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Standard Operating Procedure #6: Collecting Water Quality Samples, Version SCPN_WATER_QUALITY_SOP06_20160901

Contents

Introduction 3

Equipment 4

1 Care and cleaning of water sample bottles and tubing 4

 1.1 Preventing sample contamination 4

 1.2 Cleaning water quality sampling and sample processing equipment 5

2 Collecting water quality samples for laboratory analysis 7

 2.1 Assessing within site variability and determining appropriate sampling technique 7

 2.2 Collecting samples in streams 7

 2.3 Collecting samples in springs, seeps and very shallow streams 8

3 Processing water quality samples 8

 3.1 Filtering the samples: The USGS method 9

 3.2 Processing water quality samples: The SCPN backcountry method 11

4 Collecting QA/QC samples 12

 4.1 Blank samples 12

 4.2 Replicate samples 13

5 Maintaining water quality monitoring equipment in the field 13

6 Revision history 14

Standard Operating Procedure #6: Collecting Water Quality Samples

Version SCPN_Water_Quality_SOP06_20160901				
Revision History Log				
Previous version number	Revision date	Section and paragraph	Change(s) made	Approved by
Only changes in this specific SOP will be logged here. Record the previous version number and date of revision; identify sections and paragraphs where changes were made, who approved the revision, and the new version number. More detailed descriptions of the changes made and the reason for the changes is provided at the end of this SOP.				

This Standard Operating Procedure (SOP) provides guidance for the collection and processing of water quality samples in SCPN parks, and the cleaning of water quality sampling equipment to prevent contamination of samples.

Introduction

SCPN employs water quality sampling methods that follow the USGS protocol as published in the National Field Manual for the Collection on Water-Quality Data (NFM) (USGS, variously dated). The USGS periodically updates the NFM as water quality sampling techniques are refined and improved. These changes are documented in Comments and Errata files available at: <http://water.usgs.gov/owq/FieldManual/mastererrata.html>.

All SCPN water resources staff should be familiar with the NFM and should check the

Comments and Errata files annually for revisions. The appropriate sections of the SCPN water quality protocol should be updated to align with these revisions.

Water quality samples are collected from streams and springs in SCPN parks and analyzed for several different purposes:

- Samples are sent to an approved laboratory to be analyzed for the presence of nutrients, major elements, and trace metals.
- Samples are analyzed by SCPN water quality staff for fecal indicator bacteria and to determine turbidity, a water quality core parameter.
- For quality assurance/quality control, blank samples are collected to determine the background level of analytes in the samples, and replicate samples are collected to quantify the variability in the water quality sampling and analysis

process.

This section describes procedures for collecting samples for laboratory analysis. Procedures for collecting blanks and replicate samples are described in Section 4.1; procedures for collecting samples for turbidity are described in Section 6, SOP #5. Procedures for collecting samples to be analyzed for fecal indicator bacteria are described in SOP #7.

Equipment

Please see Appendix F for a list of the equipment needed for water quality sampling.

1 Care and cleaning of water sample bottles and tubing

The quality of data is only as good as the quality of the samples collected. Water quality sampling supplies must be clean and precautions taken to prevent contamination. A separate set of cleaned equipment, sealed in a plastic bag, should be prepared for each monitoring site. Water resources staff should follow approved standardized methods when caring for equipment, conducting water quality sampling, and processing samples. Any deviations from approved methods must be documented and experimental data obtained to ensure that the results are valid and comparable to the earlier data (SOP #18). This protocol has been adapted from Chapter A5 of the USGS National Field Manual (Wilde 2004).

1.1 Preventing sample contamination

There are number of ways in which water quality samples can become contaminated (Table 6-1). Metallic or metal-containing sampling equipment and labware can introduce trace metal contamination. Other contaminants can be introduced through improper cleaning and/or storage of equipment, from exposure to automobile exhaust or cigarette smoke and from other atmospheric inputs such as dust and dirt from nearby roads. Human contact can also contaminate the samples. Exposure to sunlight or heat can cause samples to deteriorate.

Water resources staff should take the following actions when collecting and processing samples to prevent contamination and deterioration of samples:

- Clean collection bottles using approved standardized methods (Section 1.2).
- Use only the recommended type of sample bottle for each parameter to be measured.
- Use only water sample bottles for water samples. Do not use bottles that have been used for other purposes, such as storing concentrated reagents.
- Follow recommended preservation methods. All preservatives must be of analytical grade and included as field blanks for identification of potential contamination.
- Do not touch the inner part of sample bottles and caps with bare hands, gloves, or mitts.
- Keep sample bottles in a clean environ-

Table 6-1. Common sources of contamination related to field activities (adapted from USGS 2006).

Contaminant source type	Examples
Sampling environment	Airborne particulates; precipitation; dust, soil, solid particulates; fumes from engine exhaust, chemical preservatives, upwind industrial emissions
Sample collection equipment	Pumps, sample tubing, sample bottles
Sample cleaning processes	Cleaning equipment (basins, brushes); carryover from cleaning solutions or tainted water; insufficient decontamination or rinsing
Transport and shipping	Field vehicles; coolers of other shipping containers; improperly closed or protected sample bottles
Storage	Laboratory; refrigerator, field vehicle
Personnel	Dirty hands; dirty gloves; chemicals excreted from breath or applied to skin; improper handling of equipment

ment, away from dust, dirt, fumes and grime. Vehicle cleanliness is an important factor in eliminating potential contamination of samples and equipment.

- Keep petroleum products (gasoline, oil, exhaust fumes), prime sources of contamination, away from samples. Exhaust fumes and cigarette smoke can contaminate samples with lead and other heavy metals. Air conditioning units are also a source of trace-metal contamination.
- Keep filter units and related apparatus clean, using procedures such as acid washes and soaking in special solutions, and protected from field contamination.
- Ensure that bottles or sample bags remain sterile until the sample is collected.
- Keep all foreign objects, especially metal objects, out of contact with acids and water samples.
- Store out of the sunlight in the upright position at 4°C in a cool place, ice chest, or the equivalent.
- Ship samples to the laboratory without delay.
- Keep hands clean while working with water samples and field equipment.

1.2 Cleaning water quality sampling and sample processing equipment

Equipment for water sampling must be properly cleaned before it comes in contact with the sample. Effective cleaning procedures must be implemented as part of quality control. The goal is to ensure that the equipment does not introduce foreign substances that could affect the ambient concentration or chemistry of target analytes in samples. Standard procedures for when, where and how to clean equipment and to collect equipment blanks and field blanks for quality control are described in this SOP.

1.2.1 General cleaning instructions

All sample collection and sample processing equipment must be cleaned before use in order to remove:

- manufacturing residues from new equipment
- dust and any other foreign substances from equipment that has been in storage
- substances adhering to equipment from previous sampling

To do this, rinse equipment with deionized water (DIW) while it is still wet from sampling to prevent cross-contamination between sampling sites, and then clean equipment as described in Section 1.2.3 below before re-use. Field rinsing with sample water is not a substitute for the equipment-cleaning procedures described here.

Return used equipment to the office laboratory for rigorous cleaning before reuse.

1.2.2 Cleaning supplies and equipment

The supplies commonly used to clean sample-collection and sample processing equipment are listed in Appendix F. Cleaning supplies should be stored in a contamination free cabinet. Because SCPN will analyze samples for trace metals below parts-per-billion concentrations, equipment must be kept very clean, be made of white or clear plastic, and not contain any metal parts.

1.2.3 Procedure for cleaning sample collection and sample processing equipment

Follow these steps to clean new equipment and to clean used equipment after a monitoring trip. This equipment includes tubing, sample collection bottles, and DIW bottles. Tubing, filters and gloves should be stored and transported in dust-free containers, such as a plastic bag. Although filters come individually wrapped, they should be stored in doubled plastic bags to prevent contamination.

This process for cleaning water quality equipment involves an acid soak step, **which must be done under a fume hood in the lab**. To create the cleanest possible work area, be sure to line the work area with clean plastic sheeting.

Step 1. Detergent wash and tap-water rinse

- Put on a new pair of gloves.
- Place small equipment parts into a clean wash basin labeled for detergent and fill with a 0.1- 2.0 % detergent solution of non-phosphate laboratory detergent. The amount of detergent depends on the hardness of the tap water and the degree to which the equipment is dirty or contaminated. Use between 10 and 200 mL of detergent for 10 L of solution.
- Fill tubing with solution and keep submerged; soak equipment and tubing for 30 minutes
- Scrub exterior and interior of equipment surfaces using a firm sponge to remove any adhering material. Pay particular attention to grooves, crevices, O-rings, nozzles, and other spaces where inorganic or organic materials might be trapped.
- Put on a clean pair of gloves. Rinse equipment thoroughly with warm tap water to remove detergent residue. Equipment rinsing is completed when no soap bubbles appear after the rinse water is agitated. Change gloves.

Step 2. Acid soak

- **Be sure to wear a lab coat, safety goggles, clean gloves, and closed-toed shoes when doing an acid soak.** The lab must have an eye-wash section nearby.
- **Make sure that a spill kit capable of neutralizing and absorbing all of the acid used in this procedure is within reach.** This consists of a broom, absorbent substance (such as vermiculite), neutralizing substance (such as baking soda), and trash bags for disposal.
- Under a fume hood, prepare a 5% by volume solution of trace-metal grade hydrochloric acid (HCl) and DIW. For 10 L of solution, add 1.3L of 37% HCl to 8.7 L of DIW in a clean wash basin. Be sure to fill the wash basin with DIW prior to adding the acid.

- Soak equipment in acid solution for 30 minutes. Be sure that tubing is fully submerged, and do not acid soak anything metal.

Step 3. DIW rinse

- Put on a clean pair of gloves, and rinse gloves well with DIW (residue on gloves can contaminate equipment)
- Remove equipment from acid basin and rinse thoroughly with DIW. Pay particular attention to tubing. Equipment is clean at this point; do not allow it to come in contact with anything.
- After rinsing, fill sample collection bottles 1/3 with DIW, then cap and store in doubled, sealed bags
- Allow other equipment to air dry on a clean plastic sheet in an area free from potential airborne contaminants
- After drying, place equipment into new labeled storage bags. Store double-bagged until next use
- **Neutralize acid solution prior to disposing into sink.** If using baking soda, it will take about 1.6 lbs to neutralize 10L of acid solution. Be sure to add baking soda slowly to the acid mixture, otherwise it will spill over. Use pH strips to confirm acid has been neutralized to pH 7.
- Rinse wash basins with DIW and store in clean plastic bags.

1.2.4 Procedure for cleaning inorganic sample bottles

Sample bottles are purchased from the NWQL; however, they still need to be rinsed prior to each sample trip. The one exception is the trace metals bottle, which is acid rinsed by the NWQL and does not need to be rinsed. Before leaving for the field, prepare polyethylene and glass sample bottles as follows:

1. Put on powderless, vinyl or nitrile gloves.
2. Fill each bottle about 1/4 full of DIW and cap.

3. Shake vigorously and decant DIW.
4. Repeat the DIW rinse (Steps 2 and 3 above) two more times.
5. Following the last rinse, fill each bottle 1/3 full with DIW and cap the bottle.
6. Rinse exterior of bottle with DIW and dry with lint-free laboratory tissue.
7. Store bottles in doubled plastic bags.

2 Collecting water quality samples for laboratory analysis

When collecting water quality samples, it is possible to bias the sample either by collecting from an inappropriate location or by introducing contamination. Instructions for collecting water samples that are representative of conditions at the stream or spring monitoring site are provided here.

2.1 Assessing within site variability and determining appropriate sampling technique

Quality data is representative of the conditions in the stream or spring being monitored. For this to be true, waters at the sampling site must be well-mixed and the variability of discharge and core water quality parameters of the water source must be within acceptable limits (the post-calibration range, as measured by the multi-parameter sonde, see Table 6-2). Typically, water in small steep gradient streams will be well mixed. However, water in a large river is likely to travel in a smooth flow and be poorly mixed.

If the stream's flow has changed between field visits, complete the following steps:

1. Select a sampling site to evaluate. Take measurements of temperature, pH, specific conductance and dissolved oxygen at 5 equally-spaced verticals along the cross section of the stream, and at multiple depths within each vertical, if appropriate.
2. Evaluate the data for variability in discharge and field-measurement values.
3. If the variability of the data is within acceptable limits (Table 6-2), the stream is well-mixed and sample collection can proceed.
4. If the variability of the data is outside acceptable limits, move up or down the reach to select a potentially better site and re-sample. If a well-mixed site cannot be found along the stream or spring, use the Equal Discharge Increment or Equal Width Increment method to locate points for measurement (see Wilde et al. 1999, for details).
5. In a small and well-mixed stream, a single point at the centroid of flow may be used to represent the cross section. The centroid of flow is defined as the point in the stream where discharge is equal on both sides.

2.2 Collecting samples in streams

SCPN water quality monitoring currently focuses on dissolved analytes in small, well-mixed streams. Samples that will be analyzed for this purpose will generally be collected in a single grab sample. Should sampling objectives change, or if a large, poorly mixed stream is to be sampled, consult chapter A4 of the USGS National Field Manual (USGS 2006) for procedures for collecting isokinet-

Table 6-2. Acceptable post-calibration ranges for core parameter measurements with Hydrolab MS-5 (Gibs et al 2007).

Core parameter	Post-calibration range
Temperature	± 0.2 °C
pH	± 0.2 S.U. ¹
Specific conductance	± 5 µS/cm if <100 µS/cm or ±3% if ≥100 µS/cm
Dissolved oxygen	± 0.3 mg/L, ± 3% saturation

¹If drifting persists or if measuring low conductivity waters (≤75 µS/cm), allow ± 0.2 to ± 0.3 pH units

ic, depth-integrated samples.

Steps for using the grab sample technique are as follows:

1. Fill up a 1-liter and a 0.5-liter bottle and carry bottles to all sites, using the “clean hands/dirty hands” technique described in Section 3.1 of this SOP. These bottles will carry sample water for trace-metals analysis. They should be double-bagged.
2. After determining whether the stream is well mixed (Section 2.1), identify the centroid of flow. This is where you will collect the sample.
3. **Do not walk on, or in any way disturb, the stream bottom upstream from the monitoring site.**
4. Sample in flowing water. Avoid sampling in pools or standing water where floating solids tend to accumulate.
5. Use gloves and rinse any potential residue off the gloves in stream water. For trace metal sample bottles, the “dirty hands” person opens the outer bag, while the “clean hands” person opens the inner bag and handles the sample bottles. For turbidity and bacteria, only gloved hands are required.
6. Keep hands and other potential contaminants away from the mouth of the collection container. Rinse each sample bottle three times with stream water, except for the bacteria bottle, which has been pre-sterilized.
7. Collect samples with the mouth of the sample bottle or collection container pointed upstream.
8. Remove the container from the water. Secure the cap tightly, place trace metals sample back into double bags, and store chilled (<4°C) until samples can be processed and preserved. **Full bottles must be protected from freezing.**
9. Record the time of sample collection on the *Water Quality Datasheet* (SOP #5) and proceed to the sample processing location as soon as possible.

2.3 Collecting samples in springs, seeps and very shallow streams

At large springs collect a dip sample, filling the bottle at a point as close to the spring source as possible. Typically samples cannot be dipped from small springs following the methods described above, or from very shallow streams unless pools are present. In these cases water may be collected with a syringe from shallow water. Be careful not to draw particulate matter from the bottom. It may be necessary to excavate a small pool or depression in order to collect adequate water volume for the sample. After disturbing the stream bed, allow the flowing stream to clear of sediment and turbidity before sampling.

3 Processing water quality samples

SCPN uses two methods for filtering water quality samples, depending on the monitoring site—the USGS method and the back country method. Water quality samples will be prepared by a qualified laboratory for analysis of a suite of constituents that includes nutrients, major ions, and trace metals (Table 8-1, SOP #8). These analyses require various in-field treatments, including filtration, preservation with acid, and chilling. Water is transferred from the collection bottle to appropriate sample bottles (Table 6-3) during the sample processing steps. All sample handling should take place in a clean environment and should be done in a sample processing chamber whenever possible.

The processing and preservation chambers used to protect samples from atmospheric contamination are portable and assembled at the field site (Figure 6-1). Large, clear plastic bags are clipped to the inside of the frame (rather than stretched over the frame). Plastic clips are used to hold the cover tightly in place. When the bag is clipped to the inside, it is not necessary to field clean the chamber frame. **Plastic bags must be replaced after each water sample is processed.** Never reuse a plastic bag for this purpose.

3.1 Filtering the samples: The USGS method

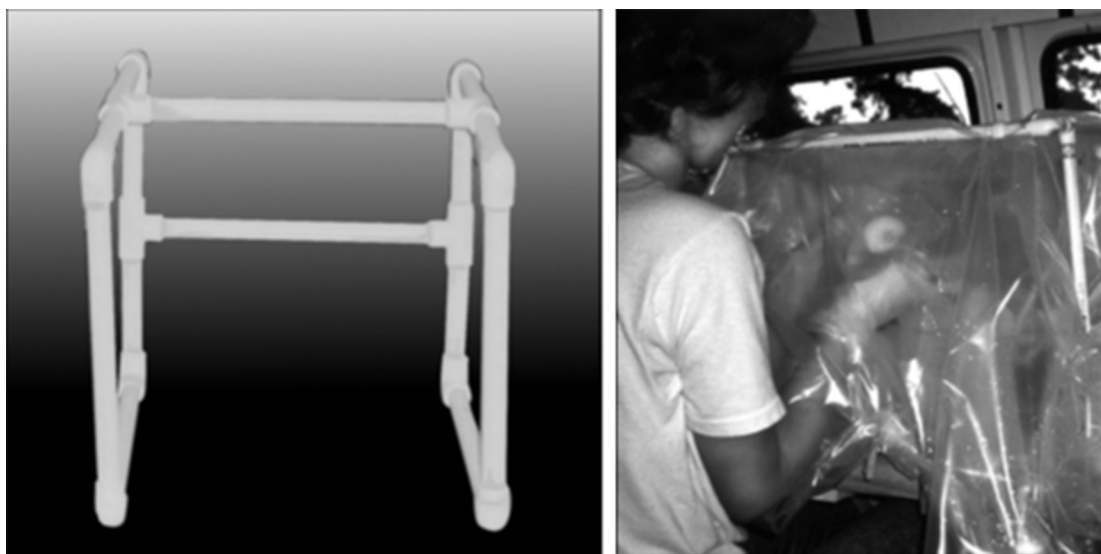


Figure 6-1. Sample processing chamber frame (left), and sample processing occurring with the frame and protective plastic bag (right). From: National Field Manual for the Collection of Water-Quality Data, Version 2.0, 3/2003 (USGS), pg. 67.

The following instructions for filtering and preserving samples are adapted from the USGS NFM (Wilde et al. 2004). This procedure is most suited to sites located near the vehicle or indoor sample processing location where samples will be filtered and preserved in a timely manner (for backcountry locations, see section 4).

Sample filtration and preservation should be done as soon after the sample has been collected as is possible. The collected sample will undergo 5 separate analyses and will be divided into 5 separate bottles for that purpose (see Table 6-3 for the bottle type required for each type of analyses). Use a peristaltic pump when filtering samples for

Table 6-3. Different laboratory analyses require different treatments for samples and different types of sample bottles as explained in this table.

Analysis	Bottle type	Bottle volume	Treatment code ¹	Rinse	Treatment and preservation	Max hold time (days)
Trace metals	Clear polyethylene, clear cap	250 ml	FA	No; these are pre-rinsed and capped	Filter through 0.45- μ m filter, use filtered sample to rinse containers and acidify sample with nitric acid (HNO_3) to pH < 2.	180
Mercury	Clear glass	250 ml	FAM	Yes	Filter through 0.45- μ m filter, use filtered sample to rinse containers and acidify sample with hydrochloric acid (HCl).	180
Nutrients	Brown polyethylene	125 ml	FCC	Yes	Filter through 0.45- μ m filter, use filtered sample to rinse containers, chill and maintain at 4°C, ship within 1 week.	30
Major elements	Clear polyethylene, clear cap #2	250 ml	FU	Yes	Filter through 0.45- μ m filter, use filtered sample to rinse containers.	180
pH, specific conductance, and acid neutralizing capacity	Clear polyethylene, clear cap #3	250 ml	RU	Yes	Use unfiltered sample to rinse bottles.	180

¹ FA: Filtered, acidified; FAM: Filtered, acidified, mercury; FCC: Filtered, chilled; FU: Filtered, unchilled; RU: Raw, untreated

the analysis of dissolved constituents. The pump forces the water through tygon tubing and through a 0.45- μ m-pore-size capsule filter. The capsule filter is a disposable, self-contained unit composed of a pleated filter medium encased in a plastic housing that can be connected in-line to a sample-delivery system which generates sufficient pressure to force water through the filter. The capsule filter is usually required when filtering samples for trace-element analysis and is recommended when filtering samples for major ion or other inorganic constituent analyses. Filters must be rinsed before use with IBW (not DIW, which can contaminate the filter) in order to remove any residues that could contaminate the water samples. Filters can be pre-rinsed in the office laboratory instead of at the field site, as long as they are kept chilled and used within one day. After filtering the sample, clean or replace the sample-delivery tubing and discard the capsule filter.

Since capsule filters lose efficiency with each successive use, sample filtration should be done in this order: trace metals, mercury, nutrients, major elements, acid neutralizing capacity, pH, and specific conductance (the order presented in Table 6-3). This order ensures that bottles for the most sensitive analyses are filtered first. Label the bottles with the site name and bottle treatment code (Table 6-3) using waterproof labels, prior to filtering and filling.

Because analysis of trace metals is part of the water quality analysis, “Clean hands/dirty hands” technique is to be used. The “clean hands” person only works in the sample chamber to avoid contaminating any of the sample water or filtration equipment. The “dirty hands” person does all the work outside of the sample chamber and is responsible for providing equipment to the “clean hands” person.

3.1.1 Preparing the work space, sample bottles, and capsule filter:

1. Assemble the processing chamber as pictured in Figure 6-1, and clip a large,

clean bag to the inside of the frame to provide a clean workspace.

2. Each worker should put on gloves, and rinse them off with DIW to remove any residue that could contaminate the water samples
3. “Dirty hands” person will open bags of filters, tubing, and sample bottles for “clean hands” person to select and place in the sampling chamber. The “clean hands” person opens the filter and attaches it to the tubing in the proper direction, while taking care not to touch the end of the tubing or filter. He/she will open the bag containing the sample bottles and place them in the order described in Table 6-2. Then, he/she will make a hole in the plastic covering of the chamber so that the tubing can reach the pump.
4. “Dirty hands” person opens the 1-L IBW container and covers it with a plastic bag (such as the tubing bag) to prevent contamination from airborne particulates.
5. “Dirty hands” person inserts intake end of peristaltic pump tubing through the plastic covering and into the 1-L container of IBW. Then, the tubing is attached to the peristaltic pump head. Do not touch any part of the tubing that will come in contact with the interior of the IBW or sample collection bottles.
6. While pump is running, “clean hands” inverts filter to evacuate air and pumps 1L IBW through tubing and filter.
7. The tubing is removed from the DIW reservoir and the pump continues to run to drain as much of the DIW that remains in the capsule filter as possible. While pump is operating, “clean hands” person shakes filter to help remove any entrained IBW.
8. Waste rinse water is discharged through a clean waste container or through a hole in the chamber.
9. Filter is ready to be used. Otherwise, it can be stored for use at the next site for

up one day. If it is not to be used immediately, detach the capsule filter from the peristaltic pump tubing, put into a clean, sealable plastic bag and store chilled.

10. “Clean hands” discards DIW stored in DIW pre-rinsed sample bottles.
11. Using bag that was covering the IBW to avoid touching the tubing, “dirty hands” removes tubing from IBW bottle and place in sample collection bottle. Although hands are protected by gloves, take care not to touch the inside of the sample bottle or the tubing

3.1.2 Filter the sample

1. Turn filter so that the outlet is pointing up (arrow on filter housing is pointing up) and the flow of the sample forces trapped air out of the filter while it is filling. Stop the peristaltic pump as soon as the capsule filter is full of sample and all air in the capsule filter has been expelled. The goal is to minimize clogging of the filter medium with suspended materials by minimizing the volume of sample that will be used to field-rinse the filter.
 2. In the course of pumping the sample water, water can spray onto the chamber cover. If any of that water drips into the sample analysis bottle, discard the bottle, change the cover and get a new bottle.
 3. As the sample is discharged through the filter, collect 25 mL in the trace metals sample container (250 mL pre-cleaned bottle). Cap the bottle, shake vigorously and then discard rinse water into appropriate receptacle
 4. Fill to the top of the upper lip of the 250 mL bottle with sample water. Cap bottle securely and set aside for chemical treatment.
 5. Stop the pump after the bottle is filled.
 6. Proceed with the remaining bottles in the same manner, starting with a single 25 mL rinse and then filling bottles in the order presented in Table 6-2.
 7. Discard the capsule filter after filtering a sample set—do not reuse.
8. Note the filter make and model, quantity used and lot number in the “Sample Collection” section of the *Water Quality Datasheet*.

3.1.3 Preserving the samples

Samples for some constituents must be stabilized by preservative treatment, which includes refrigeration or acidification.

1. Label sample bottles to indicate how the sample was treated. The designations to be used are: R = unfiltered, F = filtered through 0.45 µm filter, A = acidified, C = chilled to 4°C, U = untreated (see Table 6-3).
2. While the samples are still in the processing chamber, add nitric acid (HNO₃) to the trace metals (FA) sample, and hydrochloric acid (HCl) to the mercury (FAM) sample. Purchase 2 mL ampules from NWQL, as these are purified enough so that they will not contaminate the water samples. Be sure the outside of the ampules are clean. If samples were taken from a new site, use pH strips to confirm that the sample pH is below 2. If the pH is too high, add another ampule and make a note on the laboratory ASR.
3. After acid has been added, return the labeled bottles to plastic bags; seal and chill (if required) immediately. Refer to SOP #11 for details on sample shipment and holding times.
4. Document the acid treatments on the *Water Quality Datasheet*, including the time that the processing took place. Include lot numbers for acids and filters.

Clean the processing and preservation chambers in the laboratory after each sampling trip. Clean the frame with detergent solution, then rinse thoroughly with tap water. After the frame dries, store in a large plastic bag.

3.2 Processing water quality samples: The SCPN backcountry method

Several SCPN monitoring sites are in backcountry locations where filtering and preser-

vation steps described above could not occur in a timely manner. For these sites, it may be preferable to pump water directly from the stream into the sample analysis bottles.

All required equipment will need to be hiked to the site. The filter must be pre-rinsed with IBW prior to the sample trip and placed in clean doubled plastic bags, along with clean tubing, acid vials, and the pre-rinsed sample bottles. The front of the peristaltic pump can be removed and powered with a cordless drill. The filtration and preservation techniques described in Section 3.1 should be followed as closely as possible, with the “dirty hands” person placing the tubing in the peristaltic pump and operating the drill while the “clean hands” person attaches the filter to the tubing, rinses and fills the sample bottles, and adds the acid. To avoid contamination, the bottles should stay inside the clean bag.

4 Collecting QA/QC samples

QA/QC samples are collected to quantify variability in sampling procedures and identify possible contamination of samples due to field activities or sample processing procedures (Table 6-1). Samples should be prepared in a manner similar to that described above, depending upon the type of sample. QA/QC blanks should be collected any time there is a change in equipment or procedure. For example, if acid, tubing, or filters are purchased from a different manufacturer, blank samples should be collected to ensure the new equipment does not contaminate the samples. In addition, at least 20% of all samples should include either a replicate or blank, and QA/QC samples should be collected throughout the field season.

4.1 Blank samples

We collect blank samples to determine the concentration of target analytes that might have been introduced into the sample as a result of equipment or sampling-related activities. A water sample can become contaminated in a number of ways; a summary of common sources of contamination is in

Table 6-1. For SCPN’s regular water sampling events, which involve trace metal analysis, certified inorganic blank water (IBW) must be used in place of sample water for blank analysis. DIW should never be used in place of IBW, except in the equipment-cleaning process described in section 1.2.3. IBW must be ordered through NWQL, and the lot number of each IBW batch must be recorded in the “Sample Collection, Processing & Shipment” section of the *Water Quality Datasheet* when processing each blank. Note in the “Comments” section that you have collected a field blank. In the event that SCPN is involved in sampling for other types of analytes (such as pesticides or volatile organic compounds), an appropriate type of blank water must be obtained and certified to be clean of the target analytes.

The standard type of blank collected regularly by SCPN will be field blanks, unless there is a change of equipment or the field blank results indicate a contamination source somewhere in the sample water processing. Field blanks are a type of quality control that evaluates the entire sampling system, including the filter, pump tubing, sample collection container, sampler error, and contaminants originating from the environment at the sampling site. The blanks are collected by rinsing the sample collection bottles 3 times with IBW at the site prior to filling the bottles. Then, all of the steps described in sections 3 for water sample processing must be followed.

If there is to be a change in equipment or in a processing step, SCPN will process an equipment blank in the laboratory in a manner similar to the process described above. Should there be an issue with the sample results, refer to Chapter A4 in the USGS National Field Manual (2006) for a description of the many types of blanks that can be collected; personnel may wish to collect these blanks as well and store them for possible analysis should an issue arise with the lab results for the equipment blank.

4.2 Replicate samples

For the purposes of quantifying the variability in the stream sampling and analysis process, SCPN will collect replicate sample every third trip and process them in a similar manner. Replicates will be collected in clean sample bottles of the same type, and in close succession to one another. Replicates will then be processed according to the instructions in Section 3. The filter must be changed between replicates in order to avoid the potential effects of particulate loading.

5 Maintaining water quality monitoring equipment in the field

Rinse all equipment, specifically tubing and sample collection bottles, immediately after use while at the field site. You must wear gloves.

- While still wet, rinse used sample bottles with DIW. Tubing should be rinsed inside and outside with DIW, using the peristaltic pump to pass DIW through the tubing
- Return rinsed bottles and tubing to plastic storage bags. Seal bags to avoid further contamination.

This is not a substitution for the intensive cleaning procedure described above. Tubing and sample bottles cannot be reused, and must be cleaned in the lab using the methods described in section 1 of this SOP.

6 Revision history

Provide the following information for each revision made to SOP #6.

New version:

SCPN_WATER_QUALITY_SOP06_YYYYMMDD

Date:

Author:

Sections affected:

Changes & reasons: