

Quality Assurance/ Quality Control Protocol
Virginia Save Our Streams Program
Rocky Bottom Benthic Macroinvertebrate Method
July 2007

The Virginia Save Our Streams Program (VA SOS)

A program of the Virginia Chapter of the Izaak Walton League of America

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Approvals:

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Date

Table of Contents

ELEMENT 3. DISTRIBUTION LIST	2
ELEMENT 4. PROJECT/ TASK ORGANIZATION	2
VIRGINIA SAVE OUR STREAMS PROGRAM COORDINATOR OR DESIGNEE	2
VA SOS REGIONAL TRAINERS	3
VA SOS REGIONAL COORDINATORS	3
VA SOS QUALITY ASSURANCE AUDITORS	3
VA SOS VOLUNTEERS	3
VA SOS DATA USERS	4
ELEMENT 5. PROBLEM DEFINITION/ BACKGROUND	4
ELEMENT 6. PROJECT/ TASK DESCRIPTION	5
ELEMENT 7. DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA	5
ELEMENT 8. TRAINING REQUIREMENTS/ CERTIFICATION	7
VA SOS VOLUNTEER	7
QUALITY ASSURANCE AUDITOR	7
REGIONAL COORDINATOR.....	8
REGIONAL TRAINERS	8
ELEMENT 9. DOCUMENTATION AND RECORDS	9
VOLUNTEER FIELD SHEETS	9
TRAINING AND CERTIFICATION FORMS	9
QUALITY ASSURANCE FORMS	9
UNKNOWN SPECIMEN SUBMITTAL	10
ELEMENT 10. SAMPLING PROCESS DESIGN	10
ELEMENT 11. SAMPLING METHODS REQUIREMENTS	11
CHOOSING WHERE TO SAMPLE WITHIN THE STREAM	11
HOW TO SAMPLE.....	12
PROCESSING THE SAMPLE	12
HABITAT ANALYSIS	13
ELEMENT 12. SAMPLE HANDLING AND CUSTODY REQUIREMENTS	13
QUALITY ASSURANCE SAMPLES	14
UNKNOWN SPECIMENS.....	14
ELEMENT 13. ANALYTICAL METHODS REQUIREMENTS	14
ELEMENT 14. QUALITY CONTROL REQUIREMENTS	15
REFERENCE COLLECTION	15
METHOD EVALUATION.....	16
ELEMENT 15. INSTRUMENT/ EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS	16
ELEMENT 16. INSTRUMENT CALIBRATION AND FREQUENCY	17
ELEMENT 17. INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES	17

ELEMENT 18. DATA ACQUISITION REQUIREMENTS	17
ELEMENT 19. DATA MANAGEMENT	18
ELEMENT 20. ASSESSMENTS AND RESPONSE ACTIONS	19
ELEMENT 21. REPORTS	19
ELEMENT 22. DATA REVIEW, VALIDATION AND VERIFICATION REQUIREMENTS.....	19
ELEMENT 23. VALIDATION AND VERIFICATION METHODS.....	20
ELEMENT 24. RECONCILIATION WITH DATA QUALITY OBJECTIVES	20
PRECISION AND ACCURACY	20
REPRESENTATIVENESS	20
COMPARABILITY	21
COMPLETENESS	21
REFERENCES CITED.....	21
APPENDIX A	1
APPENDIX B.....	5
APPENDIX C	8
APPENDIX D	11
APPENDIX E.....	13
APPENDIX F.....	15
APPENDIX G	17
APPENDIX H	19
APPENDIX I.....	21
APPENDIX J	25
APPENDIX K	28
APPENDIX L.....	29
APPENDIX M.....	30
APPENDIX N	31
APPENDIX O	35

Element 3. Distribution List

The following groups and people will receive copies of the VA Save Our Streams (VA SOS) quality assurance plan for sampling rocky bottomed streams with the modified VA SOS method:

VA Save Our Stream Staff:

- Stacey Brown, Coordinator
- Advisory Committee Members – Jay Gilliam, Paul Bugas, Kent Ford, John Murphy, Joanna Cornell, Wes Jargowski
- Other appropriate personnel to be determined

VA Department of Environmental Quality Personnel:

- Regional Biologists
- Data Liasion
- Biological Monitoring Coordinator
- Other appropriate personnel to be determined

VA Department of Conservation and Recreation

- Appropriate personnel to be determined

US Environmental Protection Agency

- Otto Guttenson, Senior Ecologist
- Other appropriate personnel to be determined

Groups using VA SOS methods

VA SOS Regional Trainers

The quality assurance plan will also be provided to anyone requesting it, and will be made available on the VA SOS website (www.vasos.org).

Element 4. Project/ Task Organization

Virginia Save Our Streams Program Coordinator or Designee

- Provides training and follow-up testing to volunteers
- Trains additional regional trainers and quality assurance auditors
- Acts as quality assurance auditor when necessary
- Develops and maintains partnerships with groups and agencies across the state
- Assists in site selection
- Assist volunteers who have failed quality assurance procedures to correct problems

- Database manager – Reviews all incoming data, assesses for inclusion in database, makes all updates to database, makes the data available through reports and on the VA SOS website (www.vasos.org)
- Maintains databases of trained, certified, regional trainers, and quality assurance auditors
- Ensures field sheets and training materials are up to date
- Identifies, analyzes, and stores incoming quality assurance samples
- Identifies incoming unknown specimens for volunteers
- Develops and maintains reference and testing collections

VA SOS Regional Trainers

- Locally trains and certifies volunteers
- Maintains equipment needed to train volunteers

VA SOS Regional Coordinators

- Does initial review and updates of local data and sends it to VA SOS Coordinator or designee in a timely fashion
- Makes sure volunteers in his or her area are progressing to certification and doing their sampling in a timely manner
- May maintain database of local monitoring data and volunteer monitors
- May purchase and maintain approved sampling equipment for volunteer monitors
- May assist in site selection.
- May develop and maintain reference and testing collections

VA SOS Quality Assurance Auditors

- Periodically goes into the field with volunteers to review their equipment and procedures
- Sends results of these observations to VA SOS Coordinator or designee in a timely fashion
- Helps volunteers preserve their samples for submittal to VA SOS Coordinator or designee for identification checks

VA SOS Volunteers

- Attends the proper training and passes the certification test
- Purchases and maintains approved sampling equipment
- Monitors adopted site(s) four times a year
- Follows proper procedures for maintaining certification status

VA SOS Data Users

There are a wide variety of data users for this statewide program. These users include the Virginia Department of Environmental Quality (DEQ), the Virginia Department of Conservation and Recreation (DCR), local Soil and Water Conservation Districts, localities, planning commissions, and universities. The VA SOS data is available to any interested party on the website (www.vasos.org) or by request.

Virginia Save Our Streams recommends that all potential data users contact the VA SOS Coordinator to discuss the use of the volunteer collected data and the appropriate uses of this data.

Element 5. Problem Definition/ Background

With the passage of the Clean Water Act in the early seventies, there has been a focus on cleaning up our nation's waterways. Great strides have been made in reducing point source pollution, or that pollution that enters the stream through a specific known source, such as a discharge pipe. Discharging parties must obtain permits and are regulated to prevent too much pollution from entering our waterways.

While our waterways have greatly improved since these efforts were implemented, there are still steps to be taken. In the last ten years, there has been a shift in thinking to include non-point source pollution in addition to the point sources. Non-point source pollution is hard to regulate, as it comes from a broad area rather than one easily located source. Non-point source pollution includes nutrient additions and erosion from livestock in streams, runoff of fertilizer from agricultural fields and suburban lawns, and stormwater runoff carrying not just large pieces of litter but also all the oils and chemicals on our roadways and parking lots. It takes a broader monitoring plan to detect these types of pollution and to determine their origin.

This means that already overburdened state agencies must increase the monitoring they must do throughout the state. There are thousands of miles of streams in Virginia that must be monitored, and agencies have very limited resources with which to monitor all these streams. With current workloads and limited resources, it is not feasible that the majority of these streams are monitored on a regular basis. This is where the Virginia Save Our Streams Program helps.

The Virginia Save Our Streams Program has monitors across the state collecting large quantities of benthic macroinvertebrate data. The data collected under this quality assurance plan will be used in DEQ and DCR water quality assessment reports including the 305(b) report. It will be used to identify waters where agency scientists will conduct follow-up monitoring to identify if the water should be classified as impaired on the 303(d) report. VA SOS data not be used to list streams on the 303(d) report. It will be used to identify pollution incidents when immediate agency response is required to mitigate the pollution event. VA SOS data may also be used in the development and implementation of total maximum daily load plans.

In addition, the data collected by VA SOS volunteers can be used locally by Soil and Water Conservation Districts when looking at the effectiveness of implemented best management practices (BMPs). It can also help determine where future BMPs should be implemented. Localities can also use the volunteer data in evaluating current land use practices, to create an integrated water quality management approach to land use development, and to identify pristine conditions so that future developments do not degrade local streams.

Element 6. Project/ Task Description

Training and certification sessions will be held as needed for VA SOS monitors. This training program will continue in perpetuity.

The VA SOS volunteers monitor the benthic macroinvertebrate populations and the habitat of their adopted stream four times a year, once each season, using a method developed for the VA SOS program by Virginia Tech scientists (Engel 2000). This method is outlined in the Sampling Methods Requirements section of this document. The samples are analyzed in the field using a multimetric index developed as part of the Virginia Tech study. Additional information about the analysis can be found in the Analytical Methods Requirements section of this document. The field analysis gives a water quality score to let the volunteer know if the ecological conditions of the stream are acceptable or unacceptable.

VA SOS volunteers will record general site conditions and fill out a streamside visual assessment sheet.

Data is submitted and reviewed by regional coordinators and the VA SOS Coordinator or designee. Data is compiled in a database that is kept current. Reports are made to interested parties whenever requested, and data is updated on the VA SOS website biannually.

Element 7. Data Quality Objectives for Measurement Data

Precision and Accuracy

The VA SOS modified method was developed and tested by scientists at Virginia Tech (Engel 2000) and further tested in 2006 in a study by Virginia Tech (Voshell, 2006) and Virginia Commonwealth University (Garey, 2006), to accurately represent the stream condition and compare favorably with the results VA Department of Environmental Quality professional biologists would find when sampling the same sites. The new method compared very favorably with agency findings, and was found to be a good method for volunteers to use to determine the condition of their streams (Engel 2000). Further evaluation in the 2006 studies compared the VA SOS modified method with the Virginia Department of Environmental Quality's Virginia Stream Condition Index (VSCI). The 2006 studies found that a change in the final VA SOS multi-metric scoring

is needed to be comparable to the VSCI. These changes are reflected in this QAPP and the field sheets found in Appendix A. The 2006 studies can be found in the Appendices.

The precision and accuracy of VA SOS volunteers will be measured in the lab. Every two years, volunteers will be asked to preserve their entire sample and submit it to the VA SOS Coordinator for lab identification. The volunteers must correctly identify the number and type of each organism 90% of the time.

The precision of the VA SOS method will be evaluated every four years. The method will be conducted at the same time as a professional Department of Environmental Quality biologist to determine if the results correlate 90% of the time.

Representativeness

For the VA SOS program, representativeness depends largely upon site selection. Volunteers are requested to select sites that are representative of the stream and the conditions that are influencing the stream (see appendix M). However, volunteers are asked not to monitor below permitted discharges. In selecting a riffle, volunteers survey the stream section to determine the most appropriate and representative riffle. Also, generally more than one sample in the riffle is collected. Each sample is picked in its entirety and the results are composite into the final score.

Comparability

VA SOS ensures comparability requiring all volunteers to use the protocol designed by scientists at Virginia Tech (abstract located in Appendix K). This protocol includes taxonomic keys to identify macroinvertebrates correctly. VA SOS also maintains several sets of reference collections for use by volunteers in the field.

During development of the protocol, comparisons were made with findings from VA Department of Environmental Quality professional biologists at the same sites. The new method compared very favorably with agency findings. The VA SOS multimetric rating is similar to that rating used by DEQ biologists.

The comparability of the VA SOS method to professional methods will be evaluated every four years. The VA SOS method will be conducted at the same time as a professional Department of Environmental Quality biologist to determine if the results correlate 90% of the time.

Completeness

VA SOS does not apply rigorous completion standards to the volunteers collecting data. VA SOS expects each monitoring site to be monitored 4 times during the course of a year. The completion of all 4 monitoring events during the year is hampered by several factors: the need for the site (as identified by the monitor or regional coordinator) may have changed during the course of the year or the volunteer may have dropped from the program (the need for the change should be documented and kept with other site information). We do instruct volunteer monitors that monitoring over an extended period of time and during the same approximate times per year provides the most useful data.

Element 8. Training Requirements/ Certification

VA SOS Volunteer

Persons interested in becoming a VA SOS volunteer must attend at least one training session given by VA SOS staff or a regional trainer. This training session includes information about the program and basic watershed education, safety information, instruction in methods of collection and analysis, instruction in macroinvertebrate identification, and a hands on experience with the methods (Appendix B). The volunteer then has up to 18 months to practice the method and identification before becoming certified. This practice can be done alone, with other volunteers, or at other official training sessions. If it has been over 18 months since the volunteer last attended an official training session, they must attend another session before becoming certified. The volunteer cannot be certified during their initial training session.

The certification process includes an in-stream observation and a macroinvertebrate identification test. VA SOS staff or a regional trainer must administer the certification procedure. The in-stream observation consists of the volunteer completing an entire sampling session (collecting and processing an entire sample and completing the habitat assessment), while the person doing the certification fills out an observation report (Appendix C). This portion of the test is open book and can be completed as a team with other volunteers attempting certification.

The identification portion of the process is a written test (Appendix C). There are 19 lettered, unidentified vials containing preserved representatives of groups used in the VA SOS method. The volunteer must identify at least 17 vials correctly in order to pass. While this portion of the certification process is open book, it must be completed individually by each individual wishing to become certified.

Within two months of successfully completing both parts of the certification process, the volunteer receives a certificate indicating (s)he is a VA SOS monitor. If the volunteer continues to pass further quality assurance measures (see Quality Control Requirements), (s)he will remain a certified volunteer. If the volunteer misses sampling for 18 months, or 6 subsequent sampling events, (s)he will lose his or her certification status and must go through the certification process again.

Quality Assurance Auditor

Volunteers wishing to become quality assurance auditors must have been a certified volunteer for at least 6 months and have completed at least two monitoring events. During these two monitoring events, the volunteer must have demonstrated their ability to follow the method by completely and accurately filling out the data forms for all monitoring events.

If the interested volunteer meets these requirements, (s)he attends a training session that teaches him or her how to conduct an audit of a volunteer. During this session, equipment needs and condition is covered, as are proper methods. How to complete the audit checklist used during the audit is covered (Appendix D).

The auditor must complete at least two audits every two years to remain an auditor, and must send the audit forms to the regional biologist with three weeks of completion. Incoming audits are reviewed by the Coordinator or designee. Should the audit form not be filled out properly, the Coordinator or designee works with the auditor to improve his or her auditing performance. Should the auditor continually fail to properly complete the forms, (s)he is required to attend another auditor training session or will lose his or her auditing status.

Regional Coordinator

As this is a local organization position, no additional training is required to be a regional coordinator. However, the VA SOS staff will remain in close contact with the regional coordinators and will act as a resource to these volunteers. In addition, the Coordinator or designee will remain in close contact with these volunteers to help them learn to assess the incoming data for completeness and how to respond to incomplete data forms.

Regional Trainers

Volunteers wishing to become trainers must have been a certified volunteer for at least 6 months and have completed at least two monitoring events. During these two monitoring events, the volunteer must have demonstrated his or her ability to follow the method by completely and accurately filling out the data forms for all monitoring events. The potential trainer must also have observed at least two training sessions implemented by VA SOS staff or regional trainers. The initial training session a volunteer attended to become a monitor may count as one of these sessions. In addition, the volunteer must feel comfortable talking in front of a group, and must remember that (s)he is representing the VA SOS program while training volunteers so must accurately and correctly represent the goals and opinions of the VA SOS program.

Should the volunteer meet these requirements, (s)he must go through an additional training session administered by the VA SOS staff before training other volunteers. This training includes a discussion of what is involved in a training session. A checklist of these items will be given to each regional trainer during this training session (Appendix B). In addition, the training session will cover how to be an effective trainer, frequently asked questions, reference collections, and the certification process. The potential regional trainer must complete the macroinvertebrate identification portion of the certification process again, but must receive a 100% in order to become a trainer. (The same form will be used for both the certification process and the regional trainer process – Appendix C).

Once the regional trainer successfully completes the training requirements, (s)he will enter an observational period. VA SOS staff must observe the regional trainer's first training session, either in person or via videotape, for review and comment on the trainer's performance. A training observation report will be completed at that time and a copy will be returned to the trainer within three weeks of the training (Appendix E). The regional trainer must complete at least one training session and certify at least one volunteer per year in order to remain a trainer. In addition, the trainer must undergo an observation by VA SOS staff in person or by video once every two years.

Element 9. Documentation and Records

Volunteer Field Sheets

All volunteers complete a field sheet packet at each sampling event (Appendix A). The packet includes a front informational sheet, which includes date, location, sampling team, and some basic physical stream information. The second sheet contains raw macroinvertebrate counts, the third sheet has individual metric calculations, and the fourth sheet is a multimetric index calculation. The fifth sheet is a habitat assessment form.

The volunteer saves a copy of these forms and sends another copy, either hard copy or electronically, to the regional coordinator or the VA SOS Coordinator or designee. Those sheets sent to the regional coordinator are copied and sent hardcopy or electronically to the Coordinator or designee. The Coordinator or designee compiles the data in a database, where they are permanently saved. Back-up copies of the database are housed elsewhere outside of the main VA SOS office.

Training and Certification Forms

A sign-in sheet should be completed at each training session, whether it is for volunteers, quality assurance officer training, or regional trainer training (Appendix F). Regional trainers or coordinators should send a copy of these sheets to the VA SOS office within three weeks of the training session, retaining a copy for themselves. The Coordinator or designee will maintain a permanent database of all volunteers. Back-up copies of this database are housed elsewhere outside of the main VA SOS office. Hardcopies of sign-in sheets will be kept on file in the VA SOS offices for a minimum of five years, and then recycled.

All certification tests will be handled in the same manner as the sign-in sheets.

Quality Assurance Forms

A copy of forms filled out by the quality assurance auditor should be sent to the Coordinator or designee within three weeks of the audit (Appendix D). The pass/ fail status of each volunteer will be recorded in the database of volunteers. A copy of the audit will be sent to the volunteer(s) in question, and a copy will be kept on file for a minimum of five years at the VA SOS offices.

All samples preserved for quality assurance purposes (See Quality Control Requirements) must be properly labeled with a sample submittal form (Appendix D). This form will be kept with the sample at all times. After these samples have been identified, the laboratory record sheet (Appendix G) will be housed in the VA SOS records for a minimum of five years, and then recycled. The pass/fail status will be recorded in the database of volunteers, and a copy of this status will be sent to the volunteer(s) in question. Preserved samples will be archived for a minimum of five years, then the organisms will be used in reference collection development or donated to a school, college, or university.

The results of the quality assurance audit and identification check will be sent to the volunteer(s) in question within three months of the audited monitoring event.

Unknown Specimen Submittal

All unknown specimens needing identification by the Coordinator or designee must be properly labeled with an unknown specimen form (Appendix H). After identification, the form will be completed by the Coordinator or designee. A copy of the form will be filed in the VA SOS offices for a minimum of five years, and a copy of the form and the unknown specimen will be returned to the volunteer.

Element 10. Sampling Process Design

Volunteers collect macroinvertebrate samples and complete habitat assessments every three months, or once each season. While sampling can occur any time during a season, it is recommended that sampling occur in January, April, July, and October, on a regular basis. Descriptive location information and latitude and longitude identify each monitoring site.

Most volunteers have a specific stream they wish to monitor. Often, this stream is located in close proximity to their home, or they spend time on the stream for recreational purposes. To promote continued interest and involvement in the VA SOS program, it is important that volunteers be allowed to monitor these locations. Some monitors do not have a specific spot in which they are interested, but rather wish to monitor somewhere in their watershed of interest. In such a case, VA SOS staff with representatives from DEQ and DCR, will use GIS maps, to assess where current volunteer and agency monitoring is occurring, and help the volunteer choose the most appropriate site. Site selection will also take in consideration potential uses of the data (background information, assess effectiveness of BMPS, monitor land use changes, etc). All sites must be located on public property, or the volunteer must obtain permission if they choose to monitor private property. Sites are added to the program as often as new volunteers are trained. Sites may also be changed if the need for the monitoring site has changed. For example, if a volunteer chooses a site below a construction site to evaluate potential impacts, once the

construction is complete, the volunteer may choose to abandon the site. See appendix M for detailed site location directions.

Volunteers are not to conduct their normal sampling within one week of heavy rainfall. Rather, they should sample the stream during its average conditions for that season. Should there be heavy rain, the sampling must be postponed to allow the stream to return to normal conditions.

If the volunteer is not going to be able to complete their sampling for a season, they should alert their regional coordinator or the VA SOS staff, and assist them in locating a substitute volunteer for that season.

The VA SOS program has some specific safety recommendations to keep all volunteers safe and healthy:

- Monitoring sites should be conducted in wadable sections of streams. The depth of the stream should be no deeper than 3 feet (the height of the net).
- If high waters are present at the site, this should be noted on the front page of the field sheet and the site should not be monitored at this time.
- Always monitor in at least pairs.
- Never allow children to go to the stream alone. When monitoring with children, stress that they should not come back to the stream without an adult present.
- All kits should contain some sort of waterless hand sanitizer and/or peroxide. These should be used frequently, especially before touching face or eyes and before eating.
- Be careful of glass. If a site has known glass, use a garden rake to dig up substrates and consider purchasing neoprene gloves to help protect hands. Should a volunteer get cut, (s)he should clean the cut immediately.
- Be sure to have plenty of water and sunscreen in the summer, and wear plenty of clothing in the winter. In the winter, consider purchasing neoprene gloves to help keep hands warm, and bring plenty of towels to stay dry.

Element 11. Sampling Methods Requirements

Required equipment includes a 1/16" mesh kick-seine, a sheet for under the net, forceps, a plastic container in which to sort bugs, collection jars and alcohol for collecting unknown specimens, a magnifying glass, pencils, stream shoes, field sheets and a simple calculator. Volunteers are responsible for purchasing and maintaining their own equipment. The VA SOS program provides volunteers with a list of needed equipment and approved vendors (Appendix I).

Choosing where to sample within the stream

Volunteers select a riffle typical of the stream, that is, a shallow, fast-moving area with a depth of 3 to 12 inches (8 to 30 cm) and stones, which are cobble-sized (2 – 12 inches). Stone size is important since the macroinvertebrates surveyed prefer these stones for

protection and food supply. In addition, the bubbling of water over the rocks provides needed oxygen for healthy growth.

How to Sample

Volunteers place the kick seine perpendicular to the flow of water immediately downstream of the 1 foot² area in the riffle they have selected to sample. The bottom, weighted edge of the net should fit tightly against the stream bottom. Volunteers use cleaned rocks from outside the sampling area to hold the net firmly to the bottom. This prevents insects from escaping under the net. Volunteers tilt the net back, so the water flowing through the net covers a large portion of the net, however, they are careful not to tilt the net so much that water flows over the top, allowing organisms to escape.

A volunteer quickly samples the targeted area for 20 seconds. To sample, (s)he lifts and rubs underwater all large rocks in the sample area to dislodge any clinging organisms. (S)he rubs all exposed surfaces of rocks in the sampling area that are too large to lift. (S)he then digs around in the small rocks and sediments on the streambed in order to dislodge any burrowing macroinvertebrates.

After sampling for 20 seconds, volunteers carefully rub off any rocks used to anchor the net. They then remove the seine with an upstream scooping motion, being careful not to allow water to escape over the top of the net, in order to keep all the macroinvertebrates in the net.

For more detailed information about how to sample, reference the VA SOS Modified Method Field Guide.

Processing the Sample

Volunteers place the net on a flat, light colored surface, such as a white sheet, table, or piece of plastic. This makes the organisms easier to see. Using forceps or their fingers, volunteers gently pick all the macroinvertebrates from the net and place them in a collecting container. Volunteers carefully look on both sides of any debris in the sample, as many insects will cling to any available litter. They look closely for very small organisms. It is important to thoroughly pick all the organisms from the net. Once all the organisms have been sorted off the net, the net is lifted and the underlying area is examined. Any organisms that have crawled through the net are collected. Again, it is important to collect all these organisms to have an accurate sample.

Once all the macroinvertebrates are removed from the seine and underlying sheet, the number of organisms in the sample is counted. If at least 200 organisms have not been collected, another net must be collected from a different area in the same riffle. The organisms from the second net are added to the first. The length of sampling time can be adjusted depending on the number of organisms collected in the first, with the maximum sampling time per net being 90 seconds. The second net and area beneath are again sorted in their entirety. Again the organisms are counted, and a third net is collected if

200 organisms have not been obtained. This process is repeated until at least 200 organisms are found or 4 nets are collected, whichever is first. Each net collected must be sorted in its entirety, even if that leads to a sample of well over 200 organisms.

Once at least 200 organisms have been obtained, the organisms are separated into look-alike groups, using primarily body shape and number of legs and tails, as the same family or order can vary considerably in size and color. Volunteers use the tally sheet (Appendix A), the macroinvertebrate identification card (Appendix J), and other reference materials as to aid in the identification process. Volunteers record the number of individuals they find in each taxonomic group on the tally sheet. The tally sheet has one box set aside for “other aquatic macroinvertebrates”. Volunteer should note the number and type (if known) of aquatic macroinvertebrate not included in the tally sheet. The number put in this box will be included in the total number of organisms found in the sample. Please do not use this box to document fish, salamanders or other aquatic or semi-aquatic organisms. When identification and recording are completed, samples are returned to the stream unless the quality assurance audit is occurring (See Quality Control Requirements). All equipment should be thoroughly rinsed at this time so as not to contaminate future samples.

For more detailed information about how to process the sample, reference the VA SOS Modified Method Field Guide.

Habitat Analysis

Volunteers complete a qualitative streamside visual analysis that assesses the general conditions in the stream (Appendix A) every time they conduct a biomonitoring session. Some parameters require volunteers to pick the most representative description for their sites, while other parameters require volunteers to determine percentages present at their site. Guidelines for completing the habitat analysis are available to the volunteers on the VA SOS website (www.vasos.org) or in the Save Our Stream's Monitor's Guide to Aquatic Macroinvertebrates (Kellogg 1994). These data are used to gain perspective on the macroinvertebrate data collected from the same site.

Virginia Save Our Streams also recommends volunteers complete a quantitative annual habitat assessment of their stream. Volunteers interested in conducting an annual habitat assessment of their stream should attend a training session conducted by VA SOS staff or regional VA SOS trainers. Directions for completing the habitat analysis are available to the volunteers on the VA SOS website and are also included in Appendix O. Data collected by the annual habitat assessment can be used to gain perspective on the macroinvertebrate data collected at the same site and also can be used to evaluate potential threats to the stream's aquatic life.

Element 12. Sample Handling and Custody Requirements

Quality Assurance Samples

The majority of VA SOS volunteer samples are processed in the field and the macroinvertebrates are returned to the stream within a few hours of their collection. However, samples for the identification quality assurance procedure are preserved for identification by VA SOS staff. The preserved samples are treated as follows:

In the field, the samples are the responsibility of the volunteers. The volunteers must provide the jar and alcohol, and are responsible for preserving the sample. At that time, the volunteer must properly fill out the sample submittal form and properly label the jar (Appendix D). The label should be written in permanent ink or pencil and placed inside the sample container. This form and the label must remain with the sample at all times. A copy of the data sheet for the sampling event must also accompany the sample.

The sample then becomes the responsibility of the quality assurance auditor. They must transport the sample to the regional drop-off location within three weeks of its collection.

The VA SOS Coordinator or designee is responsible for picking up the samples and identifying them within three months of their collection. After the sample has been processed by the VA SOS Coordinator or designee, the organisms will be used in reference collections or donated to schools, colleges, or universities.

Unknown Specimens

Individual organisms that volunteers collect but cannot identify should either be preserved and send to the VA SOS office for identification (see instructions below) or alternatively, a picture of the organism may be taken for identification.

If the organism is preserved, please place organism in a vial and fill with rubbing alcohol (available at a local drugstore), label properly (Appendix H), and sent to the VA SOS office for identification or delivered to VA SOS employee at an appropriate time. The label should be written in permanent ink or pencil and placed inside the sample container. The volunteer is responsible for all costs associated with delivering the sample to the VA SOS office. The VA SOS program will return the identified sample to the volunteer for future reference.

If the organism is photographed, take as many photographs as possible to document the number of legs/appendages (if any), the head and mouth features, the thorax and abdomen (top and bottom if possible), any tail features, and other distinguishing characteristics. In addition, a photo with another object (like a ruler) in the picture for scale purposes is helpful.

Element 13. Analytical Methods Requirements

Volunteers use a multimetric index based on six individual metrics to analyze their macroinvertebrate data. Scientists at Virginia Tech developed this index for the VA SOS

volunteers (Engel 2000). Volunteers complete the index by following the steps in four tables found on pages three and four in the field sheet packet (Appendix A). The results of the multimetric index are calibrated to determine if stream condition is acceptable or not. There is no real analytical procedure for analyzing the results of the streamside visual analysis. Rather, the results from this analysis are used to help the data users understand the scores obtained by the macroinvertebrate samples.

Element 14. Quality Control Requirements

There are four quality control requirements that VA SOS maintains for its monitoring program.

Training and Certification

All Virginia SOS volunteers must attend an initial training session and complete a subsequent certification test. See the Training Requirements/ Certification section for details on these quality assurance efforts. Upon the completion of these requirements a volunteer is considered a certified monitor. Certified monitors go through the rigors outlined in this quality assurance plan and provide data for the state water quality agencies. If a certified monitor does not collect and submit data to the VA SOS office during the two year period after their initial certification, they are considered inactive and must go through the training and certification process again. VA SOS monitors are those who routinely monitor their sites (at least twice a year) are considered active certified monitors and must maintain their quality assurance status by participating in the field and lab audits as outlined below.

Reference Collection

VA SOS staff and regional trainers and/or coordinators have a complete reference collection of macroinvertebrates for volunteers to use during the course of their sampling. VA SOS staff is responsible for maintaining these reference collections.

Field and Lab Audits

All certified monitors must undergo periodic quality assurance audits. The quality assurance audit will occur once during the two years after the initial certification and at least every four years in subsequent years for active monitors (those who conduct sampling at least twice a year). The quality assurance audits involve a field visit by a quality assurance auditor. The auditor reviews all volunteer materials to check that the proper equipment is used and is functioning properly. In addition, the auditor watches the volunteers collect and process their sample. The auditor uses a checklist (Appendix D) to assure the volunteers are correctly completing their sampling event. The completed auditing forms are sent to VA SOS staff. The forms are reviewed by VA SOS staff. Should the volunteers fail their audit, the VA SOS staff will work with the volunteer to update his or her equipment and/or collection and processing methods. The volunteers must have each sampling event audited until they pass. Once a volunteer fails an audit, his or her certification is revoked until (s)he successfully completes an audit. Should the

volunteer fail three audits in a row, (s)he must attend a training session with an official trainer to refresh his or her sampling methods.

At the time the auditor reviews the volunteers' field methods and equipment, the volunteers will also preserve their entire sample. The samples will be sent to the VA SOS Coordinator or designee (See Sample Handling and Custody Requirements), who will re-identify these samples to check the volunteers' identification skills. Should the volunteer fail to correctly identify a significant portion of the sample (over 10%), his or her certified status will go on hiatus. The VA SOS staff will work closely with the volunteer to help him or her learn troublesome organisms. The volunteer must successfully complete the macroinvertebrate identification test (See Training and Certification) in order to re-instate their certified status. The volunteer must preserve his or her next sample after his or her certification status is re-instated for review by the Coordinator or designee. Should the volunteer fail that identification check, (s)he must go through a training session with an official trainer and must once again go through the certification process in order to be a certified volunteer.

Method Evaluation

Every four years, VA SOS staff will coordinate sampling with the Virginia Department of Environmental Quality professional biologists to evaluate the continued correlation of the two methods. Efforts to sample different flow regimes, ecological conditions, and regions will be made to ensure the VA SOS water quality assessment corresponds with the professional assessment under a variety of conditions and across different areas of the state. If the method does not correspond to the professional assessment, the VA SOS method will undergo a re-evaluation by scientists in the aquatic entomology field.

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

Each VA SOS volunteer will be responsible for maintaining his or her own equipment. Prior to each monitoring event, the volunteer should check his or her net for cleanliness and for any small rips or holes. A sewing repair kit should be included in each kit, and small holes and rips should be repaired prior to sampling. Should the hole or rip be of substantial size (irreparable), the volunteer is responsible for obtaining a new net prior to sampling. The sheet for under the net should also be cleaned and repaired as needed prior to sampling.

In addition, each volunteer is responsible for keeping the rest of his or her equipment up to date, clean, and in good condition. The volunteer is responsible for repairing or replacing all necessary equipment. The volunteer is also responsible for having the proper field sheets with them, either by making copies or downloading them from the VA SOS website (www.vasos.org). The volunteer should have the most current, up to date field sheets available.

The quality assurance officer will review all equipment and supplies during the field audit.

The VA SOS program will assist volunteers in keeping current, functioning supplies by providing volunteers recommendations as to where to purchase equipment (Appendix I). The VA SOS program will keep all necessary documents current on the website, and will supply copy masters of these documents to those volunteers without Internet access.

Element 16. Instrument Calibration and Frequency

No calibration is needed for macroinvertebrate collection/ processing equipment. However, the quality assurance officer will review all equipment during his or her visit with the volunteer.

Element 17. Inspection and Acceptance Requirements for Supplies

All equipment must meet specifications for VA SOS macroinvertebrate collection. Kick seines must be approximately 3 ft x 3 foot, and must have a 1/16" mesh size. These nets can be purchased from an approved supplier (Appendix I) or the VA SOS program. If the nets are obtained through another supplier or made by the volunteer, they must be mailed to the VA SOS state office for inspection prior to use. The sheet must be at least the same size as the net, if not larger, and may be obtained at a local supply store. All other supplies may be obtained from a local supply store or through catalogs, and are subject to review during the quality assurance officer's regular visit.

The VA SOS program encourages its volunteers to be innovative in order to improve the collection and analytical process. However, all innovations must be reviewed by the VA SOS state office either in person, by mail, or through photographs prior to their use in data collection.

Element 18. Data Acquisition Requirements

The VA SOS uses collection and analytical methods for benthic macroinvertebrates developed for the program by Virginia Tech scientists (Engel 2000). USGS 7.5-minute quadrangles are used together with GIS maps for site selection and land use data. The GIS maps include land use data, location of dams, roads, and permitted discharges, and collection locations for agencies (VA DEQ, US FWS, etc). A USGS 7.5-minute topographic map or a GPS unit is used to determine the latitude and longitude of the volunteers' sites.

Some VA SOS volunteers also collect chemical parameter data. When this information is reported to the VA SOS database manager, it is included in the master database under the

memo field (not searchable). However, their chemical data is not covered by the VA SOS quality assurance plan. Those volunteers collecting chemical data should create and submit their own quality assurance plan for that monitoring.

Element 19. Data Management

Field sheets (Appendix A) are filled out completely by the volunteers in the field. The volunteer should review his or her data sheets from each sampling event to make sure they are filled in as completely and accurately as possible. The volunteers have four weeks to submit their data hardcopy or electronically, keeping a copy of the data themselves.

Where available, field sheets are sent to the regional coordinators, who review the data for completeness. Should there be any data gaps, the regional coordinators contact the volunteers to fill in the missing information as much as possible. The regional coordinators must send his or her region's data to the VA SOS staff hardcopy or electronically within three weeks of obtaining all of that season's monitoring reports for his or her area. Again, the regional coordinators keep a copy of all data forms. Where no regional coordinator is available, the VA SOS Coordinator or designee acts as first reviewer of data.

The VA SOS Coordinator or designee reviews all data coming to the state office. Should there still be missing or incorrect information, the Coordinator or designee works with the volunteers, regional coordinator, and maps if necessary to fill in the gaps. VA SOS staff has final say over whether the data is complete enough to be entered in the state database by VA SOS staff. The VA SOS Coordinator or designee also maintains a database of all volunteers and their certification status, so can appropriately mark data as certified or not. The database will contain all data from all years. Hardcopy forms will be filed and kept by the VA SOS program for a minimum of five years from its collection. After this time, the data forms will be recycled.

The data for the last five years will be delivered in electronic database form to the Department of Environmental Quality every other year, or when needed. The database is reviewed and manipulated as needed by the DEQ Data Liaison, who works closely with the VA SOS Coordinator or designee to correct any problems found in the database. Other organizations requesting the data are responsible for reviewing the database in accordance with their data needs.

The VA SOS staff will also keep data available on the VA SOS website for easy review by all interested parties. The data on the website will have gone through reviews by the VA SOS Coordinator or designee, and will be updated biannually. Data request needs that cannot be met by the internet data retrieval site should be made in writing. Data will be label with the following: "This data is intended for uses outlined in our most recent Letter of Agreement with state and federal natural resource agencies."

Element 20. Assessments and Response Actions

A quality assurance auditor will review the field performance and equipment of all certified volunteers as outlined in the Quality Control Requirements section. In addition, the volunteer's identification skills will be reviewed by VA SOS staff through preserved samples in conjunction with a monitor's quality assurance audit (see Quality Control Requirements). Corrective actions, if necessary, will be taken and are discussed in detail in the Quality Control Requirements section.

All field sheets will be reviewed for completeness and anomalies by the collecting volunteer, regional coordinator, and VA SOS Coordinator or designee. Should any problems be detected, the involved parties will work together to fix the problem and assure future field sheets will be complete and meet quality assurance standards. Should the problem be irreparable, the VA SOS Coordinator or designee may decide not to include the data in the statewide public database.

Element 21. Reports

The data collected by the VA SOS volunteers will be available to anyone interested on the VA SOS website (www.vasos.org). The website is updated biannually, and contains highlights of the data from each site. Those parties interested in seeing the full data from any site can request such from the VA SOS program. A full report will be made to the requesting group within three weeks of said request. Full data sets will not include the name of the certified monitor, but may include the organization name (such as Streamwatch or Friends of the Maury River).

Reports, in terms of the full database from the last five years, are made to the VA DEQ every other year or when requested. Should other information, such as information about passage of quality assurance audits and identification passage, be required, it will be delivered upon request. Data collected when a volunteer has failed to pass a quality assurance check will be marked as uncertified when submitted to the DEQ.

As the database of volunteer data will be marked appropriately with certification status, the "raw" results of the quality assurance tests will not be available unless requested, and specific names will only be provided to the Department of Environmental Quality and other appropriate agencies, and to the regional coordinators. The names of volunteers having quality assurance troubles will not be made public to any other interested parties. However, statistics such as percentage passed in each watershed or overall will be available by request and on the VA SOS website.

Element 22. Data Review, Validation and Verification Requirements

All data sheets are reviewed by the collecting volunteer, the regional coordinator where appropriate, and the VA SOS Coordinator or designee. In addition, the DEQ Data Liaison reviews the database once every other year. The decision to accept or reject data is made by the VA SOS Coordinator or designee.

Data entry is checked for errors as it is entered. Data will be entered into a spreadsheet set up to calculate metrics and final scores. Should the scores in the spreadsheet be different from those calculated by the volunteers, the data will be reviewed for accurate entry. Habitat assessments are mainly ranges of scores, and these will be reviewed at the time of entry.

Element 23. Validation and Verification Methods

The data will be reviewed for any inaccuracies and gaps and will be updated as described in the Data Management Section. Data will be updated as available. The VA SOS Coordinator or designee makes the final decision as to whether or not the data is complete and accurate enough to include in the database.

All quality assurance data will also be reviewed and recorded by the Coordinator or designee, as described in the Quality Control Requirements section. Any problems will be dealt with as described in that section by the VA SOS staff.

All data reported to users will have undergone all reviews and will have passed all completeness and accuracy tests prior to reporting.

Element 24. Reconciliation with Data Quality Objectives

Precision and Accuracy

The precision and accuracy of the VA SOS monitoring program is evaluated during the quality assurance audits and at the time the method is evaluated. If a volunteer fails the quality assurance audits, they must go through corrective action as outlined in Element 14, Quality Control Requirements.

During the method evaluation process, if the VA SOS method does not correlate with the professional method 90% of the time, the VA SOS method will not be considered precise or accurate and will undergo scientific evaluation and validation to make any necessary changes to the actual collection method or the metrics that are calculated.

Representativeness

The representativeness of the sample will be evaluated during data entry and during the field portion of the quality assurance audits. VA SOS will evaluate the site sampled during data entry (or data review) to make sure the site is representative of the conditions in the area. During the data review, VA SOS staff will also make sure that more than 200 organisms were selected and that the riffle was sampled for the appropriate amount of

time and the appropriate number of times. The quality assurance auditor will make sure the volunteer chooses the most appropriate riffle in the course of the field audit and that the riffle is sampled for the appropriate length of time and number of times. If either course indicates the site location is not representative or the riffle was not sampled in a representative manner corrective actions as outline in the Element 14, Quality Control Requirements, will be taken.

Comparability

Adherence to the VA SOS protocol will be evaluated periodically as outlined in the quality assurance audit section. At the same time the ability to correctly identify the macroinvertebrates will be determined through a lab audit. If the volunteer does not successfully complete either element, corrective actions as identified in Element 14, Quality Control Requirements, will be taken.

The VA SOS Method will also be evaluated every four years to ensure comparability. During the method evaluation process, if the VA SOS method does not correlate with the professional method 90% of the time, the VA SOS method will not be considered comparable and will undergo scientific evaluation and validation to make any necessary changes to the actual collection method or the metrics that are calculated.

Completeness

VA SOS will continue to encourage its volunteers to conduct sampling at their sites 4 times a year. This will be considered a complete sample set. No corrective action will be taken if a volunteer fails to monitor his or her site 4 times during a year, but the data may not be considered as useful by VA SOS or data users.

References Cited

- Engel, S.R. 2000. The effectiveness of using volunteers for biological monitoring of streams. Masters Thesis, Department of Entomology, Virginia Polytechnic Institute and State University.
- Kellogg, L. 1994. Monitor's guide to aquatic macroinvertebrates. The Izaak Walton League of America, Gaithersburg, Maryland.