QUALITY ASSURANCE/WORK PLAN

WATER QUALITY AND BIOLOGICAL SURVEY OF THE JUNIATA SUBBASIN

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I. PROJECT NAME

Water Quality and Biological Survey of the Juniata Subbasin

II. PROJECT OFFICER

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Biologist

III. QUALITY ASSURANCE OFFICER

David W. Heicher, Chief
Division of Watershed Assessment and Protection

IV. DATE OF PROJECT INITIATION

June 2004

V. PROJECT DESCRIPTION

A. Objective and Scope

The Susquehanna River Basin Commission (Commission) has been conducting water quality and biological surveys on selected streams within each major subbasin on a 10- to 12-year cycle, as part of the Commission's continuing program for assessment of water quality in the Susquehanna River Basin.

Commission staff proposes to conduct a survey of the Juniata Subbasin. The data collected during this survey will provide a qualitative assessment of conditions in the basin. Figure 1 shows the general location of the study area. The sampling sites on the Juniata River will be located upstream and downstream of major tributaries and major point sources. Sampling sites on tributaries will be located near the mouth and at some point upstream, depending on the character of the watershed. The sites sampled during surveys conducted by the Commission in 1986 and 1995 will be resampled for comparison.

B. Data Usage

The study will provide information to: (1) assess the chemical and biological condition of the streams within the subbasin; (2) document changes in stream quality over time; and (3) identify major sources of pollution and lengths of stream impacted. Data collected during the survey also will be used in completing the Section 305(b) Water Quality Assessment Report, and in reviewing projects affecting water quality in the basin.

C. Monitoring Network Design and Rationale

The Commission has a long-term water quality monitoring station at Newport, Pa., near the mouth of the Juniata River. Biological data are not collected routinely at this site. Data collection from the Juniata River has been very limited in recent years. The sampling sites listed in Table 1 were selected so that data collected during this survey can be compared with past data collected by the Commission. Additional sites have been added on tributary streams to provide better coverage of the subbasin. The locations for the Juniata River sites were chosen to evaluate the influences (or "effects") on water quality from major tributaries, as well as from agricultural and urban land uses. The tributary sites were selected based on geologic setting, stream designated use, and documented sources of pollution associated with agricultural, abandoned mine drainage, and point source discharges.

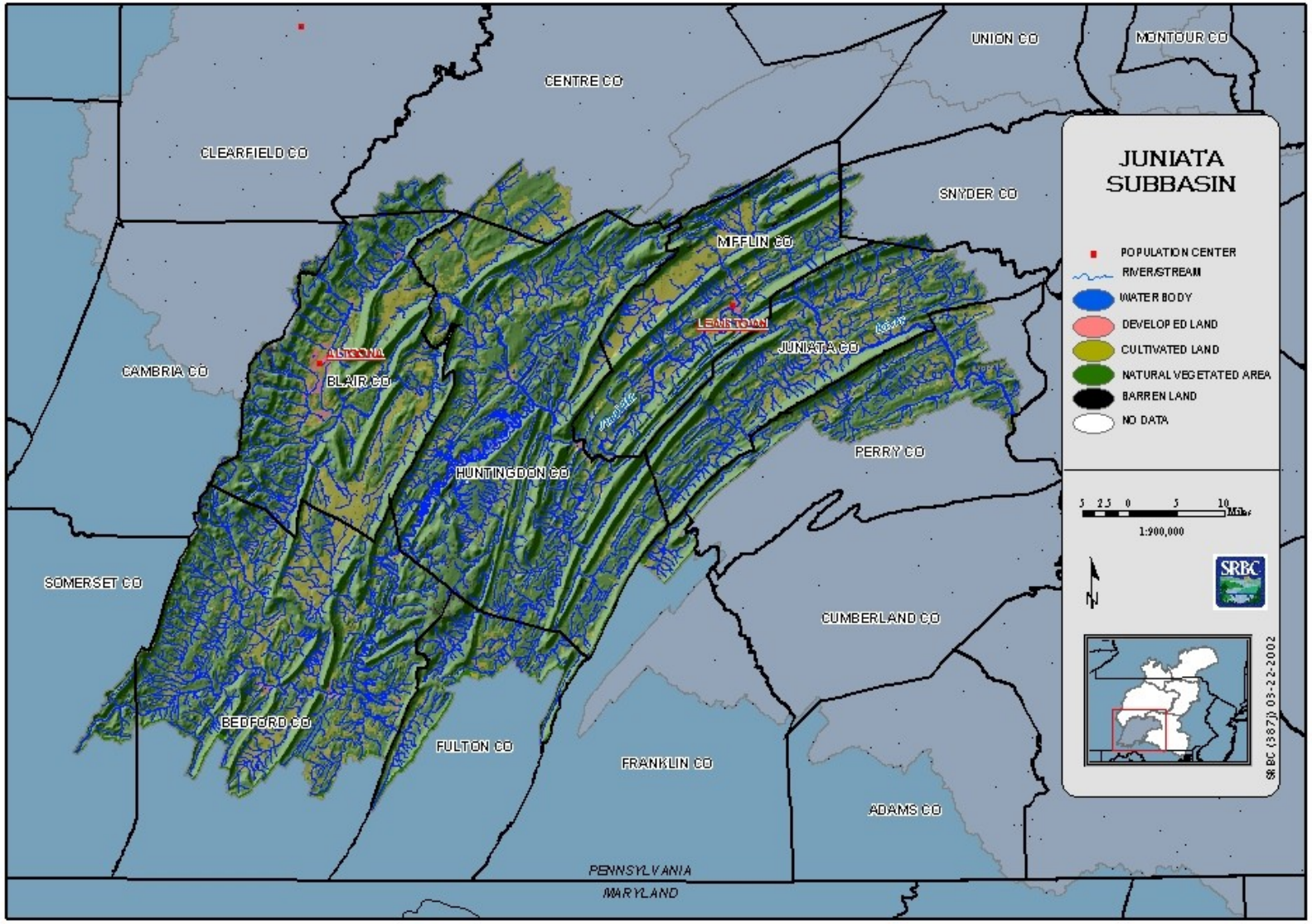


Figure 1. Juniata Subbasin Study Area

Table 1. Juniata Subbasin Survey Station Locations

Site	Sample Site	Location	Latitude	Longitude
1	AUGH 0.7	Aughwick Creek upstream of Rt. 103/1303 Bridge, near Kisler	40.35889	-77.83889
2	AUGH 17.2	Aughwick Creek downstream of Three Springs Creek	40.21861	-77.92667
3	BVDB 0.5	Beaverdam Branch near Hollidaysburg	40.43056	-78.36583
4	BVDB 5.0	Beaverdam Branch near Canan, upstream of Westerly Wastewater Treatment Facility	40.4587	-78.4247
5	BELG 2.4	Bells Gap Run at Hunter Road (500)	40.6098	-78.3644
6	BIGF 1.0	Big Fill Run near Bald Eagle, near Sportsmans Club	40.7384	-78.1945
7	BLLG 1.2	Blacklog Creek, upstream of Orbisonia-Rockhill Jt. M.A., Orbisonia	40.24611	-77.90111
8	BLLG 4.6	Blacklog Creek upstream of Peterson Rd. Bridge	40.24083	-77.85417
9	BLRG 2.5	Blair Gap Run near Foot of Ten, upstream of Mill Run Road	40.4145	-78.4658
10	BOBS 0.5	Bobs Creek at tractor crossing, near Reynoldsdale	40.14806	-78.55139
11	BOBS 10.9	Bobs Creek at ball field, near Pavia	40.25972	-78.58611
12	BRUS 1.0	Brush Creek near Breezewood	39.9975	-78.29472
13	BRUS 14.1	Brush Creek near Crystal Spring, at SR 3017	39.9266	-78.2399
14	BUFF 0.4	Buffalo Creek at SR 1007 bridge, Newport	40.49444	-77.13917
15	BUFF 16.1	Buffalo Creek off of Rt. 849, upstream of Eschol	40.44	-77.3275
16	BUFR 0.4	Buffalo Run near Manns Choice	40.0007	-78.5978
17	BURG 0.5	Burgoon Run at Leopold Park	40.4910	-78.4510
18	CLOV 0.1	Clover Creek at church near mouth, Williamsburg	40.47611	-78.17583
19	COCO 0.2	Cocalamus Creek at old Rt. 22 bridge, Millerstown	40.53722	-77.14611
20	COCO 10.2	Cocolamus Creek at T 475 bridge, Greenwood Twp.	40.61722	-77.15444
21	COVE 7.7	Cove Creek upstream SR 1004	39.9507	-78.4625
22	CRKD 0.3	Crooked Creek near Huntingdon, upstream SR 3033	40.4798	-78.0228
23	DELA 0.6	Delaware Creek upstream of Thompsontown Municipal Authority, Thompsontown	40.5625	-77.236389
24	DOER 0.3	Doe Run upstream of SR 2003 bridge near Mexico	40.5464	-77.3491
25	DUNN 0.1	Dunning Ck at mouth, Bedford	40.02056	-78.47667
26	DUNN 10.5	Dunning Creek upstream E. St. Clair Twp. Municipal Authority STP discharge, East St. Clair Twp.	40.11528	-78.55806
27	EBSS 0.5	East Branch Standing Stone along East Branch Road	40.5795	-77.8585
28	ELCK 0.1	East Licking Creek at church on Rt. 333 upstream Rt. 333/75 intersection	40.52917	-77.39583
29	ELCK 10.2	East Licking Creek at SR 4002 bridge, above Clearview Reservoir	40.5475	-77.52667
30	FRNK 4.3	Frankstown Branch Juniata upstream Alexandria-Porter Twp. J.A. STP, Porter Twp.	40.555	-78.09611
31	FRNK 18.9	Frankstown Branch Juniata near Williamsburg	40.46306	-78.2000
32	FRNK 33.2	Frankstown Branch Juniata near Hollidaysburg	40.42833	-78.36583

Table 1. Juniata Subbasin Survey Station Locations- continued

Site	Sample Site	Location	Latitude	Longitude
33	FRNK 38.7	Frankstown Branch Juniata upstream Appleton Papers discharge, Brooks Mill	40.3775	-78.4175
34	GTRC 3.4	Great Trough Creek at Trough Creek S.P., upstream Trough Creek Drive Bridge	40.32083	-78.12194
35	HALT 0.6	Halter Creek near McKee, upstream Rt. 36	40.3589	-78.4175
36	HONY 0.4	Honey Creek at Reedsville	40.66528	-77.5925
37	HSVR 0.5	Horse Valley Run along SR 3002 downstream of Kansas Valley Run	40.3634	-77.6081
38	JACK 3.1	Jacks Creek at SR 2004 bridge, between Lewistown & Maitland	40.61278	-77.53194
39	JACK 11.7	Jacks Creek, upstream T707 between Shindle & Soradoville	40.6718	-77.4156
40	JUNR 2.0	Juniata River at Amity Hall	40.42528	-77.01639
41	JUNR 16.8	Juniata River upstream Cocolamus Creek, Millerstown	40.53972	-77.15083
42	JUNR 34.3	Juniata River at Mifflintown	40.56833	-77.40028
43	JUNR 46.6	Juniata River upstream Kishacoquillas Creek, Lewistown	40.59389	-77.58
44	JUNR 62.0	Juniata River at McVeytown	40.50083	-77.7375
45	JUNR 84.6	Juniata River at Mapleton Depot	40.39222	-77.93528
46	JUNR 94.0	Juniata River at Huntingdon	40.48611	-78.01944
47	KISH 0.4	Kishacoquillas Creek at Lewistown	40.596944	-77.57056
48	KISH 5.9	Kishacoquillas Creek upstream of Standard Steel, Burnham	40.65472	-77.58333
49	KISH 15.6	Kishacoquillas Creek upstream of Union Twp. M.A. STP, Belleville	40.60306	-77.7125
50	LAUG 1.1	Little Aughwick Creek near Brownsville	40.12722	-77.95639
51	LBUF 2.1	Little Buffalo Creek in Little Buffalo State Park	40.4574	-77.1677
52	LJUN 3.8	Little Juniata River at State Forest Boundary, near Barree	40.59083	-78.10972
53	LJUN 15.4	Little Juniata River upstream of Tyrone Borough STP, Tyrone	40.66806	-78.2325
54	LJUN 19.4	Little Juniata River upstream of PPG Works #27, Antis Twp.	40.631389	-78.28278
55	LJUN 29.6	Little Juniata River upstream of Altoona City Authority East STP, Altoona	40.54944	-78.36722
56	LLOS 0.5	Little Lost Creek upstream of SR 2007	40.6048	-77.3104
57	LOSC 0.2	Lost Creek upstream of SR 3002 near Cuba Mills	40.5912	-77.4055
58	LTRO 0.8	Little Trough Creek upstream of SR3008	40.2976	-78.0583
59	MILL 0.3	Mill Creek at Mill Creek, downstream of Flush Run at the Lions Club Park	40.4379	-77.9306
60	NBLA 1.4	North Branch Little Aughwick Creek, upstream of T457 bridge	40.0910	-77.9029
61	NBTC 3.1	Narrows Branch Tuscarora Creek at SR 4007 bridge, Concord	40.24861	-77.70472
62	PINY 0.6	Piney Creek at Franklin Forge	40.4545	-78.2500
63	RACC 0.2	Raccoon Creek near Millerstown, upstream of SR 4006	40.5426	-77.1574
64	RAYS 5.2	Raystown Branch Juniata downstream of Raystown Dam	40.43194	-77.99833

Table 1. Juniata Subbasin Survey Station Locations – continued

Site	Sample Site	Location	Latitude	Longitude
65	RAYS 38.9	Raystown Branch Juniata upstream of Saxton Borough STP, Saxton	40.22111	-78.25028
66	RAYS 51.9	Raystown Branch Juniata at Hopewell	40.11639	-78.27639
67	RAYS 77.5	Raystown Branch Juniata downstream of confluence of Greys Run, West Providence Twp.	40.01083	-78.3175
68	RAYS 100.8	Raystown Branch Juniata downstream of covered bridge on SR 4005 near Manns Choice	40.01694	-78.59333
69	SBEC 1.4	South Bald Eagle Creek at USGS gauging station, Tyrone	40.68361	-78.23389
70	SBLA 8.3	South Branch Little Aughwick Creek, upstream of Cowans Gap Lake	39.9906	-77.9315
71	SHAD 1.8	Shade Creek downstream of Shade Gap Area M.A., Shade Gap	40.18806	-77.8575
72	SHAV 0.4	Shaver Creek downstream of S.R. 4011 bridge near Petersburg	40.56917	-78.04917
73	SHAV 10.0	Shaver Creek at Rt. 536 downstream of University Dam	40.6440	-77.9306
74	SHOB 0.4	Shobers Run downstream of Bedford Springs	39.9942	-78.5100
75	SHUP 0.1	Shoup Run along Rt. 913 near Middletown	40.2239	-78.2442
76	SHWN 4.2	Shawnee Branch upstream of Shawnee Lake, upstream of T443	40.0384	-78.6547
77	SIDE 1.0	Sideling Hill Creek near Brownsville	40.13361	-77.96556
78	SIDE 13.9	Sideling Hill Creek near New Granada, along Rt. 913	40.1335	-78.0880
79	SINK 0.3	Sinking Run near Union Furnace, upstream of SR 1013	40.6130	-78.1772
80	SIXM 0.3	Sixmile Run near Riddlesburg	40.1618	-78.2522
81	SPRR 1.0	Spring Run near Penn State Altoona Campus	40.5398	-78.4101
82	SPRU 1.0	Spruce Creek at Pa. Fish & Boat Commission Special Regulations Area, Spruce Creek	40.61806	-78.12583
83	SPRU 10.6	Spruce Creek at Rt. 45 bridge, Graysville	40.69028	-78.0294
84	STST0.1	Standing Stone Creek at Huntingdon	40.48194	-78.00389
85	STST 26.8	Standing Stone Creek at 1st bridge upstream of SR 1023/Black Lick Rd., Jackson Twp.	40.68111	-77.79389
86	TIPT 1.3	Tipton Run near Tipton	40.6470	-78.3209
87	TSPC 0.5	Three Spring Creek near Three Springs	40.21111	-77.935
88	TUSC 0.6	Tuscarora Creek at Mifflintown	40.52667	-77.38389
89	TUSC 22.5	Tuscarora Creek near Reeds Gap	40.41917	-77.56333
90	TUSC 39.7	Tuscarora Creek downstream of Trough Spring Branch, near Blairs Mills	40.27167	-77.73472
91	WILL 0.4	Willow Creek near Reeds Gap	40.43111	-77.58333
92	YELL 3.5	Yellow Creek at SR 1009 bridge, Hopewell Twp.	40.12472	-78.30472
93	YELL 9.1	Yellow Creek near Waterside, along Rt. 36	40.1884	-78.3756

D. Monitoring Parameters

Parameters of interest are listed in Table 2. Discharge will be measured manually at most stations using standard U.S. Geological Survey (USGS) equipment and methods (Buchanan and Somers, 1969). Discharge at sites adjacent to USGS gaging stations will be obtained from USGS rating tables. Macroinvertebrate data will be comprised of a list of different genera collected and an estimate of population density. Chemical water quality and biological samples, as well as instream flow and physical habitat information, will be collected once during base flow conditions.

VI. PROJECT FISCAL INFORMATION

See USEPA grant application.

VII. SCHEDULE

	2004												2005											
Activity	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Coordination	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Quality Sampling						X	X	X	X															
Macroinvertebrate Sampling						X	X	X	X															
Identify Macroinvertebrates									X	X	X	X	X											
Compile and Evaluate Data												X	X	X	X									
Report Writing															X	X	X	X	X					
Final Report																			X					

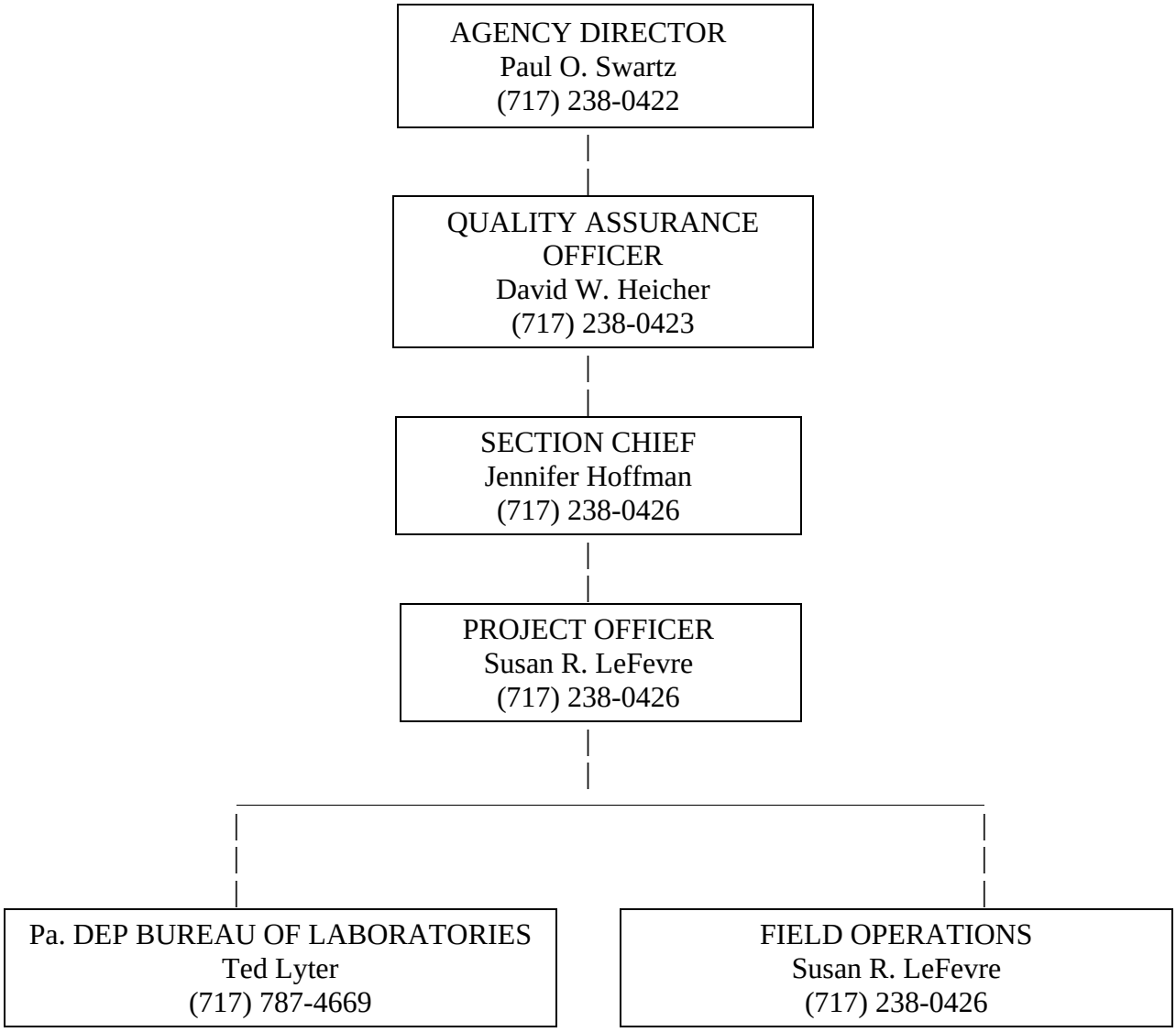
Table 2. Monitoring Parameters

Parameter	Number of Samples	Analytical Sample Matrix	Method Reference	Sample Preservation	Holding Time
Flow	NA	NA	Buchanan and Somers, 1969	NA	NA
Temperature	134	aq.	In situ	none	0
Dissolved Oxygen	134	aq.	In situ	none	0
Conductivity	134	aq.	In situ	none	0
pH	134	aq.	In situ	none	0
Alkalinity	134	aq.	In situ	none	0
Acidity	134	aq.	In situ	none	0
Total Residue	134	aq.	EPA 160.3	cooling to 4° C	24 hours
Total Suspended Solids	134	aq.	EPA 160.2	cooling to 4° C	24 hours
Total Organic Carbon	134	aq.	EPA 415.2	cooling to 4° C, H_2SO_4 to pH <2	24 hours
Total NH_3-N	134	aq.	EPA 350.1	cooling to 4° C, H_2SO_4 to pH <2	24 hours
Total NO_2-N	134	aq.	EPA 353.2	cooling to 4° C	24 hours
Total NO_3-N	134	aq.	EPA 353.2	cooling to 4° C	24 hours
Total Nitrogen	134	aq.	Std Method 4500-N-D[1]	cooling to 4° C	24 hours
Total Phosphorus	134	aq.	EPA 365.3	cooling to 4° C, H_2SO_4 to pH <2	24 hours
Total Orthophosphate	134	aq.	EPA 365.1	cooling to 4° C	24 hours
Total Hardness	134	aq.	EPA 130.1	cooling to 4° C, HNO_3 to pH <2	6 months
Total Sodium	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Potassium	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Magnesium	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Calcium	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Chloride	134	aq.	EPA 325.2	cooling to 4^oC	24 hours
Total Sulfate	134	aq.	EPA 375.2	cooling to 4^oC	24 hours
Total Iron	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Manganese	134	aq.	EPA 200.7	HNO_3 to pH <2	6 months
Total Aluminum	134	aq.	200.8[2]	HNO_3 to pH <2	6 months
Total Lead	134	aq.	200.8[2]	HNO_3 to pH <2	6 months
Total Copper	134	aq.	200.8[2]	HNO_3 to pH <2	6 months
Total Zinc	134	aq.	200.8[2]	HNO_3 to pH <2	6 months
Total Nickel	134	aq.	200.8[2]	HNO_3 to pH <2	6 months
Macroinvertebrates	134		Barbour and others, 1999	preserve in denatured alcohol	1 year

1. Standard Methods, 19th edition
2. Determination of Trace Elements in Water and Wastes by Inductively Coupled Plasma -Mass Spectrometry. Version 4, September 1989

VIII. PROJECT ORGANIZATION AND RESPONSIBILITY

A. Project Organization



B. Project Responsibility

1. Sampling operations—S. LeFevre, SRBC
2. Sampling QC—S. LeFevre, SRBC
3. Laboratory analysis—T. Lyter, Pa. DEP
4. Laboratory QC—T. Lyter, Pa. DEP
5. Data processing activities—S. LeFevre, SRBC
6. Data processing QC—S. LeFevre, SRBC
7. Data quality review—S. LeFevre, SRBC
8. Performance auditing—D. Heicher, SRBC
9. Systems auditing—S. LeFevre, SRBC
10. Overall QA—D. Heicher, SRBC
11. Overall project coordination—D. Heicher, SRBC

IX. DATA QUALITY REQUIREMENTS AND ASSESSMENTS

Table 3. Data Quality Requirements and Assessments

Parameter	Detection Limit (mg/l)	Accuracy[1]	Precision[2]
Total Organic Carbon	1	**+/-10%**	+/-10%
Total Residue	2.0	**+/-10%**	+/-10%
Tot Suspended Solids	2.0	**+/-10%**	+/-10%
Total NH_3-N	0.02	**+/-10%**	+/-10%
Total NO_2-N	0.004	**+/-10%**	+/-10%
Total NO_3-N	0.04	**+/-10%**	+/-10%
Total Nitrogen	0.04	**+/-10%**	+/-10%
Total Phosphorus	0.01	**+/-10%**	+/-10%
Total Orthophosphate	0.002	**+/-10%**	+/-10%
Total Hardness	3.0	**+/-10%**	+/-10%
Total Sodium	0.2	**+/-10%**	+/-10%
Total Potassium	2.0	**+/-10%**	+/-10%
Total Magnesium	0.01	**+/-10%**	+/-10%
Total Calcium	0.03	**+/-10%**	+/-10%
Total Chloride	0.001	**+/-10%**	+/-10%
Total Sulfate	0.01	**+/-10%**	+/-10%
Total Iron	0.01	**+/-10%**	+/-10%
Total Manganese	0.01	**+/-10%**	+/-10%
Total Aluminum	0.035	**+/-10%**	+/-10%
Total Lead	0.004	**+/-10%**	+/-10%
Total Copper	0.004	**+/-10%**	+/-10%
Total Zinc	0.005	**+/-10%**	+/-10%
Total Nickel	0.004	**+/-10%**	+/-10%
Macroinvertebrates	NA	**NA**	+/- 10%

1. Calculate Accuracy using the formulas:

For matrix spikes: $\%R = 100 \times \frac{S - U}{C_{sa}}$

%R = percent recovery
S = measured concentration in spiked aliquot
U = measured concentration in unspiked aliquot
C_{sa} = actual concentration of spike added

For standard reference material: $\%R = 100 \times \frac{C_m}{C_{rm}}$

%R = percent recovery
C_m = measured concentration of standard reference material
C_{rm} = actual concentration of standard reference material

2. Calculate precision using the formula: $RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100$

RPD = relative percent difference
C_1 = larger of two observed values
C_2 = smaller of two observed values

A. Data Representativeness

Water samples are collected at six points along a transect across the stream with depth-integrating samplers. The depth-integrating sampler provides a composite of the whole water column. Vertical samples are then composited in a churn, where the final sample is withdrawn. This provides a composite sample representing average stream quality.

Sampling stations are placed at specific locations, such as the mouths of streams, headwater areas, and below significant tributaries, to represent large segments of the watershed. Additionally, macroinvertebrate sampling will occur in riffle/run habitats to help ensure that the samples are representative of the best available habitat conditions.

B. Data Comparability

The purpose of this QA plan is to eliminate factors in sampling and analysis that reduce the comparability of data collected at different points in space and time. All sampling, analysis, and processing procedures are standardized to ensure comparability. One field crew is used to collect samples at all sites to reduce variability in sampling.

C. Data Completeness

Collection of 95 percent of the total programmed samples will be deemed as fulfilling the project objectives**.**

Completeness can be calculated using the formula: $\%C = 100 \times \frac{V}{N}$

%C = percent completeness
V = number of measurements judged valid
N = total number of measurements necessary to achieve a specific s statistical level of confidence in decision making

X. SAMPLING PROCEDURES

A. Sample Collection

Water samples are collected using depth-integrating samplers. Samples are collected using a hand-line sampler from a boat or bridge, or a hand sampler by wading. The sampler is faced upstream into the current to prevent collection of sediments kicked up by the sampler or field personnel. At each station, eight vertical samples are collected, composited in a churn splitter and churned while the sample bottle is filled.

B. Water Samples

One liter of water will be collected at each station for laboratory analysis. The samples consist of one 250-ml bottle for nutrients, one 250-ml bottle for metals analysis, and one 500-ml bottle for all additional parameters. The samples for metals analyses will be acidified to pH 2 or less with 1 N nitric acid. Samples for total ammonia, total hardness, total phosphorus, and total organic carbon will be preserved in the field with 10 percent sulfuric acid. Duplicate samples will be collected at a frequency of one per day, or one per 10 samples, whichever is more frequent. The samples will be chilled on ice, and shipped within 24 hours to the Pennsylvania Department of Environmental Protection (Pa. DEP) Lab. A

temperature blank will be included for measuring the temperature in the shipping container at the laboratory, in addition to the laboratory requirement that ice must be visible in the shipping container.

C. Field Chemistry

Temperature is measured with a field thermometer in degrees Celsius. Dissolved oxygen is measured using a YSI 55 dissolved oxygen meter. Conductivity is measured using a Cole-Parmer Model 1481 conductivity meter. A Cole-Parmer Model 5996 meter is used to measure pH. Alkalinity and acidity are measured using field titrations. Alkalinity is measured in the field by titrating a known volume of sample water to pH 4.5 with 0.02N H_2SO_4 (Attachment A). Acidity is measured in the field by titrating a known volume of sample water to pH 8.3 with 0.02N NaOH (Attachment B**).** Titrations are measured using syringes. Separate syringes will be used for sulfuric acid and for sodium hydroxide. Magnetic stirring bars and beakers will be thoroughly rinsed with distilled water and with sample water to be tested before titrations are conducted. Personnel conducting field titrations will be required to undergo six months of on-the-job training with an experienced field person.

D. Discharge Measurements

Discharge at sites near USGS gaging stations will be obtained from the USGS database. At other stations, flow measurements are made by field personnel using pygmy or AA meters and standard USGS procedures (Buchanan and Somers, 1969). Personnel collecting flow measurements will undergo yearly training and a quality assurance check.

E. Macroinvertebrates

Macroinvertebrate assessments are adapted from Rapid Bioassessment Protocol (RBP) III, described by Barbour and others (1999). Macroinvertebrate sampling is conducted in the best available habitat (riffle/run areas) at each station. Sampling is conducted by placing a 600 micron, 1-square- meter kick screen perpendicular to the current and raking the substrate so dislodged macroinvertebrates are carried into the screen. Two kick screens are composited into one sample at each site. Duplicate samples are collected at 10 percent of the sites (or one site per day). All collected specimens are preserved in 95 percent ethanol and returned to Commission offices for identification and enumeration. Subsampling and sorting procedures are based on the 1999 RBP document (Barbour and others, 1999). In the laboratory, composite samples are sorted into 200-organism subsamples using a gridded pan and a random numbers table. The organisms contained in the subsamples are identified to genus (except Chironomidae and Oligochaeta), when possible, and enumerated. Benthic macroinvertebrates are identified by professional biologists**,** with a minimum of a Master of Science degree in biology, skilled at recognizing most benthos to the family level by sight, and to the genus level with appropriate keys. Biologists also attend the annual Mid-Atlantic Water Pollution Biology Workshop in Berkley Springs, WV and the annual Pennsylvania State Biologist Workshop. Work is supervised by Mr. David Heicher, who was formerly Assistant Benthos Section Leader for Icthyological Associates, Inc. in Stamford, N.Y. Mr. Heicher has 15 graduate level credits in courses related to macroinvertebrate identification, including Entomology, Aquatic Insect Ecology, Identification and Quantification of Invertebrates, and his M.S. thesis research.

After sampling has been completed at a given site, all equipment that has come in contact with the sample will be rinsed thoroughly, examined carefully, and picked free of algae or debris before sampling at the next site. Additional organisms that are found on examination are placed into the sample containers.

F. Physical Habitat Assessment

Physical habitat conditions at each station are assessed using a slightly modified version of the habitat assessment procedure outlined by Barbour and others (1999). Eleven habitat parameters are field-evaluated at each site and used to calculate a site-specific habitat assessment score. Physical habitat assessments are performed for riffle/run or glide/pool areas, depending on stream type. Figure 2 and Table 4 show habitat assessment forms and the criteria used to evaluate habitat in riffle/run streams and Figure 3 and Table 5 show forms and criteria used to evaluate habitat in glide/pool stream types.

G. Training Records

Training records will be maintained in the Watershed Assessment and Protection Division files by the Quality Assurance Coordinator.

XI. SAMPLE CUSTODY PROCEDURES

Water quality samples are delivered to the laboratory by the collectors or shipped to the Pa. DEP Lab by overnight courier service. A sample submission sheet, provided by Pa. DEP Lab, is included for each sample sent to the Pa. DEP Lab by Commission staff. This submission sheet contains all relevant information about the sample, including collector, date, time, location, and method of preservation (if needed). Sample numbers, as well as field chemistry and flow data, are stored in a field logbook and checked against sample numbers received from Pa. DEP Lab. For macroinvertebrate samples, a logbook is kept containing information regarding the collection, preservation, subsampling, and identification of the macroinvertebrates. The station identification data is recorded on each macroinvertebrate sample and entered into a logbook in the field. This logbook is used to track the macroinvertebrate sample though the laboratory process. Staff members are responsible for entering the date and their initials for each sample during processing and identification of the sample.

XII. CALIBRATION PROCEDURES AND PREVENTATIVE MAINTENANCE

A. Dissolved Oxygen (DO) Meter

A YSI 55 model dissolved oxygen meter is calibrated using the air-saturated chamber technique prior to use each day. This calibration test is repeated in the event of a membrane replacement or other maintenance that may affect the accuracy of the meter.

Figure 2. Rifle/Run Habitat Assessment Sheet

Riffle/ Run Habitat Assessment Sheet

Stream	**Date**
Station ID	**Time**
Sample #	**Crew**
Location Description:	
Stream type: Limestone Sandstone Valley Headwater Large River Glacial Other _____	

Habitat Assessment		**Weather Conditions**			
Parameter	Score	Air Temperature ©	_____		
1. Epifaunal Substrate		Current Conditions: Sunny Cloudy Partly Cloudy			
		Present Precipitation: None Rain Snow Mixed Precip.			
		Heavy? (> 1 inch) Yes No			
2. Instream Cover		Precip. Within last 24 hours: None Rain Snow Mixed Precip.			
		Heavy? (> 1 inch) Yes No			
		Ice Present at Site? Yes No			
3. Embeddedness		**Functionally Important Stream Characteristics**			
4. Velocity/ Depth Regimes					
5. Sediment Deposition					
6. Channel Flow Status					
7. Channel Alteration		**Predominant Substrate Material (circle one)**			
		Bedrock (> 160 inches in diameter) Boulder (10 – 160 inches in diameter) Cobble (2.5 – 10 inches in diameter) Gravel (0.1 – 2.5 inches in diameter) Sand/Silt/Clay (< 0.1 inches in diameter)			
8. Frequency of Riffles					
9. Condition of Banks (Score each bank)		Residential		Commercial	
		Industrial		Cropland	
		Nursery		Pasture	
Left Bank		Abd. Mining		Old Fields	
		Forest		Other	
Right Bank		**Comments:**			
10. Vegetative Protective Cover (score each bank)					
Left Bank					
Right Bank					
11. Riparian Vegetative Zone Width (score each bank)					
Left Bank		**Temp.**	**Cond.**	**D.O.**	
Right Bank		**pH**	**Acid.**	**Alk.**	

Table 4. Riffle/Run Habitat Assessment Criteria

HABITAT PARAMETER	CATEGORY			
	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
1. Epifaunal Substrate	Well-developed riffle/run; riffle is as wide as stream and length extends 2 times the width of stream; abundance of cobble	Riffle is as wide as stream but length is less than 2 times width; abundance of cobble; boulders and gravel common	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; some cobble present	Riffle or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking
2. Instream Cover	> 50% mix of boulders, cobble, submerged logs, undercut banks or other stable habitat	30–50% mix of boulder, cobble, or other stable habitat; adequate habitat	10–30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable	<10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious
3. Embeddedness	Gravel, cobble, and boulder particles are 0–25% surrounded by fine sediments	Gravel, cobble, and boulder particles are 25–50% surrounded by fine sediments	Gravel, cobble, and boulder particles are 50–75% surrounded by fine sediments	Gravel, cobble, and boulder particles are >75% surrounded by fine sediments
4. Velocity/ Depth Regimes	All 4 velocity/depth regimes present (slow/deep, slow/shallow, fast/deep, fast/shallow)	Only 3 of 4 regimes present (if fast/shallow is missing, score lower than if missing other regimes)	Only 2 of 4 regimes present (if fast/shallow or slow/shallow are missing, score low)	Dominated by 1 velocity/depth regime
5. Sediment Deposition	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from coarse gravel; 5–30% of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, coarse sand on old and new bars; 30–50% of the bottom affected; sediment deposits at obstructions; moderate deposition of pools prevalent	Heavy deposits of fine material, increased bar development; >50% of the bottom changing frequently; pools almost absent due to sediment deposition
6. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed	Water fills >75% of the available channel; or <25% of channel substrate exposed	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	Very little water in channel and mostly present as standing pools
7. Channel Alteration	No channelization or dredging present	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 yr) may be present, but not recent	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted	Banks shored with gabion or cement; >80% of the reach channelized and disrupted

Table 4. Riffle/Run Habitat Assessment Criteria *(continued)*

HABITAT PARAMETER	CATEGORY			
	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
8. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the stream width is between 15-25	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is >25
9. Condition of Banks (score each bank 0-10)	Banks stable; no evidence of erosion or bank failure; little potential for future problems; <5% of bank affected	Moderately stable; infrequent, small areas of erosion mostly healed over; 5-30% of bank in reach has areas of erosion	Moderately unstable, 30-60% of banks in reach have areas of erosion; high erosion potential during floods	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars
10. Vegetative Protective Cover (score each bank 0-10)	>90% of the streambank surfaces covered by vegetation; vegetative disruption through grazing or mowing minimal	70-90% of the streambank surfaces covered by vegetation; disruption evident but not affecting full plant growth potential to any great extent	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation	<50% of the steambank surfaces covered by vegetation; disruption is very high; vegetation removed to 5 cm or less
11. Riparian Vegetative Zone Width (score each bank 0-10)	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone only minimally	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities

Figure 3. Glide/Pool Habitat Assessment

Glide/Pool Habitat Assessment Sheet

Stream	**Date**
Station ID	**Time**
Sample #	**Crew**
Location Description:	
Stream Type: Limestone Sandstone Valley Headwater Large River Glacial Other __	

Habitat Assessment		**Weather Conditions**
Parameter	Score	Air Temperature (^{o}C)
1. Epifaunal Substrate		Current Conditions: Sunny Cloudy Partly Cloudy
		Present Precipitation: None Rain Snow Mixed Precip.
		Heavy? (> 1 inch) Yes No
2. Instream Cover		Precip. within last 24 Hours: None Rain Snow Mixed Precip.
		Heavy? (>1 inch) Yes No
		Ice Present at Site? Yes No
3. Pool Substrate Characterization		**Functionally Important Stream Characteristics**
4. Pool Variability		
5. Sediment Deposition		
6. Channel Flow Status		
7. Channel Alteration		**Predominant Substrate Material (circle one)**
		Bedrock (>160 inches in diameter) Boulder (10-160 inches in diameter) Cobble (2.5 – 10 inches in diameter) Gravel (0.1 – 2.5 inches in diameter) Sand/Silt/Clay (<0.1 inches in diameter)
8. Channel Sinuosity		
9. Condition of Banks (Score each bank)		
Left Bank		Residential % Commercial %
		Industrial % Cropland %
Right Bank		Nursery % Pasture %
		Abd. Mining % Old Fields %
10. Vegetative Protective Cover (score each bank)		Forest % Other %
		Comments:
Left Bank		
Right Bank		
11. Riparian Vegetative Zone Width (score each bank)		
Left Bank		**Temp.** **Cond.** **D.O.**
Right Bank		pH **Acid.** **Alk.**

Table 5. Glide/Pool Habitat Assessment Criteria

HABITAT PARAMETER	CATEGORY			
	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
1. Epifaunal Substrate	Preferred benthic substrate abundant throughout stream site and at stage to allow full colonization (i.e. log/snags that are not new fall and not transient)	Substrate common but not prevalent or well suited for full colonization potential	Substrate frequently disturbed or removed	Substrate unstable or lacking
2. Instream Cover	> 50% mix of snags, submerged logs, undercut banks or other stable habitat; rubble, gravel may be present	30-50% mix of stable habitat; adequate habitat for maintenance of populations	10-30% mix of stable habitat; habitat availability less than desirable	Less than 10% stable habitat; lack of habitat obvious
3. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present	All mud or clay or sand bottom; little or no root mat; no submerged vegetation	Hard-pan clay or bedrock; no root mat or vegetation
4. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present	Majority of pools large-deep; very few shallow	Shallow pools much more prevalent than deep pools	Majority of pools small-shallow or pools absent
5. Sediment Deposition	Less than 20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of island or point bars	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial movement during storm events	Channelized; mud, silt, and/or sand in braided or non-braided channels; pools almost absent due to substantial sediment deposition
6. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed	Water fills >75% of the available channel; or <25% of channel substrate exposed	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed	Very little water in channel and mostly present as standing pools
7. Channel Alteration	No channelization or dredging present	Some channelization present, usually in areas of bridge abutments; evidence of past channelization (>20 yr) may be present, but not recent	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted	Banks shored with gabion or cement; >80% of the reach channelized and disrupted

Table 5. Glide/Pool Habitat Assessment Criteria *(continued)*

HABITAT PARAMETER	CATEGORY			
	OPTIMAL (20-16)	SUBOPTIMAL (15-11)	MARGINAL (10-6)	POOR (5-0)
8. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line	Channel straight; waterway has been channelized for a long time
9. Condition of Banks (score each bank 0-10)	Banks stable; no evidence of erosion or bank failure; side slopes generally <30%; little potential for future problems; <5% of bank affected	Moderately stable; infrequent, small areas of erosion mostly healed over; side slopes up to 40% on one bank; slight erosion potential in extreme floods; 5-30% of bank in reach has areas of erosion	Moderately unstable; moderate frequency and size of erosional areas; side slopes up to 60% on some banks; high erosion potential during extremely high flow; 30-60% of bank in reach has areas of erosion	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes; side slopes >60% common; 60-100% of bank has erosional scars
10. Vegetative Protective Cover (score each bank 0-10)	>90% of the streambank surfaces covered by vegetation; vegetative disruption through grazing or mowing minimal	70-90% of the streambank surfaces covered by vegetation; disruption evident but not affecting full plant growth potential to any great extent	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation	<50% of the steambank surfaces covered by vegetation; disruption is very high; vegetation removed to 5 cm or less
11. Riparian Vegetative Zone Width (score each bank 0-10)	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone only minimally	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities

B. Specific Conductance Meter

The Cole-Parmer conductivity meter is calibrated prior to sampling by checking the meter readings against three fresh specific conductance standards. Calibration checks are made after every 10 samples. Results are recorded in the calibration log, and new rating curves are generated, as necessary.

Acceptable Criteria	
Standards (<1000 µmhos/cm)	± 4%
(>1000 µmhos/cm)	± 3%

C. pH Meters

The meter is calibrated against two buffers daily, before and during use. Calibration checks are made after every 10 samples. These checks are recorded in the calibration log.

D. Flow meter

Current meters are sent to the manufacturer for calibration, as necessary. Spin tests are performed before and after each day of use.

XIII. DOCUMENTATION

Water and macroinvertebrate sample bottles are labeled at the time of collection. Water samples are labeled with a seven-digit identification number, the station, date, and time, whether the sample is filtered or raw, and whether any fixatives were added to the sample. This information is recorded on laboratory analysis forms. One copy is submitted to the laboratory with the sample, while another is retained as a record. Results of field chemistry are recorded on this form.

Results of laboratory analyses are entered into an Excel spreadsheet. Data entries are verified, and reductions are performed using computer files to eliminate transcription errors. Field chemistry and laboratory analysis sheets are retained for a period of two years and subsequently archived. Excel spreadsheets containing all information are retained on the Commission's server for ready access. Additionally, all information will be entered into STORET.

Databases for all water quality, physical habitat, field chemistry, and macroinvertebrate data consist of Excel spreadsheets developed for in-house needs. The databases are located on the Commission's server. Back-up copies are retained by the project manager in addition to a copy kept in the filing system with hard copies of the data sheets.

Macroinvertebrate bottles are labeled with the station and date. A logbook is kept for all sites, containing information on the macroinvertebrate sample collection, such as station number, stream name, date, the number of bottles, and the person who collected the sample. Identification is conducted by staff biologists at the Commission office, where additional information such as dates of subsampling and identification and the personnel associated with each activity is added to the logbook. Log sheets (Figure 4) are used to record the number of specimens for each genus identified. This information is transcribed into Excel spreadsheets and verified.

XIV. DATA REDUCTION

Water quality data are formatted into tables by station. The data are compared to state standards and to other limit values based on current state and federal regulations or references for approximate tolerances of aquatic life. The differences between each value and the limit value are calculated for each site, and if the value does not exceed the limit value, the site is given a score of zero. If the limit value is exceeded, the difference is listed, and an average of all the parameters for each site is calculated.

Data reduction procedures are similar to those described in RBP III (Barbour and others, 1999). The data for each station are reduced to the following metrics: (1) taxa richness; (2) modified Hilsenhoff Biotic Index; (3) percent Ephemeroptera; (4) percent contribution of dominant taxon; (5) number of Ephemeroptera/Plecoptera/Trichoptera taxa; (6) percent Chironomidae; and (7) Shannon Weiner Diversity Index. These metrics are quantified and compared to a reference station with the best available conditions based on physical habitat, water quality, and macroinvertebrate information.

The subsample data are used to generate scores for each of the seven macroinvertebrate metrics listed above. Each metric score is then converted to a biological condition score, based on the percent similarity of the metric score, relative to the metric score of the reference site. The sum of the biological condition scores constitutes the total biological score for the sample site, and total biological scores are used to assign each site to a biological condition category. A sampling site that scores 83 percent or greater as compared to the reference site is designated nonimpaired. A score of 79 to 54 percent is termed slightly impaired; moderately compared conditions are characterized as 50 to 21 percent of the reference site; and a score of less than 17 percent is designated severely impaired.

Habitat assessment scores of sample sites are compared to those of the reference sites to classify each sample site into a habitat condition category. Habitat parameters for riffle-run and glide-pool habitat types are listed in Tables 4 and 5, respectively. A site that scores 90 percent or greater as compared to the reference score is designated excellent (comparable to reference). A habitat score of 75 to 89 percent is designated supporting; partially supporting conditions are characterized as 60 to 74 percent of the reference score; and a score of less than 60 percent is determined to be nonsupporting.

XV. DATA VALIDATION

Primary responsibility for data validation lies with the project officer. The collector may assist the project officer in determining the acceptability of the data based on his knowledge of the stream conditions. Field collections are conducted according to the above methodology to insure accurate data. The use of duplicates, reviewed by the project officer, also validates the water quality analyses. A separate staff member also checks the information after input to ensure correct data entry.

Five percent of the macroinvertebrate samples identified by one biologist are validated by a second biologist and recorded in the logbook. A biologist also spot-checks five percent of the samples picked by laboratory personnel during subsampling and records the samples in the logbook.

XVI. PERFORMANCE AND SYSTEMS AUDITS

A. Laboratory Analyses

Analytical and quality assurance procedures for the Pa. DEP Lab are detailed in the QA plan submitted by the laboratory. The laboratory analyzes a matrix spike/matrix spike duplicate at a frequency of one per 10 samples per matrix. Duplicate samples and blanks will be submitted to the laboratory (at least one per 10 samples).

Figure 4. Benthic Macroinvertebrate Enumeration Sheet

MACROINVERTEBRATE ENUMBERATION LIST

SITE _____ **DATE SAMPLED_____**
IDENTIFIED BY: _____ **DATE IDENTIFIED: _____**

FAMILY/GENUS	NUMBER OF INDIVIDUALS
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	
22.	
23.	
24.	
25.	
26.	

B. Field Procedures

Yearly, field operator techniques are tested for pH, specific conductance, and alkalinity with USGS standard samples. The project officer is responsible for insuring that all field personnel are competent in measurement and collection techniques prior to fieldwork. The project officer also is responsible for insuring the quality of all equipment and reagents. The quality assurance officer also performs a field audit near the beginning of sampling. The field audit for this project is scheduled for July 2004, weather and stream flows permitting.

Duplicate tests are performed on alkalinity and acidity in the same proportion as other duplicate analyses and results with a relative percent difference of 10 is acceptable. Temperature readings from the dissolved oxygen meter are checked against a standard laboratory thermometer. These checks are performed prior to fieldwork.

C. Biological Sampling

A second biologist verifies the identifications on five percent of the sorted samples.

XVII. CORRECTIVE ACTION

Implementation of corrective action involving any of the sampling procedures, equipment, or data reduction and processing is the responsibility of the project officer. The QA officer is responsible for seeing that such corrective action is done. Implementation of corrective action involving laboratory analyses is the responsibility of the laboratory analysis officer, with oversight by the laboratory quality control officer.

The results of any corrective actions taken will be documented by the individual(s) taking the necessary actions.

XVIII. REPORTS

A report describing the results of the monitoring program will be published. This report will include a description of the methods and data analysis. Conclusions and recommendations will be made, as appropriate. The data will be available on the Commission's website (www.srbc.net). In addition, the data are utilized by staff for project review and for inclusion in the Commission's 305(b) report.

REFERENCES

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water; Washington, D.C.

Buchanan, T.J. and W.P. Somers. 1969. Discharge Measurements at Gaging Stations. USGS Techniques of Water-Resources Investigations, Book 3, Chapter A8.

SUSQUEHANNA RIVER BASIN COMMISSION

STANDARD OPERATION PROCEDURE (SOP) FOR DETERMINATION OF ALKALINITY

Prepared by: Charles S. Takita Date: September 15, 2000
WQ Program Specialist

Reviewed by: David W. Heicher Date: September 18, 2000
Quality Assurance Coordinator

Procedural Section

1.0 Scope & application

1.1 This method is applicable to surface waters, sewage and industrial wastes.
1.2 The method is applicable for all ranges of alkalinity.

2.0 Summary of method

2.1 The alkalinity of a sample is its quantitative capacity to react with a strong acid to a certain pH. The pH of the unaltered sample is determined and a measured amount of standard acid is added to lower the pH to an endpoint of 4.5.

3.0 Interference

3.1 The sample must be analyzed as soon as practical; preferably, within a few hours.
3.2 Substances, such as salts of weak organic and inorganic acids present in large amounts, may cause interference in the electrometric pH measurements.
3.3 Oil and grease, by coating the pH electrode, may also interfere, causing sluggish response.

4.0 Apparatus

4.1 Analog field pH meter
4.2 Syringe with 0.2 ml graduation
4.3 Magnetic stirrer
4.4 Stirring bars
4.5 Glass beaker, 100 ml
4.6 Graduated cylinder, 50 ml

5.0 Reagent

5.1 0.02N H_2SO_4

6.0 Procedure

6.1 Measure 50 ml of sample with graduated cylinder and pour into the 100 ml beaker.
6.2 Measure the pH of the sample.
6.3 Using the syringe, drop 0.02N H_2SO_4 into sample in increments of 0.5 ml or less until the pH in the sample approaches 4.5 then add H_2SO_4, dropwise, pausing between drops to allow the pH to stabilize until a pH of 4.5 is reached.
6.4 Determine the amount of 0.02N H_2SO_4 added to sample.

7.0 Calculation

7.1 Calculate alkalinity, as mg/l, using the following formula:

$$\text{Alkalinity, mg/l as } CaCO_3 = \frac{A \times N \times 50{,}000}{\text{ml of sample}}$$

where:

A = ml of H_2SO_4used
N = normality of H_2SO_4

Quality Control and Quality Assurance

1.0 Choose one sample from the set of analyses and run a duplicate. Results should be within 10 percent.

Reference

1.0 Standard Methods for Examination of Water and Wastewater, 17th Edition.

SUSQUEHANNA RIVER BASIN COMMISSION

STANDARD OPERATION PROCEDURE (SOP) FOR DETERMINATION OF ACIDITY

Prepared by: Charles S. Takita Date: September 15, 2000
WQ Program Specialist

Reviewed by: David W. Heicher Date: September 18, 2000
Quality Assurance Coordinator

Procedural Section

1.0 Scope & application

1.1 This method is applicable to surface waters, sewage and industrial wastes, particularly mine drainage and receiving streams, and other wastes containing ferrous iron and other polyvalent ions in a reduced state.
1.2 The method is applicable for samples with acidities less than 1,000 mg/l using a 50 ml sample.

2.0 Summary of method

2.1 The acidity of a sample is its quantitative capacity to react with a strong base to a certain pH. The pH of the sample is determined and a measured amount of standard alkali is added to raise the pH to 8.3.

3.0 Interference

3.1 Suspended matter present in the sample or precipitates formed during the titration may cause a sluggish electrode response. This may be offset by allowing a 15-20 second pause between additions of titrant or by slow dropwise addition of titrant as the endpoint is approached.

4.0 Apparatus

4.1 Analog field pH meter
4.2 Syringe with 0.2 ml graduation
4.3 Magnetic stirrer
4.4 Stirring bars
4.5 Glass beaker, 100 ml
4.6 Graduated cylinder, 50 ml

5.0 Reagent

5.1 0.02N NaOH

6.0 Procedure

6.1 Measure 50 ml of sample with graduated cylinder and pour into the 100 ml beaker.
6.2 Measure the pH of the sample.
6.3 Using the syringe, drop 0.02N NaOH into sample in increments of 0.5 ml or less until the pH in the sample approaches 8.3 then add NaOH, dropwise, pausing between drops to allow the pH to stabilize until a pH of 8.3 is reached.
6.4 Determine the amount of 0.02N NaOH added to sample.

7.0 Calculation

7.1 Calculate acidity, as mg/l, using the following formula:

$$\text{Acidity, mg/l as } CaCO_3 = \frac{A \times N \times 50{,}000}{\text{ml of sample}}$$

where:

A = ml of NaOH used
N = normality of NaOH

Quality Control and Quality Assurance

1.0 Choose one sample from the set of analyses and run a duplicate. Results should be within 10 percent.

Reference

1.0 Standard Methods for Examination of Water and Wastewater, 17th Edition.