

Data Collection Methods

The Project was organized to provide documentation of water quality conditions on a watershed-scale, substantiate anecdotal fishery improvements in the river, and provide baseline documentation of benthic macroinvertebrate populations and habitat conditions in AMD impacted tributaries.

Water Quality and Flow

The only water quality evaluation of a similar magnitude occurred in 1984 by the USGS. As part of this evaluation, stream-flow and water quality were measured in May and July 1984 at four sites on the West Branch Susquehanna River and near the mouths of 94 tributaries between Curwensville and Renovo. All data were collected during high baseflow conditions in May 1984 and during low baseflow conditions in July 1984, with the exception of the river site at Renovo in which a rain event resulted in conditions not representative of baseflow (Hainly & Barker 1993).

As part of the Project, stream flow and water quality data (Table 1) were collected in May and July 2009 at 48 of the sites sampled in 1984. While the 1984 survey sampled every tributary along the river, the Project only resampled those tributaries deemed AMD impaired according to DEP's Integrated List. The Project also included collections at an additional 9 river sites and 23 tributaries so as to include every AMD impacted tributary entering the river from its headwaters to Lock Haven, as well as selected sites within larger subwatersheds (Tables 2a, 2b and Centerfold map).

In order to accurately compare data collected between the sites included in the Project and also to the data collected in 1984, all sites were sampled within a 3-day spring and summer period and during the recession portion of the hydrograph when there was no appreciable surface runoff flow component. The only exception was 15 samples collected in August as denoted in Tables 2a and 2b. Precipitation events required a lag time between sampling from these sites and the other 65 sites sampled during summer conditions to ensure that stream levels reflected the recession portion of the hydrograph.

Table 1—Water quality parameters measured.

Parameter	Method
Acidity	SM 2310B
Alkalinity	SM 2320B
Aluminum	EPA 200.7
Aluminum (Dissolved)	EPA 200.7
Calcium	EPA 200.7
Calcium (Dissolved)	EPA 200.7
Chloride	SM 44110B
Copper	EPA 200.7
Copper (Dissolved)	EPA 200.7
Iron	EPA 200.7
Iron (Dissolved)	EPA 200.7
Magnesium	EPA 200.7
Magnesium (Dissolved)	EPA 200.7
Manganese	EPA 200.7
Manganese (Dissolved)	EPA 200.7
Nickel	EPA 200.7
Nickel (Dissolved)	EPA 200.7
pH	SM 4500B
Specific Conductance	SM 2510B
Sulfate	SM 4110B
Total Dissolved Solids	USGS I-1750-85
Total Suspended Solids	USGS I-3765-85
Zinc	EPA 200.7
Zinc (Dissolved)	EPA 200.7



Photo: R. Kester

Alysha Trexler and Mark Killar measure flow rate.



Photo: M. Carrello

Shirley Sholtis and Pam Milavec prepare to sample the river.



Photo: R. Dunlap

Study participants are trained how to properly take flow measurements.

Flow measurements were made perpendicular to the direction of mid-channel flow and in areas where backwater and as many obstacles as possible could be avoided. Cross-sectional measurements of depth, velocity at 6/10th of the stream depth, and distance from the bank were taken at approximately 20 locations or at intervals that comprised no more than 10% of the entire flow of the site. Where flows were too large to measure using conventional wading techniques, the existing USGS stream gage network was used.

Water quality samples were taken from the vertical profile of the main current usually in the center of the stream. In the case of larger tributaries or main stem river sample locations, 3 to 6 samples from across the sample site were composited. A 500-ml raw sample, a 250-ml sample fixed with 15 to 20 drops of HNO₃, and a 250-ml sample filtered through a 0.45-micron filter and then fixed with 15 to 20 drops of HNO₃ were obtained from each site. Samples were placed on ice and transferred to a DEP-accredited laboratory for analysis of 24 parameters (Table 1). In addition, field measurements of pH, temperature, and conductivity were taken at each site.

For quality assurance purposes, an orientation and training session was held during which project participants were trained in proper water quality and flow data collection techniques. Each sampling team consisted of a “leader” from TU or the DEP and all persons collecting data were TU personnel, DEP personnel, County Conservation District personnel, or other relevant professionals.

Fish

The last comprehensive evaluation of the fishery of the river from its headwaters to Lock Haven by the PFBC was in 1998 and 1999 (Hollender and Kristine 1998 & 1999). For the purposes of this Project, PFBC re-surveyed 9 (Tables 2a and 2b) and the SRBC re-surveyed 8 of 12 historic sampling locations. Sampling occurred at sites along a stretch that encompassed approximately 144 miles of the upper and middle West Branch Susquehanna River during the period of June through August 2009. Data collection protocols followed those of Hollender and Kristine (1998 and 1999) using backpack and mini-boom boat electrofishing gear.

Backpack electrofishing samples consisted of two 100-meter single-pass runs along the shoreline. When possible, a 100-meter site was conducted on each side of the river. The fish catch reported for each backpack site is the sum of the two 100-meter samples combined. Mini-boom boat electrofishing samples consisted of two > 20 minute single-pass runs along the shoreline. One run was conducted on each side of the river. The fish catch reported for each mini-boom site is the sum of the two > 20 minute runs combined. An attempt to capture all fish observed was made and all fish captured that could be identified at the site were tallied by species and released. Juvenile cyprinids and other unidentifiable fish were preserved and returned to the laboratory for identification.



Photo provided by PFBC

Jason Detar, Dave Kristine, and Andrew Leakey prepare to sample the river at Hyner.



Photo provided by PFBC

Dave Kristine and Andrew Leakey sample the river at Hyner.

For quality assurance purposes, a training session was held to familiarize the SRBC with PFBC sampling protocols prior to the reinventory. However, due to high river flows, the training was limited to a “dry run” on land. In addition, PFBC personnel utilized a Coffelt-type generator-powered AC backpack electrofisher to maintain consistency with the Hollender and Kristine (1998 and 1999) surveys while SRBC staff used a battery-powered AC backpack electrofisher. Significant differences in number of species collected and overall catch rates were documented between PFBC and SRBC sampling. It is unclear as to why these differences occurred, but they may have been a result of differences in backpack electrofishing gear, inability to conduct an actual electrofishing run during the training session to ensure that both groups were using similar effort, and higher river flows during SRBC evaluations. For these reasons, the SRBC data were not used in subsequent analyses.

Benthic Macroinvertebrate and Habitat

In order to provide a baseline of biological and habitat conditions in the AMD impacted tributaries entering the river and in the river itself, benthic macroinvertebrate and habitat data were collected at 66 locations. All benthic collections were carried out according to DEP's ICE protocols (Chalfant 2007) and were conducted by TU personnel who were previously trained by DEP Bureau of Water Standards and Facility Regulation staff in such protocols. Benthic macroinvertebrate samples consisted of a combination of six kick 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-m² 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. Samples were composited and then identified.

Although the ICE protocol only requires individuals to be identified to genus or the next highest possible taxonomic level in order for evaluation according to the six standardized metrics comprising the DEP's IBI, individuals were identified to species or the next highest possible taxonomic level by North American Benthological Society certified taxonomists for the Project. This was done assuming that a change in community structure over time would be first documented at the species-level. This level of precision paired with DEP collection techniques will allow future studies to detect recovery more quickly by assessing species-shift as water quality improves, and will also allow the DEP to use the genera-level identifications for its purposes.

A qualitative habitat assessment was also conducted on a 100-meter reach of stream at each site according to DEP's ICE protocols. The habitat assessment included rating twelve parameters (instream fish cover, epifaunal substrate, embeddedness, velocity/depth regime, channel alteration, sediment deposition, riffle frequency, channel flow status, conditions of banks, bank vegetative protection, grazing or other disruptive pressures, and riparian vegetative zone widths) as optimal, suboptimal, marginal, or poor by using a numeric value ranging from 0-20. In order to reduce the amount of variation due to subjectivity by different investigators between sites, habitat evaluations were conducted by the same person at each site when possible.



Photo: R. Dunlap

Rachel Kester collects benthic macroinvertebrates from Wolf Run.

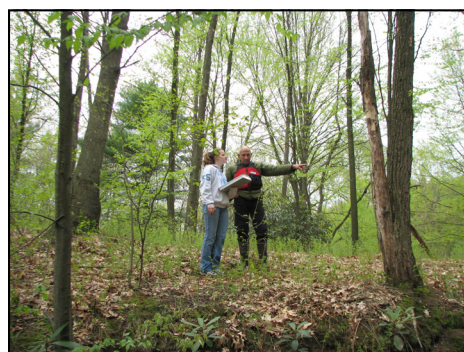


Photo: R. Dunlap

Lori Smith and Carl Undercoffler assess habitat of an unnamed tributary.

Table 2a—Data collection sites. † Indicates lag summer water quality and flow collections. * Indicates control site.

Site Number	Site Name	Water Quality (80)	Flow (71)	Benthic Macroinvertebrates & Habitat (66)	Fish (9)	Included in 1984 Study (48)
1	Lesle Run†	X	X	X		
2	Fox Run†	X	X	X		
3	Walnut Run†	X	X	X		
4	Moss Creek†	X	X	X		
5	Cush Cushion Creek†	X	X	X		
6	Bear Run†	X	X	X		
7	Chest Creek at Mahaffey†	X	X	X		
R1	West Branch Susquehanna at Cherry Tree†	X	X	X		
F1	West Branch at Shyrock Run				X	
R2	West Branch Susquehanna at Burnside†	X	X	X		
R3 / F2	West Branch Susquehanna at McGees Mills†	X			X	
R4 / F3	West Branch Susquehanna at Bower†	X	X		X	
8	Anderson Creek	X	X			X
F4	West Branch Susquehanna River at Hogback Run				X	
9	Hartshorn Run	X	X	X		X
10	Tributary 26641	X	X	X		X
11	Montgomery Creek	X	X	X		X
R5	West Branch Susquehanna at Lumber City	X				
R6	West Branch Susquehanna at Curwensville	X	X			
F5	West Branch Susquehanna at Clearfield				X	
12	Moose Creek	X	X	X		X
13	Tributary 26608	X	X	X		X
R7	West Branch Susquehanna at 879 Bridge	X				
14	Wolf Run	X	X	X		X
15	Clearfield Creek	X	X	X		X
16	Abes Run	X	X	X		X
17	Tributary 26104	X	X	X		X
18	Lick Run	X	X	X		X
19	Devils Run	X	X	X		X
R8	West Branch Susquehanna at Shawville	X		X		
20	Trout Run	X	X	X		X
F6	West Branch Susquehanna at Egypt				X	
21	Millstone Run	X	X	X		X
22	Surveyor Run	X	X	X		X
23	Bald Hill Run	X	X	X		X
24	Moravian Run	X	X	X		X
25	Deer Creek	X	X	X		X
F7	West Branch Susquehanna at Deer Creek				X	
26	Tributary 25976	X	X	X		X
27	Big Run	X	X	X		X
28	Sandy Creek	X	X	X		X
29	Alder Run	X	X	X		X
30	Rollingstone Run	X	X	X		X

Table 2b—Data collection sites. † Indicates lag summer water quality and flow collections. * Indicates control site.

Site Number	Site Name	Water		Benthic	Included in 1984 Study
		Quality	Flow	Macroinvertebrates & Habitat	
31	Mowry Run	X	X	X	X
32	Basin Run	X	X	X	X
33	Rock Run	X	X	X	X
34	Potter Run*	X	X	X	X
35	Tributary 25913*	X	X	X	X
36	Rupley Run*	X	X	X	X
37	Moshannon Creek	X	X	X	X
38	Redlick Run	X	X	X	X
39	Tributary 25693*	X	X	X	X
40	Mosquito Creek	X	X	X	X
R9	West Branch Susquehanna at Karthus	X			X
41	Laurel Run*	X	X	X	X
42	Tributary 25622	X	X	X	X
43	Saltlick Run	X	X	X	X
44	Tributary 25611*	X	X	X	X
45	Sterling Run	X	X	X	X
45	Loop Run	X	X	X	X
47	Birch Island Run	X	X	X	X
48	Black Stump Run	X	X	X	X
F8	West Branch Susquehanna at Burns Run				X
49	Sinnemahoning Creek†	X	X	X	X
50	Cooks Run	X	X	X	X
51	Milligan Run	X	X	X	X
52	Kettle Creek	X	X	X	X
53	Drury Run	X	X	X	X
R10	West Branch Susquehanna at Westport	X			
R11	West Branch Susquehanna at Renovo	X			X
F9	West Branch Susquehanna at Hyner				X
54	Tangascootak Creek	X	X	X	
R12	West Branch Susquehanna at Lock Haven	X			
55	Clearfield Creek at SR 1021	X	X		
56	Muddy Run	X	X		
57	Clearfield Creek at Dimeling	X			
58	Chest Creek at Westover†	X	X	X	
59	Moshannon Creek at Osceola Mills	X	X	X	
60	Moshannon Creek at Philipsburg	X	X		
61	Little Anderson Creek	X	X	X	
62	Kratzer Run†	X	X	X	
63	Twomile Run	X	X	X	
64	Babb Creek	X	X	X	
65	Sterling Run (Sinnemahoning)†	X	X	X	
66	Bennett Branch†	X	X	X	
67	Beech Creek	X	X	X	
68	Dents Run†	X	X	X	