pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

Continuous Instream Monitoring Report (CIMR)

Station Description

STREAM CODE: 14764
STREAM NAME: Little Kettle Creek
SITE NAME: Blumenthal Hollow

Most recent revision: 3/15/2012
Revised by: Lookenbill/Shull

LATITUDE: 41.643618 **LONGITUDE:** -77.703402

COUNTY: Potter

HUC: 02050503

LOCATION DESCRIPTION: Approximately 225 meters upstream of TR422, Hoppe Hollow Road and just downstream of Blumenthal Hollow.

DRAINAGE AREA: 4.7 sq. miles

BACKGROUND AND HISTORY: Little Kettle Creek is a freestone tributary to Kettle Creek encompassing portions of Abbott and West Branch Townships, Potter County (Figure 1). The basin is characterized by relatively steep topography with land use, consisting mostly of forested land (92.4%). The site itself is just upstream of a short, lower gradient reach with beaver (*Castor canadensis*) activity and a significant amount of bedload movement and deposition. The reach just upstream has a higher gradient with very little sediment deposition and less bedload movement. There is one dirt and gravel road crossing upstream along with a small amount of low intensity agriculture. The Little Kettle Creek basin is currently designated Exceptional Value. There are historical shallow gas wells just upstream of the site location. Most of these wells may be capped. There have been wells drilled since May 2010. At least one is a deep well and the others may be shallow.

The primary objectives of the assessment were to:

1. Characterize seasonal and diel temperature, specific conductance, pH, and flow using 24-hour monitoring.
2. Characterize seasonal water chemistry.
3. Characterize baseline biological communities.

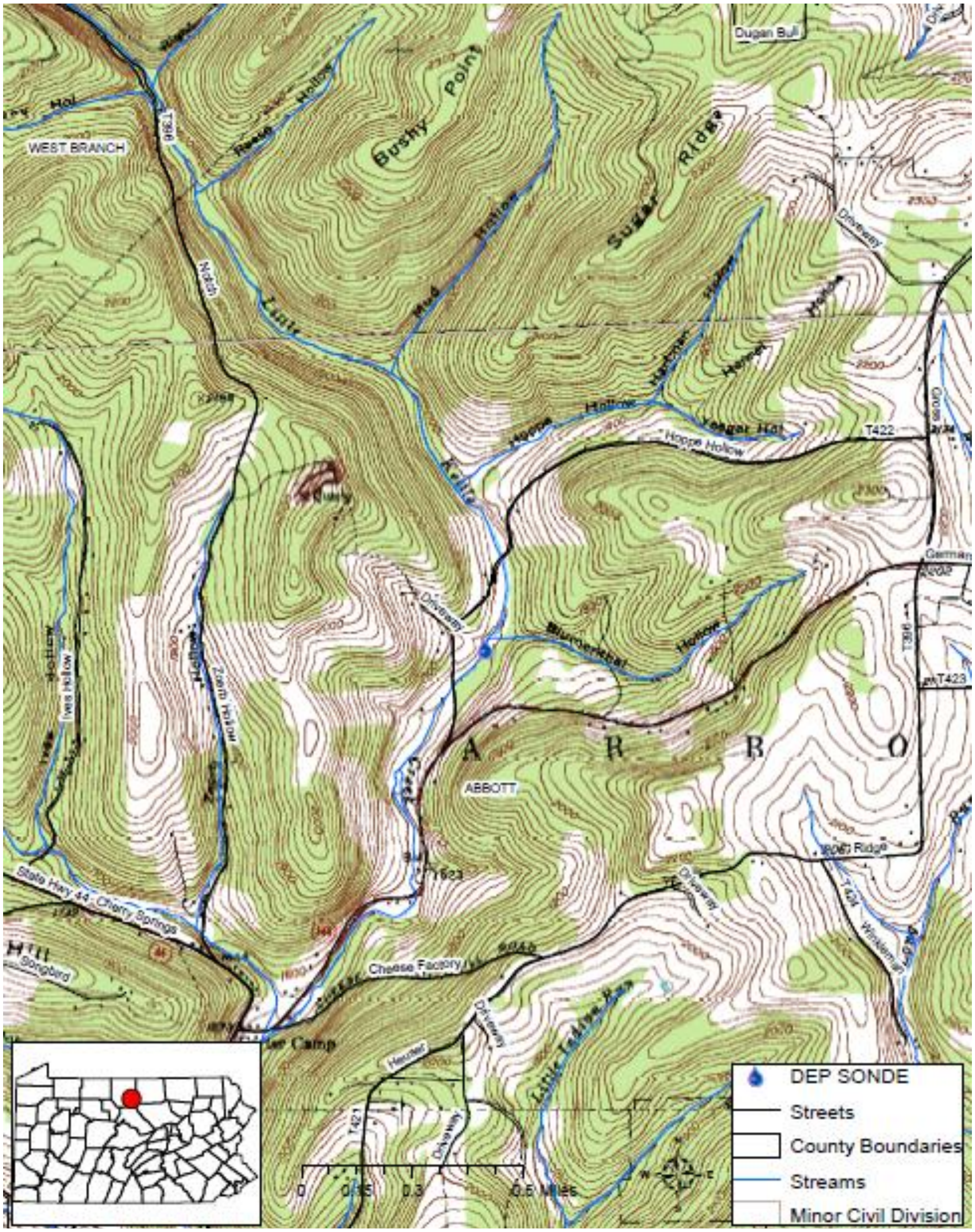

Figure 1. Little Kettle Creek sonde location: Blumenthal Hollow.

WATER QUALITY PARAMETERS:

Parameter	Units
Temperature	°C
Depth	Feet
pH	standard units
Specific Conductance	μS/cm[c]

EQUIPMENT:

A single Yellow Springs Instruments (YSI) 6920 water-quality sonde was used at this station. The sonde (Serial #10B 100975) was installed on May 18, 2010 at 13:00 and began recording at 15:00. The sonde continued logging until it was pulled on May 11, 2011 at 13:00.

The sonde was housed in a 24-inch length of 4-inch diameter schedule 80 PVC pipe with holes drilled in it to allow for flow through. One end of the pipe was capped, and a notch was cut to accommodate the metal attachment bar on the top of the sonde. The attachment bar was clipped to an eye-bolt attached to rebar driven into the stream bed. The attachment bar was also clipped to a cable attached to a second piece of rebar located just upstream of the first. The sonde recorded water quality parameters every 60 minutes.

PERIOD OF RECORD: May 18, 2010 to May 11, 2011

The station was visited nine times over the twelve-month period for the purpose of calibrating, cleaning, and servicing the sonde. Water chemistry grabs and manual flow measurements were collected during each visit, except for the November 24, 2010 visit. Benthic macroinvertebrates were collected on 5/18/2010, 11/24/2010, and again on 5/5/2011.

DATA:

No data were collected during the period 1/21/2011 to 2/17/2011. The sonde had not been serviced because of ice since 11/24/2011 and the batteries had died. Despite the long period without maintenance the sonde and probes were intact, and with a new set of batteries and a cleaning were operating correctly.

Depth: Depth is actually the measure of water column pressure plus atmospheric pressure. Depth is calculated from the pressure exerted by the water column. Depth is calibrated or zeroed with the sonde in air in order to subtract the atmospheric pressure from all subsequent measurements. Changes in atmospheric pressure while the sonde is deployed appear as changes in depth. The error is equal to 0.045 feet for every 1mm Hg change in atmospheric pressure. Frequent calibrations can eliminate most of this error. This data has not been corrected for confounding changes it atmospheric pressure. For this reason, depth data will be considered qualitative.

Temperature: Average: 9.41°C; Maximum: 23.4°C; Minimum: -0.06°C

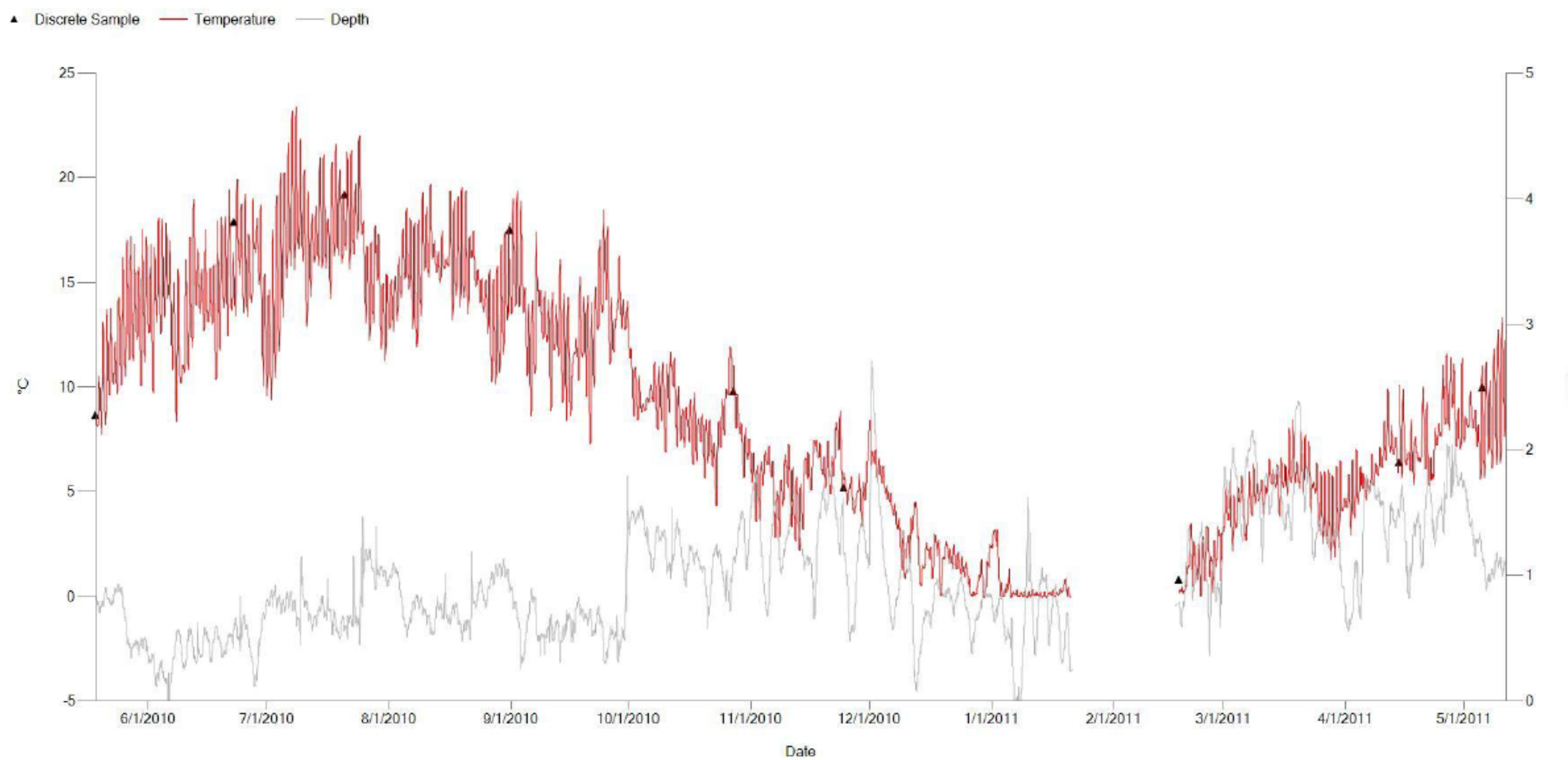

Figure 1. Temperature vs. Depth.

Specific Conductance: Average: 59.75 µS/cm; Maximum: 86.4 µS/cm; Minimum: 32.26 µS/cm

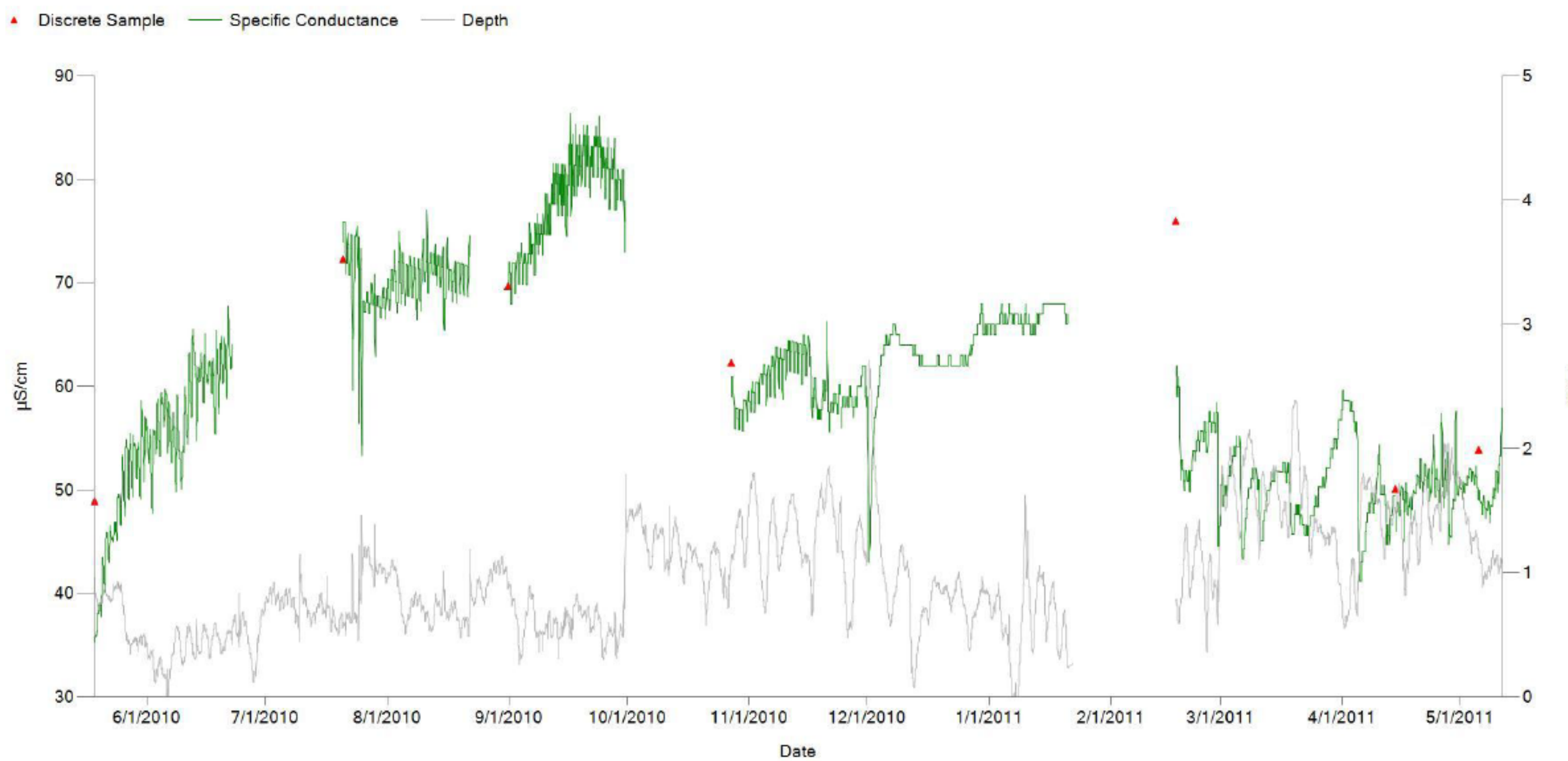

Figure 2. Specific Conductance vs. Depth.

pH: Average: 7.23; Maximum: 7.83; Minimum: 6.44

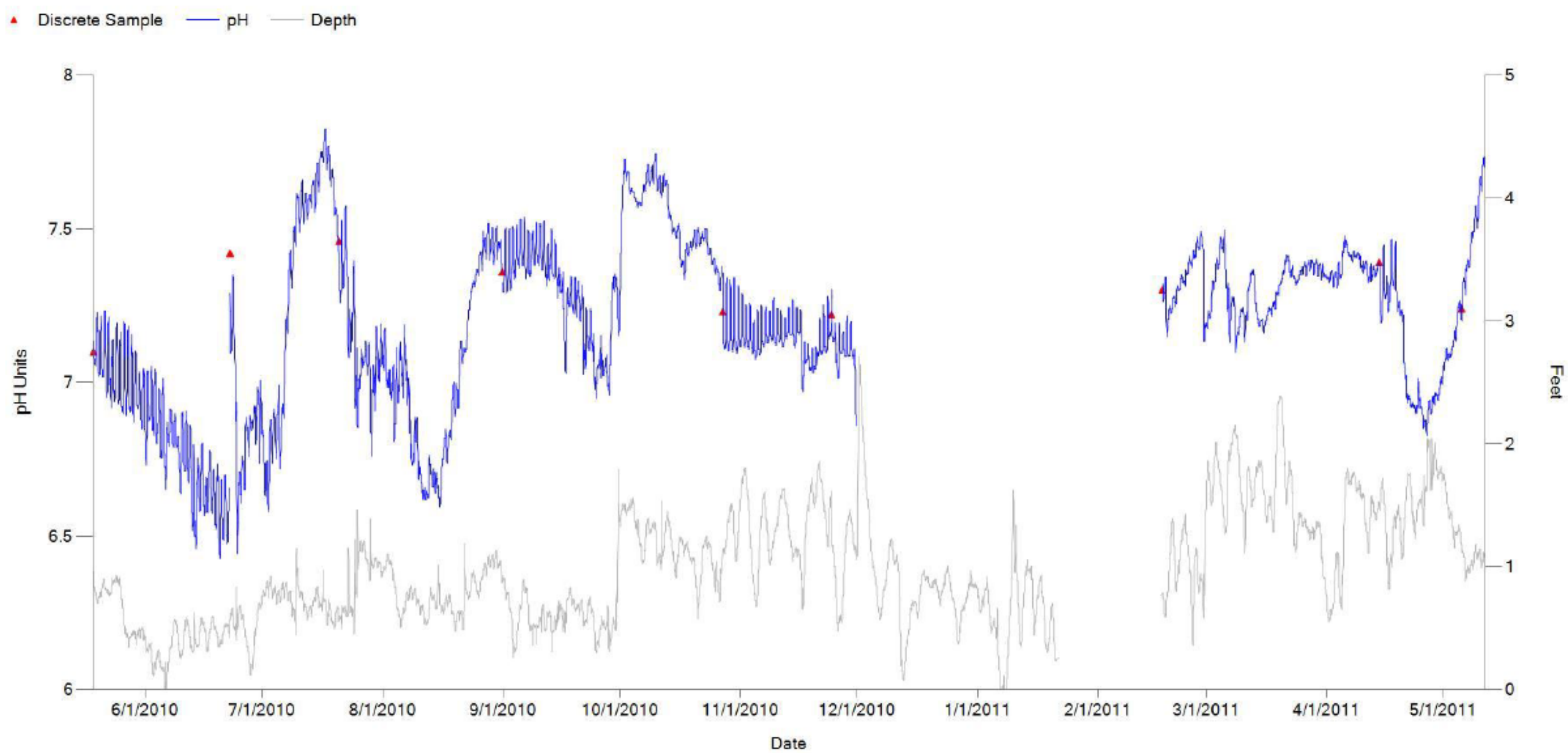

Figure 3. pH vs. Depth.

In-situ Water Chemistry: Samples were collected seven times using standard analysis code (SAC) 046, once using SAC 018 (5/5/2011), and once using field meters and an alkalinity titration kit (11/24/2010).

Table 1. Chemical grab sample results SAC 046 analytes and tests.

TEST	UNITS	5/18/2010	6/22/2010	7/20/2010	8/31/2010	10/27/2010	11/24/2010	2/17/2011	4/14/2011	5/5/2011
Temperature	C	8.67	17.9	19.2	17.5	9.8	5.2	0.8	6.4	10
Sp Cond. @ 25 C	µs/cm	50	62.4	69.5	69.5	60.5	57	66	47.2	48.6
pH Field	pH units	7.1	7.42	7.46	7.36	7.23	7.22	7 3	7.39	7.24
Dissolved Oxygen	MG/L	10.63	10.45	8.03	9.72	11.33	13.24	12.49	11.75	13.88
Discharge	CFS	NS	1.425	0.648	0.754	5.136	NS	0.599	22.298	10.228
BOD	MG/L	0.7	0.7	0.2	0.6	0.4	NS	0.7	1	NS
Alkalinity	MG/L	10.2	20	21.6	20.6	13.8	12	15	8	9.4
Hardness	MG/L	19	24	27	25	23	NS	26	17	18
TSS	MG/L	6	5	5	5	5	NS	5	6	8
TDS @ 180C	MG/L	32	66	58	50	36	NS	14	36	54
Osmotic Pressure	MOSM	ND	ND	ND	ND	3	NS	3	2	NS
Nitrogen, Total	MG/L	0.77	0.82	0.66	0.86	0.8	NS	1.12	0.83	
Phosphorus, Total	MG/L	0.021	0.029	0.023	0.022	0.018	NS	0.013	0.017	0.022
Ammonia	MG/L	ND	ND	ND	ND	ND	NS	ND	ND	ND
Aluminum, Total	UG/L	ND	ND	ND	ND	ND	NS	ND	ND	95.7
Arsenic, Total	UG/L	ND	ND	ND	ND	ND	NS	ND	ND	ND
Iron, Total	UG/L	250	330	177	162	160	NS	49	234	183
Magnesium, Total	MG/L	1.498	1.941	2 233	2.072	1.85	NS	2.227	1 385	1.442
Manganese, Total	UG/L	22	37	23	18	16	NS	10	18	18
Selenium	UG/L	ND	ND	ND	ND	ND	NS	ND	ND	NS
Zinc, Total	UG/L	ND	ND	ND	ND	ND	NS	ND	ND	ND
Barium	UG/L	26	28	29	28	29	NS	28	22	NS
Boron	UG/L	ND	ND	ND	ND	ND	NS	ND	ND	NS
Bromide	MG/L	ND	ND	ND	ND	ND	NS	ND	ND	NS
Calcium	MG/L	5.05	6.395	7.131	6.763	6.065	NS	6.907	4.645	4.753
Chloride	MG/L	0.7	1.27	1.78	1.57	1.67	NS	1.79	1.56	ND
Sodium	MG/L	0.991	1.589	2.041	1.78	1.64	NS	1.976	1 336	NS
Strontium	UG/L	17	24	29	28	21	NS	28	14	
Sulfate	MG/L	7.03	7.16	7.73	7.59	6.82	NS	8.62	7.72	ND

Table 2. Chemical grab sample results SAC 018 additional analytes and tests.

TEST	UNITS	5/18/2010	6/22/2010	7/20/2010	8/31/2010	10/27/2010	11/24/2010	2/17/2011	4/14/2011	5/5/2011
Acidity	MG/L	NS	NS	NS	NS	NS	NS	NS	NS	-12.4
Aluminum, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Arsenic, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Cadmium, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Cadmium, Total	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Chromium, Total	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Copper, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Copper, Total	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Lead, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Lead, Total	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Nickel, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Nickel, Total	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Nitrate	MG/L	NS	NS	NS	NS	NS	NS	NS	NS	0.84
Nitrite	MG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND
Zinc, Dissolved	UG/L	NS	NS	NS	NS	NS	NS	NS	NS	ND

NS = No Sample; ND = Non-Detect

Biology: The indigenous aquatic community is an excellent indicator of long-term conditions and is used as a measure of water quality. Benthic macroinvertebrates were collected on 5/18/2010, 11/24/2010, and again on 5/5/2011 using the Department's ICE protocol (Tables 3.1 & 3.2).

Table 3.1

		May 18, 2010	November 24, 2010	May 5, 2011
MAYFLIES				
Baetidae	***Acentrella***	51		20
	Acerpenna		1	
	Baetis	4	16	11
	Diphetor	7		6
Heptageniidae	***Cinygmula***	6		3
	Epeorus	7	5	6
	Leucrocuta	1	1	1
	Maccaffertium	1		2
Ephemerelidae	***Dannella***	2		
	Drunella	1		
	Ephemerella	9	12	27
	Eurylophella		2	
	Serratella	3	4	8
Leptophlebiidae	***Paraleptophlebia***	16	30	17
STONFLIES				
Capniidae	***Paracapnia***		9	
Leuctridae	***Leuctra***	23	3	15
Nemouridae	***Amphinemura***			2
Perlidae	***Acroneuria***	1		1
	Agnetina	3	3	4
Perlodidae	***Isoperla***	2	4	4
	Sweltsa	1		
Taeniopterygidae	***Taeniopteryx***		12	
CADDISFLIES				
Apataniidae	***Apatania***			2
Brachycentridae	***Micrasema***	4		1
Hydropsyche	***Ceratopsyche***	4	4	5
	Cheumatopsyche	1		1
	Diplectrona	1	1	
Lepidostomatidae	***Lepidostoma***		1	
Philopotamidae	***Dolophilodes***	5	1	
Polycentropidae	***Polycentropus***	1		1
Rhyacophilidae	***Rhyacophila***	1	1	3
Uenoidae	***Neophylax***		1	

Table 3.2

		May 18, 2010	November 24, 2010	May 5, 2011
TRUE FLIES				
Empididae	***Chelifera***	1		
	Neoplasta	1		
Tipulidae	***Antocha***	2		6
	Dicranota		1	2
	Hexatoma	1	5	1
Simuliidae	***Prosimulium***		23	1
	Simulium	5		13
Chironomidae		44	22	9
MISC. INSECT TAXA				
Cambaridae				1
Corydalidae	***Nigronia***			1
Elmidae	***Optioservus***	5	17	12
	Oulimnius	7	2	8
	Promoresia	3	1	4
Gomphidae	***Lanthus***		1	
	Stylogomphus			1
Psephenidae	***Ectopria***		2	1
NON-INSECT TAXA				
Oligochaeta		2		
TOTAL TAXA		226	185	200

ASSESSMENT:

Specific Conductance/TDS Relationship: A linear regression was applied to the eight specific conductance and TDS results to determine a relationship. The predicted formula based on this analysis is $y = 0.2658x + 27.513$, where y = TDS and x = specific conductance. An R^2 of 0.0218 indicates that this is a very weak relationship (Figure 5). This is most likely the result of few data points compounded with reduced analysis resolution at the low end of the specific conductance and TDS range.

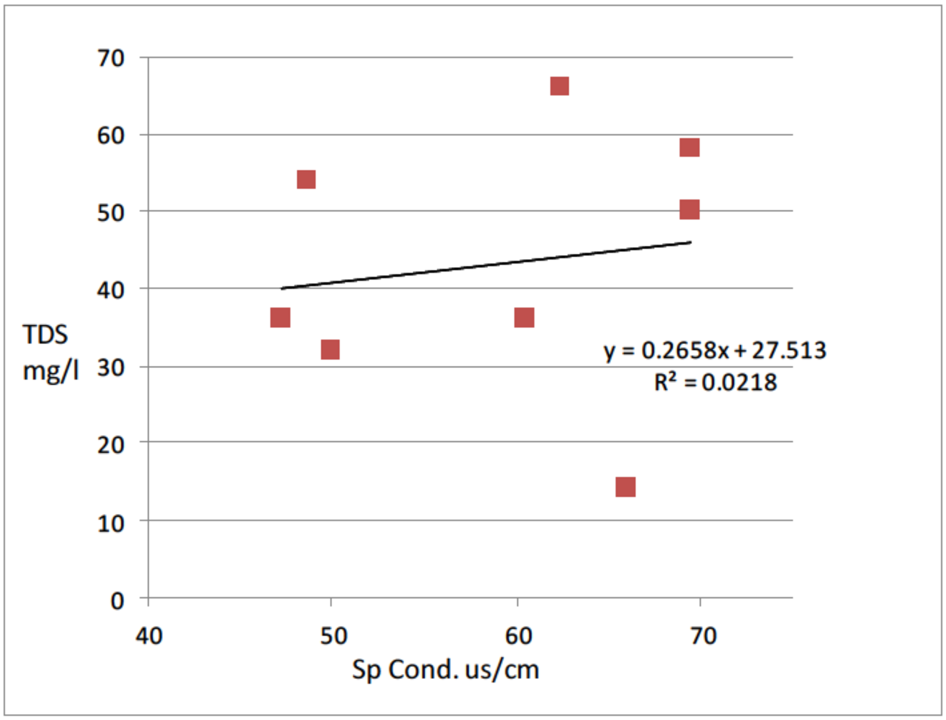

Figure 5.

Biological: Overall the benthic macroinvertebrate community is very good with nearly half of the two spring samples being comprised of intolerant mayflies and the fall sample with a healthy 29.1%. Nineteen of the 34 total taxa from the May 18, 2010 sample consist of intolerant Ephemeroptera, Plecoptera & Trichoptera (EPT). The dominant taxon for the May 18, 2010 sample, at just over 22% of the sample, was Acentrella. The dominant taxon for the November 24, 2010 sample was Prosimulium. And the dominant taxon for the May 5, 2011 sample was Ephemerella. Each sample supported a modest Hilsonhoff Biotic Index (2.80-3.38) typical of forested dominant systems with a moderate amount of anthropogenic influence.

Table 4.

Date	IBI	Richness	Mod EPT	HBI	% Dom	% Mod May	Beck3	Shannon Div
May 18, 2010	87	34	19	3.38	22.5	42.9	36	2.71
November 24, 2010	85	28	16	2.80	16.2	29.1	31	2.74
May 5, 2011	85	34	16	2.98	13.5	42	27	3.05

SUMMARY:

Overall water quality is good, exhibiting limited influences from upstream sources. Specific conductance over the period was low with highest levels (91.6 us/cm) occurring during the late-summer, early-fall low flow period (Figure 2). This is not uncommon, but can indicate some level of anthropogenic or geologic influence. Circumneutral pH throughout the summer and through the fall is typical of a moderately buffered system. A slight depression in pH did occur during the first major "cold-weather" precipitation event in late-November/early-December. Chemistry samples indicate low levels of dissolved solids.

The benthic macroinvertebrate community contains a high diversity of intolerant taxa, while being dominated by moderate to tolerant individuals in the spring and sensitive mayflies in the fall. This coupled with slightly elevated nitrate/nitrite and phosphorus levels (Table 1) indicates some degree of instability upstream of the site location. This may be remnant of a historical, more intense agriculture pressure characterized by elevated nutrients (fertilizer application & livestock) coupled with riparian degradation. Based on consistent IBI scores and stable diversity metrics this influence is minimal and episodic.