pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF CLEAN WATER

Continuous Instream Monitoring Report (CIMR)

Most recent revision: 3/10/2017
Revised by: Lookenbill & Wertz

STATION DESCRIPTION:
STREAM CODE: 19876
STREAM NAME: Wallis Run
SITE CODE: 66911313-001
SITE NAME: Downstream Murray Run

COUNTY: Lycoming

LATITUDE: 41.381494 **LONGITUDE:** -76.926564

LOCATION DESCRIPTION: Approximately 750 meters downstream from Murray Run, along Wallis Run Road.

HUC: 02050206

DRAINAGE AREA: 32.2 sq. miles

BACKGROUND AND HISTORY: Wallis Run is a freestone tributary to Loyalsock Creek encompassing a small portion of central Lycoming County (Figure 1). The Wallis Run basin is characterized by relatively steep topography, and current land use consists of forested land (92%), agricultural (6%), waterways and wetlands (1%) and low density urban/developed (1%). The purpose of this survey was to collect baseline data to document baseline conditions prior to natural gas development activities.

The Department surveyed Wallis Run in response to a Stream Resignation Petition to redesignate Loyalsock Creek. The current designated use of Wallis Run is High Quality – Cold Water Fishes, Migratory Fishes (HQ-CWF, MF). Based on surveys conducted in 2008 the Department determined that the existing use of Wallis Run to be Exceptional Value, Migratory Fishes (EV, MF). An existing use memorandum for the Loyalsock Creek basin, which included Wallis Run, was signed on June 10, 2010. Existing use documentation can be found on the Department's website subsequent to final stream redesignation rulemaking.

The primary objectives of the assessment were to:

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

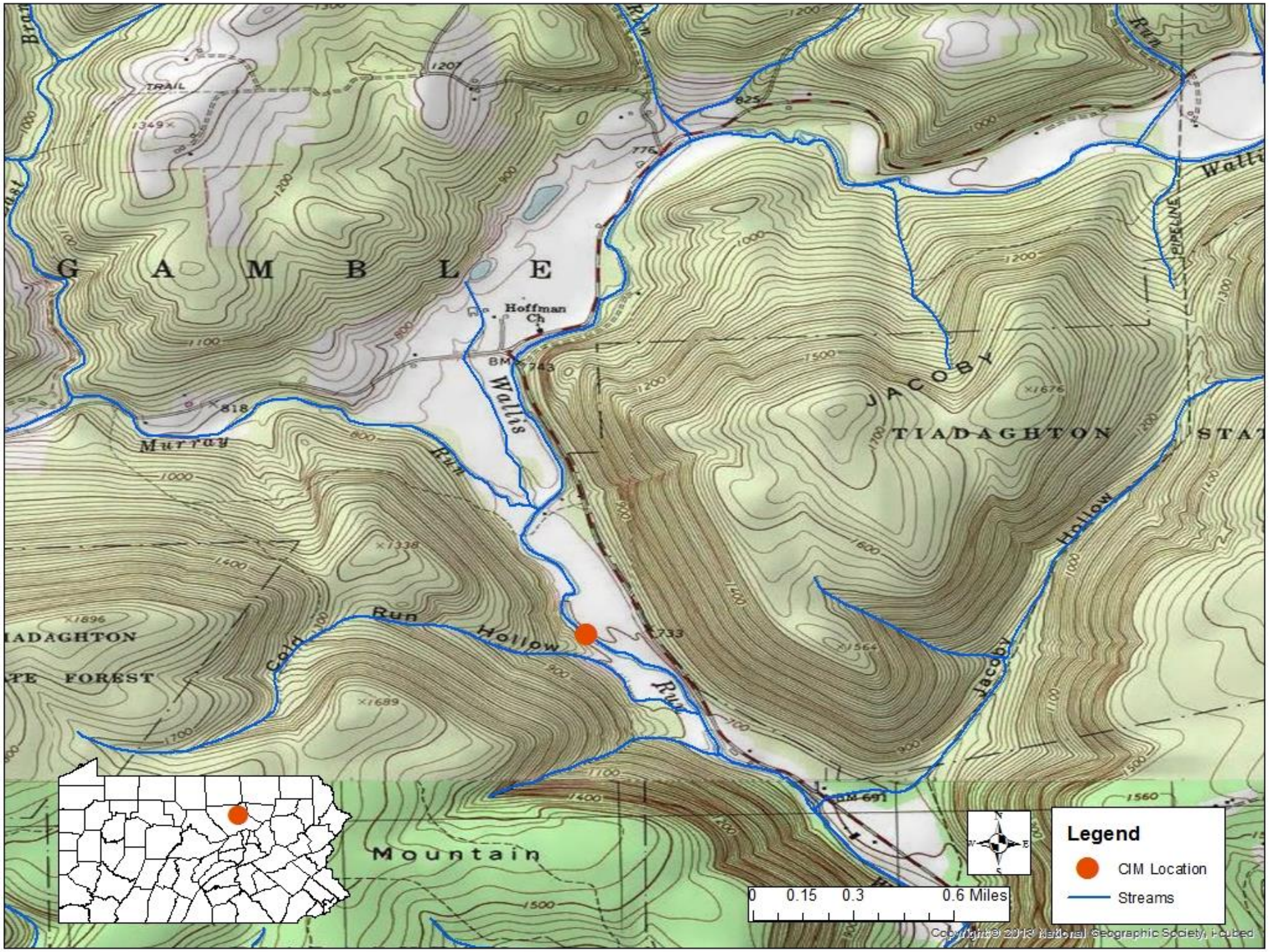

Figure 1. Wallis Run continuous instream monitoring (CIM) site.

Figure 2. Wallis Run 2011 – 2012 sampling location.

WATER QUALITY PARAMETERS:

Parameter	Units
Depth	feet
Water Temperature	°C
Specific Conductance (@25°C)	μS/cm[c]
pH	standard units

EQUIPMENT:

A Yellow Springs Instruments (YSI) 6920 water-quality sonde (Serial #10B100977) was installed on May 23, 2011, and was maintained through August 2011. In late-August through early-September 2011 Wallis Run basin was impacted by Hurricane Irene and Tropical Storm Lee. The CIM location experienced significant changes to the streambed morphology, and the water-quality sonde was unable to be located until December 19, 2011. A second YSI 6920 water-quality sonde (Serial # 00018B9B) was installed on September 29, 2011 and was maintained through July 12, 2012.

The sondes were housed in 24-inch lengths of 4-inch diameter schedule 80 PVC pipe with holes drilled in them to allow for flow through. One end of each 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 sondes recorded water quality parameters every 60 minutes.

PERIOD OF RECORD: May 23, 2011 to July 12, 2012.

The station was visited twelve times over the fourteen-month deployment for the purpose of calibrating, cleaning, and servicing the sondes.

DATA:

Water chemistry grabs were collected 11 times and sediment was collected once during the sampling period. Benthic macroinvertebrates were collected on November 18, 2008, prior to CIM; and on April 18, 2011; November 30, 2011; and April 12, 2012 during the sampling period. Fish were collected on July 12, 2012. Biological samples were collected following the Department's ICE protocol (PA DEP, 2013b) and Wadable Semi-Quantitative Fish Sampling Protocol (PA DEP, 2013c). Continuous data are graded based on a combination of fouling and calibration error (PA DEP, 2013a). Temperature, specific conductance, and pH data for the period September 4, 2011 through September 29, 2011 was graded unusable and deleted from the final data due to significant changes to channel morphology and subsequent burying of the equipment. In addition, pH data for the period September 29, 2011 through October 28, 2011 was graded unusable and deleted from the final data due to equipment malfunction. Temperature, specific conductance, and pH data for the period June 24, 2012 through July 12, 2012 was graded unverified due to lack of appropriate fouling and calibration checks, but was retained without corrections.

Depth: Depth recorded by this non-vented sonde is actually the measure of water column pressure plus atmospheric pressure. Therefore, changes in atmospheric pressure appear as changes in depth. Using atmospheric pressure data from the Lycoming County Airport weather station in Montoursville, PA these data were corrected by eliminating the variations in depth due to changes in atmospheric pressure.

Temperature: Min: 0.2°C; Average: 10.9°C; Max: 21.3°C

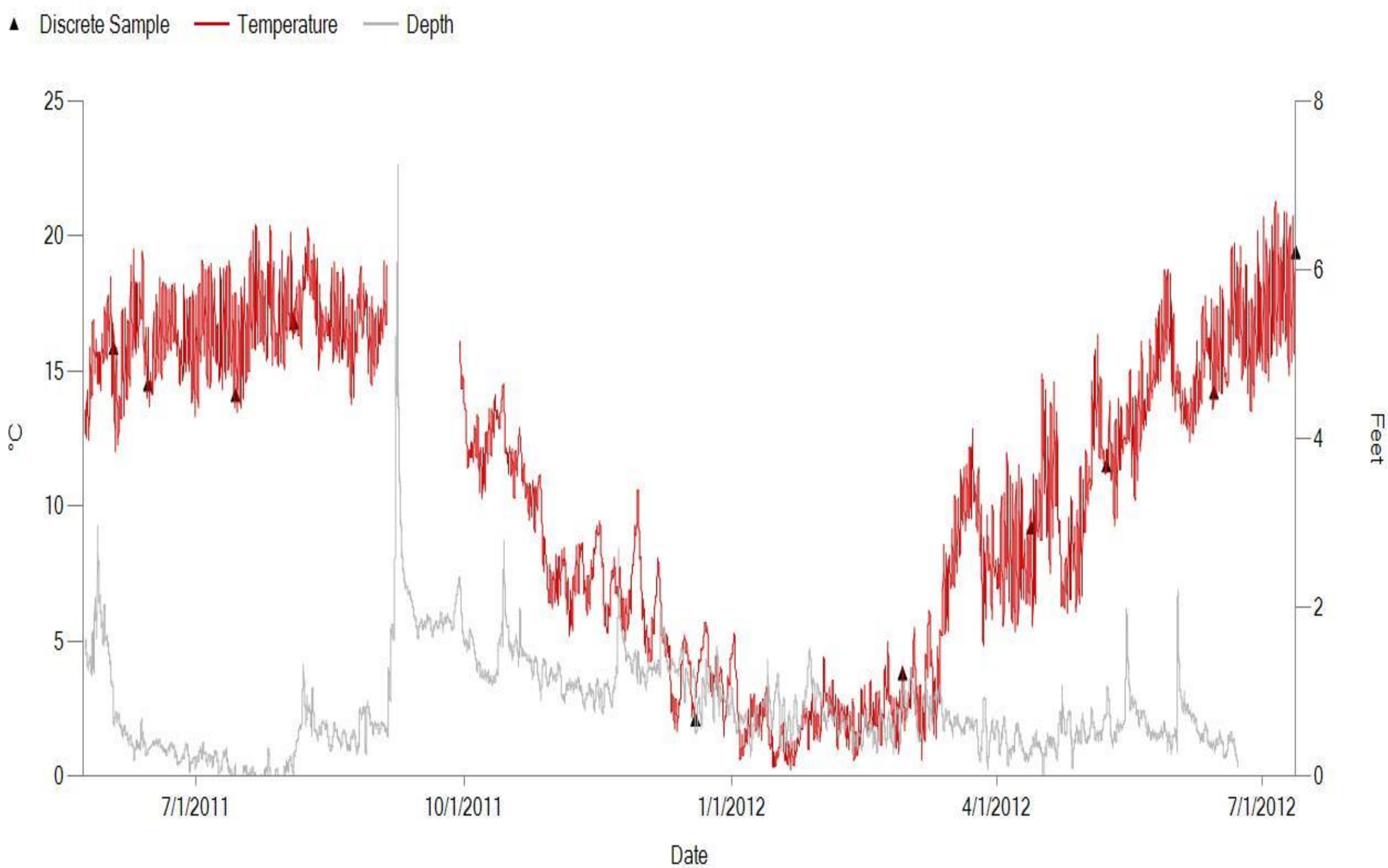

Figure 3. Continuous water temperature and depth from May 23, 2011 to July 12, 2012.

Specific Conductance: Min: 39 µS/cm; Average: 61 µS/cm; Max: 119 µS/cm

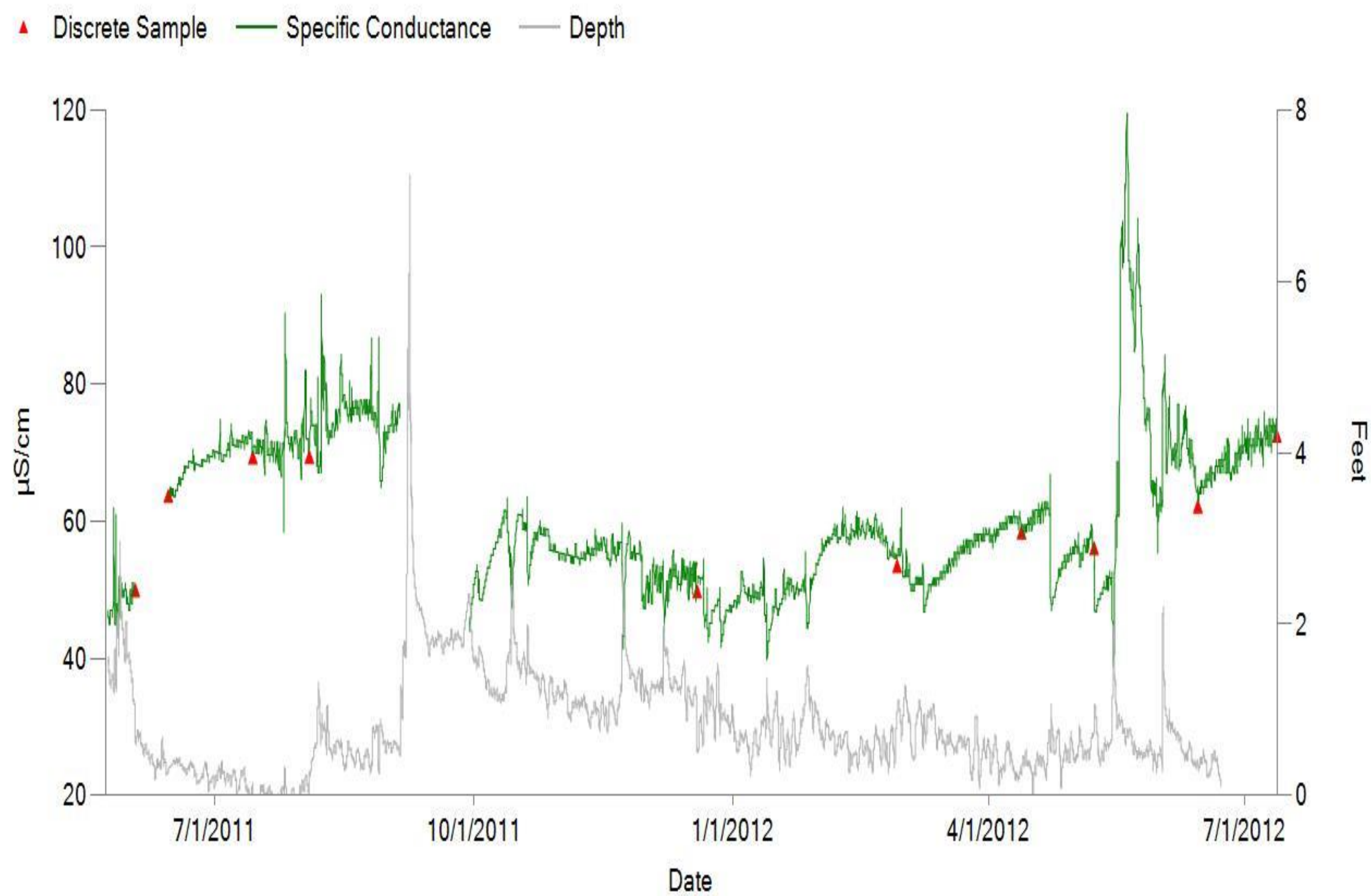

Figure 4. Continuous specific conductance and depth from May 23, 2011 to July 12, 2012.

pH: Min: 6.6 units; Average: 7.0 units; Max: 7.1 units

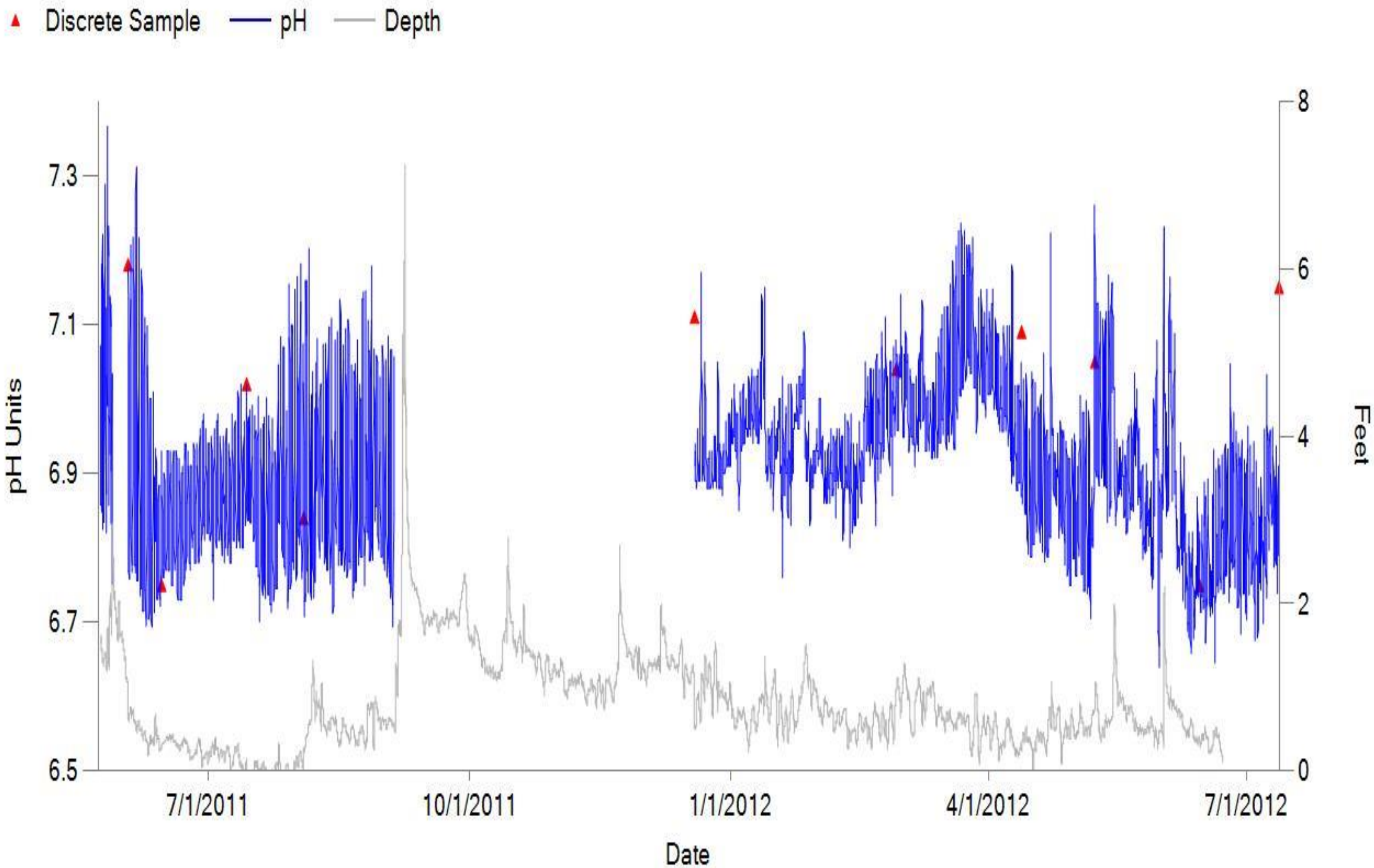

Figure 5. Continuous pH and depth from May 23, 2011 to July 12, 2012.

In-situ Water & Sediment Chemistry: Samples were collected 10 times from each site using standard analysis code (SAC) 046 (Table 1). In June 2011 a sediment sample and duplicate along with an additional water chemistry sample were collected as part of a statewide effort to determine natural background concentrations of radionuclides and metals in sediment and waters, and to determine if oil and gas treatment facilities elevate these levels over the expected natural background. The study examined sediment and water samples from background sites and locations that discharge oil and gas treated wastewater. Wallis Run was sampled as a background site, and the results of the effort indicated that levels were indeed background from Wallis Run (Tables 2 & 3) (PADEP, 2013. Unpublished). Measurements with "<" indicate concentrations below the reporting limit.

Table 1. Chemical grab sample results from Wallis Run.

PARAMETERS	UNITS	5/23/2011	6/14/2011	7/14/2011	8/3/2011	12/19/2011	2/28/2012	4/12/2012	5/8/2012	6/14/2012	7/12/2012
ALKALINITY	MG/L	10.4	16.2	21.6	23.2	10.6	10.4	13.8	13.8	16.6	22.4
ALUMINUM T	UG/L	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200
AMMONIA T	MG/L	< 0.02	< 0.02	0.03	< 0.02	< 0.02	0.05	< 0.02	< 0.02	< 0.02	< 0.02
ARSENIC T	UG/L	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
BARIUM T	UG/L	31	38	44	42	29	27	32	31	37	43
BORON T	UG/L	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200	< 200
CALCIUM T	MG/L	5.08	6.662	8.506	8.322	5.235	5.64	6.492	6.101	7.194	8.163
BOD	MG/L	1.1	0.4	0.5	1	1	< 0.2	0.8	0.6	0.6	1.4
HARDNESS T	MG/L	16	21	27	26	17	18	21	19	23	26
IRON T	UG/L	72	26	28	20	27	30	59	36	25	160
LITHIUM T	UG/L					< 25	< 25	< 25	< 25	< 25	< 25
BROMIDE T	UG/L	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50
MAGNESIUM T	MG/L	0.878	1.105	1.379	1.308	0.876	0.933	1.064	1.004	1.152	1.318
MANGANESE T	UG/L	< 10	< 10	11	< 10	< 10	< 10	< 10	< 10	< 10	28
OSMOTIC PRESSURE	MOSM	< 1	< 1	38	< 1	< 1	2	< 1	< 1	< 1	< 1
SELENIUM T	UG/L	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7	< 7
SODIUM T	MG/L	1.61	1.993	2.47	2.457	1.6	1.92	2.042	1.926	2.08	2.482
STRONTIUM T	UG/L	25	33	40	39	26	26	31	29	35	38
CHLORIDE T	MG/L	1.71	2.12	2.72	3.32	1.96	2.38	2.43	2.1	2.17	2.8
TDS	MG/L	48	52	54	22	62	30	46	48	58	50
NITRATE & NITRITE T	MG/L	0.06	0.12	0.26	0.11	0.26	0.32	0.31	0.22	0.24	0.22
PHOSPHORUS T	MG/L	< 0.01	< 0.01	0.014	< 0.01	< 0.01	< 0.01	< 0.01	0.018	0.011	0.01
SULFATE T	MG/L	7.23	6.97	7.61	7.68	7.51	7.51	8.18	7.07	6.88	7.2
TSS	MG/L	6	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5
ZINC T	UG/L	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10

Table 2. Water radiation results from Wallis Run (Analyzed at Pace Analytical Laboratories, Greensburg, PA)

PARAMETER	UNITS	6/14/2011
RA-226	pCi/L	0.0534
RA-226 CE[1]	pCi/L	0.234
RA-226 LLD[2]	pCi/L	0.496
RA-228	pCi/L	0.331
RA-228 CE	pCi/L	0.401
RA-228 LLD	pCi/L	0.848
URANIUM T	ug/L	0.014
URANIUM CE T	ug/L	0.001
URANIUM LLD T	ug/L	0.21

[1]CE = Counting Error
[2]LLD = Lower Limit of Detection

Table 3. Sediment results from Wallis Run

PARAMETER	UNITS	6/14/2011
AMERICIUM 241	PCI/KG	0
BARIUM 140	PCI/KG	0
BERYLLIUM 7	PCI/KG	0
CESIUM 134	PCI/KG	0
CESIUM 137	PCI/KG	21 +/- 5
COBALT 58	PCI/KG	0
COBALT 60	PCI/KG	0
IODINE 131	PCI/KG	0
IRIDIUM 192	PCI/KG	0
IRON 59	PCI/KG	0
LANTHANUM 140	PCI/KG	0
LEAD 212	PCI/KG	714 +/- 27
LEAD 214	PCI/KG	522 +/- 56
MANGANESE 54	PCI/KG	0
NIOBIUM 95	PCI/KG	0
RADIUM 226	PCI/KG	1,140 +/- 135
RADIUM 228	PCI/KG	654 +/- 25
RUTHENIUM 103	PCI/KG	0
RUTHENIUM 106	PCI/KG	0
URANIUM 235	PCI/KG	0
URANIUM 238	PCI/KG	507 +/- 311
ZINC 65	PCI/KG	0
ZIRCONIUM 95	PCI/KG	0

PARAMETER	UNITS	6/14/2011	REPLICATE
ALUMINUM	MG/KG	7,349	4,901
ARSENIC	MG/KG	3.81	3.46
BARIUM	MG/KG	57.6	50.9
BROMIDE	MG/L	<0.2	<0.2
CADMIUM	MG/KG	<0.489	<0.652
CALCIUM	MG/KG	443	347
CHLORIDE	MG/L	<0.5	<0.5
CHROMIUM	MG/KG	8.26	6.2
COPPER	MG/KG	7.29	5.41
IRON	MG/KG	18,801	13,265
LEAD	MG/KG	7.19	7.5
MAGNESIUM	MG/KG	1,954	1,386
MANGANESE	MG/KG	345	279
MERCURY	MG/KG	<0.098	<0.13
NICKEL	MG/KG	11	8.02
POTASSIUM	MG/KG	842	632
SILVER	MG/KG	<0.489	<0.652
SODIUM	MG/KG	<48.9	<65.2
STRONTIUM	MG/KG	4.5	3.59
URANIUM	MG/KG	<4.89	<6.52
ZINC	MG/KG	34.7	28.6

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 at Wallis Run on November 18, 2008, April 18, 2011, November 30, 2011, and April 12, 2012 (Table 4). Fish were collected on July 12, 2012 (Table 5).

Table 4. Taxa list for benthic macroinvertebrate surveys (yyyymmdd-hhmm-collector)

GENUS	20081118-1337-mlookenbil	20110418-1340-mlookenbil	20111130-1600-bchalfant	20120412-1505-jbutt
Acentrella			1	
Acerpenna	1			4
Isonychia	6	1	5	3
Epeorus	12	24	36	3
Leucrocuta		2		1
Rhithrogena	2	3	4	
Stenacron		5		
Maccaffertium	3		4	
Cinygmula	1	30		9
Drunella	2	14		8
Ephemerella	28	32	4	63
Eurylophella	1			
Serratella	5	1	3	
Teloganopsis				6
Habrophlebiodes				1
Paraleptophlebia	57	29	29	41
Pteronarcys		2		1
Taeniopteryx			2	
Taenionema	14		53	
Amphinemura		2		2
Prostoia	1		8	
Leuctra	1	3	1	3
Allocapnia	1			
Paracapnia			10	
Agnetina	3	3	1	1
Acroneuria			1	1
Diploperla	1			
Isoperla	7	7	11	4
Alloperla	1			
Haploperla		17		14
Suwallia			1	
Sweltsa	1	3	7	
Nigronia	1		1	
Dolophilodes	5		2	2
Polycentropus	2			
Ceratopsyche	12	1		
Cheumatopsyche	8	1		2
Hydropsyche				7
Rhyacophila	2	1	1	
Micrasema	1			

Table 4 cont. Taxa list for benthic macroinvertebrate surveys (yyyymmdd-hhmm-collector)

GENUS	20081118-1337-mlookenbil	20110418-1340-mlookenbil	20111130-1600-bchalfant	20120412-1505-jbutt
Lepidostoma	4			
Apatania	1			
Neophylax		8		
Optioservus	2	4		3
Oulimnius		1		1
Promoresia	2			
Probezzia		1	1	
Antocha				1
Dicranota			1	
Hexatoma	1	1		
Prosimulium	1	4	9	5
Stygobromus				1
Chironomidae (Family)	36	13	6	40
Oligochaeta (Subclass)		3	1	1

Table 5. Taxa list for fish surveys (yyyymmdd-hhmm-collector)

Family	Scientific Name	Common Name	20120712-1230-mlookenbil
Cottidae	*Cottus cognatus*	Slimy Sculpin	180
Cyprinidae	*Exoglossum maxillingua*	Cutlip Minnow	1
Cyprinidae	*Rhinichthys atratulus*	Eastern Blacknose Dace	370
Cyprinidae	*Rhinichthys cataractae*	Longnose Dace	105
Cyprinidae	*Semotilus atromaculatus*	Creek Chub	1
Salmonidae	*Salmo trutta*	Brown Trout	13
Catostomidae	*Catostomus commersonii*	White Sucker	6
Ictaluridae	*Noturus insignis*	Margined Madtom	1

ASSESSMENT:

Continuous: Continuous instream monitors (CIMs) record instream parameters that have defined water quality standards (WQS) in 25 Pa Code §93.7 (temperature, pH and DO). Certain conditions must be met in order to properly assess data from CIMs. Any readings that do not comply with the applicable numeric WQS criteria are considered exceedances and are reviewed to determine if representative of the stream segment and if representative of natural quality as stated in 25 Pa Code §93.7(d). All data reviews are consistent with requirements as described in 25 Pa Code §96.3 which includes the 99 percent frequency measurement rule.

Defining Criteria Exceedance

The WQS criteria for pH and DO are expressed as either a discrete minimum, discrete maximum, or as a daily average (continuous 24-hour period, §93.1) concentration. The individual recordings exceeding the listed criteria are summed and the percent of the year (%Y) that those readings represent is calculated using the following equation:

%Y = 100 * [n / (525,600 / i)]

Where

n = number of exceedances
i = recording interval in minutes
The constant (525,600) is the number of minutes in a year (365 days * 24 hrs/day * 60 min/hr)

If %Y > 1, then the criterion is not achieved 99% of the time as required by §96.3(c), and the waterbody is considered in violation of water quality standards. A period of one year is applied as a rolling year to avoid arbitrary divides as with a calendar year or water year. The 99 percent frequency measurement calculation is based on one continuous 365-day period.

Sampling Critical Time Periods

Temperature, pH and DO are all affected by seasonal change and can, therefore, be predicted to a certain degree. For example, CIMs may be deployed during the growing season when increases in instream production and respiration occur. The Department's CIM efforts have documented increases in pH values, increases in diel pH fluctuation, corresponding decreases in DO values, and increases in diel DO fluctuation beginning in early spring and persisting through the fall. This correlates with increased photoperiod and increased air and surface water temperatures. The effect of increased temperature and photoperiod to increased instream production and respiration are well documented (Odum 1956, Strickland et al. 1970, Neori and Holm-Hansen 1982, Raven and Geider 1988). Diel fluctuation is the difference of minimum and maximum values over a 24-hour period. This is caused by both plant photosynthetic activity and respiration throughout the day and community respiration at night (Odum 1956, White et al. 1991, Wurts 2003). An increased photoperiod with adequate nutrition will increase the standing biomass of photosynthetic organisms (Valenti et al. 2011). Phosphorus has been documented to be the limiting factor of standing biomass in freshwater systems (Stevenson 2006), however other studies indicate increased nitrogen and phosphorus can produce higher biomass than nitrogen or phosphorus alone, suggesting co-limitation (Carrick and Price 2011). During the growing season, pH is most likely to exceed maximum criteria (9.0) and DO to fall below the minimum criteria or 7-day average as described in §93.7, for each critical use. Sampling during critical periods may give sufficient information to make an assessment decision and greatly reduce the amount of resources needed to conduct the survey.

The Department must also recognize that critical or limiting conditions may not be consistent year-to-year, and a single year of data may not accurately represent conditions that water quality standards were developed to protect. Typically, this is driven by the amount and timing of precipitation for a given period or year. Elevated precipitation will result in increased surface water discharge, which moderates limiting conditions characterized by temperature, pH and DO. The Department has documented in past surveys that elevated discharge can reduce daily DO, pH, and temperature fluctuations and increase daily minimum DO values and decrease maximum pH and temperature values. It is imperative to characterize conditions that drive critical or limiting conditions, and reference those conditions as part of the protected use assessment and subsequent reassessments.

CIM, Temperature

Temperature criteria in §93.7 are applied to heated waste sources regulated under 25 Pa Code Chapters 92a and 96. Temperature limits apply to other sources when they are needed to protect designated and existing uses. An appropriate thermal evaluation includes a biological assessment based on instream flora and fauna to determine whether the biological community is affected by the thermal regime. Typically, fish community evaluations have the best resolution in characterizing a waterbody's thermal regime due to the effects to physiology and distribution patterns (Shuter et al. 1980, Ridgeway and Shuter 1991, Azevedo et al. 1998, Wehrly and Wiley 2003, Lyons et al. 2009). CIM temperature data is not typically used to assess critical uses. However, High Quality criterion in § 93.4b (a)(1)(i), "The water has long-term water quality, based on at least one year of data which exceeds levels….at least 99% of the time…" for a list of parameters including temperature may be applied to qualify as a High Quality Water.

CIM temperature data was compared to temperature criteria found in Table 7 of §93.7. Since the Wallis Run CIM was deployed for more than one year, two continuous 365-day periods (May 23, 2011 to May 23, 2012 and July 12, 2011 to July 12, 2012 were used for the 99% rule calculation. Both periods meet Trout Stocking (TSF) criteria 100% of the time and neither meet Cold Water Fishes (CWF) criteria 99% of the time (Table 6). The maximum temperature (21.3°C) occurred on July 5, 2012, average temperatures for May through July were higher in 2012. The minimum temperature for May through July occurred in May 2012 (Figure 3, Table 7).

Table 6. CIM temperature data when compared to temperature criteria found at §93.7.

Period	Meets CWF	Meets TSF
5/23/2011 – 5/23/2012	26%	100%
7/12/2011 – 7/12/2012	27%	100%

Table 7. CIM monthly temperature statistics

Period	Average	Max	Min
May 2011	15.1	17.8	12.4
May 2012	13.5	20.2	9.0
June 2011	15.9	19.5	12.0
June 2012	15.5	20.2	12.4
July 2011	16.7	20.4	13.5
July 2012	17.6	21.3	14.6
May – July 2011	15.9	19.5	12.0
May – July 2012	15.0	21.3	9.0

CIM, Specific Conductance

Specific conductance measurements from Wallis Run showed a relatively consistent pattern throughout the sampling period. Throughout periods of reduced or base flow discharge (July – September 2011) specific conductance was generally low with a mean of 69µS/cm. During more elevated discharge conditions (October 2011 through May 2012) the mean decreased to 57µS/cm. Specific conductance increased approximately 80µS/cm over a five-day period beginning on May 15, which reached a maximum of 119µS/cm on May 20, 2012. This increase was preceded by the typical decrease in specific conductance as discharge increased, presumably due to a precipitation event. As discharge receded, specific conductance began recovering at an expected rate, but continued past baseline conditions reaching a maximum of 119µS/cm. Additional, notable increases occurred on July 26, 2011 and August 2, 2011 (Figure 4).

CIM, pH

CIM pH data collected from Wallis Run was below the criteria maximum (9.0) and above the criteria minimum (6.0) found at §93.7 at least 99% of the time for the entire period. The minimum (6.6) pH occurred on May 28, 2011 as a result of a rain event. Depressions in pH caused by rain were common, but the magnitude of decrease over time was not significant, and there were no pH values recorded less then criteria minimum (6.0). Maximum daily fluctuation (0.6) occurred on June 6, 2011 and the median for the entire period (0.2) is indicative of a fairly intact system with adequate buffering capacity and minimal instream production (Figure 5).

Biology: Benthic macroinvertebrates were collected from Wallis Run on November 18, 2008 (prior to CIM deployment) in response to a Stream Resignation Petition to redesignate Loyalsock Creek. An index of biotic integrity (IBI) score 95.1, indicates aquatic life use attainment. Additional samples collected throughout the CIM deployment had IBI scores of 95.3, 93.3, and 86.0. All samples indicate attainment, all scores are within precision estimates, and would be interpreted as no change in water quality over the period (PA DEP, 2015). The range of scores (95.1 – 86.0) represents a difference of 9.1 between samples collected 2008 through 2012, each successive sample has a decreasing score, and subsequent monitoring within Wallis Run should consider these scores and consider them the benchmark for the Exceptional Value (EV) existing use.

Table 8. Benthic macroinvertebrate metric calculations

Date	IBI	Richness	Mod EPT	HBI	% Dom	% Mod May	Beck3	Shannon Div
November 18, 2008	95.1	34	24	2.52	25.2	51.8	40	2.65
April 18, 2011	95.3	28	19	1.57	14.8	65.3	35	2.71
November 30, 2011	93.3	26	20	1.77	26.1	42.4	36	2.47
April 12, 2012	86.0	27	20	2.28	27.6	58.8	32	2.38

Fish assemblage data was collected on July 12, 2012. The presence of reproducing brown trout and sculpin is indicative of flora and fauna characteristic of a cold water fishery and meets the definition of CWF at §93.3. The lack of native brook trout (*Salvelinus fontinalis*) is interesting, but expected due to the proximity of the site to Loyalsock Creek (PA Fish and Boat Commission Trout Stocked Water) and the probability of stocking by local clubs. The proportional abundance of cold water fish to cool water fish is slightly lower than expected for this size of stream, attributed to the high proportional abundance of Eastern Blacknose Dace (*Rhinichthys atratulus*). The prevalence of Blacknose Dace in the assemblage is also of note along the trilateral continuum theory of life history traits (Winemiller and Rose 1992). This theory identifies three strategies. 1) Periodic strategists are larger-bodied, late-maturing species, with high fecundity per spawning event and low-survivorship. They tend to inhabit periodically suitable streams (i.e. seasonally available). 2) Equilibrium strategist are typically characterized by being small to medium-bodied fishes with moderate age of maturity, and high survivorship of juvenile (i.e. some form of parental care). They tend to inhabit areas with stable habitat conditions. 3) Opportunistic strategists are generally characterized as small-bodied, have low fecundity per spawning event but typically have multiple events, early maturation but with low survivorship of juveniles that inhabit areas of frequent disturbance. The opportunistic strategists are typically thought to be "pioneering" species, and are usually the quickest to colonize disturbed areas (Winemiller and Rose 1992, Winemiller 2005, Olden et al. 2010). While still considered closer to the "equilibrium strategist" the Eastern Blacknose Dace displays some to the strongest traits of the "opportunistic strategist" found within the basin that also prefers cooler stream. This potentially makes it an ideal pioneer for disturbed smaller tributaries within the Susquehanna River basin, especially along a gradient of hydrologic variability.

SUMMARY:

The Wallis Run CIM and chemistry data is indicative of very healthy system with adequate buffering, minimal nutrient enrichment, and background or normal levels of radiological constituents. Specific conductance for the period was low, typically less than 100 µS/cm with the exception of a period May 15, 2012 through May 20, 2012 (Figure 4). These low specific conductance measurements are consistent with low concentrations of water chemistry constituents (Table 1). Hurricane Irene and Tropical Storm Lee caused significant changes to the stream bed morphology, but seemed to have minimal effect to the benthic macroinvertebrate sample collected November 30, 2011. Fish data collected July 12, 2012 is still supportive of a coldwater fishery, but may be better described as a cool water transitional fishery, in agreement with the TSF temperature criteria comparison. The strict dominance of Blacknose Dace may be a recovery response to the habitat altering flows of Irene and Lee, however more study along this front is needed.

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