COMMONWEALTH OF PENNSYLVANIA
Department of Environmental Protection
August 23, 2011

SUBJECT: Aquatic Biological Investigation
Laurel Lake Creek (DEP Stream File #31899)
Silver Lake Twp., Susquehanna County

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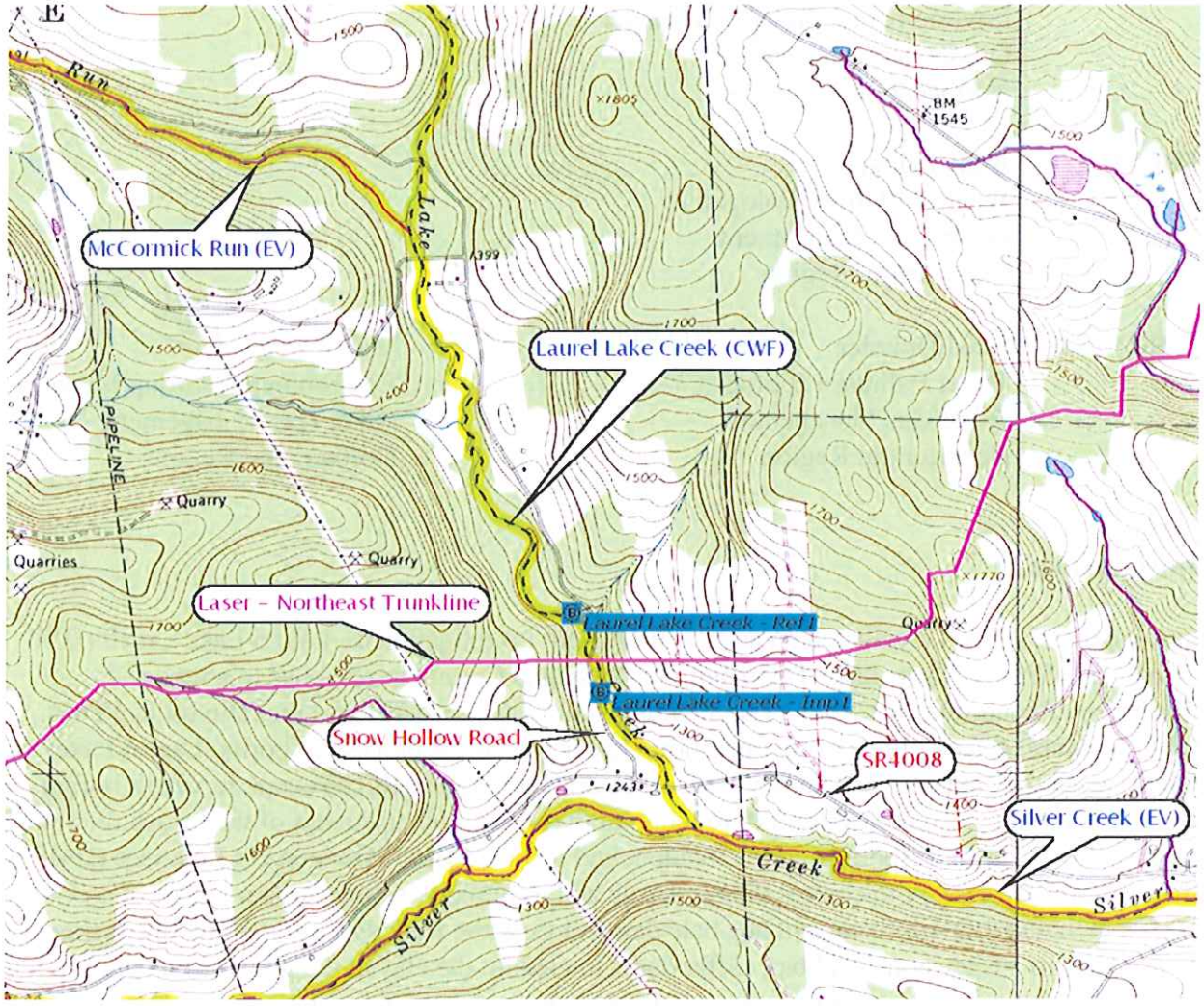
Introduction

On August 9, 2011, I conducted an aquatic biological investigation on Laurel Lake Creek (DEP Stream #31899) in Silver Lake Township, Susquehanna County in response to a reported discharge of bentonite clay from a Laser Midstream, LLC (Laser) Horizontal Directional Drill (HDD) natural gas pipeline boring operation. Laser was in the process of boring Laurel Lake Creek when they experienced an Inadvertent Return To Surface (IRTS) event, in which boring fluids (bentonite clay and water mixture) entered the stream just upstream of the bridge on Snow Hollow Road. Laser responded to the incident and installed Best Management Practices (BMPs) they felt were necessary to control the discharge and minimize its downstream extent. Laser's BMPs included four silt fence and hay bale dams to slow the flow down and allow the sediments to drop out of suspension, sand bag coffer dams to contain the clay at the point of the IRTS, and a coffer dam and pipe flume setup designed to divert the majority of stream flow and bypass the IRTS location. The purpose of this survey was to quantify any biological effects the discharge may have had on the receiving stream and downstream reaches.

Study Area

Laurel Lake Creek is a third order perennial stream draining approximately 7.2 square miles. The location of the IRTS is approximately 50 feet upstream of the bridge on Snow Hollow Road where it crosses Laurel Lake Creek. The approximate coordinates for this location are N 41° 55' 14.09", W 75° 53' 36.28".

Figure 1. Site Map and Sampling Locations on Laurel Lake Creek (Stream File #31899). Silver Lake Township, Susquehanna County. August 9, 2011.



Laurel Lake Creek empties into Silver Creek near the junction of Snow Hollow Road and SR4008, which then flows into Snake Creek at the town of Franklin Forks. The majority of the Silver Creek watershed was recently upgraded to Exceptional Value (EV) and placed on the DEP Statewide Existing Use List. Laurel Lake Creek is one of the exceptions to this aquatic life use change and is still listed in 25 PA Code §93.I as a Cold Water Fishery (CWF) under the basin designation of Snake Creek. In the Laurel Lake Creek watershed, one tributary, McCormick

Run, was upgraded to EV. Laurel Lake Creek, along with downstream reaches of Silver Creek, are known to support naturally reproducing trout populations (aka wild trout) and are listed by the PA Fish & Boat Commission (PFBC) as such.

Sampling Methods

The purpose of this investigation was to document potential impacts to the aquatic community as a result of the IRTS discharge. Two sampling sites were selected on Laurel Lake Creek (Figure 1, Table 1) to bracket the IRTS discharge location (Figure 1).

Table 1. Station locations on Laurel Lake Creek (Stream File #31899). Silver Lake Township, Susquehanna County. August 9, 2011.

Station	Location
Ref-1	Laurel Lake Creek – Reference Site. The site was approximately 620 feet upstream of the Snow Hollow Road bridge and approximately 570 feet upstream of the IRTS discharge location. Lat/Lon: N 41° 55' 18.68", W 75° 53' 37.79"
Imp-1	Laurel Lake Creek – Study Site. The site was approximately 480 feet downstream of the Snow Hollow Road bridge and approximately 530 feet downstream of the IRTS discharge location. Lat/Lon: N 41° 55' 9.57", W 75° 53' 33.43"

The reference site (Ref-1) was located approximately 570 feet upstream of the IRTS location (Figures 2 and 3) and the study site (Imp-1) was located approximately 530 feet downstream of the IRTS location (Figures 4 and 5).

Stream sites were sampled using the Department's benthic macroinvertebrate sampling protocol entitled: *An Index of Biotic Integrity for Wadeable Freestone Riffle-Run Streams in Pennsylvania.* Benthic macroinvertebrate samples consisted of six composite D-frame kicks from riffle/run habitat. Samples were preserved using 95% ethanol and later processed to yield a 200 +/- 20% organism subsample. Benthic organisms were identified to the lowest practical taxonomic level, which is primarily to genus. Habitat was assessed at each site (Table 2). Water quality (chemistry) field and laboratory samples were collected at a different time by the PFBC (results not included in this report).

Benthic data were compiled to allow for metric calculation and the generation of an overall site IBI score. Currently, a total IBI score equal to or less than 50 indicates stream impairment and a

score between 50 and 63 may indicate impairment but requires additional best professional judgment to determine impairment.

Figure 2. Photo of Laurel Lake Creek looking downstream at the reference location (Ref-1). Silver Lake Township, Susquehanna County. Photo taken August 9, 2011.

Figure 3. Photo of Laurel Lake Creek looking upstream at the reference location (Ref-1). Silver Lake Township, Susquehanna County. Photo taken August 9, 2011.

Figure 4. Photo of Laurel Lake Creek looking downstream at the study location (Imp-1). Silver Lake Township, Susquehanna County. Photo taken August 9, 2011.

Figure 5. Photo of Laurel Lake Creek looking upstream at the study location (Imp-1). Silver Lake Township, Susquehanna County. Photo taken August 9, 2011.

Survey Results

Conditions at the time of sampling were intermittent periods of light rain. Stream flow was normal for this time of year. Water clarity was noticeably better at the upstream reference site than the downstream study site, presumably due to ongoing in-stream work by the directional boring subcontractor commissioned by Laser to accomplish the HDD bore.

Habitat values were similar for both sites, with the exception of Embeddedness, Channel Alterations, Condition of Banks, Grazing or Disruptive Pressure, and Riparian Vegetation (Table 2). These metrics differed due to the influence of the township road disturbance near to and paralleling the stream. A large earthen mound, presumably side-cast material from the road excavation, forms the right bank of the stream at Imp-1 and is heavily eroded (Figure 6).

Table 2. Habitat values at two station locations on Laurel Lake Creek (Stream File #31899). Silver Lake Township, Susquehanna County. August 9, 2011.

Habitat Parameter	***Ref-1***	***Imp-1***
In-stream Cover	14	15
Epifaunal Substrate	12	12
Embeddedness	14	10
Velocity/Depth Regimes	14	13
Channel Alterations	18	12
Sediment Deposition	14	15
Frequency of Riffles	17	17
Channel Flow Status	14	14
Condition of Banks	14	8
Bank Vegetation	17	16
Grazing or Disruptive Pressure	18	14
Riparian Vegetation	20	15
Total habitat Score	***186***	***161***

Habitat Scoring Ranges: Optimal (16-20), Sub-Optimal (11-15), Marginal (6-10), Poor (1-5)

Figure 6. Photo of side-cast earthen mound on the banks of Laurel Lake Creek looking Southwest at the study location (Imp-1). Silver Lake Township, Susquehanna County. Photo taken August 9, 2011.

Benthic macroinvertebrate metrics showed a slight decline (3.4 points) in overall IBI scores in Laurel Lake Creek at the study site (Imp-1; 76.7) compared to the reference site (Ref-1; 80.1). Individual metrics were very similar at these two stations (Table 3).

A summary of the raw data collected for this survey is attached to this report. The summary was generated by the Department's ICE database program.

Table 3. Metric calculations for macroinvertebrate samples collected at two sites on Laurel Lake Creek on August 9, 2011.

	Sites:		
Metric	**Ref-1**	**Imp-1**	**Diff**
Taxa Richness	34	28	-6
EPT Richness (PTV 0-4)	16	15	-1
Beck's Index, Version 3	30	29	-1
Hilsenhoff Biotic Index	3.91	3.80	+0.11
% Intolerant Individuals (PTV 0-3)	35.8	41.4	+5.6
Shannon Diversity Index	3.10	2.71	-0.39
IBI Score	***80.1***	***76.7***	***-3.4***

Raw score differences (Diff) are noted as positive (+) when there is an improvement over the reference site and negative (-) when there is a decrease in biological integrity.

Conclusion/Discussion

The IBI scores found at the two sites were very similar and fell well within the expected range of variability[1] of the IBI. Careful examination of the taxa found at each site does not reveal any

significant loss of families or functional feeding groups. Also, there was no loss of the most pollution sensitive taxa and no increase in pollution tolerant taxa as a result of the IRTS discharge event, as evidenced by a very similar Beck's Index score (Ref-1; 30, Imp-1; 29).

In summary, the IRTS discharge event caused by Laser's HDD bore of Laurel Lake Creek did not result in a discernable impact of biological resources in Laurel Lake Creek, as determined at the time of the investigation.

Literature Cited

[1] Pennsylvania Department of Environmental Protection. April 2009. *An Index of Biotic Integrity for Wadeable Freestone Riffle-Run Streams in Pennsylvania.*

Ref - 1

Macroinvertebrate Sample Summary

version: 3.0 8/16/2011 4:30:52 PM

Assessment ID: 62425
Station ID: 20110809-1154-anklinger (Latitude: 41.9218, Longitude: -75.8938)
Method: 6-Dframe Composite, 200 subsample
Location: Upstream C/E reference site - 100 yds upstream of HDD inadvertent return in stream

Comments:

Land Use:
Impairment:

Taxa:

Total # Organisms: 232

Code	Standardized ID Level	Number	Tolerance
1020400200	Acerpenna	6	6
1020400300	Baetis	10	6
1020500100	Isonychia	11	3
1020600100	Epeorus	2	0
1020600600	Stenacron	1	4
1020600701	Stenonema	7	4
1020600702	Maccaffertium	12	3
1020800100	Attenella	2	2
1021000200	Caenis	1	7
1021200500	Paraleptophlebia	1	1
1021400100	Ephemera	5	2
1030200700	Lanthus	2	5
1030300400	Boyeria	1	2
1040500200	Leuctra	6	0
1040500300	Paraleuctra	3	0
1040700100	Agnetina	3	2
1040700400	Acroneuria	7	0
1040800000	Perlodidae	1	2
1040900600	Sweltsa	6	0
1060200400	Nigronia	4	2
1080100200	Dolophilodes	4	0
1080400600	Cheumatopsyche	19	6
1080400700	Hydropsyche	29	5
1081300200	Psilotreta	4	0
1101000200	Psephenus	5	4
1101300200	Dubiraphia	1	6
1101300600	Optioservus	18	4
1101300800	Oulimnius	8	5
1101301000	Stenelmis	14	5
1120201500	Probezzia	1	6
1121900400	Tipula	1	4
1121901100	Dicranota	4	3
1121901500	Hexatoma	7	2
1122200000	Chironomidae	26	6

Metrics:

Metric Name	Raw Metric Values	Standarized Metric Values						
		Freestone Riffle-Run						
		6D200 2009 Small	6D200 2009 Large	6D200 2007	2D100	Multihabitat Pool-Glide	Limestone 2006	Limestone 2009

Total Richness	34	103.0	103.0	97.1		109.7	183.8	188.9
Ephemeroptera Richness	11					183.3		
Trichoptera Richness	4					36.4		
EPT Richness	21			91.3	137.3	123.5	262.5	262.5
Trichoptera Richness (PTV 0-4)	2				55.6			
EPT Richness (PTV 0-4)	16	84.2	88.9					
Becks Index (version 3)	30	78.9	100.0	76.9				
Becks Index (version 4)	31				155.8	140.9		258.3
FC + PR + SH Richness	16				137.9			
Hilsenhoff Biotic Index	3.91	75.1	81.2	74.1	90.4		96.8	98.9
% Intolerant Individuals (PTV 0-3)	35.8	42.4	53.8				136.1	
% Intolerant Individuals (PTV 0-5)	72.4			78.3				
% Tolerant Individuals (PTV 7-10)	0.4						100.6	101.1
Shannon Diversity	3.10	108.3	109.4	106.8		127.4	161.3	145.4
IBI Score	80.1	87.3	86.3	89.2	89.4	99.5	99.8	

% Ephemeroptera: 25 % Plecoptera: 11.21 % Trichoptera: 24.14
% Ephemeroptera (PTV 0-4): 17.67 % Dominant Taxon: 12.50

Habitat:

1 Instream Cover:	14	2 Epifaunal Substrate:	12	
3 Embeddedness:	14	4 Velocity/Depth Regimes:	14	
5 Channel Alterations:	18	6 Sediment Deposition:	14	
7 Frequency of Riffles:	17	8 Channel Flow Status:	14	
9 Condition of Banks:	14	10 Bank Vegetation:	17	**Total**
11 Grazing or Disruptive:	18	12 Riparian Vegetation:	20	186

Impairment:

Insufficient? N Impaired? N Biology Impaired? N
Habitat Impaired? N Rock picks influenced? N Impact Localized? N
Designated Use needs reevaluation? N

Imp - 1

Macroinvertebrate Sample Summary

version: 3.0 8/16/2011 4:30:52 PM

Assessment ID:	62426
Station ID:	20110809-1240-anklinger (Latitude: 41.9193, Longitude: -75.8925)
Method:	6-Dframe Composite, 200 subsample
Location:	Downstream of HDD inadvertent return location. Recent sedimentation evident on rocks above the current flow level. Sedimentation extent ends just below this site.

Comments:
Land Use:
Impairment:

Taxa:
Total # Organisms: 220

Code	Standardized ID Level	Number	Tolerance
1020400300	Baetis	5	6
1020500100	Isonychia	6	3
1020600100	Epeorus	4	0
1020600702	Maccaffertium	17	3
1020800100	Attenella	2	2
1020800700	Dannella	1	3
1021200500	Paraleptophlebia	2	1
1021400100	Ephemera	3	2
1030200700	Lanthus	1	5
1040500200	Leuctra	9	0
1040700100	Agnetina	11	2
1040700300	Paragnetina	2	1
1040700400	Acroneuria	10	0
1040900600	Sweltsa	3	0
1060200400	Nigronia	6	2
1080100300	Wormaldia	1	0
1080300200	Cyrnellus	1	8
1080400300	Diplectrona	1	0
1080400600	Cheumatopsyche	33	6
1080400700	Hydropsyche	48	5
1080500100	Rhyacophila	1	1
1101300600	Optioservus	17	4
1101300800	Oulimnius	5	5
1101301000	Stenelmis	1	5
1121901100	Dicranota	5	3
1121901500	Hexatoma	7	2
1122200000	Chironomidae	17	6
13040100100	Cambarus	1	6

Metrics:

Metric Name	Raw Metric Values	Standarized Metric Values						
		Freestone Riffle-Run						
		6D200 2009 Small	6D200 2009 Large	6D200 2007	2D100	Multihabitat Pool-Glide	Limestone 2006	Limestone 2009
Total Richness	28	84.8	84.8	80.0		90.3	151.4	155.6
Ephemeroptera Richness	8					133.3		

Trichoptera Richness	6					54.5		
EPT Richness	19			82.6	124.2	111.8	237.5	237.5
Trichoptera Richness (PTV 0-4)	3				83.3			
EPT Richness (PTV 0-4)	15	78.9	83.3					
Becks Index (version 3)	29	76.3	96.7	74.4				
Becks Index (version 4)	28				140.7	127.3		233.3
FC + PR + SH Richness	15				129.3			
Hilsenhoff Biotic Index	3.80	76.4	82.7	75.4	92.0		98.6	100.6
% Intolerant Individuals (PTV 0-3)	41.4	49.0	62.3				157.4	
% Intolerant Individuals (PTV 0-5)	74.1			80.1				
% Tolerant Individuals (PTV 7-10)	0.5						100.5	101.0
Shannon Diversity	2.71	94.7	95.8	93.4		111.5	141.1	127.2
	IBI Score	76.7	84.3	81.0	95.1	90.8	99.8	100.0

% Ephemeroptera: 18.18 % Plecoptera: 15.91 % Trichoptera: 38.64
% Ephemeroptera (PTV 0-4): 15.91 % Dominant Taxon: 21.82

Habitat:

1 Instream Cover:	15	2 Epifaunal Substrate:	12	
3 Embeddedness:	10	4 Velocity/Depth Regimes:	13	
5 Channel Alterations:	12	6 Sediment Deposition:	15	
7 Frequency of Riffles:	17	8 Channel Flow Status:	14	
9 Condition of Banks:	8	10 Bank Vegetation:	16	**Total**
11 Grazing or Disruptive:	14	12 Riparian Vegetation:	15	161

Impairment:

Insufficient? N Impaired? N Biology Impaired? N
Habitat Impaired? N Rock picks influenced? N Impact Localized? N
Designated Use needs reevaluation? N