BOWMAN'S CREEK WATERSHED ASSOCIATION

ACID DEPOSITION MITIGATION MONITORING:

PRE/POST LIME APPLICATION REPORT

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Bowman's Creek Acid Deposition Mitigation Report

Acknowledgements

Funding for this project was provided by the PA DEP through the Growing Greener Grant Program. The volunteers from Bowman's Creek Watershed Association with help from the Retirement Seniors Volunteer Program (RSVP) completed numerous water quality samplings and assisted with limestone applications. The Wyoming County Planning Commission administrates grant funding for analysis of Bowman's Creek water quality and mitigation of the acid precipitation damage on the stream. Wyoming County Planning Commission personnel assisted with the project throughout this study. The PA Fish and Boat Commission and the PA Game Commission supplied additional technical assistance, cooperation and help. PA Fish and Boat Commission conducted electronic shocking to evaluate native brook trout (*Salvelinus fontinalis)* and other fish species populations prior to lime addition. Access to the lime application points and sampling stations for Bowman's Creek was supplied by the PA Game Commission. Additional support came from the Wyoming County Conservation District. Without the assistance of the many Agencies, Commissions and Volunteer Groups, this project would not be possible.

Native Brook Trout (***Salvelinus fontinalis)***

Introduction

The Bowman's Creek Watershed Association (BCWA) has taken on a great challenge to maintain the fishery in Bowman's Creek. The primary water quality problem for the cold water fishery that is recognized by the PA Fish and Boat Commission (PA F&BC) and PA Department of Environmental Protection (PA DEP) is acid deposition. This problem is also known as acid rain or acid precipitation.

Pollutants discharged to the atmosphere, predominantly from the burning of fossil fuels cause acid precipitation. The National Atmospheric Deposition Program collects particulate and precipitation data throughout the United States for laboratory analysis. (See Appendix 1) Precipitation in northeastern Pennsylvania is acidified from air pollutants discharged to the atmosphere west of Pennsylvania. As nitrates and sulfates from burning of fuels are discharged to the air, the components react with water droplets in rain/snow clouds creating nitric and sulfuric acid. Additionally, fine particulate matter from the burning of fossil fuels, are deposited during periods lacking precipitation. This creates a fine deposit that can reduce the pH of precipitation when the matter becomes wet. Rain has an instantaneous effect on the stream causing the water to become low in pH or acidic. Existing average precipitation pH is 4.3 in the region of Bowman's Creek Watershed. A neutral pH of water is 7.0 with a minimum of a 5.0 pH for fish survival. Levels of pH 5.0 to 5.5 are suspect to be lethal for eggs and larvae (*Nemerow 1985*). Geologic formations and soils in the Bowman's Creek watershed do not contain buffering alkaline formations and therefore, do not reduce acidity in the water runoff from acidic precipitation.

Snow and ice in winter precipitation is also acidic and is stored in a frozen form until Spring thaw occurs. Spring runoff conditions may last a few days or weeks dependent upon the amount of precipitation accumulated during winter. Thawing conditions create an acid flush through the stream basin. The acid precipitation and acid flushes are extremely damaging to aquatic organisms including aquatic insects (macro-invertebrates), forage fish (sculpins, suckers, chubs, shiners etc.) native trout and stocked trout. Recognition of damage from acid deposition caused the PA F&BC to cease the stocking of trout in Mountain Springs Lake in the Bowman's Creek watershed.

Data compiled in this study indicate that sections of Bowman's Creek have lost all macroinvertebrates and therefore, probably all fish life as well. These locations devoid of aquatic macro life correlate to lower levels of water pH identified by the BCWA volunteers. The sections of Bowman's Creek that are devoid of aquatic life can be restored with native populations of brook trout and aquatic insects. However, restoration will take continued applications of lime in inventive ways to improve populations of fish and aquatic macroinvertebrates.

Limestone sand addition is one method of mitigating pH and alkalinity levels to return the stream to a productive recreational fishery. Mitigation of the acidification of Bowman's Creek was initiated in August 2001. Nearly 82 tons of limestone sand were applied to the upper Bowman's Creek basin to enhance pH levels based on calculations conducted by Borton-Lawson Engineering. Calculated estimations of the limestone sand application were based on the Downey Limestone Dose Model (Weigmann et al. 1993) with drainage areas extracted from the Bowman's Creek Stormwater Management Plan (Borton-Lawson Engineering 2000). However, limestone addition is only a temporary measure to address problems caused by air pollutants. A reduction in air pollutant loading is the most critical method of maintaining viable fisheries.

This report in conjunction with future data collection on limestone sand additions is intended to assess the effectiveness and environmental impacts of the acid mitigation for Bowman's Creek.

Project Area

Sampling stations and lime application points are located from The Meadows bridge across the North Branch of Bowman's Creek to the Stull bridge crossing of Bowman's Creek to Sorber Mountain (Appendix 2). Stations are described below:

1. Bridge crossing of North Branch of Bowman's Creek immediately downstream of the Meadows marsh (lime applied and sampling point).
2. Mountain Springs Lake dam and Bowman's Creek immediately below the dam (sampling point only). Lime application point at Mountain Springs access road crossing of North Branch Bowman's Creek near Bowman's Creek confluence.
3. Bean Run bridge. (lime applied and sampling point)
4. Wolf Run bridge. (lime applied and sampling point)
5. Water Tower Run bridge. (lime applied and sampling point)
6. Beth Run (sampling point only)
7. Conservation Corp bridge over unnamed tributary to Cider Run. (lime applied and sampling point)
8. Along Township Road between Cider Run confluence and Baker Run confluence with Bowman's Creek. (lime applied and sampling point)
9. Along Township Road between Baker Run confluence and Sober Run confluence with Bowman's Creek. (lime applied and sampling point)
10. Bridge crossing Bowman's Creek at Stull. (lime applied and sampling point)

The PA Fish and Boat Commission conducted fish electro-shock surveys at seven 300 meter sections within the study area:

1. Bean Run upstream of the lime application point.
2. Bean Run downstream of the lime application point.
3. Bowman's Creek upstream of Wolf Run confluence
4. Bowman's Creek downstream of Wolf Run confluence
5. North Branch Bowman's Creek upstream of Mountain Springs Lake access road.
6. Cider Run upstream of lime application

7. Cider Run downstream of lime application.

Problem History

Several years ago, Trout Unlimited (TU) approached Borton-Lawson Engineering staff asking for assistance on reasons for the diminishing fishery in Bowman's Creek. TU members suggested that fish stocked by the Pennsylvania Fish and Boat Commission leave the stream and few "hold-over" trout are found in Bowman's Creek as the fishery existed in the past. However, no one had solid evidence of the fish traveling from Bowman's Creek to the Susquehanna River. Discussions of acid rain and possible pollutant damage were reviewed at meetings but no data was available to prove any speculations. The biological and chemical suitability study conducted by Wilkes University students in 1997 evaluated the viability of Bowman's Creek as Trout Habitat (Brojakowski et al. 1997). Findings in this study indicate that the primary limiting factor for trout habitat found was the low pH and alkalinity values.

Water quality data collected by PADEP on Bowman's Creek includes sampling from 1988 through 1998 (PA DEP data file 1998) at the Stull Bridge in Noxen Township, Wyoming County. Samples were collected monthly and included pH, alkalinity, hardness, acidity, aluminum, iron and zinc (Appendix 3). Alkalinity included a high and low value of 8 and 2 parts per million consecutively. Alkalinity values are extremely low in the soils and geology of the upper watershed to enhance water pH levels. The pH levels sampled during the same period show poor values for the maintenance of a coldwater fishery with a gradual progression downward in pH levels <6. Optimum values for hatchery raised brook trout are a minimum of 6.4 pH. However, native brook trout are known to survive pH levels<6.0 in Bowman's Creek and other locations. Brook trout are extremely susceptible to destruction immediately after hatching from water quality concerns.

Results from sampling of native fish in Mountains Springs Lake and Bowman's Creek by the PA F&BC includes evidence that the fish populations are affected by acid deposition. Only brook trout and spring salamanders were found during electronic shock sampling of Bowman's Creek headwaters for this study. Yellow perch, brown bullhead and pumpkinseed sunfish are the only remnant populations of reproductive fish populations found in Mountain Springs Lake. (Unpublished data, PA Fish and Boat Commission, 2001) Yellow perch found during the electronic-shocking of Mountain Springs Lake include very old samples of fish dating up to ages of 18 years. Virtually no young age class diversity was found during the sampling of the fish in Mountain Springs Lake. All three fish species found in the Lake are the most resilient species to the effects of acid deposition. Some yellow perch were found lacking appropriate gill covers as is documented in other acidified waters. Water sampling for pH and alkalinity levels on the Bowman's Creek watershed further verify the loss of pH balanced waters.

Spring thaw conditions create an acid flush through the stream basin. Trout spawning occurs in the fall of the year with young fry leaving the egg sacks in late winter to early spring. Unfortunately, the hatching of young trout coincides with the spring thaw and the decrease in stream pH from ice and snowmelt. The time of the spawn hatch parallels with spring thaw and is suspected to cause an increased mortality in the fry. Additionally, as forage fish and aquatic insect populations are reduced in number from acid precipitation events, brook trout lose feed sources to maintain healthy populations.

Stream pH Testing

The BCWA and RSVP volunteers conducted stream pH sampling. Periodically, alkalinity samples were tested. Stream sampling began in 1998 to evaluate lime application needs for the study area. Additional data was collected by PA DEP from 1972 to 1987 including pH, total alkalinity, total hardness, total acidity, aluminum, iron and zinc. However, the sampling station location was changed from Eaton Township in 1987 to the Stull area in Noxen Township. The Stull sampling station collection began in 1988 and ended in 1998. Data included at Stull is much closer to the study area and is included in Appendix 3. BCWA data on pH throughout the watershed indicates a gradual increase in pH as the Stream progresses out of the mountainous terrain. It is suspected that pH increases in the watershed can be partially attributed to lime applications in agricultural surroundings. Additionally, good agricultural production soil series typically contain more alkalinity creating better pH buffering characteristics.

The PA DEP Stull sampling shows a range of pH values from the low 6s to the low 5s in standard pH units (Appendix 3). Spring thaw events show evidence that thawing of low pH precipitation is lowering the Stream pH considerably for extended periods. Alkalinity values are extremely low, never exceeding 10 parts per million. This is a strong indication of a lack of resilience to acid rain damage.

Based on the pH data collected prior to lime application through BCWA, Water Tower and Wolf Runs are the lowest pH values within the study area. Watertower Run averages around a 4.2 pH and Wolf Run averages at 4.6 pH. Both pH levels are well below acceptable limits for the maintenance of fish populations. It is believed that most fish can not survive pH levels below 5.

The highest pH values for tributaries to Bowman's Creek found within the study area includes Beth and Bean Run at an average pH values of 5.8 and 5.7 consecutively. Bowman's Creek alone maintains pH values in the 5.5 to 6.3 range prior to lime application.

Macro-invertebrate Sampling

Sampling of macro-invertebrates was conducted under methods of the US EPA Rapid Bioassessment Protocol for use in streams. Protocol I was used to evaluate the presence of aquatic invertebrates to level of Order.

Two people conducted the sampling. One person held the sample net downstream of the sample location and the second person scoured the bottom of the stream from the net edge to approximately 1 meter upstream. Rocks were extracted from the bottom and brushed clean by hand in the current flow above the net. After removing all cobbles that could be moved by hand, the bottom of the stream was scoured by use of sampler's feet to a minimum of approximately 10 to 15 centimeters. If a rock was too large to be moved during the sampling, the net was cleaned and relocated to a new sample point. If no invertebrates were found during the collection, a second sample was tried to verify that the location was lacking aquatic life. Additional data was collected and included estimates of percent tree canopy cover, stream width, stream depth, stream velocity, water temperature and an estimation of percent stream bottom material (boulders, cobbles, gravel or sand).

After a sample collection was complete, a large metallic tray was used to review the collection of debris and aquatic life. Clean water was used to separate debris from invertebrates. Information collected on invertebrates was transferred to data forms and are in Appendix 5.

Two sample locations were devoid of aquatic life. Wolf Run, Station 4, contained one crayfish after several sampling attempts. Bowman's Creek downstream of the confluence with Watertower Run, Station 5, did not contain any aquatic life.
Bowman's Creek downstream of the North Branch of Bowman's Creek confluence, Station 2, contained the best diversity with 5 Orders present. It included Beetle (*Coleoptera)*, Hellgrammites *(Megaloptera)*, Stoneflys *(Plecoptera)*, Mayflies *(Ephemeroptera)*, and Caddisflies *(Trichoptera)*. The stream bottom contained heavy moss on the rock surfaces.

The second best location of aquatic life was found at both Cider Run at Station 7 and Bean Run at Station 3. The sampling occurred at the confluence of Cider Run and the

Unnamed tributary to Cider Run that flows under the CC Road Bridge. This location contained the highest number of Caddisfly in the entire sampling. Stoneflys *(Plecoptera)*, Mayflies *(Ephemeroptera)*, and Caddisflies *(Trichoptera)* were found in Cider Run. Bean Run was sampled downstream of the abandoned Railroad Bridge.

It appears that pH levels must average above approximately 5 to maintain macroinvertebrates in the stream. No invertebrates were found in the sampling that indicate any pollution issues involving toxins or organic loading other than the pH problems. It is possible that the abundance of invertebrates at Station 2 may be assisted by the lime applications that were applied to Mountain Springs Lake by Nanticoke Conservation Club in previous years. However, the data collected in this study can not verify this speculation. Additionally, the lime applied to the PA Game Commission food plots within the drainage area of Bean Run may enhance water quality. Eugene Weiner, Land Manager indicated that application of lime occurs annually on the food plots to improve plant growth and wildlife foods on the Game Lands.

Electro-Shock Fish Survey

The PA Fish and Boat Commission Biology staff conducted fish surveys to evaluate what improvements or damages may occur from the lime applications to Bowman's Creek. Seven survey stretches were evaluated. Each stretch was 300 meters long and fish were shocked, netted, marked and released. Four samples were resurveyed a second time to evaluate the number of fish missed during the first run. Surveys were conducted on Bean Run, Cider Run, North Branch of Bowman's Creek and Bowman's Creek main branch above and below Wolf Run confluence.

Brook trout were the only fish species found in the survey. A spring salamander and a wood frog were also found during the survey. The best numbers of fish were found in Bean Run upstream of the planned lime application and Bowman's Creek upstream of Wolf Run. Very few fry class brook trout were found in the survey. Most fish were in the 50 to 100 mm range of size in Bean Run. Only 9 brook trout were found in the <25mm class in Bean Run in 600 meters of survey. In Bowman's Creek, above and below Wolf Run, no fish <75 mm were found. Only 3 brook trout were found in the North Branch of Bowman's Creek in 300 meters of sampling, ranging from 125 mm to 200 mm. Only 26 brook trout were found in a single survey run on Cider Run. The fish sizes ranged from 50 mm to 200 mm.

Low numbers of small fry sized trout indicates that recruitment is poor a best. A healthy population of reproducing fish should contain the largest numbers of fish in the smallest or youngest class. If a stream is lacking lower sized naturally reproducing fish, reproduction is failing due to some cause. Acid deposition is the most probable cause of the lack of young fish classes in this population.

Recommendations

Several recommendations are in order to maintain the Bowman's Creek fishery for native trout. It is fortunate that the BCWA has pursued this problem prior to losing the entire native brook trout population. The Bowman's Creek basin has always had influences of natural acids since the last ice age period thawed away. The acid bogs on top of the mountains surrounding the Bowman's Creek headwaters have probably never allowed a perfectly neutral 7 pH to occur in the previous 15,000 years. Brook trout from this basin are possibly adapted to lower than 7 pH level waters. However, even adapted populations of fish still have their limit at which they can no longer survive. In addition to low pH, the soils and geology of the basin contain high natural levels of aluminum. Aluminum is toxic to fish when low pH precipitation leaches the metal from the soils and the solution flows through the stream basin. The adjustment of pH in the water for a fishery is best neutralized within the soils of the basin. If the pH of storm flows or spring thaws became neutral prior to meeting the streams, it would retain a large quantity of metals in the soils. This maybe accomplished by the addition of lime to the riparian areas along the stream tributaries. The application would be costly since it would have to be applied by helicopter in many locations. However, the application may not be as frequent as direct application of limestone sand to the streambed. Limestone sand can be flushed through the system in one flood flow and not offer any buffering to the section of stream intended. Lime applied to soils would increase the alkalinity of the surrounding soils and leach through the soils over time. A study would be needed to evaluate the effectiveness of this method.

A second point that is very important is that continued study of these applications is critical to identify the successes and failures of lime addition programs. The stream has contained acid surroundings for many years naturally and the aquatic life that has survived the lower pH levels have possibly adapted somewhat. Lime addition calculated for this study used a model that was proven to not meet the requirements of reaching neutral water. This model was used to gradually bring pH levels up to acceptable levels for the specific population of brook trout that inhabits this stream. Additionally, the macro-invertebrate populations have adapted to this surrounding as well. It is critical to bring the pH levels to acceptable levels for all aquatic organisms in the stream or the natural food chain that is surviving the acid will be disrupted or destroyed.

The first lime application in August 2001 (Appendix 7) changed pH and alkalinity slightly for a short period. The Downey Limestone Model was used for the initial calculation and research of scientific literature indicated that the model fell short of the limestone requirements for streams studied. Comparison of this model to other limestone applications show that this method is as low as 1/6 of the limestone amounts required to neutralize stream waters. Borton-Lawson staff believed that the aquatic life in the stream is somewhat adapted to the acid waters of the stream and adjustments should not occur quickly. Reproduction success appears to be severely hampered and sections of stream are presently lacking all macro aquatic life. Therefore, the pH adjustment should continue gradually with effective monitoring to designate the optimum pH level for restoration of trout breeding and macroinvertebrate populations. Since no large changes occurred in the field analysis results after the 2001 lime application, and the model used is anticipated to be 1/6 of the requirement to fully neutralize water, lime amounts were increased by a multiplication factor of 2 for 2002. The lime was applied in March 2002 and tonnage are shown in Appendix 7.

Although laboratory analysis did not indicate a large change in pH or alkalinity for Bowman's Creek after 2001 lime application, fishing reports improved downstream. Several devoted fishermen that regularly fish the fly fishing only stretch of Bowman's Creek indicated that stocked trout held in the stream into October. It was further stated that it was the best fishing they had in 7 or 8 years. Their information, although not scientifically proven, may indicate that acid deposition maybe the cause of fish movements after stocking. Further lime applications and detailed study is the only method to identify accurately the changes that are occurring.

The third point that needs to be addressed is to encourage the volunteers of BCWA and other organizations to attend training to assist them in their sampling programs. The volunteers have conducted a wonderful job on this study and have assisted the general public in improving the recreational value of these waters. It is critical and extremely helpful for the volunteers to attain further training on their efforts to better understand the benefits they are creating by donating their time.

Bowman's Creek Watershed Association Acid Mitigation
Lime Application Tonnage Data
Post Lime Samples of pH at Stations

Date		Sta. 1	Sta. 2	Sta. 3	Sta.4	Sta. 5	Sta. 6	Sta. 7	Sta. 8	Sta. 9	Sta. 10
					Lime Tonnage Applied						
8/15/2001		8	0	4	12	16	0	14	2	2	4
		8 *									
Total Tons		16	0	4	12	16	0	14	2	2	4
	pH Relation				pH Data						
Date	to Lime	Sta. 1	Sta. 2	Sta. 3	Sta.4	Sta. 5	Sta. 6	Sta. 7	Sta. 8	Sta. 9	Sta. 10
9/1/2001	Tributary	NA	NA	NA	NA	4.5	6		NT	NT	
	Up. Str.	6	6.25	6	5	6.5	6.5	6.25	NT	NT	
	Dwn. Str.	6	5.75	NT	6.25	6.25	6.5	6.25	NT	NT	
9/25/2001	Tributary	NA	NA	NA	NA	4	6.3	4.4	NT	NT	
	Up. Str.	5.2	5.8	5.8	4.5	4.7	5.4	5.7	NT	NT	
	Dwn. Str.	5.2	5.8	6	4.5	5.3	5.8	5.3	NT	NT	
11/29/2001	Tributary	NA	NA	NA	NA	4	6	5.5	NT	NT	
	Up. Str.	NT	NT	NT	NT	6	6	6	NT	NT	
	Dwn. Str.	5.5	5.5	6	5	5.7	5.7	6	NT	NT	
12/12/2001	Tributary	NA	NA	NA	NA	4.4	6.4	6.4	NT	NT	
	Up. Str.	5.7	5.8	6	5	6	6.4	6.5	NT	NT	
	Dwn. Str.	5.7	5.6	6	5.2	5.7	6.4	6.4	NT	NT	
2/23/2002	Tributary	NA	NA	NA	NA	4.2	6.6	5.1	NT	NT	NA
	Up. Str.	5.1	5.2	5.8	4.8	6.3	6.3	6.3	NT	NT	6.4
	Dwn. Str.	5.6	NT	6.2	5.1	5.6	6.3	5.8	NT	NT	6.5

Station 1) North Branch Bowman's Creek at bridge below Bowman's Marsh *Lime also at Mountain Springs bridge across North Branch
Station 2) Bowman's Creek below Mountain Springs Lake (Control Sampling no Lime in Lake and Stream below dam)
Station 3) Bean Run bridge
Station 4) Wolf Run bridge
Station 5) Water Tower Run
Station 6) Beth Run (Control Sampling)
Station 7) Conservation Corp bridge over unnamed tributary to Cider Run
Station 8) Along Township Road on Bowman's Creek above Ayers property
Station 9) Along Township Road on Bowman's Creek below Ayers property
Station 10) At Stull bridge in Bowman's Creek

2002 Bowmans Creek Lime Addition Estimate-Hettesheimer Run to Head Waters
Limestone Sand-First Application

					**	***	****			
Station	*Subarea	%Subarea	*Sq. Mile	Acres	pH	D1	Tons Lime	Est. Field Applied Tons	Date Applied	Application Locations:
1	2,3	1	3.69	2,362	5.2	0.00325	15.35	17	3/21/2002	N. Branch Bowmans Cr. bridge dwnstr. Bowman Marsh
2	1	1	3.5	2,240	5.2	0.00325	14.56	17	3/29/2002	Bridge over N. Br. Bowmans Cr. to Mt. Spring Dam
3	5,6,7	1	2.23	1,427	5.7	0.00185	5.28	5	3/21/2002	Bean Run bridge above railroad grade
4	8	0.4	3.696	2,365	4.6	0.00525	24.84	12 17	3/21/2002 4/1/2002	Wolf Run bridge on railroad grade
5	8	0.6	5.544	3,548	4.2	0.0068	48.25	34 17	3/27/2002 3/28/2002	Watertower bridge on railroad grade
6	9,10,11, 12,13	1	6.17	3,949	5.3	0.00295	23.30	34	4/3/2002	CC road bridge over Cider Run
7	16	0.5	0.55	352	5.7	0.00185	1.30	17	4/2/2002	Bowmans Cr. above Ayers from railroad grade
8	16	0.5	0.55	352	5.7	0.00185	1.30			Bowmans Cr. below Ayers and above hatchery
9	17	1	2.07	1,325	5.7	0.00185	4.90			Sorber Mt. bridge or headwaters of Sorber Run
10	19,20	1	4.66	2,982	5.7	0.00185	11.03			Stone Run headwaters on S. Mt. Club
11	21	1	1.47	941	5.8	0.0016	3.01			York Run headwaters on S. Mt. Club
12	22	1	2.01	1,286	4.9	0.00415	10.68			Hettersheimer Run headwaters on S. Mt. Club
Totals:							163.81	170		

* Subareas listed and drainage areas extrapolated from Bowmans Creek Act 167 study done for Wyoming County under PADEP grant funding.
**pH data from information collected prior to year 2001 application of lime.
***Dosage Multiplier Factor from Guidelines for Liming Acidified Streams and Rivers, Va. Water Resource Research Center, Va. Polytechnic Institute.
****Dosage applied for 2002 at a 2 multiplier due to low results from 2001 applications.
Calculations prepared by Borton-Lawson Engineering, Wilkes-Barre, PA. Telephone(570)821-1999

John Levitsky

From: Wnuk, Robert [rwnuk@state.pa.us]
Sent: Tuesday, September 17, 2002 10:42 AM
To: John Levitsky
Subject: RE: Bowman Creek Watershed

Thanks for the help John. I know all about limited budgets!

The data I have certainly indicate that fry survival and recruitment to adult size have greatly improved in Roaring Run and the South Branch. Both streams supported only a handful of wild brook trout in 1981, but this year we found tons of them with numerous year classes present. We did two sites on Roaring and one on the South Branch. Our biomass estimates ranged from 49 to 75 kg/ha. We define anything with over 30 kg/ha of brook trout to be a Class A stream, in the top 10% statewide. Brook trout ranged from 50 to 249 mm in length.

Our data also indicate that the chems have improved. In April 1981, pH ranged from 6.6 to 6.8 and alkalinity ranged from 2 to 6 mg/l in the two streams. In August 2002 we found a pH range of 6.4 to 7.0 and an alkalinity range from 8 to 16 mg/l.

I guess the question I'm trying to answer is why the improvement? I'm sure the limestone is part of the answer but it may not be the whole story. For example, if the Association is treating Roaring Run but not the South Branch, why would chems and fish populations show dramatic improvements in both streams? We didn't age the fish in Roaring Run but a typical 175 mm wild brook trout in PA is 6 or 7 years old, so many of the adult fish we captured in these streams were spawned prior to the limestone sand treatment. Also, take the case of Newton Run. Newton Run is a small trib to Roaring Run flowing off the mountain in Eaton Township. It had 17 mg/l alkalinity and my guess is that it's not treated with sand.

Hopefully, the data you send me on application rates and sites will help clear some of this up. I'm just now beginning to analyze the stuff we collected this summer so I don't really know how Bowmans and many of the other tribs compare to previous years. I can say that, at least in terms of its trout population, Bowmans Creek seems to have taken a step backward. We didn't find any holdover stocked trout at the site we did on the fly stretch, and wild trout populations were down from historic levels. Maybe it was just the warm, dry summer we had.

Thanks again for the help. I'll make sure that you and the association get a copy of the report when it's finalized (probably around this time next year).

Rob

-----Original Message-----
From: John Levitsky [mailto:jlevitsky@borton-lawson.com]
Sent: Tuesday, September 17, 2002 9:24 AM
To: 'Wnuk, Robert'
Cc: 'Dorne White'; Joshua Longmore (E-mail)
Subject: RE: Bowman Creek Watershed

Hello Robert,

The Bowman's Creek Watershed Association has been applying lime to Roaring Run for a few years prior to my involvement and I should have made that statement in the report that it was not included in the study area. Our study budget was not nearly enough to cover the areas we completed so work for Roaring Run was not included. I am getting good reports from fishermen that Bowman's Creek is holding stocked fish much better than it has for probably 8 years. Fishermen last year indicated that they were catching holdover stocked fish into October on the flyfishing stretch.

I will track down the amounts and time frames for lime application on Roaring Run for you to keep on file. I checked my data and found May 1998 that South Branch Roaring Run and Roaring Run was 5.0 pH. February, March, April, May 2000, pH range from 6.0 to 6.5 in both S. Branch Roaring Run and Roaring Run. The Watershed Associations work in Roaring Run is prior to my involvement, so I do not have all the data. As soon as I track it down, I'll have the Association or myself send it to you.

How is the fry to adult size ratio? Does the data indicate that there maybe better fry survival?

We'll be in touch with further information.
Best regards,
John Levitsky
phone:821-1994X256
fax:821-1990

> -----Original Message-----
> From: Wnuk, Robert [SMTP:rwnuk@state.pa.us]
> Sent: Tuesday, September 17, 2002 8:29 AM
> To: John Levitsky
> Subject: Bowman Creek Watershed
>
> Good Morning John:
>
> I was wondering if you were applying limestone sand to Roaring Run or the
> South Branch of Roaring Run in the Bowman Creek watershed. We saw several
> stockpiles along Roaring Run during our surveys this year but it's not on
> the list of application sites you sent us and it wasn't clear if the sand
> was applied to the stream. Chems and fish populations in both Roaring Run
> and the South Branch of Roaring Run were greatly improved from historic
> data.
>
> Hope you can clear this up for me.
>
> Thanks,
>
> Rob

Subject: Re: Bowmans Creek Lime Application

From: John Levitsky (j_levitsky@yahoo.com)

To: rwnuk@pa.gov;

Date: Tuesday, March 4, 2014 1:49 PM

Hi Rob,

Is there any recent shock studies on Bowman's Creek and tributaries indicating natural reproduction successes, failures or no change? I have one very serious fisherman that indicated that the lower reaches of Bowman's Creek had high numbers of native brook trout in the stream. I am suspicious as the hatcheries lost a number of fish including brood fish and am wondering if they are really wild fish, hold-overs from the flood losses or now reproduction from brood fish lost.

Thanks for your input. If you have any concerns or questions, please send me a return email.

Take care,

John Levitsky

On Tuesday, March 4, 2014 8:01 AM, "Wnuk, Robert" <rwnuk@pa.gov> wrote:
John,

Sounds like a great idea. Please keep me informed.

Rob

From: John Levitsky [mailto:j_levitsky@yahoo.com]
Sent: Monday, March 03, 2014 4:45 PM
To: Wnuk, Robert
Subject: Bowmans Creek Lime Application

Good Afternoon Rob,

I am assisting Trout Unlimited in attempting a lime application for Bowman's Creek. We are looking at my recommendations from the 2001 study and possibly applying limestone sand on the railroad bed and Mountain Springs Road near select cross culverts and perennial streams. I am asking for your input on the idea to make sure I am not missing any concerns you may have.

The goal is to keep the limestone from being flushed out of the stream in high water events and continue leaching the alkalinity over time to the creek. Additionally, the vehicle traffic over the limestone will maintain a crushing action increasing lime sediment to wash into the stream during precipitation events. This type of application I'm hoping will create long term benefits without shock loading the stream.

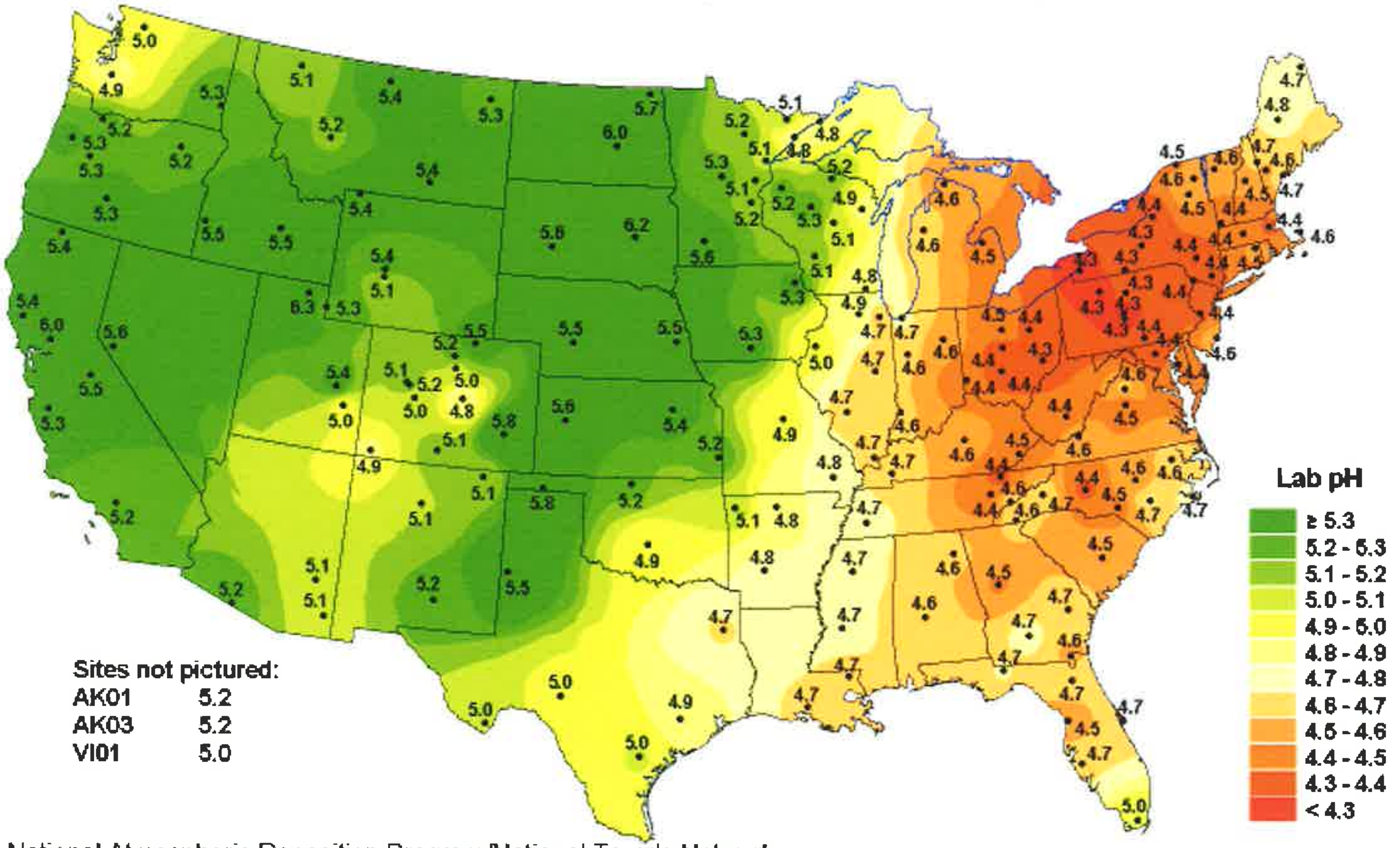
I will be in touch with Jim Jolley, PA Game Commission Land Manager for the area to discuss as well since we will need the PGC's approval to conduct the applications within Game Lands.

Please respond to this email or call me at your earliest convenience.

Sincerely,

John Levitsky
Cell 570-239-1013

Hydrogen ion concentration as pH from measurements made at the Central Analytical Laboratory, 2000

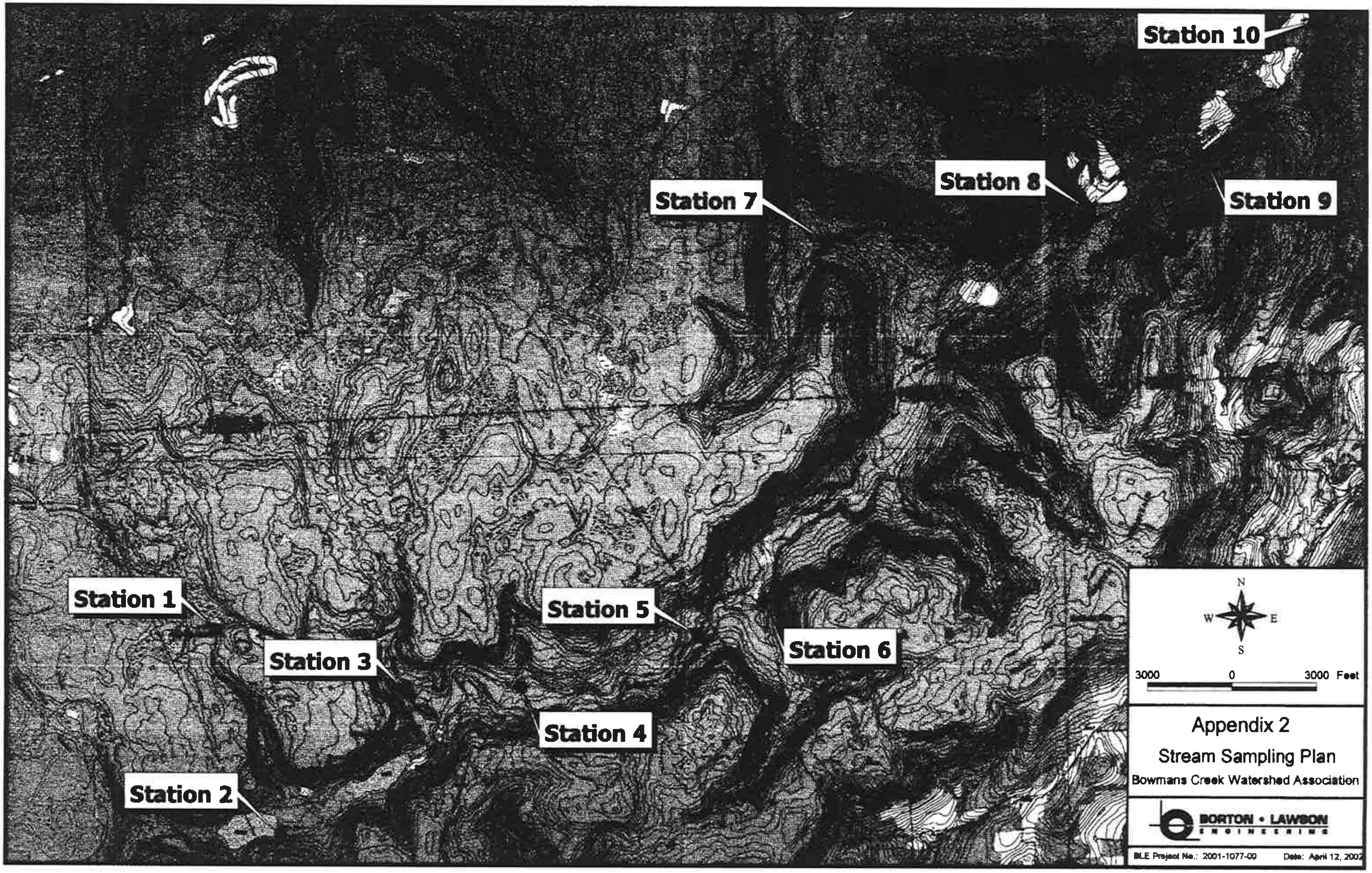


Sites not pictured:

AK01	5.2
AK03	5.2
VI01	5.0

National Atmospheric Deposition Program/National Trends Network
http://nadp.sws.uiuc.edu

Appendix 1. National Atmospheric Deposition Program: Measurements of pH found in year 2000 from both precipitation and particulate deposition.



Appendix 2

Stream Sampling Plan

Bowmans Creek Watershed Association

BORTON • LAWSON ENGINEERING

BLE Project No.: 2001-1077-00 Date: April 12, 2002

APPENDIX 3
PA DEP WATER QUALITY SAMPLING DATA
1988 TO 1998

STORET RETRIEVAL DATE 98/10/28 PGM=RET

WQN0337 PFBC4-007

41 24 57.0 076 05 27.0 4

BOWMAN CRK-T310 BR 1.3 MI N STULL-NOXEN TWP

42131 PENNSYLVANIA WYOMING

SUSQEHANNA RIVER BASIN

BOWMAN CREEK /TYPA/AMBNT/STREAM/BIO

21PA 880305 02050106

0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	MEDIUM	SMK OR DEPTH (FT)	00060 STREAM FLOW CFS	00061 STREAM FLOW, INST-CFS	00400 PH SU	00403 PH LAB SU	00410 T ALK CACO3 MG/L	00900 TOT HARD CACO3 MG/L	70508 T ACDITY AS CACO3 HOT-MG/L	01105 ALUMINUM AL,TOT UG/L	01045 IRON FE,TOT UG/L	01092 ZINC ZN,TOT UG/L
88/01/21	1000	WATER				6.10	6.0	4	14		135K	61	24
88/02/11	0850	WATER				5.65	6.0	4	11		135K	54	37
88/03/17	1015	WATER				6.40	5.8	4	10		135K	33	18
88/04/19	0930	WATER				6.60	6.0	4	10		135K	109	10K
88/05/24	1100	WATER				6.00	6.0	2	13		169	154	16
88/06/13	1000	WATER				6.60	6.0	4	10K		135K	38	10K
88/08/09	0920	WATER				7.00	6.2	6	10		281	59	16
88/09/19	0915	WATER				6.80	6.2	4	10K		280	269	15
88/10/03	0730	WATER			20								
88/10/03	0900	WATER				6.20	6.2	4	15		175	83	48
88/11/16	0800	WATER			90								
88/11/16	0900	WATER				6.90	5.8	4	13		91	49	16
88/12/07	0830	WATER			35								
88/12/07	0930	WATER				6.50	5.9	4	10K		135K	10K	10K
89/01/02	0800	WATER			33								
89/01/03	0900	WATER				7.10	5.9	4	12		150	232	10K
89/02/01	0930	WATER				7.20	5.9	4	12		135K	51	24
89/02/01	1230	WATER			31								
89/03/01	0800	WATER			29								
89/03/01	0900	WATER				6.80	6.1	4	11		135K	79	10K
89/04/25	0800	WATER			39								
89/04/25	0930	WATER				7.20					135K	38	10K
89/05/23	0800	WATER			86								
89/05/23	0930	WATER				6.20	5.9	4	10		140	57	24
89/06/15	0810	WATER			134								
89/06/15	0930	WATER				6.40	6.1	2	10K	44	135K	55	12
89/07/06	0910	WATER			95	5.00	6.0	4	10	16	135K	90	10K
89/08/23	0850	WATER				6.50	6.5	6	11	0C	135K	41	10K
89/09/13	0930	WATER				6.10	6.7	6	10K	0C	135K	10K	10K
89/10/24	0900	WATER				7.00	6.1	4	10K	14	135K	64	11
89/10/24	1300	WATER			86								
89/11/28	0800	WATER			44								
89/11/28	0930	WATER				6.70	5.9	3	12	8	135K	69	10K
89/12/07	0730	WATER			27								
89/12/07	0930	WATER				7.30	6.3	4	10	22	135K	23	10K
90/01/08	1130	WATER			15		6.4	4	11	6	135K	95	13
90/02/08	0830	WATER			100	6.30	6.1	3	11	24	135K	29	16
90/03/14	0800	WATER			47								
90/03/14	0830	WATER				6.20	5.8	2	10	8	135K	35	10
90/04/24	0800	WATER			414	6.70	6.2	4	13	12	135K	41	10K
90/05/14	0845	WATER			238								

STORET RETRIEVAL DATE 98/10/28 PGM=RET
WQN0337 PFBC4-007
41 24 57.0 076 05 27.0 4
BOWMAN CRK-T310 BR 1.3 MI N STULL-NOXEN TWP
42131 PENNSYLVANIA WYOMING
SUSQEHANNA RIVER BASIN
BOWMAN CREEK /TYPA/AMBNT/STREAM/BIO
21PA 880305 02050106
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	MEDIUM	SMK OR DEPTH (FT)	00060 STREAM FLOW CFS	00061 STREAM FLOW, INST-CFS	00400 PH SU	00403 PH LAB SU	00410 T ALK CACO3 MG/L	00900 TOT HARD CACO3 MG/L	70508 T ACDITY AS CACO3 HOT-MG/L	01105 ALUMINUM AL,TOT UG/L	01045 IRON FE,TOT UG/L	01092 ZINC ZN,TOT UG/L
90/05/14	0900	WATER				5.67	5.5	2	12	6	173	87	13
90/06/20	0930	WATER			14	6.49	6.3	4	10K	6	588	36	72
90/07/19	1130	WATER			38	6.61	6.4	4	11	4	54	48	8
90/08/23	0800	WATER			78								
90/08/23	0845	WATER				6.00	5.5	2	12	2	138	140	12
90/09/20	1230	WATER			22								
90/09/20		WATER				6.49	6.0	5	10K	4	49	45	10
90/10/22	1400	WATER			95	6.31	5.8	4	11	24	111	43	14
90/11/20	1400	WATER			68	6.23	5.9	3	12	15	155	36	35
90/11/28	1230	WATER				6.10	6.0	4	12	7	206	24	7
90/12/06	1300	WATER			187	5.16	5.8	2	12	12	180	73	20
91/01/10	1400	WATER			47	6.50	5.9	3	13	7	77	104	14
91/02/26	0830	WATER				4.62	5.9	3	10K	4	90	36	14
91/02/26	0900	WATER			83								
91/03/26	1300	WATER			101	4.55	5.4	5	12	8	149	37	14
91/04/29	0730	WATER			74	7.20	6.1	3	10	6	77	165	12
91/05/28	1300	WATER			21								
91/05/28	1330	WATER				5.80	6.2	4	10K	5	59	56	5
91/06/05	1430	WATER			12	7.04	6.6	5	13	0C	37	53	7
91/07/22	1500	WATER			4	6.81	6.6	5	16	0C	45	48	4
91/08/13	1400	WATER			5	6.94	6.5	6	10	0C	23	41	2
91/09/16	0800	WATER			4								
91/09/16	0815	WATER				6.00	6.6	6	13	0C	17	33	3
91/10/15	0800	WATER			7	7.30	6.3	5	14	9	21	24	4
91/11/26	1015	WATER				4.70	5.9	3	13	11	76	60	14
91/11/26	1030	WATER			59								
91/12/11	0730	WATER			59	4.45	5.8	2	13	6	87	61	15
92/01/13	1040	WATER			37								
92/01/13	1100	WATER				7.90	6.0	3	13	13	60	53	12
92/02/24	1300	WATER			38								
92/02/25	1305	WATER				6.80	5.3	2	11	7	70	85	11
92/03/23	1010	WATER					6.0	3	12	13	63	19	11
92/04/27	1240	WATER					5.7	3	10K	6	93	30	12
92/05/14	1030	WATER			86								
92/05/14	1040	WATER				6.30	6.2	6	12	9	116	214	15
92/06/22	1130	WATER			20	7.65	6.2	3	12	10	83	107	9
92/07/20	1310	WATER			74	6.20	5.8	2	12	11	168	175	14
92/08/20	1000	WATER				6.50	6.1	4	10	10	59	29	8
92/08/20	1230	WATER			27								
92/09/15	1015	WATER				7.40	5.9	5	13	4	43	28	7
92/09/15	1100	WATER			19								

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41 24 57.0 076 05 27.0 4
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DATE FROM TO	TIME OF DAY	MEDIUM	SMK OR DEPTH (FT)	00060 STREAM FLOW CFS	00061 STREAM FLOW, INST-CFS	00400 PH SU	00403 PH LAB SU	00410 T ALK CACO3 MG/L	00900 TOT HARD CACO3 MG/L	70508 T ACDITY AS CACO3 HOT-MG/L	01105 ALUMINUM AL,TOT UG/L	01045 IRON FE,TOT UG/L	01092 ZINC ZN,TOT UG/L
92/10/13	1110	WATER				7.10	6.0	3	11	.6	75	32	10
92/10/13	1210	WATER			45								
92/11/12	1015	WATER			61	6.90	6.2	5	12	14	83	48	12
92/12/10	0850	WATER				6.25	6.2	5	11	4	55	24	11
92/12/10	0900	WATER			30								
93/01/25	0950	WATER					5.6	3	13	5	97	50	12
93/01/25	1030	WATER			90								
93/02/17	1245	WATER			25	6.44	6.0	3	11	2	40	57	9
93/03/24	1400	WATER			48	6.55	6.1	4	13	3	178	188	8
93/04/28	1420	WATER			157	6.00	5.3	3	10	3	347	426	17
93/05/24	1445	WATER			22	6.30	6.3	4	15	4	127	258	6
93/06/08	0830	WATER			12								
93/06/08	0845	WATER				6.30	6.2	4	10K	10	98	86	5
93/07/19	1100	WATER			3	6.30	6.1	8	10K	4	68	56	3
93/08/12	1300	WATER			6	6.70	6.3	5	15	2	108	130	2
93/09/15	1030	WATER			5	6.55	6.2	5	10K	6	335	87	3
93/10/14	1100	WATER				6.30	6.1	4	18	1	43	59	4
93/10/14	1130	WATER			14								
93/11/15	0930	WATER				6.20	5.9	3	10K	1	74	65	11
93/11/15	1000	WATER			43								
93/12/14	1130	WATER			76	5.80	5.3	3	12	6	807	59	13
94/01/12	1300	WATER			30	6.00	5.9	3	10K	2	41	177	8
94/02/08	1130	WATER			36	6.00	5.8	3	10K		78	119	9
94/03/08	1130	WATER			74	5.90	5.7	3	10K		75	62	17
94/04/20	0830	WATER			121	5.50	5.2	3	10K	12	124	70	11
94/05/23	1300	WATER			35	6.20	6.0	3	12	8	67	93	6
94/06/14	1100	WATER			65	5.90	6.1	4	12	10	99	112	9
94/07/13	1100	WATER			28								
94/07/13	1130	WATER				5.85	5.9	4	10K	0	61	68	6
94/08/17	0830	WATER			28	6.00	6.3	4	11	14	80	110	6
94/09/13	1230	WATER			15	5.95	5.9	4	11	38	39	47	5
94/10/17	0900	WATER			25	5.75	6.2	4	11	0	46	66	7
94/11/16	1300	WATER			28	6.06	6.2	4	10K	6	47	41	5
94/12/12	1130	WATER			75	5.25	5.5	3	12	19	1108	46	14
95/01/19	1100	WATER			83	5.92	5.7	3	16	4	516	83	14
95/02/23	0800	WATER			28								
95/02/23	0830	WATER				5.95	6.1	4	13	4	471	47	38
95/03/22	1130	WATER			55	5.60	5.8	3	10K	11	565	28	9
95/04/17	1130	WATER			58	5.81	5.9	3	12	12	53	47	10
95/05/08	1130	WATER			25	6.06	6.2	4	11	22	31	24	6
95/06/14	1130	WATER			24	5.94	6.1	4	11	2	54	64	8

STORET RETRIEVAL DATE 98/10/28 PGM=RET
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DATE FROM TO	TIME OF DAY	MEDIUM	SMK OR DEPTH (FT)	00060 STREAM FLOW CFS	00061 STREAM FLOW, INST-CFS	00400 PH SU	00403 PH LAB SU	00410 T ALK CACO3 MG/L	00900 TOT HARD CACO3 MG/L	70508 T ACDITY AS CACO3 HOT-MG/L	01105 ALUMINUM AL,TOT UG/L	01045 IRON FE,TOT UG/L	01092 ZINC ZN,TOT UG/L
95/07/12	1130	WATER			22	6.16	6.2	5	10K	0C	102	76	5
95/08/17	1130	WATER			5	6.43	6.3	6	12	0	26	32	28
95/09/18	1130	WATER			5	6.15	6.4	7	12	3	47	26	5K
95/10/18	1230	WATER			19	5.74	6.0	4	11	14	26	69	5K
95/11/20	1130	WATER			75	5.78	5.6	3	10K	10	90	28	13
95/12/14	1130	WATER			34	5.90	6.1	4	10	7	56	57	9
96/01/31	1130	WATER			131	5.10	5.3	3	14	12	188	100	16
96/02/28	1230	WATER			183	5.31	5.5	3	10K		232	123	19
96/03/20	1230	WATER			168	5.02	5.2	3	10	9	251	153	17
96/04/15	1300	WATER			130	5.51	5.5	3	12	0	125	55	13
96/05/22	0930	WATER			60	6.10	5.7	3	10K	24	88	50K	11
96/06/20	1130	WATER			31	6.09	6.2	4	14	10	63	48	6
96/07/18	1130	WATER			25	5.63	6.2	4	10K	1	55	44	5
96/08/22	1100	WATER			18	6.00	5.9	4	14		53	56	6
96/09/24	1130	WATER			50								
96/09/24	1131	WATER				5.24	5.9	3	10K		77	38	7
96/10/28	1300	WATER				5.97	6.0	3	10K	4	85	32	12
96/11/19	0930	WATER				5.31	5.9	3	10K	8	85	41	11
96/12/11	1300	WATER				5.20	5.9	3	10K		103	35	12
97/01/09	1230	WATER				5.20	5.7	3	215	17	78	40	12
97/02/12	1230	WATER				5.80	6.0	4	13		46	17	8
97/03/19	1230	WATER				5.40	5.9	3	10K	4	83	71	11
97/04/03	1130	WATER				5.63	6.0	4	10K	3	50	15	8
97/05/27	1130	WATER				5.87	6.1	4	10K		48	23	5
97/06/16	0900	WATER				6.26	6.1	4	10K	8	47	38	5K
97/07/01	0915	WATER				6.60	6.1	5	12	5	45	27	6
97/08/05	0900	WATER				6.50	6.2	6	16	3	40	40	5K
97/09/18	0900	WATER				6.80	5.9	5	10K	4	33	43	5
97/10/01	0930	WATER				6.40	5.9	6	12	5	40	34	5K
97/11/06	1000	WATER				6.80	6.1	4	10K	4	70	27	12
97/12/03	0900	WATER				7.60	6.0	3	10K	2	94	44	11
98/01/05	0930	WATER				7.40	5.7	3	10K	2	109	130	8
98/02/23	1410	WATER				7.80	5.7	3	10K	3	121	39	12
98/03/17	1120	WATER					5.5	3	10K	3	144	170	12

DATA with REMARK CODES

Observations in STORET are stored as numerical values usually representing the result of a laboratory or field analysis to quantify the concentration of a chemical in a water sample. In some cases, the numerical value stored represents something other than a normal outcome, and a "Remark Code" is associated with the value as it is entered. Remark codes which are permitted are listed below with their definitions.

REMARK	DEFINITION
(blank)	Data not remarked. Number should be interpreted exactly as reported.
B	Results based upon colony counts outside the acceptable range.
C	Calculated. Value stored was not measured directly, but was calculated from other data available.
D	Field measurement. Some parameter codes (e.g., 400, "Field pH") imply this condition without this remark.
E	Extra sample taken in compositing process.
F	In the case of species, F indicates Female sex.
J	Estimated. Value shown is not a result of analytical measurement.
K	Off-scale low. Actual value not known, but known to be less than value shown. Usually used to indicate a failure to detect the substance.
L	Off-scale high. Actual value not known, but known to be greater than value shown.
M	Presence of material verified, but not quantified. Indicates a positive detection, at a level too low to permit accurate quantification. In the case of temperature or oxygen reduction potential, M indicates a negative value. In the case of species, M indicates Male sex.
N	Presumptive evidence of presence of material.
O	Sampled for, but analysis lost. Accompanying value is not meaningful for analysis.
S	Laboratory test.
T	Value reported is less than the criteria of detection.
U	Material was analyzed for, but not detected. Value stored is the limit of detection for the process in use. In the case of species, U indicates Undetermined sex.
W	Value observed is less than the lowest value reportable under remark "T".
$	Calculated by retrieval software. Numerical value was neither measured nor reported to the database, but was calculated from other data available during generation of the retrieval report. □

APPENDIX 4
BCWA STREAM SAMPLING RESULTS

Bowmans Creeek Watershed Association
Water Quality Testing Results
North Branch Bowmans Creek
Station 1 Bridge downstream of Bowman's Marsh

Date	pH Upst.	pH Dwnst.	Alkalinity	Remarks
4/27/98	4.25		0	
4/28/98	4.25		0	
5/19/98	4.25		0	
8/25/98	5.8		0	
5/16/99	4.75		0	
7/24/99	4.25		0	
Jul-00	5.3			
Aug-00	6			
Sep-00	5.6			
Oct-00	5.5			
Nov-00	5.4			
Dec-00	5.7			
Apr-01	5			
May-01	6			
6/13/01	5.8			
6/19/01	5.5			
8/15/01	NT	NT		First lime application (8 Tons)
9/1/01	6	6		
9/25/01	5.2	5.2		2" rain, high water
11/29/01	5.5		12	
12/12/01	5.7	5.7		
2/23/02	5.1	5.6		
3/21/02	NT	NT		Second Lime Application (17 Tons)
4/8/02	NT	6.25	7	

Bowmans Creeek Watershed Association
Water Quality Testing Results
Mountains Springs Lake
Station 2 Lake above and Stream below dam

Date	pH Lake	pH Stream	Alkalinity	Remarks
4/27/98	4.5		0	Spillway samples
4/28/98	4.5		2	
5/19/98	4.5		0	
8/25/98	5.7		0	
5/16/99	5.5		2	
7/24/99	5		2	
Jul-00	5.4			
Aug-00	5.5			
Sep-00	5.4			
Oct-00	5.5			
Nov-00	5.2			
Dec-00	5.2			
Apr-01	5.2			
May-01	5.3			
6/13/01				
6/19/01	6.1	6.1		
8/15/01	NT	NT	NT	No lime applied at this location
9/1/01	6.25	5.75		
9/25/01	5.8	5.8		2" rain, water high
11/29/01	5.5	5.5	12	
12/12/01	5.8	5.6		
2/23/02	5.2	NT	7	
3/21/02	NT	NT		No lime applied at this location
3/27/02	NT	NT		No lime applied at this location
4/8/02	5.3	NT	7	

Bowmans Creeek Watershed Association

Water Quality Testing Results

Bean Run

Station 3 Bridge upstream of abandoned railroad bridge

Date	pH Upst.	pH Dwnst.	Alkalinity	Remarks
4/27/98	4.75		2	From bridge
4/28/98	4.75		2	
5/19/98	4.75		2	
8/25/98	6.3		4	
5/16/99	5.25		0	
7/24/99	4.5		2	
Jul-00	6			
Aug-00	6.2			
Sep-00	5.9			
Oct-00	5.9			
Nov-00	6.3			
Dec-00	6.5			
Apr-01	6			
May-01	6.3			
6/13/01	6.25			
6/19/01	6.1			
8/15/01	NT	NT	NT	First lime application (4 Tons)
9/1/01	6			
9/25/01	5.8	6		2" rain, high water
11/29/01	6			
12/12/01	6	6		
2/23/02	5.8	6.2	6	
3/21/02	NT	NT	NT	Second lime application (5 Tons)
4/8/02	6.2	NT	7	

Bowmans Creeek Watershed Association

Water Quality Testing Results

Wolf Run

Station 4 Bridge on old railroad bed

Date	pH Upst.	pH Dwnst.	Alkalinity	Remarks
4/27/98	4		0	From bridge
4/28/98	4		0	
5/19/98	4		0	
8/25/98	4.6		0	
5/16/99	4		0	
7/24/99	4		0	
Jul-00	5			
Aug-00	5			
Sep-00	4.9			
Oct-00	5			
Nov-00	5			
Dec-00	5			
Apr-01	5			
May-01	5			
6/13/01	5			
6/19/01	5.1			
8/15/01	NT	NT	NT	First lime application (12 Tons)
9/1/01	5	6.25		
9/25/01	4.5	4.5		2" rain, high water
11/29/01	5		12	
12/12/01	5	5.2		
2/23/02	4.8	5.1	6	
3/21/02	NT	NT	NT	Second lime application (12 Tons)
4/1/02	NT	NT	NT	Lime application (17 Tons)
4/8/02	6.2	NT	7	

Bowmans Creeek Watershed Association

Water Quality Testing Results

Watertower Run

Station 5 Bridge on old railroad bed

Date	pH Upst. in Trib.	pH Upst. in Bowm.	pH Dwnst. in Bowm.	Alkalinity	Remarks
4/27/98	3.75			0	From bridge
4/28/98	3.75			0	
5/19/98	4			0	
8/25/98	4.3			0	
5/16/99	3.75			0	
Jul-00	4.3				
Aug-00	4.5				
Sep-00	4.5				
Oct-00	4.2				
Nov-00	4.5				
Dec-00	4.5				
Apr-01	4.5				
May-01	4.4				
6/13/01					
6/19/01	4.3	5.2			
8/15/01	NT	NT		NT	First lime application (24 Tons)
9/1/01	4.5	6.5			
9/25/01	4.5	4.5			2" rain, high water
11/29/01	4	5.7		12	
12/12/01	4.4	5.7			
3/27/02	NT	NT		NT	Second lime application (34 Tons)
3/28/02	NT	NT		NT	Lime application (17 Tons)
4/8/02	4.2	6.2	6.2	7 & 14	

Bowmans Creeek Watershed Association
Water Quality Testing Results
Beth Run
Station 6 Control Sampling

Date	pH Upst. in Trib.	pH Upst. in Bowm.	pH Dwnst. in Bowm.	Alkalinity	Remarks
4/27/98	4.5			2	No lime applied on this location.
4/28/98	4.5			2	
5/19/98	4.75			2	
8/25/98	6.8			6	
5/16/99	5.5			4	
Jul-00	6.5				
Aug-00	6.5				
Sep-00	5.8				
Oct-00	6.2				
Nov-00	6.3				
Dec-00	6.3				
Apr-01	6				
May-01	6.2				
6/13/01					
6/19/01	5.8				
8/15/01	NT	NT		NT	No lime applied on this location.
9/1/01	6				
9/25/01	6.3				2" rain, high water
11/29/01	6				
12/12/01	6.4				
3/27/02	NT	NT		NT	No lime applied on this location.
3/28/02	NT	NT		NT	No lime applied on this location.
4/8/02	6.2	6.2	6.2	7 & 7	

Bowmans Creeek Watershed Association

Water Quality Testing Results

Cider Run : Lime application 1 mile upstream of sampling point on CC Bridge

Station 7 Sampling point at old railroad bridge over Cider Run

Date	pH Upstr. in Trib.	pH Upstr. in Bowm.	pH Dwnst. in Bowm.	Alkalinity	Remarks
4/27/98	4.25			0	
4/28/98	4.25			0	
5/19/98	4.25			2	
8/25/98	6.8			2	
5/16/99	5			2	
Jul-00	6.3				
Aug-00	5.75				
Sep-00	5.1				
Oct-00	NT				
Nov-00	5.3				
Dec-00	5.4				
Apr-01	5				
May-01	5.7				
6/13/01	5				
6/19/01	6.1		6.1		
8/15/01	NT		NT	NT	First lime application (14 Tons)
9/1/01	6.25		6.25		
9/25/01	5.7		5.3*		*Run from mountain a pH of 4.5
11/29/01	5.5		6	12	
12/12/01	6.4		6.4		
2/23/02	5.1	6.3	5.8	6	
4/3/02	NT	NT	NT	NT	Second lime application (34 Tons)
4/8/02	6.2		6.3	7 &10	

Bowmans Creeek Watershed Association			
Water Quality Testing Results			
Bowmans Creek Station No sampling only lime application			
Station 8 Along Township road upstream of Ayers property			
Date	pH	Alkalinity	Remarks
8/20/01	NT	NT	First lime application (2 Tons)
4/2/02	NT	NT	Second lime application (17 Tons)

Bowmans Creeek Watershed Association

Water Quality Testing Results

Bowmans Creek Station No sampling only lime application

Station 9 Along Township road downstream of Ayers property

Date	pH	Alkalinity	Remarks
8/20/01	NT	NT	First lime application (2 Tons)
4/2/02	NT	NT	No lime application

Bowmans Creeek Watershed Association

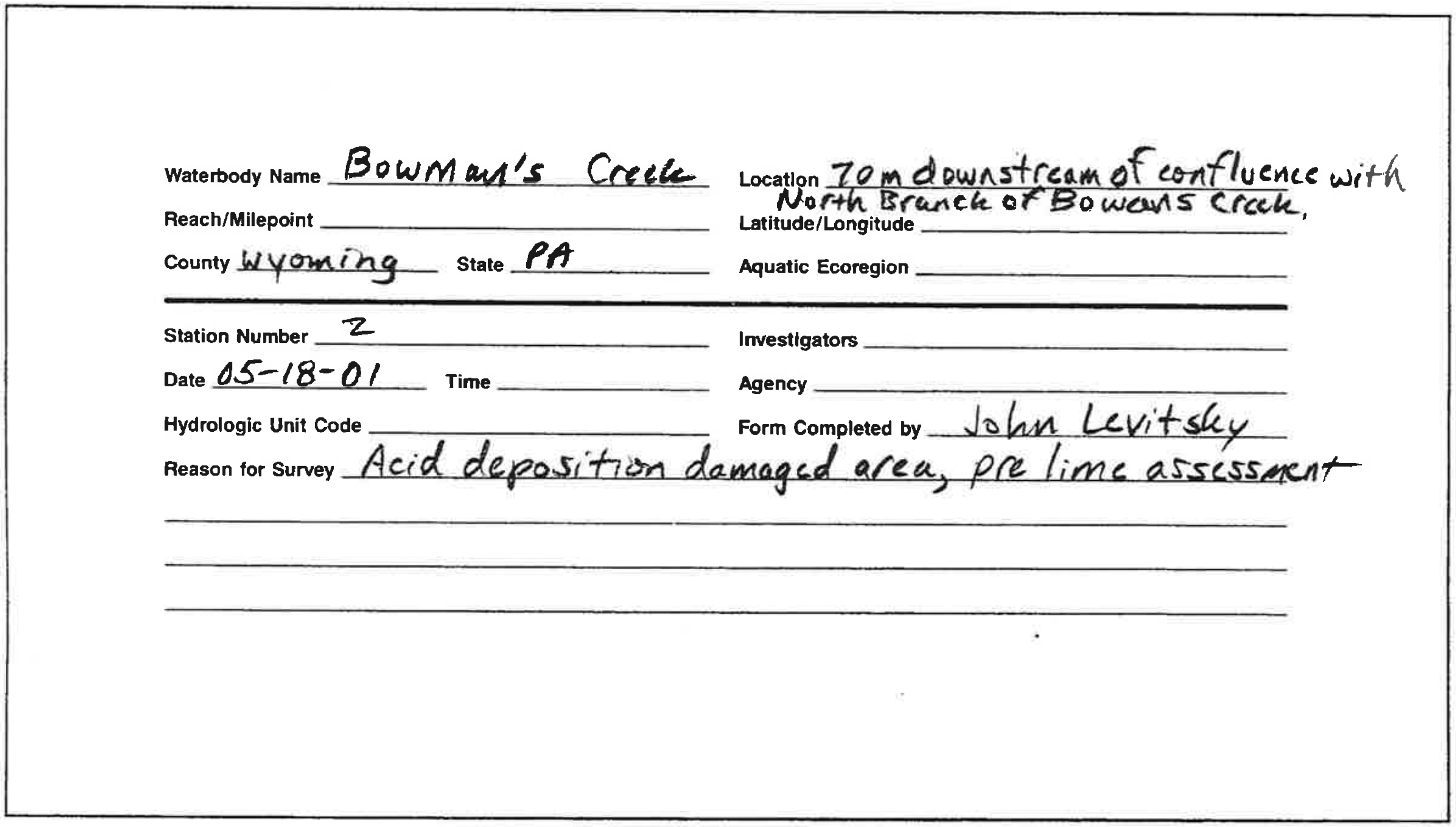
Water Quality Testing Results

Bowmans Creek

Station 10 Bridge at Stull over Bowman's Creek

Date	pH Upst.	pH Dwnst.	Alkalinity	Remarks
8/20/01	NT	NT		First lime application (4 Tons)
2/23/02	6.4	6.5		
3/21/02	NT	NT		No lime applied

APPENDIX 5
MACRO-INVERTEBRATE SURVEY RESULTS



Waterbody Name Bowman's Creek

Location 70m downstream of confluence with North Branch of Bowmans Creek,

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 2

Investigators

Date 05-18-01 Time

Agency

Hydrologic Unit Code

Form Completed by John Levitsky

Reason for Survey Acid deposition damaged area, pre lime assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Bowman's Creek: 70m downstream of the confluence with 5-18-01
station #2 North Branch of Bowmans Creek.

JJL/LMS

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	[✓ 3]	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed 1 = Rare 2 = Common 3 = Abundant 4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST (Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

Porifera		Anisoptera		Chironomidae	
Hydrozoa		Zygoptera		Plecoptera	C (2 sp)
Platyhelminthes		Hemiptera		Ephemeroptera	C (1 sp)
Turbellaria		Coleoptera	R (1 sp)	Trichoptera	R (1 sp)
Hirudinea		Lepidoptera		Other	
Oligochaeta		Sialidae		Megaloptera	A (1 sp)
Isopoda		Corydalidae			
Amphipoda		Tipulidae			
Decapoda		Empididae			
Gastropoda		Simuliidae			
Bivalvia		Tabanidae			
		Culicidae			

Rare < 3 Common 3–9 Abundant > 10 Dominant > 50 (Estimate)

Observations Canopy Cover 5% Temp 12.5°C
Stream width 4.3m
Avg depth 0.15m
Stream velocity 34m/min
Stream bottom: < 5% boulders
85% cobbles
15% gravel
heavy moss on rock surfaces

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.

Waterbody Name Bean Run

Location 10 m downstream of abandoned railroad bridge

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 3

Investigators Lisa Stack/ John Levitsky

Date 5-18-01 Time

Agency

Hydrologic Unit Code

Form Completed by John Levitsky

Reason for Survey Acid deposition damaged area, pre lime assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Bean Run; 10m downstream of abandoned railroad bridge 5·18·01
Station#3
JJL/LMS

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	[✓ 3]	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed   1 = Rare   2 = Common   3 = Abundant   4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST(Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

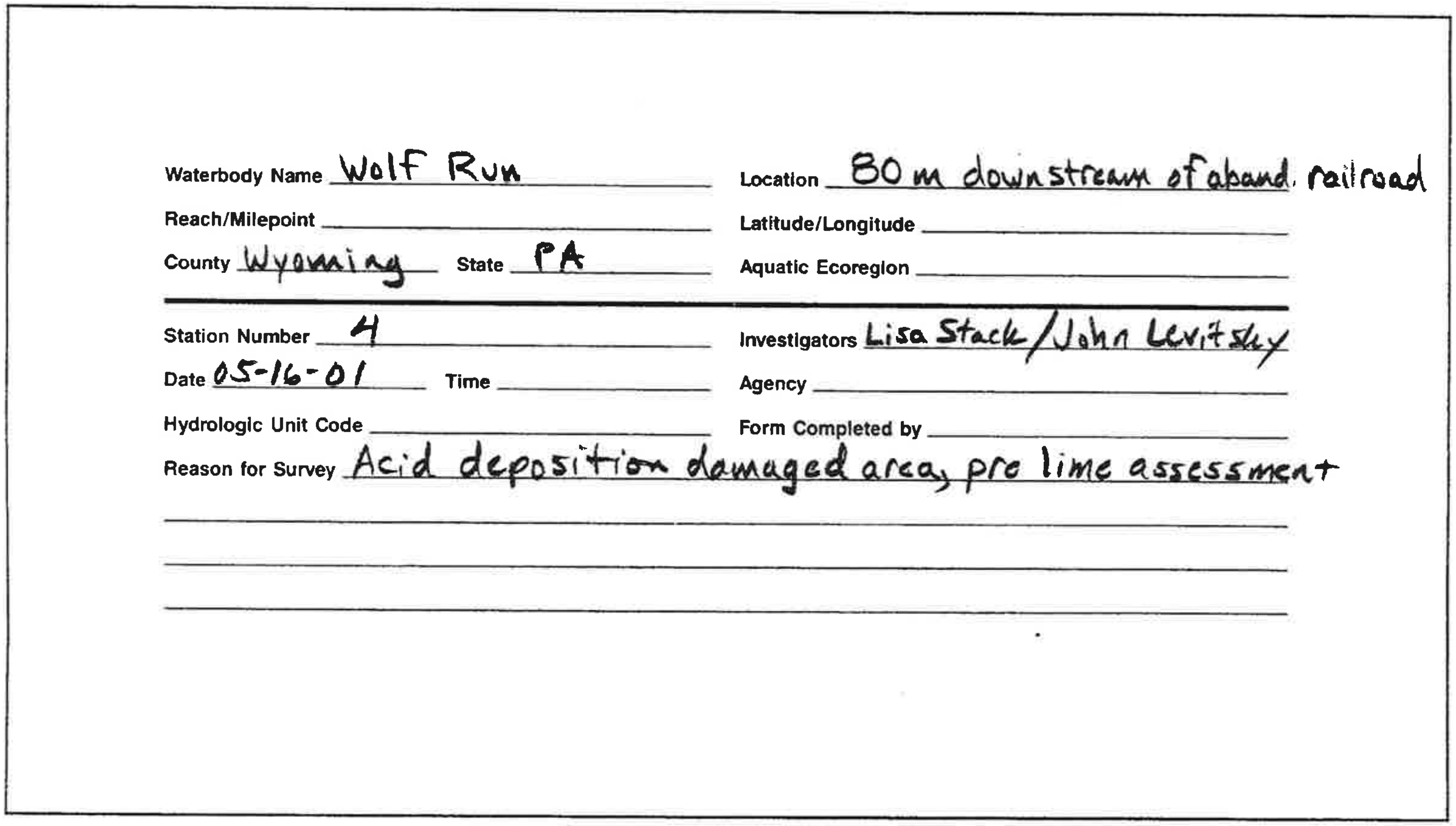
Porifera		Anisoptera		Chironomidae	
Hydrozoa		Zygoptera		Plecoptera	A (2sp)
Platyhelminthes		Hemiptera		Ephemeroptera	C
Turbellaria		Coleoptera		Trichoptera	R
Hirudinea		Lepidoptera		Other	
Oligochaeta		Sialidae		Odonata	R
Isopoda		Corydalidae			
Amphipoda		Tipulidae			
Decapoda	|	Empididae			
Gastropoda		Simuliidae			
Bivalvia		Tabanidae			
		Culicidae			

Rare < 3   Common 3–9   Abundant > 10   Dominant > 50 (Estimate)

Observations Canopy Cover 100%
Stream width 5.5m
Avg. depth 0.1m
Stream velocity 56m/min
Stream bottom: 5% boulders
85% cobbles
15% gravel

Temperature 10°C

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Wolf Run

Reach/Milepoint

County Wyoming State PA

Location 80 m downstream of aband. railroad

Latitude/Longitude

Aquatic Ecoregion

Station Number 4

Date 05-16-01 Time

Hydrologic Unit Code

Investigators Lisa Stack/John Levitsky

Agency

Form Completed by

Reason for Survey Acid deposition damaged area, pre lime assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Wolf Run 80m downstream of abandoned railroad bed 05-16-01
Station 4
JJL/LMS

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	[✓ 0]	1	2	3	4	Macroinvertebrates	0	[✓ 1]	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed 1 = Rare 2 = Common 3 = Abundant 4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST (Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

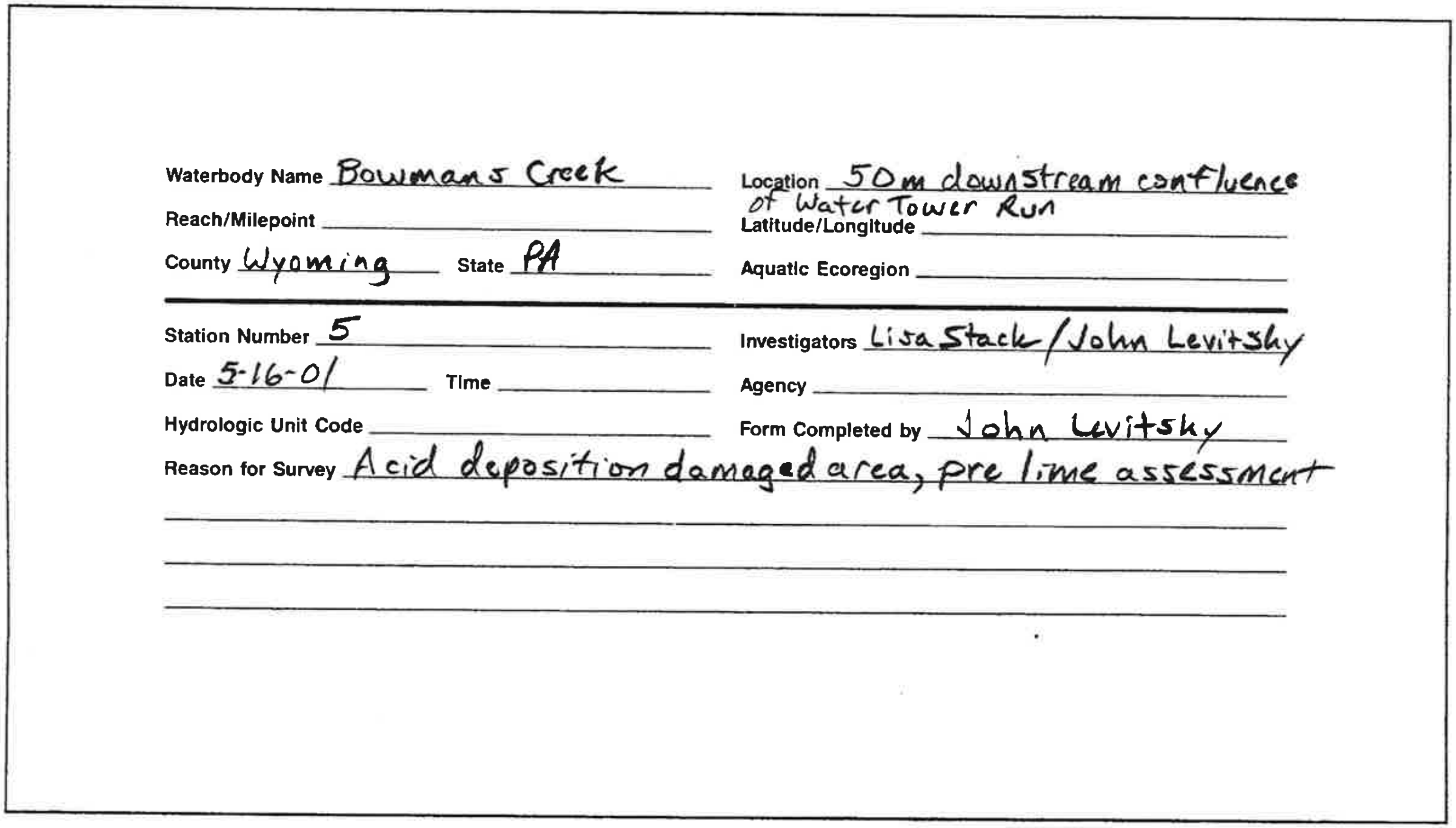
Porifera	Anisoptera	Chironomidae
Hydrozoa	Zygoptera	Plecoptera
Platyhelminthes	Hemiptera	Ephemeroptera
Turbellaria	Coleoptera	Trichoptera
Hirudinea	Lepidoptera	Other
Oligochaeta	Sialidae	
Isopoda	Corydalidae	
Amphipoda	Tipulidae	
Decapoda 1 found	Empididae	
Gastropoda	Simuliidae	
Bivalvia	Tabanidae	
	Culicidae	

Rare < 3 Common 3–9 Abundant > 10 Dominant > 50 (Estimate)

Observations Canopy Cover 100% Temperature 10°C
Stream width 4.5m
Avg. depth 8 cm
Stream velocity 24m/min
Stream bottom: < 5% boulders
70% cobbles
20% gravel
5% tree debris

1 crayfish found only no aquatic insects

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Bowmans Creek

Location 50m downstream confluence of Water Tower Run

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 5

Investigators Lisa Stack/John Levitsky

Date 5-16-01 Time

Agency

Hydrologic Unit Code

Form Completed by John Levitsky

Reason for Survey Acid deposition damaged area, pre lime assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Bowman's Creek 50m down stream of
Watertower Run
Station #5

5-16-01
JJL/LMS

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	[✓ 0]	1	2	3	4	
Filamentous Algae	[✓ 0]	1	2	3	4	Macroinvertebrates	[✓ 0]	1	2	3	4	
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4	NS

0 = Absent/Not Observed   1 = Rare   2 = Common   3 = Abundant   4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST (Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

Porifera	Anisoptera	Chironomidae
Hydrozoa	Zygoptera	Plecoptera
Platyhelminthes	Hemiptera	Ephemeroptera
Turbellaria	Coleoptera	Trichoptera
Hirudinea	Lepidoptera	Other
Oligochaeta	Sialidae	
Isopoda	Corydalidae	
Amphipoda	Tipulidae	
Decapoda	Empididae	
Gastropoda	Simuliidae	
Bivalvia	Tabanidae	
	Culicidae	

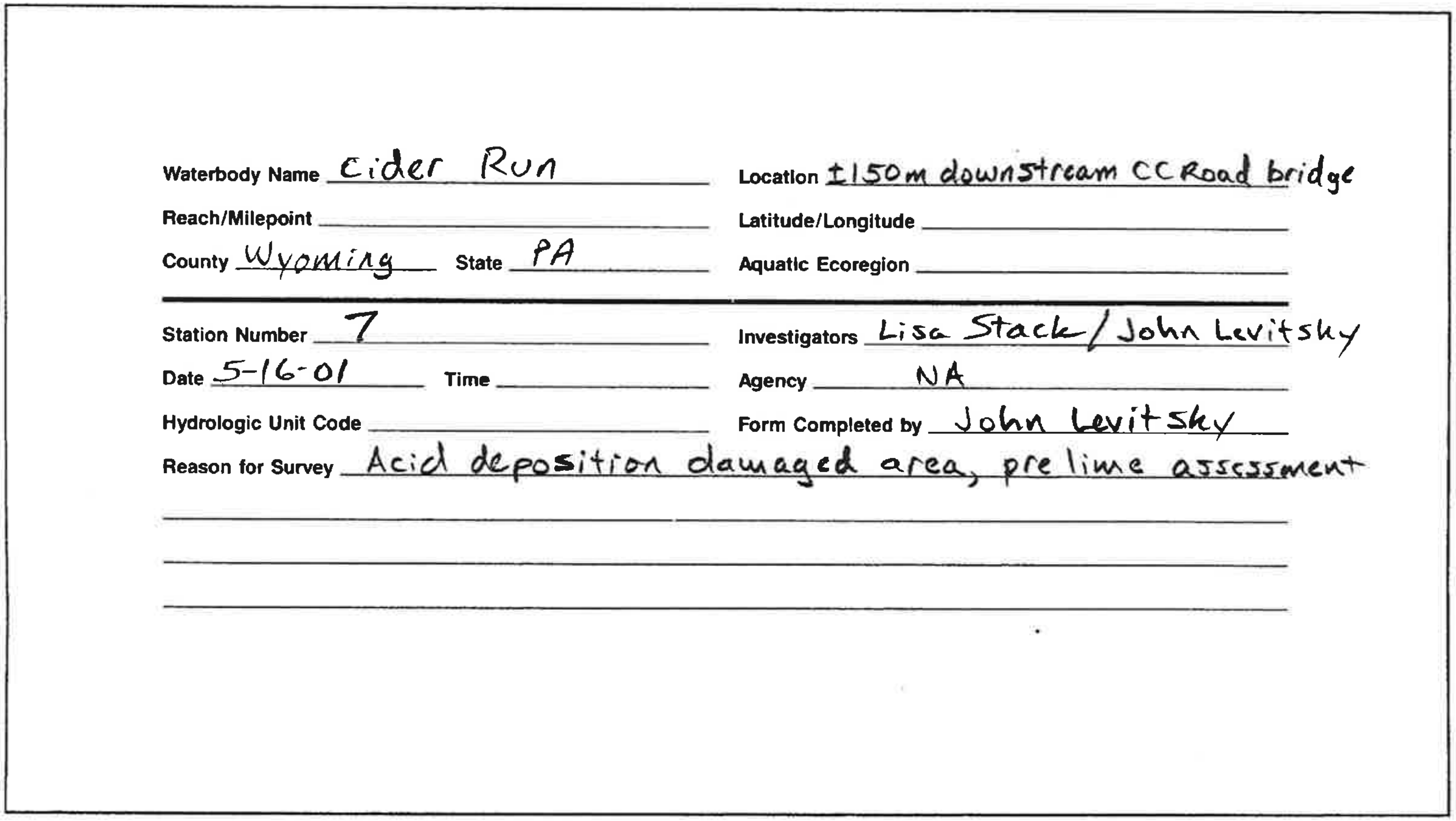
Rare < 3   Common 3–9   Abundant > 10   Dominant > 50 (Estimate)

Observations: Canopy Cover 65%
Stream width - 15m
Avg. depth - 23 cm
Stream velocity - 22m/min
Stream bottom: 35% boulders
45% cobbles
20% gravel

Water Temp 13°C

No macro invertebrates found at this station

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Cider Run

Reach/Milepoint

County Wyoming State PA

Location ±150m downstream CC Road bridge

Latitude/Longitude

Aquatic Ecoregion

Station Number 7

Date 5-16-01 Time

Hydrologic Unit Code

Investigators Lisa Stack / John Levitsky

Agency NA

Form Completed by John Levitsky

Reason for Survey Acid deposition damaged area, pre lime assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Cider Run @ confluence with unnamed tributary 5-16-01
±150m downstream CC Road bridge. JJL-LMS
Station #7

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	**Slimes**	[✓ 0]	1	2	3	4
Filamentous Algae	[✓ 0]	1	2	3	4	**Macroinvertebrates**	0	1	2	3	[✓ 4]
Macrophytes	0	1	2	3	4	**Fish**	0	1	2	3	4 NS

0 = Absent/Not Observed **1 = Rare** **2 = Common** **3 = Abundant** **4 = Dominant**

MACROBENTHOS QUALITATIVE SAMPLE LIST (Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

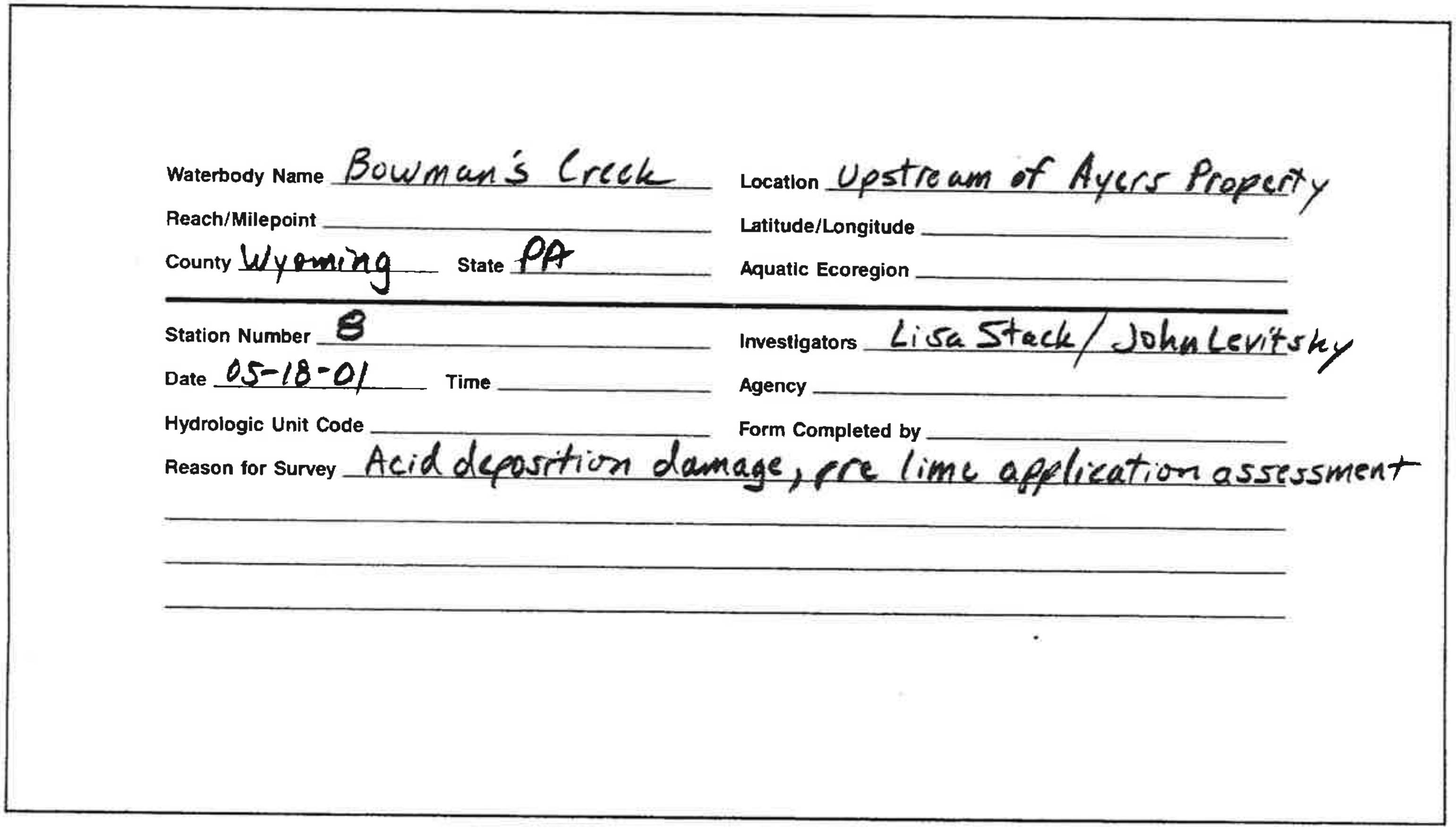
Porifera		**Anisoptera**		**Chironomidae**	
Hydrozoa		**Zygoptera**		**Plecoptera**	A. (5sp)
Platyhelminthes		**Hemiptera**		**Ephemeroptera**	A (3sp)
Turbellaria		**Coleoptera**		**Trichoptera**	C (4sp)
Hirudinea		**Lepidoptera**		**Other**	
Oligochaeta		**Sialidae**			
Isopoda		**Corydalidae**			
Amphipoda		**Tipulidae**			
Decapoda	R (1sp.)	**Empididae**			
Gastropoda		**Simuliidae**			
Bivalvia		**Tabanidae**			
		Culicidae			

Rare < 3 **Common 3–9** **Abundant > 10** **Dominant > 50 (Estimate)**

Observations 85% canopy cover
Stream width 5m
Avg. depth 15cm
Stream velocity 18 m/min
Stream bottom 15% Boulder
50% Cobbler
25% Gravel
5% Sand
5% Detrious

Water Temp 7.5°C

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Bowman's Creek

Location Upstream of Ayers Property

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 8

Investigators Lisa Stack/John Levitsky

Date 05-18-01 Time

Agency

Hydrologic Unit Code

Form Completed by

Reason for Survey Acid deposition damage, pre lime application assessment

Figure 2.6-1. Header Information used for documentation and identification for sampling stations.

Station 8 Bowman's Creek upstream of Ayers property

5-18-01

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	[✓ 2]	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed 1 = Rare 2 = Common 3 = Abundant 4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST(Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

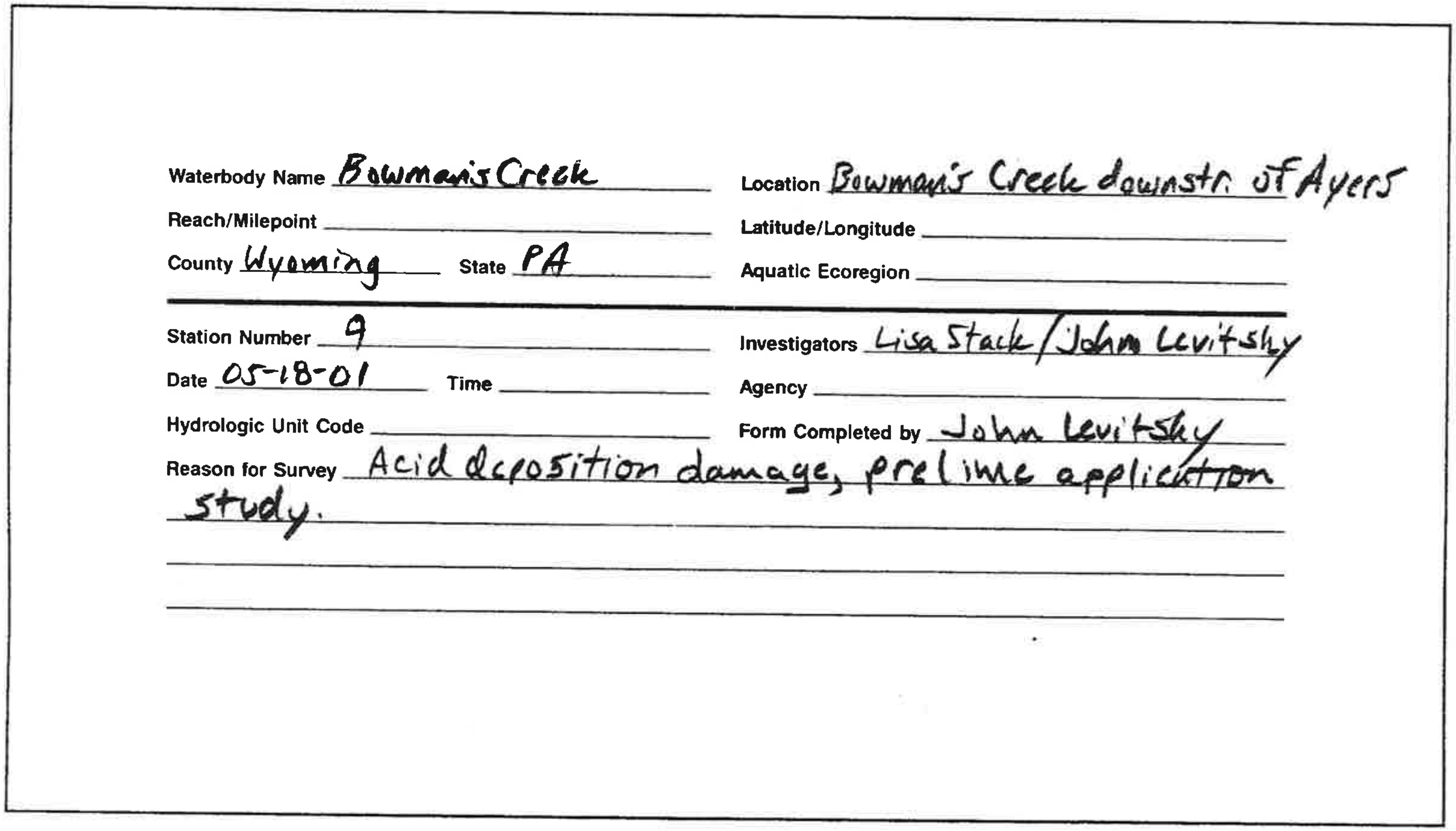
Porifera	Anisoptera	Chironomidae
Hydrozoa	Zygoptera	Plecoptera C
Platyhelminthes	Hemiptera	Ephemeroptera C
Turbellaria	Coleoptera	Trichoptera R
Hirudinea	Lepidoptera	Other
Oligochaeta	Sialidae	
Isopoda	Corydalidae	
Amphipoda	Tipulidae	
Decapoda	Empididae	
Gastropoda	Simuliidae	
Bivalvia	Tabanidae	
	Culicidae	

Rare < 3 Common 3–9 Abundant > 10 Dominant > 50 (Estimate)

Observations Canopy Cover < 5%
Stream width 20m
Avg. depth 0.15m
Stream velocity 55m/min
Stream bottom 5% boulders
90% cobbles
5% gravel

Water Temp 11°C

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Bowman's Creek

Location Bowman's Creek downstr. of Ayers

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 9

Investigators Lisa Stack / John Levitsky

Date 05-18-01 Time

Agency

Hydrologic Unit Code

Form Completed by John Levitsky

Reason for Survey Acid deposition damage, prelime application study.

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Station 9 Bowman's Creek downstream of Ayers Property 5-18-01

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	[✓ 2]	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed 1 = Rare 2 = Common 3 = Abundant 4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST(Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

Porifera	Anisoptera	Chironomidae
Hydrozoa	Zygoptera	Plecoptera C
Platyhelminthes	Hemiptera	Ephemeroptera C
Turbellaria	Coleoptera	Trichoptera R
Hirudinea	Lepidoptera	Other
Oligochaeta	Sialidae	
Isopoda	Corydalidae	
Amphipoda	Tipulidae	
Decapoda	Empididae	
Gastropoda	Simuliidae	
Bivalvia	Tabanidae	
	Culicidae	

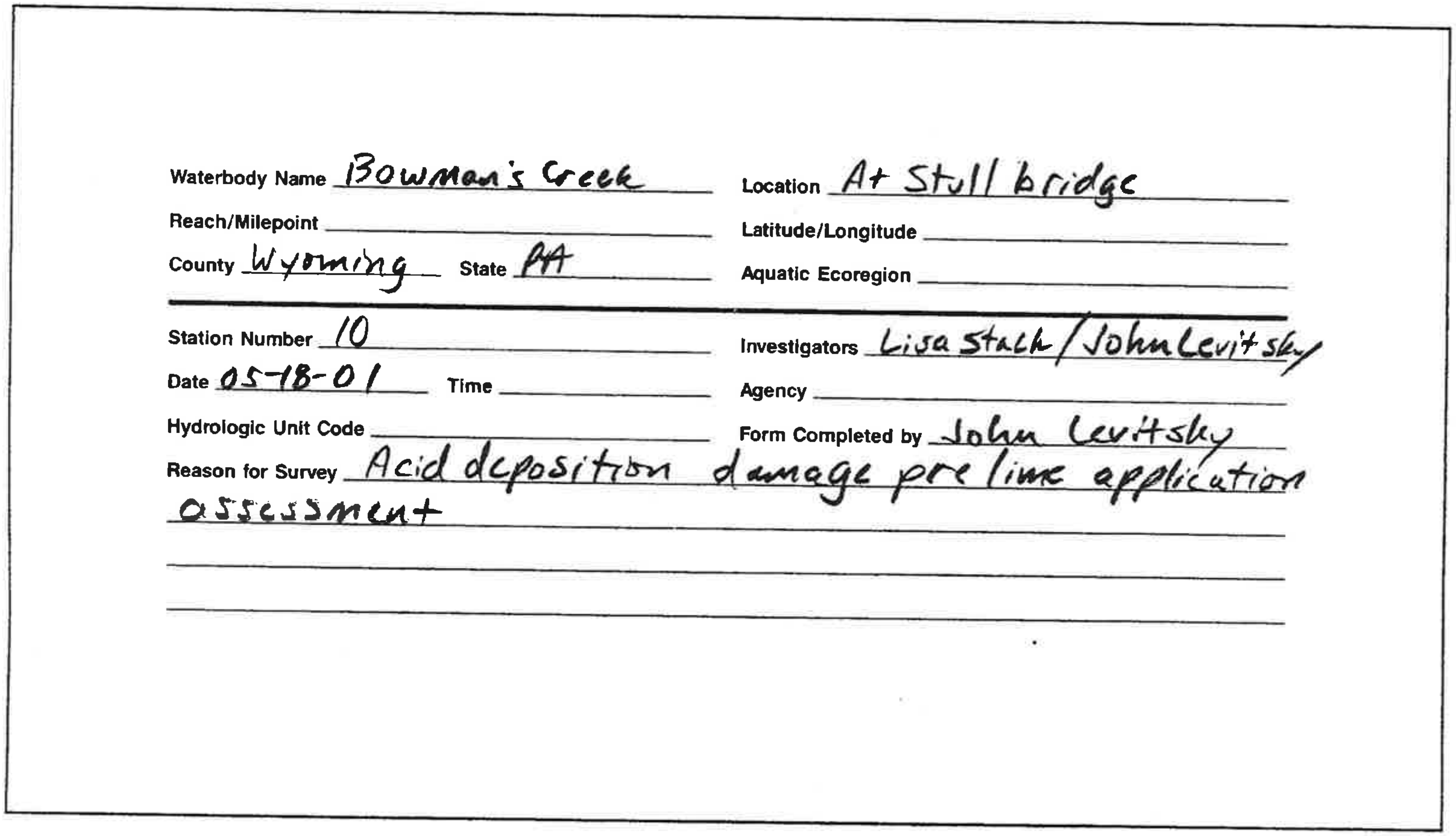
Rare < 3 Common 3–9 Abundant > 10 Dominant > 50 (Estimate)

Observations

Canopy Cover < 5%
stream width 10 m
stream depth 0.15 m
stream velocity 53 m/min
stream bottom 10% boulders
85% cobbles
5% gravel

Water Temp 11°C

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.



Waterbody Name Bowman's Creek

Location At Stull bridge

Reach/Milepoint

Latitude/Longitude

County Wyoming State PA

Aquatic Ecoregion

Station Number 10

Investigators Lisa Stack / John Levitsky

Date 05-18-01 Time

Agency

Hydrologic Unit Code

Form Completed by John Levitsky

Reason for Survey Acid deposition damage pre lime application assessment

Figure 2.6-1. Header information used for documentation and identification for sampling stations.

Station 10; Stull bridge approximatly 25 stocked trout in view during the macroinvert screening. 5-18-01

Rapid Bioassessment Protocol I

Biosurvey Field Data Sheet

RELATIVE ABUNDANCE OF AQUATIC BIOTA

Periphyton	0	1	2	3	4	Slimes	0	1	2	3	4
Filamentous Algae	0	1	2	3	4	Macroinvertebrates	0	1	2	3	4
Macrophytes	0	1	2	3	4	Fish	0	1	2	3	4

0 = Absent/Not Observed 1 = Rare 2 = Common 3 = Abundant 4 = Dominant

MACROBENTHOS QUALITATIVE SAMPLE LIST (Indicate Relative Abundance R = Rare, C = Common, A = Abundant, D = Dominant)

Porifera	Anisoptera	Chironomidae
Hydrozoa	Zygoptera	Plecoptera C
Platyhelminthes	Hemiptera	Ephemeroptera C
Turbellaria	Coleoptera	Trichoptera R
Hirudinea	Lepidoptera	Other
Oligochaeta	Sialidae	
Isopoda	Corydalidae	
Amphipoda	Tipulidae	
Decapoda	Empididae	
Gastropoda	Simuliidae	
Bivalvia	Tabanidae	
	Culicidae	

Rare < 3 Common 3–9 Abundant > 10 Dominant > 50 (Estimate)

Observations Canopy Cover < 5%
Stream width 20m
Depth 0.15m
Velocity 41m/min
Stream bottom: 10% boulder
85% cobbles
< 5% gravel

Water Temp 11.5°C

Figure 6.1-1. Biosurvey Field Data Sheet for use with Rapid Bioassessment Protocol I.

APPENDIX 6
PA FISH & BOAT COMMISSION FISH SURVEY RESULTS

NAME	SITERM	SITEDAT	COMNAME	SIZEGP	M	C	R
BEAN RN	0.42	08/14/01	BROOK TROUT	25	0	3	0
BEAN RN	0.42	08/14/01	BROOK TROUT	50	36	78	17
BEAN RN	0.42	08/14/01	BROOK TROUT	75	0	6	0
BEAN RN	0.42	08/14/01	BROOK TROUT	100	35	29	17
BEAN RN	0.42	08/14/01	BROOK TROUT	125	5	8	3
BEAN RN	0.42	08/14/01	BROOK TROUT	150	1	1	0
BEAN RN	0.42	08/14/01	BROOK TROUT	175	1	1	1
BEAN RN	0.07	08/14/01	BROOK TROUT	25	0	6	0
BEAN RN	0.07	08/14/01	BROOK TROUT	50	38	112	12
BEAN RN	0.07	08/14/01	BROOK TROUT	75	6	7	2
BEAN RN	0.07	08/14/01	BROOK TROUT	100	27	21	16
BEAN RN	0.07	08/14/01	BROOK TROUT	125	9	9	6
BEAN RN	0.07	08/14/01	BROOK TROUT	150	1	0	0
BOWMAN CK	24.66	08/14/01	BROOK TROUT	50	38	39	6
BOWMAN CK	24.66	08/14/01	BROOK TROUT	75	9	12	3
BOWMAN CK	24.66	08/14/01	BROOK TROUT	100	33	28	16
BOWMAN CK	24.66	08/14/01	BROOK TROUT	125	23	17	12
BOWMAN CK	24.66	08/14/01	BROOK TROUT	150	10	6	6
BOWMAN CK	24.66	08/14/01	BROOK TROUT	175	6	4	2
BOWMAN CK	24.66	08/14/01	BROOK TROUT	200	2	3	1
BOWMAN CK	24.66	08/14/01	BROOK TROUT	250	3	2	2
BOWMAN CK	24.83	08/14/01	BROOK TROUT	50	22	17	6
BOWMAN CK	24.83	08/14/01	BROOK TROUT	75	8	12	2
BOWMAN CK	24.83	08/14/01	BROOK TROUT	100	32	24	13
BOWMAN CK	24.83	08/14/01	BROOK TROUT	125	18	15	8
BOWMAN CK	24.83	08/14/01	BROOK TROUT	150	6	5	3
BOWMAN CK	24.83	08/14/01	BROOK TROUT	175	7	7	3
BOWMAN CK	24.83	08/14/01	BROOK TROUT	200	2	1	0
BOWMAN CK	24.83	08/14/01	BROOK TROUT	225	1	2	1

NAME	SITERM	SITEDAT	COMNAME	SIZEGP	M	C	R
BOWMAN CK N BR	0.13	08/14/01	BROOK TROUT	125	1		
BOWMAN CK N BR	0.13	08/14/01	BROOK TROUT	150	1		
BOWMAN CK N BR	0.13	08/14/01	BROOK TROUT	200	1		
CIDER RN	1.21	08/14/01	BROOK TROUT	50	1		
CIDER RN	1.21	08/14/01	BROOK TROUT	100	3		
CIDER RN	1.21	08/14/01	BROOK TROUT	125	6		
CIDER RN	1.21	08/14/01	BROOK TROUT	150	2		
CIDER RN	1.21	08/14/01	BROOK TROUT	175	3		
CIDER RN	1.21	08/14/01	BROOK TROUT	200	2		
CIDER RN	1.07	08/14/01	BROOK TROUT	100	1		
CIDER RN	1.07	08/14/01	BROOK TROUT	125	1		
CIDER RN	1.07	08/14/01	BROOK TROUT	150	5		
CIDER RN	1.07	08/14/01	BROOK TROUT	175	1		
CIDER RN	1.07	08/14/01	BROOK TROUT	200	1		

SITERM = THE RIVER MILE UPSTREAM FROM THE MOUTH OF THE STREAM
SITEDATE = IS THE DATE THE MARKING RUN WAS COMPLETED
SIZEGP = SIZE GROUP, THESE ARE 25-mm GROUPS,
M = THE NUMBER OF FISH CAUGHT DURING THE FIRST PASS OR MARKING RUN
C = THE NUMBER OF FISH CAUGHT DURING THE SECOND PASS OR RECAPTURE RUN
R = THE NUMBER OF FISH IN THE SECOND PASS THAT HAD MARKS THAT INDICATE THEY WERE CAPTURED DURING THE FIRST RUN

BEAN RN @ RIVER MILE 0.42 IS UPSTREAM FROM THE LIMING SITE
BEAN RN @ RIVER MILE 0.07 IS DOWNSTREAM FROM THE LIMING SITE
BOWMAN CK @ RIVER MILE 24.66 IS DOWNSTREAM FORM WOLF RUN
BOWMAN CK @ RIVER MILE 24.83 IS UPSTREAM FROM WOLF RUN
BOWMAN CK N BR @ RIVER MILE 0.13 IS UPSTREAM FROM THE ACCESS ROAD TO MT SPRINGS LAKE
CIDER RN @ RIVER MILE 1.21 IS UPSTREAM FROM THE LIMING SITE
CIDER RN @ RIVER MILE 1.07 IS DOWNSTREAM FROM THE LIMING SITE

APPENDIX 7
2001 AND 2002 LIME APPLICATION CALCULATIONS

2001 Bowmans Creek Lime Addition Estimate-Hettesheimer Run to Head Waters
Limestone Sand-First Application

Station	*Subarea	%Subarea	*Sq. Mile	Acres	pH	**D1	Tons Lime	Est. Field Applied Tons	Date Applied	Application Locations:
1	2,3	1	3.69	2,362	5.2	0.00325	7.68	8	8/15/01	N. Branch Bowmans Cr. bridge on Mt. Springs Rd.
2	1	1	3.5	2,240	5.2	0.00325	7.28	8	8/15/01	Old bridge over Bowmans Cr. below Mt. Spring Dam
3	5,6,7	1	2.23	1,427	5.7	0.00185	2.64	4	8/15/01	Bean Run bridge above railroad grade
4	8	0.4	3.696	2,365	4.6	0.00525	12.42	12	8/15/01	Wolf Run bridge on railroad grade
5	8	0.6	5.544	3,548	4.2	0.0068	24.13	24	8/17/01	Watertower bridge on railroad grade
6	9,10,11, 12,13	1	6.17	3,949	5.3	0.00295	11.65	14	8/20/01	CC road bridge over Cider Run
7	16	0.5	0.55	352	5.7	0.00185	0.65	2	8/20/01	Bowmans Cr. above Ayers from railroad grade
8	16	0.5	0.55	352	5.7	0.00185	0.65	2	8/20/01	Bowmans Cr. below Ayers and above hatchery
9	17	1	2.07	1,325	5.7	0.00185	2.45	4	8/20/01	Stull Bridge
10	19,20	1	4.66	2,982	5.7	0.00185	5.52	7	8/20/01	Stone Run headwaters on S. Mt. Club
11	21	1	1.47	941	5.8	0.0016	1.51	3	8/20/01	York Run headwaters on S. Mt. Club
12	22	1	2.01	1,286	4.9	0.00415	5.34	0		Hettersheimer Run headwaters on S. Mt. Club
Totals:							81.91	88.00		

* Subareas listed and drainage areas extrapolated from Bowmans Creek Act 167 study done for Wyoming County under PADEP grant funding.

**Dosage Multiplier Factor from Guidelines for Liming Acidified Streams and Rivers, Va. Water Resource Research Center, Va. Polytechnic Institute.

Calculations prepared by Borton-Lawson Engineering, Wilkes-Barre, PA. Telephone(570)821-1999

2002 Bowmans Creek Lime Addition Estimate-Hettesheimer Run to Head Waters

Limestone Sand-First Application

Station	*Subarea	%Subarea	*Sq. Mile	Acres	** pH	*** D1	**** Tons Lime	Est. Field Applied Tons	Date Applied	Application Locations:
1	2,3	1	3.69	2,362	5.2	0.00325	15.35	17	3/21/02	N. Branch Bowmans Cr. bridge dwnstr. Bowman Marsh
2	1	1	3.5	2,240	5.2	0.00325	14.56	17	3/29/02	Bridge over N. Br. Bowmans Cr. to Mt. Spring Dam
3	5,6,7	1	2.23	1,427	5.7	0.00185	5.28	5	3/21/02	Bean Run bridge above railroad grade
4	8	0.4	3.696	2,365	4.6	0.00525	24.84	12	3/21/02	Wolf Run bridge on railroad grade
								17	4/1/02	
5	8	0.6	5.544	3,548	4.2	0.0068	48.25	34	3/27/02	Watertower bridge on railroad grade
								17	3/28/02	
6	9,10,11, 12,13	1	6.17	3,949	5.3	0.00295	23.30	34	4/3/02	CC road bridge over Cider Run
7	16	0.5	0.55	352	5.7	0.00185	1.30	17	4/2/02	Bowmans Cr. above Ayers from railroad grade
8	16	0.5	0.55	352	5.7	0.00185	1.30			Bowmans Cr. below Ayers and above hatchery
9	17	1	2.07	1,325	5.7	0.00185	4.90			Sorber Mt. bridge or headwaters of Sorber Run
10	19,20	1	4.66	2,982	5.7	0.00185	11.03			Stone Run headwaters on S. Mt. Club
11	21	1	1.47	941	5.8	0.0016	3.01			York Run headwaters on S. Mt. Club
12	22	1	2.01	1,286	4.9	0.00415	10.68			Hettersheimer Run headwaters on S. Mt. Club
Totals:							163.81	170		

* Subareas listed and drainage areas extrapolated from Bowmans Creek Act 167 study done for Wyoming County under PADEP grant funding.

**pH data from information collected prior to year 2001 application of lime.

***Dosage Multiplier Factor from Guidelines for Liming Acidified Streams and Rivers, Va. Water Resource Research Center, Va. Polytechnic Institute.

****Dosage applied for 2002 at a 2 multiplier due to low results from 2001 applications.

Calculations prepared by Borton-Lawson Engineering, Wilkes-Barre, PA. Telephone(570)821-1999

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