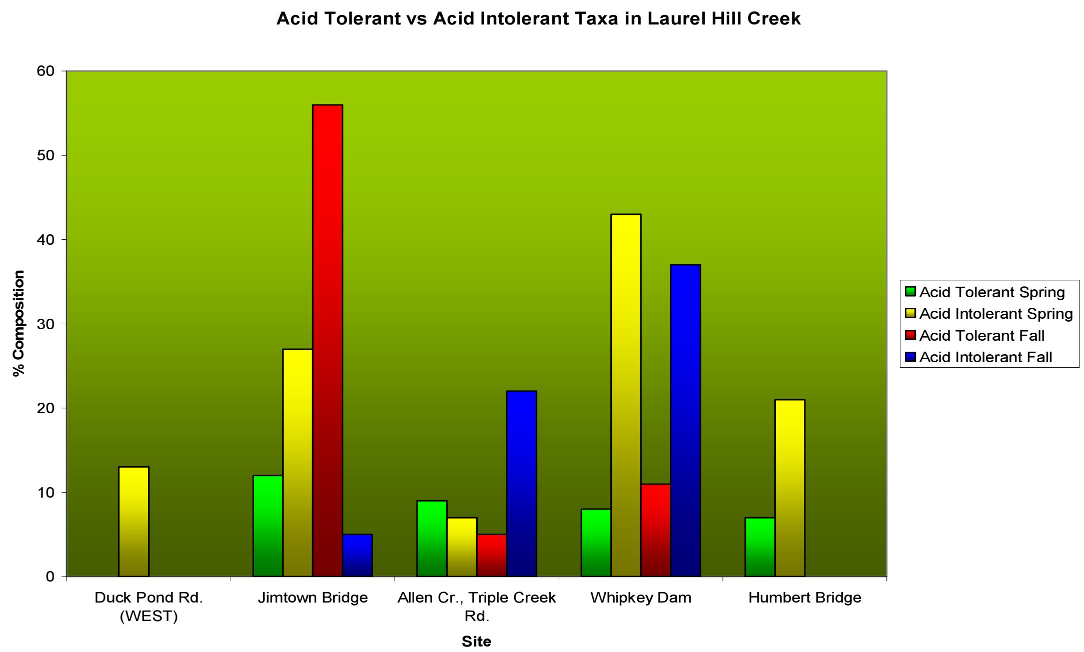
Figure 3: Percent Composition of the Dominant Taxa on Laurel Hill Creek



Percent acid tolerant vs. acid intolerant taxa

There were no sites that were dominated by acid tolerant taxa except Jim Town Road in the fall. This site was dominated by acid and organic tolerant caddis species. The percentages of acid tolerant taxa vs. acid intolerant taxa are located on Figure 4.

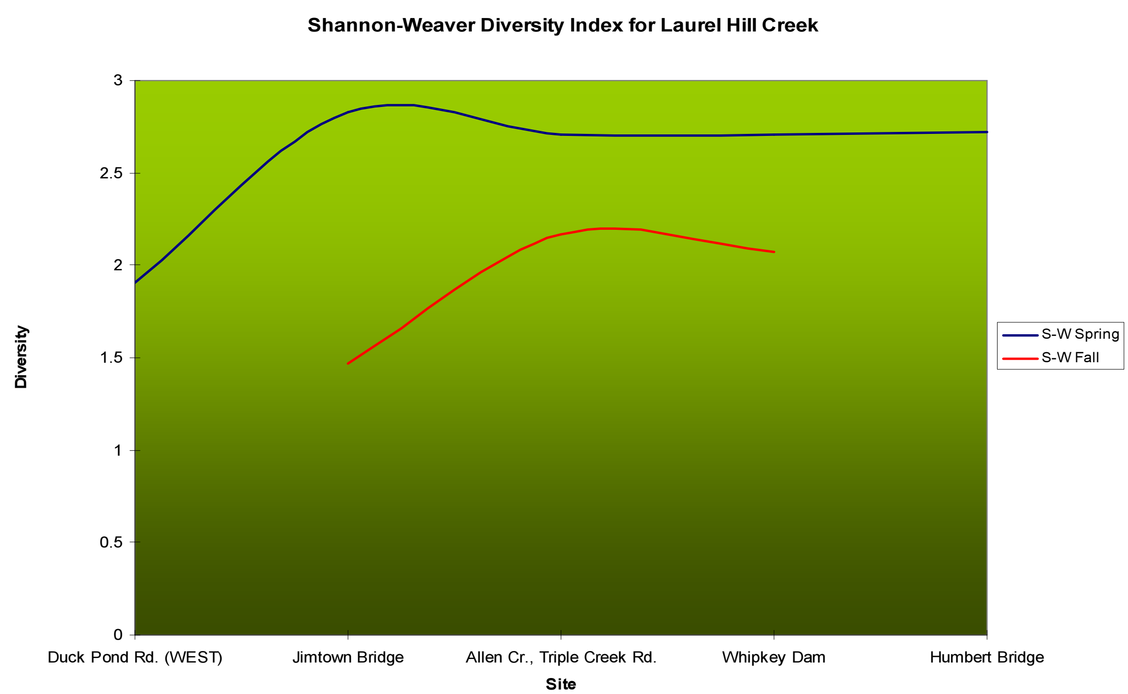
Figure 4: Acid tolerant vs. acid intolerant taxa in Laurel Hill Creek



Shannon-Weaver Mean Diversity Index

In the spring sampling Duck Pond Road exhibited the lowest diversity. Jim Town Road possessed the lowest diversity in the fall sampling. The results for the diversity index are located in Figure 5.

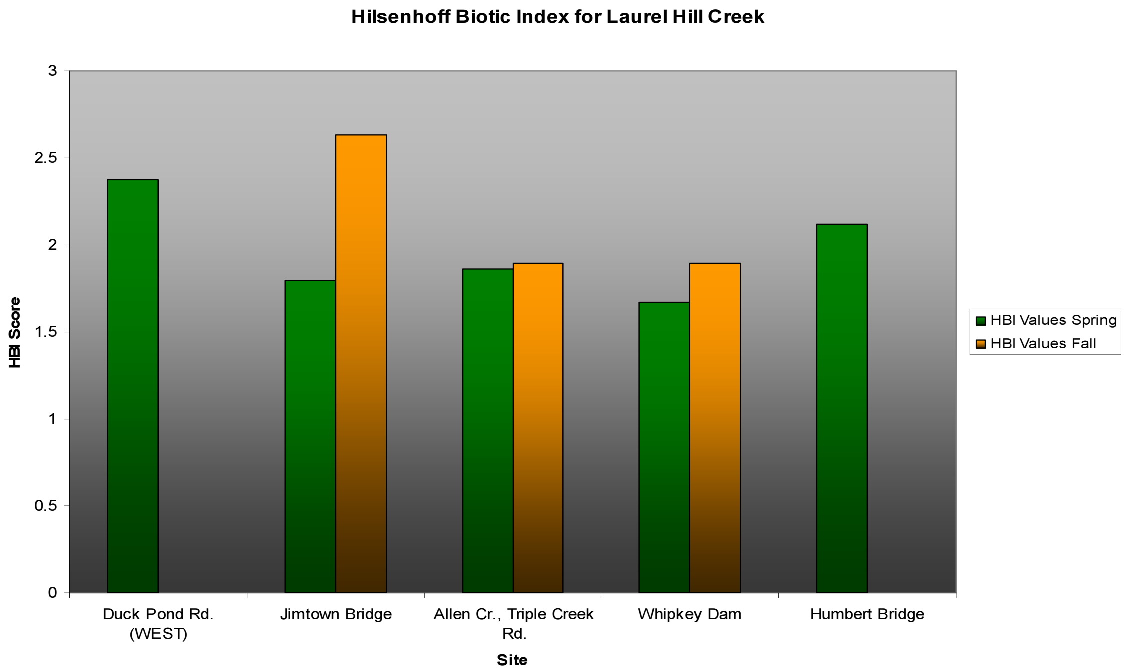
Figure 5: Shannon-Weaver Mean Diversity Index for Laurel Hill Creek



Hilsenhoff Biotic Index

The highest HBI scores were located on Duck Pond Road in the spring sampling and Jim Town Road in the fall. All HBI scores are contained in Figure 6.

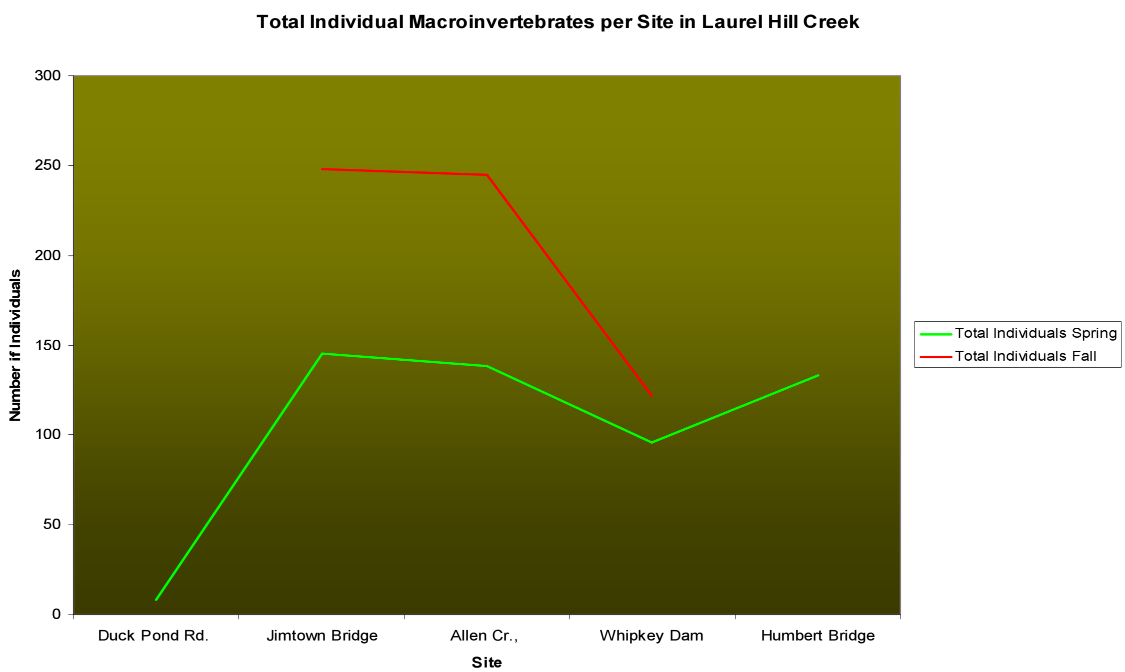
Figure 6: HBI values for Laurel Hill Creek



Total Individuals per Site

Duck Pond Road exhibited a very low number of total individuals, while the remainder of the stream exhibited high numbers of individuals. The results for the total individuals at each site are located in Figure 7.

Figure 7: Total individuals per site in Laurel Hill Creek



DISCUSSION / RECOMMEDATIONS

Overall Laurel Hill Creek is a thriving stream with a rich macroinvertebrate population. The Duck Pond Road site was the lowest rated site in the creek. This site is severely impacted by erosion and sedimentation. Jim Town Road also shows signs of being impacted by erosion and sedimentation, but nowhere near as impacted as Duck Pond Road. If the banks are stabilized in this area and some in stream flow features are installed these sections would recover quickly and mirror the downstream sites' communities. The downstream sites all have exceptional macroinvertebrate communities, while the fall sampling yielded far fewer taxa this can be attributed to the emergence time of the majority of taxa being spring and summer. Laurel Hill Creek contains no macroinvertebrate evidence of mining impacts.

Expected Outcomes of Dewatering on the Macroinvertebrate Communities

The amount of water that is presently being withdrawn is not impacting macroinvertebrate life within the stream. While water levels have fallen the macroinvertebrate community remains very diverse and composed primarily of pollution intolerant taxa. In some areas of the stream reports of increase in black fly species have been reported. This can be attributed to the increase in aquatic vegetation caused by slower stream flow velocities resulting from a decrease in water. In the sites sampled the macroinvertebrate communities remain intact. The creek is presently at withdrawal capacity. If more water is withdrawn from the creek adverse effects on the macroinvertebrate communities will be seen. The effects of lower water levels will further decrease flow, which will decrease oxygen and increase temperature. The reduction of in stream flow will also reduce the amount of substrate that can be colonized. Reduced flows, oxygen, and increased temperatures will promote aquatic plant growth. The expected outcomes that will be seen in the macroinvertebrate community will be an increase in swimming mayfly taxa (*Baetis spp*.) and black fly taxa, a decrease in total taxa, there will be an increase in percent composition of dominant taxa, and diversity will be much lower. The HBI values will rise while the total individuals will remain the same or increase slightly. These effects are measurable and can be used to assess withdrawal impacts with in the watershed.

LITERATURE CITED

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APPENDIX A

Spring Sampling 2009

Site	Species Richness	Percent EPT	Percent Dominant Taxa	Total Individuals	Acid Tolerant vs. Acid Intolerant		Shannon-Weaver	HBI
Duck Pond Road	7	38	25	8	0%	13%	1.906	2.38
Jimtown Road	28	80	18	145	12%	27%	2.827	1.79
Below Allen Run	27	64	18	138	9%	7%	2.71	1.86
Whipkey Dam	21	70	18	96	8%	43%	2.71	1.67
Humbert	29	80	23	133	7%	21%	2.72	2.12

Fall 2008 Sampling

Site	Species Richness	Percent EPT	Percent Dominant Taxa	Total Individuals	Acid Tolerant vs. Acid Intolerant		Shannon-Weaver	HBI
Jimtown Road	12	95	43	248	56%	5%	1.47	2.63
Below Allen Run	22	68	36	245	5%	22%	2.17	1.896
Whipkey Dam	14	70	31	122	11%	37%	2.07	1.893

Laurel Hill Fall 2008

Appendix B

0rder	Family	*Genus*	Allen Run	Whipkey Dam	Jimtown Road
Ephemeroptera	Heptageniidae	*Stenonema*	47	30	6
		Stenacron	1		
	Isonychidae	*Isonychia*	6	38	
Plecoptera	Taeniopterygidae	*Taeniopteryx*	89	1	79
	Perlidae	*Acroneuria*		2	
	Chloroperlidae	*Suwallia*			7
	Capniidae	*Allocapnia*	3		
Trichoptera	Hydropsychidae	*Hydropsyche*	9	6	106
		Cheumatopsyche	3	7	34
	Brachycentridae	*Brachycentrus*	7		
	Polycentropodi-dae	*Polycentropus*	1		
	Phyganeidae	*Ptilostomis*	3		
	Philopotamidae	*Chimarra*		1	
Anisoptera	Aesheidae	*Boyeria*	1		
	Gomphidae	*Stylogomphus*	1		
Coleoptera	Elmidae	*Stenelmis*	24	5	
		Microcylloepus	12		
		Optioservus	3	8	1
	Psephenidae	*Psephenus*	2	7	
Odonata	Gomphus	*Stylogomphus*			
	Aesheidae	*Boyeria*	*1*		
Megaloptera	Corydalidae	*Nigronia*	2	1	
	Sialidae	*Sialis*	2		
Diptera	Chironomidae		14	7	7
	Tipulidae	*Antocha*	4	7	
	Ancylidae	*Ferrissia*	11		
	Sphaeriidae	*Pisidium*	1		1
		Sphaerium	2		2
Decapoda	Cambarridae			2	1
Tubificida					2

Laurel Hill
Spring 2009

Order	Family	*Genus*	Duck-pond Road	Jim-town Road	Allen Run	Whip-key	Hum-bert
Ephemeroptera	Heptageniidae	*Stenonema*		16	6	17	17
		Heptagenia		1		2	
		Epeorus		4			7
		Stenacron					4
	Baetidae	*Baetis*	1	5	5	4	16
		Acentrella			3	4	31
		Centroptilum			5		1
		Cloeon					1
	Ephemerellidae	*Ephemerella*		2	1	9	3
		Dannella			1		
		Drunella					3
		Eurylophella		3			
	Isonychidae	*Isonychia*				4	1
	Neoephemeridae	*Neoephemera*					1
Plecoptera	Perlidae	*Acroneuria*	1	7	6	2	3
		Agentina			2	1	4
		Neoperla		1			
		Dioperla		1			
		Eccoptura		2			1
		Paragentina					1
	Leuctridae	*Leuctra*		5	24	10	
		Paraleuctra				1	
	Nemouridae	*Amphinemura*		3	1		
	Perlodidae	*Helopicus*					1
		Remenus			1		
	Capniidae	*Allocapneia*					
		Paracapneia					
		Capneia	1	8	9		4
	Pteronarcyidae	*Pteronarcys*					
Trichoptera	Hydropsychidae	*Hydropsyche*		9	2	7	2
		Cheumatopsyche		7	9		3
		Diplectrona					
	Brachycentridae	*Brachycentrus*			2	3	1
		Micrasema					
	Polycentropodidae	*Polycentropus*		1			1
		Cyrnellus		14			
	Philopotomidae	*Dolophilodes*		26	10	2	
	Uenoidae	*Neophylax*		1			
	Rhyacophilidae	*Rhyacophila*		1		1	

Appendix B Continued

Order	Family	*Genus*	Duck-pond Road	Jimtown Road	Allen Run	Whip-key	Hum-bert
Coleoptera	Psephenidae	*Psephenus*	1			2	10
	Elmidae	*Stenelmis*			1		
		Dubiraphia		1			
		Microcylloepus			2		
		Optioservus			1	2	
Odonata	Gomphus	*Stylogomphus*				2	
Megaloptera	Corydalidae	*Nigronia*		9		2	1
		Neoherrmes			2		
Diptera	Chironomidae		1	3	25	10	6
	Simulidae	*Simulium*	2	9	13	3	2
	Tipulidae	*Antocha*				8	5
Isopoda	Caecidotea		1				
Tubificida					2		2
Decapoda	Cambarridae			1	2		1
Amphipoda	Gammaridae	Gammarus		5			
Bivalvia	Sphaeriidae	*Pisidium*			1		
		Sphaerium			1		