QUALITY ASSURANCE/WORK PLAN

LOWER SUSQUEHANNA SUBBASIN – SMALL WATERSHED STUDY YELLOW BREECHES WATERSHED

Document Control Number SRBC - QA021

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I. PROJECT NAME

Lower Susquehanna Small Watershed Study

II. PROJECT OFFICERS

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III. QUALITY ASSURANCE OFFICER

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Division of Watershed Assessment and Protection

IV. DATE OF PROJECT INITIATION

October 2005; sampling scheduled to begin February 2006

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. In 1998, the Commission reevaluated its subbasin survey program and added a Year 2 component to better assist local interests and to perform more detailed studies in selected watersheds.

During June–November 2005, Commission staff conducted a survey of the Lower Susquehanna Subbasin. The data collected during this survey provided a qualitative assessment of conditions in the basin. Commission staff is involved in a whole watershed assessment of the Yellow Breeches Watershed, with a focus on impaired areas, for the Pennsylvania Department of Environmental Protection (PADEP). One area of interest for the PADEP is bacteria and its recreational impacts. The watershed is heavily used for recreational purposes, including fishing, swimming, and canoeing. Currently, Commission staff is participating in the activities of the Yellow Breeches Watershed Association (YBWA) through its board of directors. The YBWA recently completed a watershed assessment and rivers conservation plan and is working with Cumberland and York Counties and the Pennsylvania Fish and Boat Commission (PFBC) to develop a water trail in the lower watershed for recreational use. Additionally, there are several drinking water suppliers in the Yellow Breeches Watershed that are interested in bacterial contamination with regard to drinking water impacts. Through a grant from PADEP, the Commission prepared source water assessment reports in June 2003 for Pennsylvania American Water Company and United Water of Pennsylvania in the Yellow Breeches Watershed.

The Commission proposes to perform a small watershed survey, focused on bacteria contamination, in the Yellow Breeches Watershed in Cumberland and York Counties, Pa. The survey area encompasses the mainstem Yellow Breeches, Cedar Run, Mountain Creek, Stony Run, Dogwood Run, and Trout Run. The survey will be performed during FY-2006.

This watershed assessment will provide valuable information to the Commission and other interested parties, including PADEP, YBWA, Cumberland County Conservation District, York County Conservation District, and the water suppliers in the watershed. Streams to be sampled include: mainstem Yellow Breeches, Cedar Run, Mountain Creek, Stony Run, Dogwood Run, and Trout Run. Commission staff will perform extensive coordination with PADEP, YBWA, county conservation districts, local citizens, and other interested parties. Figure 1 shows the location of the Yellow Breeches study area.

B. Data Usage

The study will provide information to: (1) assess the bacterial impairment of the streams within the subbasin; (2) document changes in stream quality seasonally; (3) identify major sources of pollution and lengths of stream impacted; and (4) provide information on the relative contributions of fecal coliform, enterococci, and *Escherichia coli* (*E. coli*). Data collected during the survey also will be used in completing the Commission's Consolidated Listing (formerly Section 305(b) Water Quality Assessment) Report. Data will be provided to interested parties, particularly PADEP, YBWA, and the water suppliers.

C. Monitoring Network Design and Rationale

The Yellow Breeches Watershed was selected as a small watershed study for several reasons. The Commission has been working with PADEP and the YBWA on various issues within the watershed for several years. The watershed contains several reaches that are impaired due to bacteria, atmospheric deposition, agriculture, and urban runoff. The Commission will be conducting sampling within the watershed under a separate grant from PADEP during FY-2006 that will address many of these impaired reaches and will provide more detailed information on the sources and causes of impairment in the watershed. YBWA recently completed a watershed assessment and rivers conservation plan to identify and address issues important to public and private interests within the watershed. Additionally, the YBWA, in cooperation with Cumberland County, York County, and PFBC, is designing and implementing a water trail in the lower portion of the stream.

The sampling sites listed in Table 1 were selected so that data collected during this survey can be utilized as background information by PADEP and other interested parties, including the water suppliers in the Yellow Breeches Watershed. Additional sites have been added on tributary streams to provide better coverage of the watershed. The locations for the sites were chosen to evaluate the pervasiveness of bacteria pollution along the mainstem and contamination in the various tributaries.

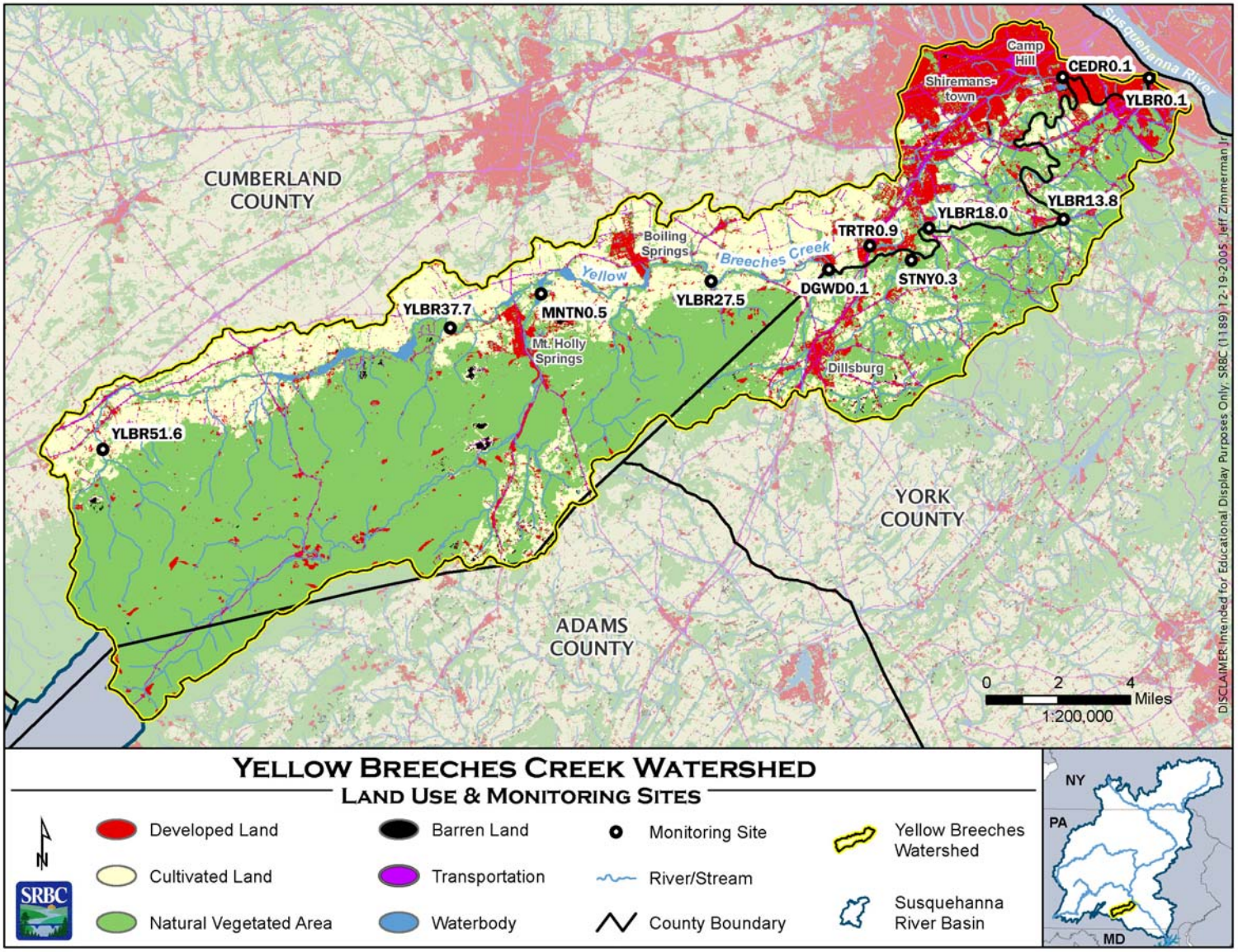


Figure 1. Yellow Breeches Watershed Study Area

Table 1. Yellow Breeches Small Watershed Study Station Locations

Site	Sample Site	Location Description	County/State	Latitude	Longitude
1	YLBR 0.1	Yellow Breeches at mouth at Bridge St. in New Cumberland, Pa.	Cumberland/Pa.	40.224322	-76.860700
2	YLBR 13.8	Yellow Breeches at Lower Allen Township Park near Lisburn, Pa.	Cumberland/Pa.	40.167683	-76.905783
3	YLBR 18.0	Yellow Breeches at Market St., near Bowmansdale, Pa.	Cumberland/Pa.	40.164056	-76.976650
4	YLBR 27.5	Yellow Breeches at SR2002, upstream of Brandtsville, Pa.	Cumberland/Pa.	40.142633	-77.090906
5	YLBR 37.7	Yellow Breeches at Church Rd. near Barnitz, Pa.	Cumberland/Pa.	40.123753	-77.227756
6	YLBR 51.6	Yellow Breeches headwaters; at SR3005, near New Lancaster, Pa.	Cumberland/Pa.	40.074378	-77.409758
7	CEDR 0.1	Cedar Run at mouth at Eberlys Mill, Pa.	Cumberland/Pa.	40.224872	-76.906394
8	DGWD 0.1	Dogwood Run at mouth at Creek Rd. near Williams Grove, Pa.	Cumberland/Pa.	40.147467	-77.029119
9	MNTN0.5	Mountain Creek at mouth, at Landor Lane, near Mount Holly Springs, Pa.	Cumberland/Pa.	40.137525	-77.180122
10	STNY0.3	Stony Run at mouth, at Grantham Road, near Grantham, Pa.	York/Pa.	40.151147	-76.985783
11	TRTR0.9	Trout Run, downstream of large spring, at Old Rt. 15, near Grantham, Pa.	Cumberland/Pa.	40.156967	-77.007458

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) when possible. Discharge at sites adjacent to USGS gaging stations (at YLBR 0.1 and MNTN 0.5) will be obtained from USGS rating tables. Bacteria data, as well as instream flow and field water chemistry information, will be collected five times per season. Bacteria samples will be processed and analyzed by PADEP, Bureau of Laboratories (Lab), in Harrisburg, Pa. Fecal coliform is analyzed using Standard Method 9222D (membrane filter method), enterococci is analyzed using U.S. Environmental Protection Agency (USEPA) method 1600 (membrane filter method with mEI agar), and *E. coli* is analyzed using USEPA Method EPA/821/R-97/004 (membrane filter method with modified MTEC agar).

VI. PROJECT FISCAL INFORMATION

See USEPA grant application.

VII. SCHEDULE

	2006												2007											
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
Bacteria Sampling		X			X			X			X													
Compile and Evaluate Data												X	X	X	X									
Report Writing															X	X	X	X	X					
Final Report																			X					

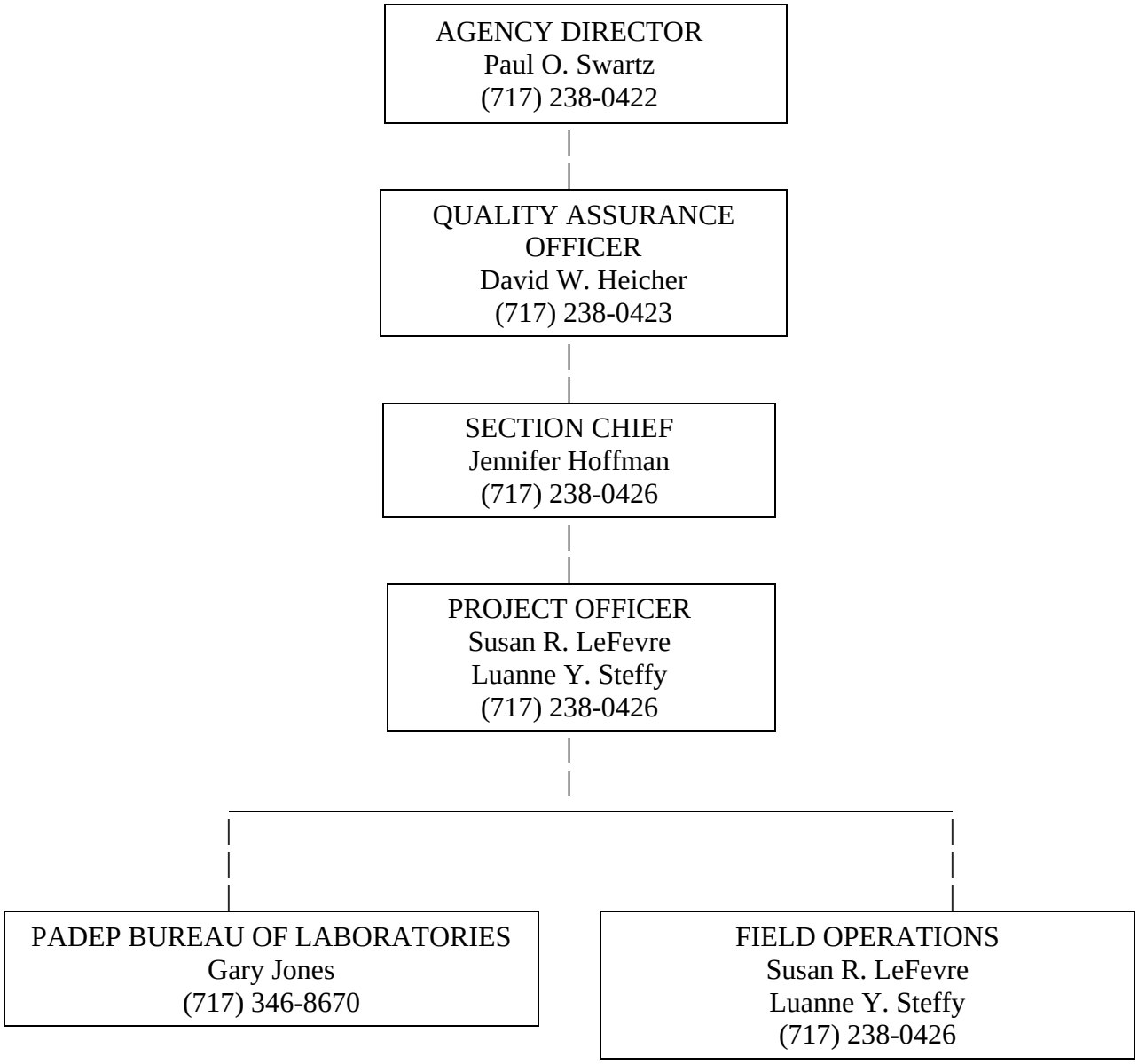
Table 2. Monitoring Parameters

Parameter	Number of Samples	Analytical Sample Matrix	Method Reference	Sample Preservation	Holding Time
Flow	NA	NA	Buchanan and Somers, 1969	NA	NA
Temperature	220	aq.	Field measurement on grab sample[1]	none	0
Dissolved oxygen	220	aq.	Field measurement on grab sample[1]	none	0
Conductivity	220	aq.	Field measurement on grab sample[1]	none	0
pH	220	aq.	Field measurement on grab sample[1]	none	0
Alkalinity	220	aq.	Field measurement on grab sample[1]	none	0
Acidity	220	aq.	Field measurement on grab sample[1]	none	0
Turbidity	220	aq.	Field measurement on grab sample[1]	none	0
Fecal coliform	220	aq.	SM9222D[2]	Chill to <4°C, preserve with $Na_2O_3S_2$	30 hours
Enterococci	220	aq.	USEPA Method 1600[3]	Chill to <4°C, preserve with $Na_2O_3S_2$	30 hours
E. coli	220	aq.	USEPA Method EPA/821/R-97/004[4]	Chill to <4°C, preserve with $Na_2O_3S_2$	30 hours

1. See description in Section X.C.
2. Standard Methods, 19th edition
3. USEPA Method 1600: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-$-D-Glucoside Agar (mEI), September 2002.
4. USEPA. 2000. Improved Enumeration Methods for the Recreational Water Quality Indicators: Enterococci and *Escherichia coli*. EPA/821/R-27/004.

VIII. PROJECT ORGANIZATION AND RESPONSIBILITY

A. Project Organization



B. Project Responsibility

1. Sampling operations—S. LeFevre, SRBC
2. Sampling QC—L. Steffy, SRBC
3. Laboratory analysis—G. Jones, PADEP
4. Laboratory QC—G. Jones, PADEP
5. Data processing activities—S. LeFevre, SRBC
6. Data processing QC—L. Steffy, 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

A. Data Representativeness

Water samples are collected at a mid-channel point in the area of the greatest flow at a depth of 8 to 12 inches, according to PADEP protocol (Commonwealth of Pennsylvania, 2004). 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.

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 statistical level of confidence in decision making

X. SAMPLING PROCEDURES

A. Sample Collection

Bacteriological samples will be collected using standard PADEP protocol (Commonwealth of Pennsylvania, 2004). Samples will be collected in the main current in the area of the greatest flow. Collectors will wade into the desired sampling location and will pause to allow disturbed sediment to wash downstream. Facing upstream, collectors will remove the cap for the sample bottle while avoiding touching the inside of the bottle or cap. If the inside of the bottle or cap is touched, a new bottle must be used. The bottle should not be rinsed. Samples should be collected from a depth of 8 to 12 inches beneath the surface. If the water is less than 16 inches deep, the sample should be collected at mid-depth. If the water is less than four inches deep, a new sampling area should be chosen. The bottle should not be filled completely; a one-inch air space should be maintained.

Bacteriological sampling will be conducted during each season (approximately February, May, August, and November). Five bacteriological samples will be collected on different days during a 30-day period and spanning a minimum of 14 days.

B. Water Samples

One hundred twenty-five milliliters of water will be collected at each station for laboratory analysis. The samples consist of one 125-ml bottle fixed with sodium thiosulfate for bacteria analysis. Duplicate samples will be collected at a frequency of one per day, or one per 10 samples, whichever is

more frequent. Each bottle should be placed inside a Ziploc plastic bag and sealed before being placed inside a cooler with ice. The samples will be chilled on ice, and delivered within 24 hours to the PADEP Lab. Bacteriological samples will be collected using 125-ml screw-capped polypropylene bottles that have been pre-sterilized and contain sodium thiosulfate.

C. Field Chemistry

Temperature is measured with a field thermometer in degrees Celsius. Dissolved oxygen is measured using a YSI dissolved oxygen meter. Conductivity is measured using a VWR conductivity meter. A Cole-Parmer meter is used to measure pH. Turbidity will be measured using a Hach 2100P portable turbidometer. The probes of all meters are rinsed with distilled water and sample water prior to collection of water quality data. Alkalinity and acidity are determined 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 (See SOP, Attachment A). Acidity is measured in the field by titrating a known volume of sample water to pH 8.3 with 0.02N NaOH (See SOP, 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. The Quality Assurance Officer will certify that training has been completed during field inspections, as well as discussions with the trainee, the trainee's supervisor, and the person(s) who provided the training.

D. Discharge Measurements

Discharge at sites near USGS gaging stations will be obtained from the USGS database. At other stations where no USGS gage exists, flow measurements are made by field personnel using pygmy or AA meter, a flow rod, headset, and standard USGS procedures (Buchanan and Somers, 1969). All staff members are required to participate in computer-assisted training provided by USGS entitled "Measurement of Stream Discharge by Wading," Water Resources Investigations Report 00-4036, by K.M. Nolan and R.R. Shields and to undergo six months of on-the-job training with an experienced staff member, as well as a yearly field check. The Quality Assurance Officer will certify that training has been completed during field inspections and through discussions as detailed in X.C. above.

E. 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 PADEP Lab by overnight courier service. A sample submission sheet (Appendix C), provided by PADEP Lab, is included for each sample sent to the PADEP 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 PADEP Lab.

XII. CALIBRATION PROCEDURES AND PREVENTATIVE MAINTENANCE

A. Dissolved Oxygen Meter

A YSI 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. Results are recorded in the calibration log.

B. Specific Conductance Meter

The VWR 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. These results are recorded in the calibration log.

E. Turbidity Meter

The turbidity meter is calibrated weekly against two standards. Calibration checks are made after every 10 samples. These checks are recorded in the calibration log.

XIII. DOCUMENTATION

Bacteria sample bottles are labeled at the time of collection. Water samples are labeled with a seven-digit identification number, the station, date, and time. This information is recorded on laboratory sample submission sheets (Appendix C). 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. In addition to laboratory submission sheets, Commission staff maintain a logbook that contains information for each water quality sample, in which the sample number, date, time, flow measurement at the time the sample was collected (if applicable), field chemistry parameters, whether a sample is a duplicate, and any other pertinent information regarding the sample.

Bacteria data from the laboratory are reported electronically to the Commission from PADEP Lab. Results of laboratory analyses are entered into a computer database. Data entries are verified by the project manager, 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.

Databases for all water quality and bacteria data consist of Excel spreadsheets developed for in-house needs. The databases are located on the Commission's server, which is backed-up daily. 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. Recently, staff has developed an Access database for data storage and to assist in transferring water quality data to USEPA's STORET.

XIV. DATA REDUCTION

Water quality and bacteria 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 (for field chemistry parameters) and recreational use (for bacteria data).

PADEP uses fecal coliform bacteria for recreational use attainment decisions in surface waters. Recreational use attainment of a stream is determined by comparing the geometric mean of the fecal coliform sampling groups (five consecutive samples collected from the stream) to Pennsylvania's numerical standards, a maximum geometric mean of 200 colony forming units (CFUs) per 100 ml during the recreational season (May 1 through September 30) and 2000 CFUs during the nonrecreational season. Enterococci and E. coli samples also will be collected to compare results of these analyses with the total fecal coliform counts.

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. The data go through a series of validations as they are entered into the database, including checking values for duplicate samples against one another, comparing computer entries to field and laboratory data sheets, looking for data gaps and missing information, checking flow calculations, and examining raw data for outliers or inappropriate measurements. A separate staff member also checks the information after input to ensure correct data entry.

XVI. PERFORMANCE AND SYSTEMS AUDITS

A. Laboratory Analyses

Analytical and quality assurance procedures for the PADEP Lab are detailed in the QA plan submitted by the laboratory. Duplicate analyses are run at least one each day by each analyst. Duplicate analyses are also run between two analysts. Duplicate samples will be submitted to the laboratory (at least one per 10 samples). PADEP Lab is certified by USEPA for drinking water parameters; the laboratory ID number is PA00001.

B. Field Procedures

Field operator techniques are tested annually for pH, specific conductance, and alkalinity with USGS standard samples. In addition, Commission staff is tested annually in the collection of flow measurements. 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 will be scheduled for August 2006, 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 as acceptable. Temperature readings from the dissolved oxygen meter are checked against a standard laboratory thermometer. These checks are performed prior to fieldwork.

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 and must be reported to the QA Officer. The QA Officer is responsible for seeing that such corrective action is completed. 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 in summer 2007. 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) and in USEPA's STORET. In addition, the data are utilized by staff for inclusion in the Commission's Consolidated Listing Report. Staff also will provide the data collected to PADEP and other interested parties.

XIX. DATA QUALITY OBJECTIVES

Parameters with state or federal standards or references for approximate tolerances of aquatic life are listed in Table 3. Chemical water quality data collected during this project will be compared against Pennsylvania standards, as well as the limits listed in Table 3. Fecal coliform data will be compared against Pennsylvania standards.

The intent of the project is to collect bacteriological information to provide an assessment of conditions found in the Yellow Breeches Watershed. At times, issues arise regarding the quality of the data collected and its applicability to the monitoring project goals. For example, when the Commission questions analysis results due to a greater than 10 percent difference between samples, staff requests the Lab to check the data entry and to reanalyze if necessary. Also, if staff finds that the upstream flow measurements are greater than the downstream flow measurements, staff performs another flow measurement. In some cases, the flows are correct due to changes in hydrology, particularly in limestone-dominated, previously mined, or glacially influenced areas.

Table 3. Water Quality Standards and Aquatic Life Tolerances

Parameter	Limit	Reference Code	Reference Code & References
Temperature	> 25 degrees	a,d	a. http://www.pacode.com/secure/data/025/chapter93/s93.7.html b. Gagen and Sharpe (1987) and Baker and Schofield (1982) c. http://www.uky.edu/WaterResources/Watershed/KRB_AR/wq_standards.htm d. http://www.hach.com/h2ou/h2wtrqual.htm e. http://sites.state.pa.us/PA_Exec/Fish_Boat/education/catalog/pondstream.pdf
Dissolved oxygen	< 4 mg/l	a,e	
Conductivity	> 800 µmhos/cm	c	
pH	< 5	b,d	
Alkalinity	< 20 mg/l	a,e	
Total fecal coliforms	Geometric mean of 200 CFUs/ 100ml during recreation season or a single sample result of 400 CFUs/100 ml; 2000 CFUs/100 ml during nonrecreation season	a	

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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

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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.

Attachment C: PADEP Laboratory Sample Submission Sheet

Fixed:

DEP Laboratory
Sample Submission Sheet

LAB USE ONLY

Lab Number:

Date Received:

Collector ID: Seq. No.: Date Collected: (MM-DD-YY) Time Collected:

SAC or Suite Code:

Reason: Cost Center: Program: SPN:

Legal Seal Number

Check If Broken:

LAB USE ONLY Matrix Code: Residual Chlorine: YES NO pH less than 2 . 0? YES NO

Custody Log Date:

How Shipped:

Received by:

Additional Information:

Addressee : _____

Address 1 : _____

Address 2 : _____

City : _____ State: _____ Zip: _____

Sampling Location: _____

Collector Name (Please PRINT) : _____

Signature: _____ **Date:** _____ **Phone:** _____

☐ = Required Information