Chapter 4: ELEMENTS OF A QAPP

This chapter discusses the 24 elements of a Quality Assurance Project Plan, as outlined in EPA quality assurance guidance, *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations* (EPA QA/R-5, August 1994). It is very likely that not all elements will apply to your project. This is an issue that should be discussed with your QAPP team and any group who will be approving the QAPP. If your project does not require all 24 elements, indicate in your QAPP which elements you will not be including. This will make review and approval of your QAPP faster and easier.

Throughout this chapter, brief examples are included. The examples are drawn from a fictional monitoring project--the *Volunteer Creek Monitoring Project*. They are not intended to be comprehensive, but rather simply to help illustrate the type of information that might be included in the elements of a QAPP. For more information, you may wish to contact other volunteer monitoring programs with approved QAPPs.

1 TITLE AND APPROVAL PAGE

Your title page should include the following:

- title and date of the QAPP
- names of the organizations involved in the project
- names, titles, signatures, and document signature dates of all appropriate approving officials such as project manager, project QA officer, and, if the project is funded by EPA, the EPA project manager and QA officer.

ELEMENTS OF A QAPP

Project Management (elements 1-9)

1. Title and Approval Page
2. Table of Contents
3. Distribution List
4. Project/Task Organization
5. Problem Identification/ Background
6. Project/Task Description
7. Data Quality Objectives for Measurement Data
8. Training Requirements/ Certification
9. Documentation and Records

Measurement/Data Acquisition (elements 10-19)

10. Sampling Process Design
11. Sampling Methods Requirements
12. Sample Handling and Custody Requirements
13. Analytical Methods Requirements
14. Quality Control Requirements
15. Instrument/Equipment Testing, Inspection, and Maintenance Requirements
16. Instrument Calibration and Frequency
17. Inspection/Acceptance Requirements for Supplies
18. Data Acquisition Requirements
19. Data Management

Assessment and Oversight (elements 20-21)

20. Assessment and Response Actions
21. Reports

Data Validation and Usability (elements 22-24)

22. Data Review, Validation, and Verification Requirements
23. Validation and Verification Methods
24. Reconciliation with Data Quality Objectives

2 TABLE OF CONTENTS

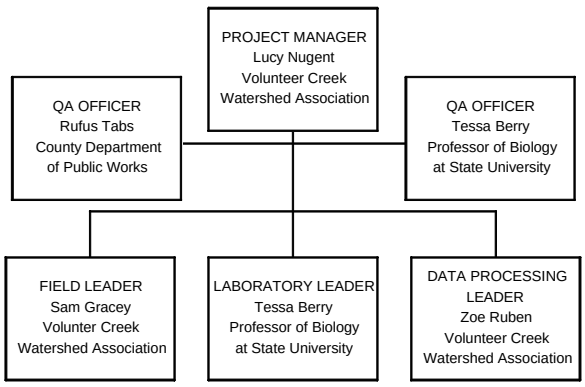
A Table of Contents should include section headings with appropriate page numbers and a list of figures and tables.

3 DISTRIBUTION LIST

List the individuals and organizations that will receive a copy of your approved QAPP and any subsequent revisions. Include representatives of all groups involved in your monitoring effort.

4 PROJECT/TASK ORGANIZATION

Identify all key personnel and organizations that are involved in your program, including data users. List their specific roles and responsibilities. In many monitoring projects, one individual may have several responsibilities. An organizational chart is a good way to graphically display the roles of key players.



ELEMENT 4
Project/Task Organization

In addition to the project officers shown, the Volunteer Creek Monitoring Project also has an Advisory Panel consisting of representatives from EPA, the state Department of Environmental Conservation (DEC), and the County Department of Public Works (DPW). Each of the leaders shown serves on the Advisory Panel. Major responsibilities of all personnel are detailed in the Volunteer Creek SOPs, attached to this document. The primary data users are the state DEC and the County DPW.

5 PROBLEM DEFINITION / BACKGROUND

In a narrative, briefly state the problem your monitoring project is designed to address. Include any background information such as previous studies that indicate why this project is needed. Identify how your data will be used and who will use it.

ELEMENT 5
Problem Definition/Background

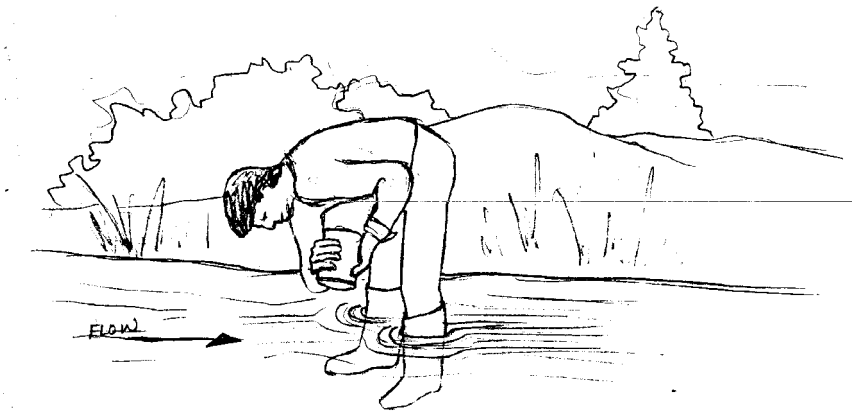
Volunteer Creek flows through an urbanizing watershed. As more communities are built, the quantity of stormwater runoff will increase. Working together, local residents and government agencies have developed plans to implement best management practices, or BMPs, designed to minimize the potential negative water quality impacts to Volunteer Creek.

The organizers of the monitoring project, including the Volunteer Creek Watershed Association, the County Department of Public Works and the State Department of Natural Resources, want to document conditions of the stream before and after development to evaluate the effects of stormwater management BMPs.

The data collected will be used by the county and state to evaluate how well these BMPs are working and to help identify specific problems that require further attention or study. The watershed association will also use the data to educate residents on the connections between land-use and water quality.

6 PROJECT/TASK DESCRIPTION

In general terms, describe the work your volunteers will perform and where it will take place. Identify what kinds of samples will be taken, what kinds of conditions they will measure, which are critical, and which are of secondary importance. Indicate how you will evaluate your results--that is, how you will be making sense out of what you find. For example, you may be comparing your water quality readings to State or EPA standards, or comparing your macroinvertebrate evaluations to State-established reference conditions or historical information.



Include an overall project timetable that outlines beginning and ending dates for the entire project as well as for specific activities within the project. The timetable should include information about sampling frequency, lab schedules, and reporting cycles.

ELEMENT 6
Project/Task Description

From January through March 1996, the Watershed Association will conduct initial volunteer recruitment and training in conjunction with the county and state. A second recruitment drive as well as training and retraining sessions will be held from August to October.

Monthly water sampling of temperature, pH, turbidity, and dissolved oxygen will occur throughout the calendar year at each of 20 sites. At the same sites, macroinvertebrate and habitat assessments will be conducted in March, July, and October. In order to characterize the stream and to create a baseline of data, each of these evaluations is a critical component of the overall study. For informational and educational purposes, volunteers will also record characteristics such as water odor and color during each assessment. Macroinvertebrate taxonomy will take place in April, August, and November at the state university biology laboratory.

Following each assessment, all data will be entered into the computerized management system and analyzed. Interim report of findings will be produced and distributed in May and September. A final, year-end report will be produced and distributed in January 1997.

MAJOR TASK CATEGORIES	J	F	M	A	M	J	J	A	S	O	N	D
volunteer recruitment, training, and re-training	X	X	X					X	X	X		
monthly pH, temp., turbidity, & dissolved oxygen sampling	X	X	X	X	X	X	X	X	X	X	X	X
seasonal macroinvertebrate & habitat assessments			X				X			X		
lab analysis				X				X			X	
data processing, analysis & reporting					X	X			X	X	X	X

7 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

Data Quality Objectives (DQOs) are the quantitative and qualitative terms you use to describe how good your data need to be to meet your project's objectives. DQOs for *measurement data* (referred to here as data quality indicators) are precision, accuracy, representativeness, completeness, comparability, and measurement range. Provide information on these indicators, in quantitative terms if possible. See Chapter 3 for a further discussion of these terms.

Since it is important to develop a QAPP prior to monitoring, it may not be possible to include actual numbers for some of the data quality measurements

within the first version of the document. You will need, however, to discuss your goals or objectives for data quality and the methods you will use to make actual determinations after monitoring has begun. You must also discuss at what point changes will be made if project specifications are not achieved. Data quality indicators should be given for each parameter you are measuring, in each "matrix" (i.e., substance you are sampling from, such as water or sediment). The easiest way to present quantitative information is in a table.

In some types of monitoring, particularly macroinvertebrate monitoring and habitat assessment, some data quality indicators cannot be quantitatively expressed. In that case, you can fulfill this requirement of the QAPP by citing and describing the method used and by providing as many of the data quality indicators as possible (e.g., completeness, representativeness, and comparability) in narrative form.

ELEMENT 7
Data Quality Objectives for Measurement Data

Precision, Accuracy, Measurement Range
The following table illustrates the precision, accuracy and measurement range for the Volunteer Creek pH, temperature, turbidity, and dissolved oxygen assessments.

Matrix	Parameter	Precision	Accuracy	MR*
water	pH	±20%	±0.5	3 to 10.5 units
water	temperature	±20%		
water	dissolved oxygen	±20%	±0.3mg/L	1 to 20 mg/l
water	turbidity	±20%	±0.2mg/L	0 to 1000 NTU

* MR = measurement range

Representativeness
In the Volunteer Creek project's assessment, representativeness depends largely on randomized sampling. The creek is a high-gradient stream with a predominance of riffle habitats. Monitoring sites selected for this study are indicative of that habitat type and the program uses sampling techniques developed for high-gradient streams. In addition, for the macroinvertebrate collection, volunteers sample at three locations within the riffle and then composite (combine) the samples so as to be more generally reflective of the entire riffle habitat.

Comparability
One of the ways that the Volunteer Creek program ensures comparability is to follow the monitoring protocol established by the State for assessment and analysis. Volunteers also use standardized taxonomic keys to identify macroinvertebrates to the family level.

Completeness
There are no legal or compliance uses anticipated for the Volunteer Creek data. In addition, there is no fraction of the planned data that must be collected in order to fulfill a statistical criteria. It is expected that samples will be collected from at least 90% of the sites unless unanticipated weather conditions prevent sampling.

Precision is the degree of agreement among repeated measurements of the same characteristic, or parameter, and gives information about the consistency of your methods.

Accuracy is a measure of confidence that describes how close a measurement is to its “true” value.

Measurement Range is the range of reliable readings of an instrument or measuring device, as specified by the manufacturer.

Representativeness is the extent to which measurements actually represent the true environmental condition.

Comparability is the degree to which data can be compared directly to similar studies. Using standardized sampling, analytical methods, and units of reporting helps to ensure comparability.

Completeness is the comparison between the amount of data you planned to collect versus how much usable data you collected, expressed as a percentage.

8 TRAINING REQUIREMENTS / CERTIFICATION

Identify any specialized training or certification requirements your volunteers will need to successfully complete their tasks. Discuss how you will provide such training, who will be conducting the training, and how you will evaluate volunteer performance.

ELEMENT 8
Training Requirements/ Certification

Volunteer Creek monitors participate in a two-day field training course conducted by state and local water quality personnel. On the first day, volunteers are instructed how to calibrate equipment and perform physical and chemical tests and analyses. The second day is devoted to macroinvertebrate and habitat sampling. Volunteers for the taxonomy lab receive a separate day of training. All participants are required to attend an annual refresher course as well.

Performance is evaluated in the field and the lab. During initial and renewal training sessions, volunteers perform a simultaneous dip-in determination of pH, temperature, and dissolved oxygen. Volunteers also determine turbidity levels of water samples using meters at the lab. In addition, during training, participants conduct macroinvertebrate sampling in small groups with trainers. To evaluate volunteer skill in the taxonomy lab, volunteers are trained and re-trained using previously identified samples from earlier assessments.

9 DOCUMENTATION AND RECORDS

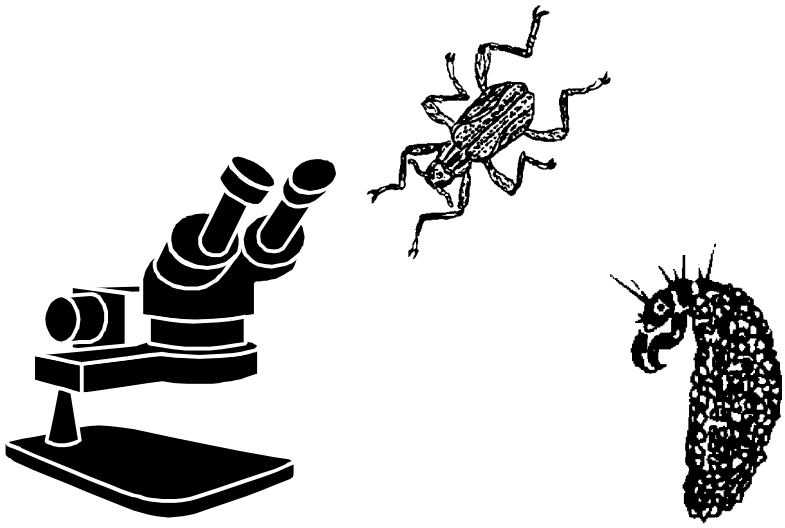
Identify the field and laboratory information and records you need for this project. These records may include raw data, QC checks, field data sheets, laboratory forms, and voucher collections. Include information on how long, and where, records will be maintained. Copies of all forms to be used in the project should be attached to the QAPP.

ELEMENT 9
Documentation and Records

Each Volunteer Creek field sampling sheet must be completed on-site at the time sampling occurs. Volunteers record site number, location, the date and time the sample was collected, and the name of each team member. Contact information for the team captain or monitor responsible for returning field sheets and macroinvertebrate samples to the watershed association office is also included on each field sheet.

Volunteers make a copy of each field sheet and keep the copy with their records. The original is returned to the Volunteer Creek Watershed Association office along with the macroinvertebrate sample (if taken). Field sheets are archived for three years. After macroinvertebrate samples have been identified, laboratory record sheets are maintained in the watershed association office for three years. Hard copies of all data as well as computer back-up disks are maintained by the Association. A macroinvertebrate voucher collection is maintained by the state university biology lab for five years.

VOLUNTEER CREEK MONITORING PROJECT	
Site #: _____	Site Location:
Date: _/_/_	Time: _____ AM PM
Team Captain:	Phone #:
Address:	
Other Monitoring Team Members:	



10 SAMPLING PROCESS DESIGN

Outline the experimental design of the project including information on types of samples required, sampling frequency, sampling period (e.g., season), and how you will select sample sites and identify them over time. Indicate whether any constraints such as weather, seasonal variations, stream flow or site access might affect scheduled activities, and how you will handle those constraints. Include site safety plans. You may cite the sections of your program's SOPs which detail the sampling design of the project, in place of extensive discussion.

ELEMENT 10
Sampling Process Design

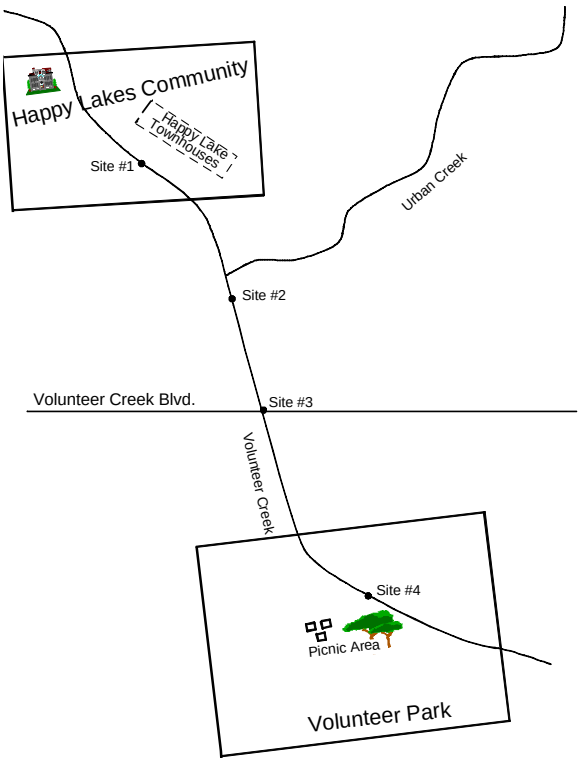
Volunteer Creek monitoring sites are sampled monthly for pH, temperature, turbidity, and dissolved oxygen. In March, July and October, a macroinvertebrate and habitat assessment is conducted at each site. Monitoring sites are identified by a number and a location.

If possible, volunteers are asked to wait at least 10 days after a heavy rain or snowfall before sampling. If this is not possible, they are instructed to contact the Field Leader so that this information can be noted immediately. In addition, if volunteers cannot conduct the scheduled sampling, they are instructed to contact the Field Leader as soon as possible, so that an alternative monitor can be found. Volunteers are instructed to work in teams of at least two people. Three team members are recommended for the macroinvertebrate sampling. If a scheduled team cannot conduct the sampling together, the team captain is instructed to contact the Field Leader so that arrangements can be made for a substitute.

Prior to final site selection, permission to access the stream is obtained from all property owners. If for some reason access to the site is a problem, the team captain is instructed to contact the Field Leader. All constraints and safety plans are detailed in the Volunteer Creek SOPs.

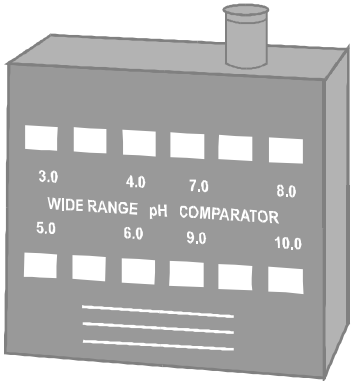
Four, or 20%, of the sampling sites surround Volunteer Creek Boulevard, which is being widened to accommodate growing residential and commercial development. They are located as follows:

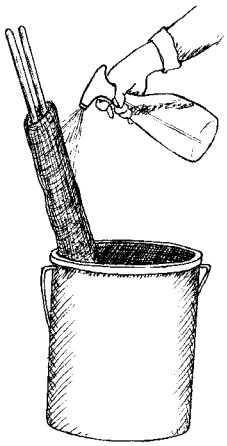
- Site #1 adjacent to the new townhome development in the Happy Lakes Community
- Site #2 downstream of the confluence with Urban Creek
- Site #3 at the crossing of Volunteer Creek Boulevard
- Site #4 within Volunteer Park, adjacent to the picnic area



11 SAMPLING METHODS REQUIREMENTS

Describe your sampling methods. Include information on parameters to be sampled, how samples will be taken, equipment and containers used, sample preservation methods used, and holding times (time between taking samples and analyzing them). If samples are composited (i.e., mixed), describe how this will be done. Describe procedures for decontamination and equipment-cleaning. (For example, kick nets need to be thoroughly rinsed and examined for clinging organisms between sampling events.) Most of this information can be presented in a table or you may also cite any SOPs that contain this information.





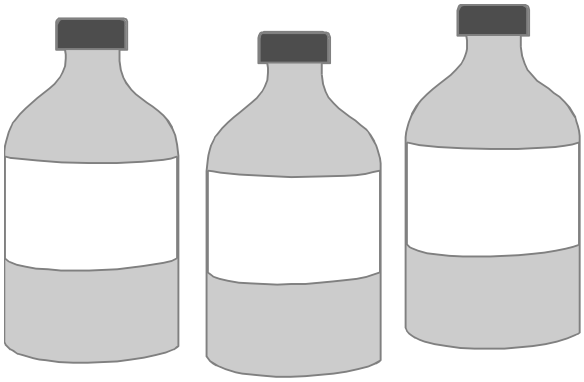
ELEMENT 11
Sampling Methods Requirements

The Volunteer Creek SOP, attached to this document, contains detailed information on all sampling protocols and equipment. The table below summarizes a portion of this information.

Matrix	Parameter	Sampling Equipment	Sample Holding Container	Method Sample Preservative	Maximum Holding Time
water	pH	Jones pH color comparator kits	screw top, glass sample bottle	none	immediately
water	temperature	Smith armored thermometer	none, measurement taken instream	none	immediately
water	dissolved oxygen	Jones DO kit	screw top, glass sample bottle	none	immediately
water	turbidity	Jones turbidity meter	screw top glass sample bottle	store on ice	48 hours
substrate	macroinvertebrates	3' X 3' kicknet; 500 micron mesh	1 liter plastic wide-mouth bottle	90% ethyl alcohol	6 weeks

12 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Sample handling procedures apply to projects that bring samples from the field to the lab for analysis, identification, or storage.



These samples should be properly labeled in the field. At a minimum, the sample identification label should include sample location, sample number, date and time of collection, sample type, sampler's name, and method used to preserve sample.

Describe the procedures used to keep track of samples that will be delivered or shipped to a laboratory for analysis. Include any chain-of-custody forms and written procedures field crews and lab personnel should follow when collecting, transferring, storing, analyzing, and disposing of samples.

ELEMENT 12
Sample Handling and Custody Requirements

All macroinvertebrate samples collected as part of the Volunteer Creek project are labeled in the field. The chain-of-custody for these samples is as follows: In the field, samples are the responsibility of, and stay with, the team captain. Once samples have been collected they are returned, by the monitoring team captain, to the Volunteer Creek Watershed Association office for temporary storage. The date and time of arrival is recorded by the Field Leader who is then responsible for transporting samples to the university laboratory for analysis. The date and time of arrival is also recorded at the lab by the Laboratory Leader. After samples are analyzed, laboratory information is added to the label. Samples are then stored and maintained in the university's biological lab for a minimum of three years. A chain-of-custody form is used to record all transport and storage information

VOLUNTEER CREEK PROJECT
MACROINVERTEBRATE SAMPLE LABEL

FIELD INFORMATION:

Site #: _____ Location: _____

Sample Number _____ of _____

Preservation Method: _____ Gear: _____

Date: __/__/__ Time: _____ AM PM

Team Captain: _____

Phone #: _____

LAB INFORMATION:

Date: __/__/__ Time: _____ AM PM

Analyst: _____

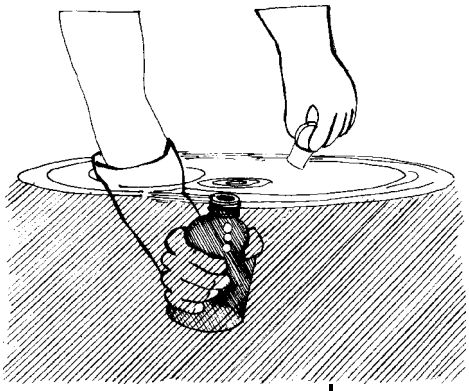
Phone #: _____

13 Analytical Methods Requirements

List the analytical methods and equipment needed for the analysis of each parameter, either in the field or the lab. If your program uses standard methods, cite these. If your program's methods differ from the standard or are not readily available in a standard reference, describe the analytical methods or cite and attach the program's SOPs.

Element 13
Analytical Methods Requirements

In the Volunteer Creek project, pH, temperature and dissolved oxygen are measured using protocols outlined in the *Citizen's Program for the Chesapeake Bay's Citizen Monitoring Manual*. Protocols for measuring turbidity come from the EPA document, *Volunteer Stream Monitoring: A Methods Manual*. Macroinvertebrate and habitat assessment methods and equipment are based on the protocols established by the state monitoring program. Each of these protocols is detailed in the Volunteer Creek SOP, attached to this document.



14 Quality Control Requirements

List the number and types of field and laboratory quality control samples your volunteers will take. (See Chapter 3 for a discussion of quality control samples.) This information can be presented in a table. If you use an outside laboratory, cite or attach the lab's QA/QC plan.

QC checks for biological monitoring programs can be described narratively, and, if appropriate, should include discussion of replicate sample collection, cross checks by different field crews, periodic sorting checks of lab samples, and maintenance of voucher and reference collections. Describe what actions you will take if the QC samples reveal a sampling or analytical problem.

Element 14
Quality Control Requirements

Replicate samples for all measurement parameters are taken at three (randomly selected) sites of the 20 Volunteer Creek monitoring sites during each sampling period (i.e. monthly for pH, temperature, turbidity, and dissolved oxygen and seasonally for macroinvertebrates). Additional QC samples include split samples and field blanks, each taken at 10% of the sites.

In addition, at least three of the macroinvertebrate samples will be reidentified by the laboratory leader during each lab session. Both a macroinvertebrate voucher and reference collection will be maintained. If sampler problems are found, the data is either thrown-out or qualified, depending on the degree of the problem, and arrangements made for monitor retraining. All volunteers are retrained at least once a year in both field and lab procedures by professional personnel.

15 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Describe your plan for routine inspection and preventive maintenance of field and lab equipment and facilities. Identify what equipment will be routinely inspected, and what spare parts and replacement equipment will be on hand to keep field and lab operations running smoothly. Include an equipment maintenance schedule, if appropriate.

Element 15
Instrument/Equipment Testing, Inspection, and Maintenance Requirements

As part of its instrument and equipment maintenance, the Volunteer Creek project performs a variety of tests. Before usage, the mercury column of each thermometer is inspected for breaks. Replacement thermometers are available from the Field Leader at the Watershed Association office. All pH and DO kits are checked to be sure all reagents, bottles, droppers, and color comparators are clean and in good working order. Reagents are replaced annually according to manufacturer's recommendations. Reagents and replacement bottles are available from the Field Leader. The turbidity meters are inspected by the Lab Manager prior to each sampling event and maintenance logs are kept on each meter. The Field Leader maintains a maintenance log book to track scheduled maintenance on all equipment. All records and equipment are held at the Volunteer Creek Watershed Association offices.

16 Instrument Calibration and Frequency

Identify how you will calibrate sampling and analytical instruments. Include information on how frequently instruments will be calibrated, and the types of standards or certified equipment that will be used to calibrate sampling instruments. Indicate how you will maintain calibration

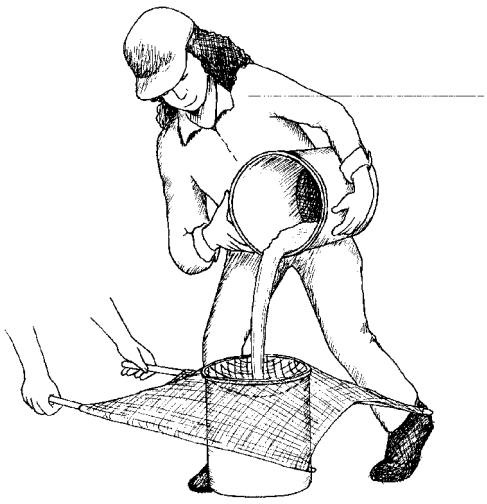
Element 16
Instrument Calibration and Frequency

The Volunteer Creek project's turbidity meters will be calibrated, prior to each sampling event, according to the manufacturer's instructions and using the manufacturer's turbidity standards. Calibration results are recorded in a log book and maintained by the Lab Manager. Calibration procedures and standards are contained in the SOP manual, available upon request.

records and ensure that records can be traced to each instrument. Instrument calibration procedures for biological monitoring programs should include routine procedures that ensure that equipment is clean and in working order.

17 Inspection and Acceptance Requirements for Supplies

Describe how you determine if supplies such as sample bottles, nets, and reagants are adequate for your program's needs.



Element 17
Inspection and Acceptance Requirements for Supplies

The Volunteer Creek project uses kick-nets for macroinvertebrate assessments. The nets are 3' X 3' attached to cylindrical wooden poles. The mesh used is 500 micron and is consistent with that used by the state monitoring program. Netting, cut into appropriate size squares, is purchased from a scientific supply house. Poles and hardware are purchased from a local supplier. All supplies and equipment are purchased under the supervision of the Field Leader.

Nets are assembled by shop students at Volunteer Creek High School. After assembly, all nets are inspected by the Field Leader. Any net that does not meet standards is taken apart and reassembled, if possible. Nets that cannot be reassembled are used for educational demonstrations. Kits and extra reagents are ordered from Smith and Jones Chemical Supply Company and inspected upon arrival by the Field Leader. Broken bottles and incomplete kits are shipped back to the manufacturer for replacement.

18 Data Acquisition Requirements

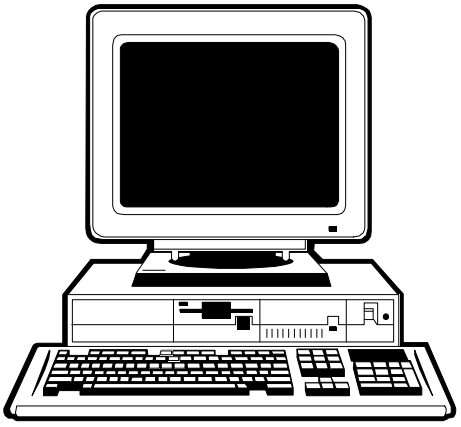
Identify any types of data your project uses that are not obtained through your monitoring activities. Examples of these types of data include historical information, information from topographical maps or aerial photos, or reports from other monitoring groups. Discuss any limits on the use of this data resulting from uncertainty about its quality.

Element 18
Data Acquisition Requirements

For the Volunteer Creek macroinvertebrate assessment analysis, pollution tolerance values assigned to organisms and metric calculation formulas are taken from the literature and documentation provided by the state water quality agency. U.S.G.S. 7.5 minute topographic maps are used to identify site locations, land-use activities, and landscape features during an initial watershed survey.

19 DATA MANAGEMENT

Trace the path your data take, from field collection and lab analysis to data storage and use. Discuss how you check for accuracy and completeness of field and lab forms, and how you minimize and correct errors in calculations, data entry to forms and databases, and report writing. Provide examples of forms and checklists. Identify the computer hardware and software you use to manage your data.

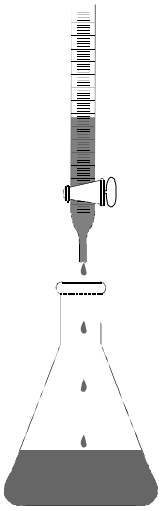


ELEMENT 19
Data Management

Field data sheets are inspected and signed by the sampling team captain before leaving the site. Field sheets are given to the field leader at the end of the sampling day for review. Within 72 hours, the field leader will contact any samplers whose field sheets contain significant errors or omissions.

The lab manager will review sample labels for turbidity and macroinvertebrate samples and remove from the dataset any that cannot be attributed to specific samplers, have not been properly preserved, or that exceed the maximum holding time. The laboratory manager will also sign-off on lab bench sheets after all QC checks have been completed. These bench sheets will be transported to the Watershed Association offices so that the data can be entered.

All data will be entered into a "Volbase" computerized spreadsheet/data base program designed for this project and compatible with hardware and software used by both the state and county water resource agencies. As a QC check, finalized data will be reviewed by a second individual.



20 ASSESSMENTS AND RESPONSE ACTIONS

Discuss how you evaluate field, lab, and data management activities, organizations (such as contract labs) and individuals in the course of your project. These can include evaluations of volunteer *performance* (for example, through field visits by staff or in laboratory refresher sessions); audits of *systems* such as equipment and analytical procedures; and audits of *data quality* (e.g., comparing actual data results with project quality objectives).

Include information on how your project will correct any problems identified through these assessments. Corrective actions might include calibrating equipment more frequently, increasing the

number of regularly scheduled training sessions, or rescheduling field or lab activities.

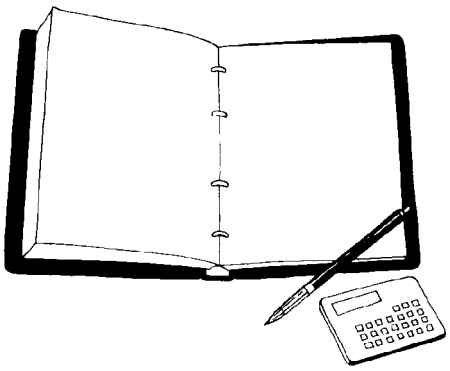
ELEMENT 20
Assessment and Response Actions

Review of Volunteer Creek field activities is the responsibility of the Field Leader, in conjunction with the Project Manager and the Quality Assurance Officer. Each field team will be accompanied and their performance evaluated by one of these individuals once a year. If possible, volunteers in need of performance improvement will be retrained on-site during the evaluation. In addition, volunteers attend yearly training renewal workshops. If errors in sampling techniques are consistently identified, retraining may be scheduled more frequently.

All field and laboratory activities may be reviewed by state and EPA quality assurance officers as requested. Systems and data quality audits are performed by the QA Officer twice yearly. Any identified procedural problems will be corrected based on recommendations from the QA Officer.

21 REPORTS

Identify the frequency, content, and distribution of reports to data users, sponsors, and partnership organizations that detail project status, results of internal assessments and audits, and how QA problems have been resolved.



ELEMENT 21
Reports

Volunteer Creek Interim reports will be produced and distributed in May (data collected from January-April) and September (data collected from May-August). A year-end report will be produced and distributed in January of the following year (data collected from September-December, as well as full-year results). The Project Manager is responsible for all report production and distribution. Reports will be forwarded to the county, state, regional EPA office, and other members of the Advisory Panel. These reports will consist of data results, interpretation of data (if possible), information on project status, volunteer highlights, results of QC audits and internal assessments. Summaries of all reports, highlighting the assessment results, project status, and volunteer achievements, will be distributed to all volunteers and Watershed Association members.

22 Data Review, Validation and Verification Requirements

State how you review data and make decisions regarding accepting, rejecting, or qualifying the data. All that is needed here is a brief statement of what will be done, by whom.

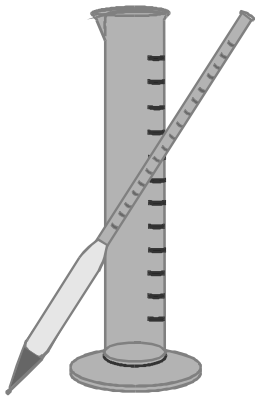
Element 22

Data Review, Validation, and Verification Requirements

All Volunteer Creek field and laboratory data is reviewed by the Project Manager, QA Officer, and Data Processing Leader to determine if the data meet QAPP objectives. In addition, personnel from the State Department of Natural Resources who are not directly connected to this project will also review data on a quarterly basis. Decisions to reject or qualify data are made by the Project Manager and the QA Officer.

23 Validation and Verification Methods

Describe the procedures you use to validate and verify data. This can include, for example, comparing computer entries to field data sheets; looking for data gaps; analyzing quality control data such as chain of custody information, spikes, and equipment calibrations; checking calculations; examining raw data for outliers or nonsensical readings; and reviewing graphs, tables and charts. Include a description of how errors, if detected, will be corrected, and how results will be conveyed to data users.



Element 23

Validation and Verification Methods

As part of the Volunteer Creek protocol, any sample readings out of the expected range are reported to the Field Leader. A second sample is taken by the Field Leader as soon as possible to verify the condition. 10-20% of the macroinvertebrate samples are reidentified as a method of verifying data. and ensuring data quality. If an error of greater than 5% is found, all samples from that sampling period will be reidentified and the taxonomist(s) retrained.

Once the data has been entered into the Volunteer Creek database, the Data Processing Leader will print out the data and proofread it against the original data sheets. Errors in data entry will be corrected. Outliers and inconsistencies will be flagged for further review, or discarded. Problems with data quality will be discussed in the interim and final reports to data users.

24 Reconciliation with Data Quality Objectives

Once the data results are compiled, describe the process for determining whether the data meet project objectives. This should include calculating and comparing the project's actual data quality indicators (precision, accuracy, completeness, representativeness, and comparability) to those you specified at the start of the project, and describing what will be done if they are not the same. Actions might include discarding data, setting limits on the use of the data, or revising the project's data quality objectives.

Element 24
Reconciliation with Data Quality Objectives

As soon as possible after each sampling event, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the project's specifications, data may be discarded and resampling may occur. The cause of failure will be evaluated. If the cause is found to be equipment failure, calibration/ maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use will be detailed in both interim and final reports, and other documentation as needed.

If failure to meet project specifications is found to be unrelated to equipment, methods, or sample error, specifications may be revised for the next sampling season. Revisions will be submitted to the state and EPA quality assurance officers for approval.