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New Mexico Environment Department  
Surface Water Quality Bureau

Standard Operating Procedure (SOP)

for

**CHEMICAL SAMPLING IN LOTIC ENVIRONMENTS – EQUIPMENT, COLLECTION METHODS, PRESERVATION, AND QUALITY CONTROL**


Approval Signatures

  
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Douglas Eib  
Subject Matter Expert

4/22/16

Date

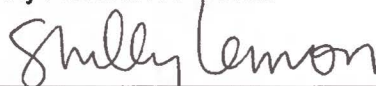
  
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Vacant  
Quality Assurance Officer

4-22-16

Date

for

  
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Shelly Lemon  
Program Manager

4-22-16

Date

**1.0 PURPOSE AND SCOPE**

The purpose of this SOP is to describe the sample collection techniques, preservation and acidification requirements, equipment, and quality control activities associated with the chemical sampling of surface water in lotic environments. Aside from some aspects of sample collection, the content of this SOP also applies to chemical sampling in lakes but it does not cover chlorophyll a sampling, or biological sampling activities in either lentic or lotic environments. Procedures for these activities are addressed in separate SOPs.

**2.0 RESPONSIBILITIES**

Staff who conduct chemical sampling activities, or who supervise those who do, are responsible for implementing this procedure.

**3.0 BACKGROUND AND PRECAUTIONS**

All chemical water sampling activities in lotic waters shall comply with this SOP. Methods of sample collection, preservation, and handling used in this SOP shall comply with methods described in the following references or that are approved by EPA:

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- “Guidelines establishing test procedures for the analysis of pollutants under the Clean Water Act,” 40 CFR Part 136 or any test procedure approved or accepted by EPA using procedures provided in 40 CFR Parts 136.3(d), 136.4 and 136.5;
- Standard Methods for the Examination of Water and Wastewater, latest edition, American Public Health Association;
- Methods for Chemical Analysis of Water and Waste, and other methods published by EPA Office of Research and Development or Office of Water;
- Techniques of Water Resource Investigations of the USGS;
- Annual Book of American Society for Testing and Materials (ASTM) Standards. Volumes 11.01 and 11.02, Water (I) and (II), latest edition, ASTM International;
- Federal Register, latest methods published for monitoring pursuant to Resource Conservation and Recovery Act regulations;
- National Handbook of Recommended Methods for Water-Data Acquisition, latest edition, prepared cooperatively by agencies of the U.S. Government under the sponsorship of the USGS; or
- Federal Register, latest methods published for monitoring pursuant to the Safe Drinking Water Act regulations.
- State of New Mexico Standards for Interstate and Intrastate Surface Waters (20.6.4 NMAC). Most current amendments.

Site conditions or project-specific data collection objectives may necessitate the use of field procedures not included in this SOP. The use of field methods other than those presented in this SOP must be approved by the Program Manager and documented in the Field Sampling Plan for the project prior to conducting sampling.

If other stream sampling work is to be done simultaneously, or prior to, the collection of water samples, collect water samples at a sufficient distance upstream to prevent interference or wait for disturbed water to flow past the collection site.

Use gloves when working in waters suspected of having high bacterial contamination.

Do not wade in a stream if the depth (ft) of the stream times the stream velocity (cfs) is greater than ten (The “RULE OF 10”).

#### 4.0 DEFINITIONS

**Analyte-Free Water** – Water free of, or with the lowest attainable concentrations, of the analytes tested for in the requested analyses for a blank. Usually deionized (di), polished water obtained from the SLD Organics Section. Purer water may be necessary for some organics analyses.

**Lentic** – Inhabiting or situated in still, fresh water (as lakes or ponds).

**Lotic** – Inhabiting or situated in rapidly moving fresh water (as rivers or streams).

**Sample** – The medium, and any reagents or acids dissolved in the medium. The sample includes those materials that cannot be readily separated from the medium that is sampled.

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**Sampling Run** – A period of time used to define the most common collecting period or grouping of sampling activities that are indicative of a SWQB MASS sampling operation. Typically, most samples are collected during multi-day collection events that depart and return to the office in a given week (M-F). Blanks associated with a sampling run are assumed to represent a group of samples collected by the same staff, and using the same equipment, vehicle, reagents, and acids. When multiple, single day sampling runs are conducted within a given week that maintain constant variables as described above, the single day sampling runs are considered collectively as a single sampling run, provided that the number of blanks collected is at least 10% of the environmental samples collected, preferably at a one blank sample per ten ambient sample frequency to allow for QC blank distribution.

#### **4.1 QUALITY CONTROL (QC) SAMPLES**

Different types of quality control samples are collected to check for contamination and background levels of analytes that may be introduced through exposure to the environment, sampling containers, reagents and acids, and laboratory equipment used to collect and analyze the various types of samples. When entering data into the database, it is important to select the correct blank type from the list appearing in the drop-down menu.

**Field blank** – A sample of analyte-free water and acid, if required, that is exposed to ambient environmental conditions at the sampling site and to transportation and storage conditions. Field blanks check for contamination from the sampling equipment, added reagents or acids, and from the environment. Field blanks are currently collected for *E. coli*, nutrient samples, and organic samples other than volatile organics samples (VOCs).

**Trip blank** – A blank prepared with analyte-free water and acid that is made at the analytical facility, sealed, transported and analyzed with environmental samples. Trip blanks are not exposed directly to ambient environmental conditions at the sampling site. Trip blanks are transported to the lab in the same manner as environmental samples. The purpose of a trip blanks is to assess the potential for in-transit contamination of samples. Trip blanks are currently run only for VOCs.

**Reagent blank** – A blank prepared in the lab using analyte-free water and reagent that is not exposed to ambient sampling conditions. Reagent blanks check for contamination from sample containers, analyte-free water and reagent. Reagent blanks are currently collected only for SLD nutrient samples.

**Equipment blank** – A sample prepared in the field, using analyte-free water and acid that has contacted all sampling equipment. Equipment blanks assess contamination from the sampling equipment and the acid, as well as from the ambient environment at the sampling site. Equipment blanks are currently collected for only for dissolved metals.

**Duplicate** – A sample that is split from a common container after sample collection and analyzed as two samples. Duplicates are used to assess the precision of sample collection and analysis.

**Replicate** – A second sample that is collected within 15 minutes and within 1 meter of an initial sample.

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## 5.0 EQUIPMENT AND TOOLS

The following list (Table 1) includes equipment that may necessary for surface water chemical sampling in lotic waters:

**Table 1.** Sampling equipment for lotic waters.

<p><b>SAMPLING SUPPLIES</b></p> <p>Field sheets</p> <p>Submittal forms</p> <p>RID stickers</p> <p>Cartridge filters (0.45 µm and 10 µm)</p> <p>Acid washed silicon tubing</p> <p>Cubitainers (quarts, gallons)</p> <p>Geo pump, with appropriate power cord(s)</p> <p>Kimwipes</p> <p>Acid kit with concentrated sulfuric and nitric acid,</p> <p>Pipettors and bagged pipettor tips</p> <p>Nitric Acid</p> <p>Sulfuric Acid</p> <p>Nitrile gloves</p> <p>Organics sample bottles (vials/bottles)</p> <p>Pencils</p> <p>Sharpies (fat and fine point)</p> <p>Pipettor repair kit</p> <p>Wash bottles with analyte-free water and/or ethanol</p> <p>Analyte-free water for preparing blanks</p> <p>Hammer</p> <p>Measuring tape (in feet and/or meters)</p> <p>Wading rod</p> <p>Flow meter and cable</p> <p>Potassium iodide (KI) starch Test Paper</p> <p>Nylon rope</p> <p>Metal bucket</p> <p>Plastic bucket</p> <p>Ice</p> <p>Coolers</p> <p>Pre-acidified containers</p> <p>pH paper</p> <p>Sodium hydroxide pellets</p> <p>10% HCl for acidifying VOC samples</p> <p>Whirl-Packs</p> <p>Reference ID stickers</p> <p>Ascorbic acid</p> <p>Sodium thiosulfate</p> <p>VOC trip blanks</p> <p>Safety glasses</p>	<p><b>GENERAL</b></p> <p>Access authorization documents</p> <p>Defensive driving certificate</p> <p>Camera</p> <p>Cell phone</p> <p>Coolers</p> <p>First aid kit</p> <p>Flashlight</p> <p>GPS unit</p> <p>Maps</p> <p>NMED ID</p> <p>Business cards</p> <p>Shovel</p> <p>Toolbox</p> <p>Calculator</p> <p>Vehicle Kit</p> <p>Hat</p> <p>Sun screen</p> <p>Neoprene gloves</p> <p>Rain gear</p> <p>Sunglasses/polarized glasses</p> <p>Clipboard</p> <p>Boots/waders/sandals</p> <p>Garbage bags</p> <p>Apron</p> <p><b>EQUAL WIDTH SAMPLING</b></p> <p>Churn splitter</p> <p>measuring tape or tagline (feet and metres)</p> <p>Isokinetic samplers</p> <p>DH-48</p> <p>DH-95</p> <p>DH-81</p> <p>nozzle (5/16-inch)</p> <p>Teflon or polypropylene 1L collection bottle</p> <p>Disposable bailer</p> <p>Winch</p> <p>1/2-in diameter wading rod</p> <p>Bridge Board</p> <p>Orange Cones and Vests</p>
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## 6.0 COLLECTING WATER SAMPLES (PROCESS DESCRIPTION)

**Collect water samples by immersing the sample container one foot beneath the surface of the water with the container mouth facing upstream and all exposed flesh downstream from the opening of the container. Attempt to sample where the stream is flowing, well mixed and preferably more than 6 inches deep. Sample at mid-channel or as far away from the bank as possible. Avoid getting streambed sediment or water surface materials in the sample. For Equal-Width-Increment and Depth-Integrated Sample Collection Methods see Appendix A.**

It is not necessary to rinse new sampling containers with analyte-free or sample water before collecting the sample. If re-using sampling containers such as buckets or one-gallon cubitainers to collect water for multiple samples, rinse the container twice with ambient water before collecting the sample. When adding acid to cubitainers, never insert the pipettor below the top of the neck of the cubitainer and keep the pipettor at an angle above the cubitainer to reduce the chance of debris falling off the pipettor or your hand into the sample. Sample containers can be pre-acidified up to one week before use. Pre-acidified containers should be stored in secondary containment, such as coolers, with the lid propped open to minimize vapor buildup. Pre-acidified containers should not be opened in a closed area or near the face. Consult the SWQB Chemical Hygiene Plan (CHP) or the SWQB Lab Safety Officer regarding acceptable practices for transferring concentrated acid in the Runnels Building Laboratory. Concentrated acid must always be transported in secondary containment in vehicles and boats with a short-term exception allowed for pre-acidified sampling containers enroute from vehicles to stream or lake.

Label all sample containers with the sample site location and sample type and place pre-printed SLD reference ID stickers on the lid. Write the RID number on the container with a Sharpie. A summary of the containers, acids and reagents, and holding times for various analyses is given below (Table 3). Use self-adhering labels for organic bottle. Fill out labels on organics bottles and label cubitainers before sampling to avoid having to write on wet surfaces. Only use pencils to fill out labels for organics.

Use a bucket or disposable bailer and nylon rope to collect water if sampling containers cannot be dipped directly in the water. Avoid contaminating the sample with debris from the rope and bridge, or other sampling platform. Use the first bucketful of water to rinse the bucket and the sampler's hands. Use the second bucket as a rinse and the third bucket of water to collect the sample. Use a metal bucket when collecting organic samples and a plastic bucket when collecting metals samples. Do not let the metallic sonde components touch the sample water prior to collecting the sample from a bucket if sampling for metals.

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## **6.1 SAMPLE COLLECTION AND PROCESSING FOR SPECIFIC PARAMETERS.**

Refer to the SLD interactive submission form for analytical suite compositions.

[http://www.sld.state.nm.us/Documents/SLD\\_CB\\_Analytical\\_Request\\_Form\\_Interactive.pdf](http://www.sld.state.nm.us/Documents/SLD_CB_Analytical_Request_Form_Interactive.pdf)).

### **6.1.1 TOTAL SUSPENDED SOLIDS (TSS), TOTAL DISSOLVED SOLIDS (TDS), CHLORIDE (CL) AND SULFATE (SO<sub>4</sub>)**

Fill a 1-quart cubitainer or a 500 ml HDPE bottle if only TSS and or TSS samples are needed. Keep sample on ice, at 6°C or less. Prepare a field blank by filling a 1-quart cubitainer with di water from SLD.

### **6.1.2 NUTRIENTS**

Fill a 1-quart cubitainer and acidify with approximately 1 ml concentrated sulfuric acid. If the conductivity is above 1000 uS/cm, check the pH with pH paper, a pH pen or other method, and add concentrated sulfuric acid iteratively in 1 ml aliquots until the pH is <2. If using a pre-acidified container, do not overfill. Samples may also be collected in 500 ml, high density polyethylene bottles, acidified with 0.5 ml concentrated sulfuric acid and tested for pH as described for cubitainers. Keep sample on ice, at 6°C or less.

Prepare a field blank by filling a 1-quart cubitainer with DI water from SLD on site, and acidifying with 1 ml of concentrated sulfuric acid. It may be desirable to prepare a reagent blank using a cubitainer filled with di water by the SLD water chemistry section that is kept 20°C or less, and in the dark to the extent possible, and acidified in the lab.

### **6.1.3 TOTAL METALS**

Fill a 1-quart cubitainer and acidify with 2 ml of concentrated nitric acid. If using a pre-acidified container, do not overfill. Keep sample at ambient temperature. There are no blanks collected for total metals samples.

### **6.1.4 TOTAL RECOVERABLE ALUMINUM**

If stream turbidity is 30 NTUs or below, follow the instructions for total metals samples. If stream turbidity is greater than 30 NTUs, follow the instructions for dissolved metals samples but use a 10 µm filter instead of a 0.45 µm filter. There are no blanks collected for total recoverable aluminum samples.

### **6.1.5 HARDNESS/DISSOLVED METALS**

To prepare an environmental sample for hardness and dissolved metals follow the steps below:

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1. Fill a cubitainer with at least 1 quart of stream, river, or lake water.
2. Attach a 0.45 µm filter to one end of acid washed, 0.19 inch internal diameter silicone tubing. Do this by pulling the plastic bag containing the filter over the upstream barbed fitting on the filter until it perforates the bag. Open the tubing bag, expose about 5 inches of tubing, and push the tubing onto the exposed barbed fitting. Leave the plastic bag on the filter.
3. Expose more of the tubing from the bag and insert the tubing into the Geo Pump and clamp.
4. Remove the rest of the tubing from the bag and place the other end into the sample.
5. Then remove the bag on the filter or push the downstream barb of the filter through the bag.
6. Turn the pump on and pump at least 75 ml of sample through the filter, discard, and collect the remainder in a 1-quart cubitainer. Keep the filter to the side of the neck of the receiving cubitainer to prevent dirt and dust from falling into the sample.
7. Acidify the sample with 2 ml of concentrated nitric acid.
8. Keep the sample at ambient temperature.
9. Place the used tubing in a separate bag from clean tubing and save for cleaning in the lab.
10. Discard the 0.45 µm filter.

To prepare a blank, fill a new cubitainer with at least a quart of DI water from SLD and follow the filtering instructions above starting at step 2. **Do Not Reuse** tubing and filters from blanks in environmental samples.

### 6.1.6 RADIONUCLIDES

Fill two, 1-gallon cubitainers and add 10 ml of concentrated nitric acid per cubitainer. Keep sample at ambient temperature. No blanks are collected for Radionuclide samples.

### 6.1.7 CYANIDE

Evaluate the sample water for the presence of chlorine. Samples from streams that are not immediately downstream from outfalls are unlikely to contain chlorine. If the chlorine is suspected to be present, samples can be checked using potassium iodide (KI)-starch test paper. A blue color indicates the presence of chlorine.

Fill a 1-quart cubitainer with sample. If chlorine is present, removed it by adding ascorbic acid, a few crystals at a time, until a drop of sample produces no color on the starch test paper, then add one additional crystal.

After adding ascorbic acid (if necessary), preserve samples for cyanide analysis with sodium hydroxide. Determine the pH of the sample on an aliquot (after adding ascorbic acid) using pH test paper. Preserve the sample with sufficient

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NaOH to produce a pH of 12 or greater. Most samples will require about 0.5 g solid NaOH per liter, approximately five pellets. Handle the pellets with wooden or plastic utensils, or pour directly from the container. Keep samples on ice, at 6°C or less.

### **6.1.8 ORGANIC CHEMICALS**

Project coordinators are responsible for obtaining organics sample containers, trip blanks, and HCL from the SLD Organics Section (505-383-9031) and should contact them at least one week prior to sample collection to ensure extractions and analyses can be carried out within holding times. When collecting samples for organic compounds, wear clean nitrile gloves. Gloves are worn to prevent organic compounds that may be present on skin from contaminating samples. Avoid the false sense of security gloves may give; a gloved hand can still spread contamination. Put gloves on as close to the time of sample collection as possible. Use sampling equipment with fluorocarbon polymer, glass, or metal components if components will directly contact samples to be analyzed for organic compounds. Do not use plastics other than fluorocarbon polymers.

Free chlorine will oxidize organic compounds in the water sample even after it is collected. If in-stream residual chlorine is suspected, measure the residual chlorine using a separate water subsample. If residual chlorine is above a detectable level (i.e., the pink color is observed upon adding the reagents), immediately add 100 mg of sodium thiosulfate to the pesticides, herbicides, semivolatiles, and volatile organic samples; invert until the sodium thiosulfate is dissolved. Record the residual chlorine concentration on the field sheet. If residual chlorine is below detectable levels, no additional sample treatment is necessary.

### **6.1.9 VOLATILE ORGANIC COMPOUNDS (VOCs)**

For each sample planned, obtain 2-40 ml vials in a Whirl-Pack from the SLD Organics Section. Fill the vials by submersion. If the sample is suspected of having residual chlorine (e.g. chlorinated wastewater plant effluent), add 25 mg of ascorbic acid and let stand for 1 minute. Add 2 drops of 10% HCl (also obtained from the SLD Organics Section and less than 30 days old) to each vial. Fill the caps with sample water and cap the vials without leaving a headspace. Keep the vials together in a closed Whirl-Pack, on ice, at 6°C or less.

Obtain a VOC Trip blank from the SLD Organics Section for each sample run that includes collecting VOC samples. Carry the trip blank into the field in a cooler, on ice, and remove the two vials from the Whirl-Pack at a sampling station. Do not open the vials or acidify. Replace the vials in the Whirl-Pack and keep them in a cooler, on ice with the environmental samples until delivered to the lab.

### **6.1.10 SEMIVOLATILE ORGANICS COMPOUNDS (SVOCs), HERBICIDES, PESTICIDES**



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For each sample planned, obtain two 1L glass, amber colored bottles with Teflon lined caps and a bubble wrap sleeve for each from the SLD Organics Section. Fill both bottles by submersion and replace the lids underwater if possible. If the stream is not deep enough to submerge the sample container, use a third, new, 1-L glass amber bottle to fill the two sample bottles. A headspace is acceptable with SVOC samples. Keep jars in bubble-wrap sleeves, obtained from the SLD organics section, before and after filling to avoid breakage. Store samples out of direct sunlight, on ice, at 6°C or less.

### 6.1.11 TOTAL RESIDUAL CHLORINE (TRC)

Collect samples for residual chlorine measurements directly below waste water treatment plant outfall when sampling for NPDES purposes. Fill the 10 ml sample cells provided in the HACH Chlorine Pocket Colorimeter kit to the line either directly from stream or from an aliquot of sample water. Wipe off excess water from the outside of sample bottles with lens paper or a KimWipe and ensure that the glass is dry and clean (no fingerprints or smudges). Add the content of one DPD Total Chlorine Powder Pillow to one 10-ml sample cell and gently shake for 20 seconds. Let it stand for 3 to 6 minutes before reading. During this period, place the other 10 ml cell bottle (the blank) into the colorimeter cell holder, with the diamond mark facing you. Tightly cover the cell with the instrument cap and press zero. Remove the blank sample cell bottle from colorimeter cell holder. Place the cell with dissolved reagent into the colorimeter cell holder and cover tightly with instrument cap. Between 3 and 6 minutes after adding the reagent to the sample press READ and record the total residual chlorine value in the comment section of field sheet.

## 6.2 AMBIENT WATER TOXICITY TESTING

The USEPA Houston laboratory conducts aquatic toxicity tests of water as part of the EPA Region 6 Ambient Toxicity Monitoring Program. An application process is required by EPA before selecting and scheduling ambient water toxicity testing. Contact the lab at 214-665-6722 for further information.

## 6.3 QUALITY CONTROL ACTIVITIES

Prepare and submit blanks at a frequency of one per sampling run, unless otherwise indicated by the field sampling plan. See Section 4.0 for definitions of quality control samples.

**Table 2.** Blank types and frequencies. Analytes not listed do not require blanks.

Analytical Suite	21* Field Blank	26* Trip Blank	27* Reagent Blank	28* Equipment Blank	Submittal Frequency (per run**)

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Analytical Suite	21* Field Blank	26* Trip Blank	27* Reagent Blank	28* Equipment Blank	Submittal Frequency (per run**)
TSS/TDS/ Cl/SO <sub>4</sub>	X				1
SLD Nutrients			X		1 (recommended)
SWQB Nutrients	X				1
<i>E.coli</i>	x				1
Dissolved Metals				X	1
VOCs		X			1

\* Numbers refer to Water Quality Exchange (WQX) activity type. \*\* Run is usually equivalent to a sampling trip. Some surveys are composed of multiple day trips in which case blanks should be collected at a rate of 10% of the total number of samples for each parameter

## 6.4 HANDLING, PACKAGING, AND TRANSPORTING SAMPLES

After collection, place samples with temperature storage requirements in coolers. Ensure that all samples required to be kept cool are surrounded and in contact with enough ice to cool to approximately 6°C. It is important that containers are in an ice bath; i.e. in contact with water that is in contact with ice, especially in warm weather, to ensure adequate cooling. Make sure that all glass sampling containers are placed in bubble-wrap sleeves to protect from breaking. Bubble-wrap may insulate samples from cooling and it may be necessary to place additional ice in coolers. Check to see that samples are adequately labeled and that container lids are secure. Handling procedures and holding times are summarized below (Table 3).

### 6.4.1 SAMPLE CUSTODY

Samples taken for ambient/assessment monitoring purposes do not require formal chain of custody procedures. However, to ensure the integrity and quality of these samples, the SWQB uses a sample tracking procedure that requires that

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the receiving laboratory acknowledges receipt of the samples by date stamping the submittal forms and providing copies of the stamped forms to the person delivering the samples.

**Table 3.** SWQB chemical sample handling procedures and holding times.

Sample Type	Sample Container	Processing, Preservation and Storage	Maximum Holding Time
TSS/TDS/Cl/SO <sub>4</sub>	1-quart polyethylene cubitainer or 250 ml HDPE bottle if sample is only for TSS/TDS	On ice, approximately 6°C	7 days if TSS included; otherwise 14 days.
Total Nutrients	1-quart polyethylene cubitainer	2.0 ml concentrated sulfuric acid, on ice, approximately 6°C	28 days
Cyanide	1-quart polyethylene cubitainer	5-7 pellets NaOH, 0.6g ascorbic acid if chlorine present, on ice, approximately 6°C	14 days
Total Metals	1-quart polyethylene cubitainer	5.0 ml concentrated nitric acid	28 days
Total Recoverable Aluminum	1-quart polyethylene cubitainer	Filter (10 µm) within 15 min of sample collection; 5.0 ml concentrated nitric acid.	6 months
Dissolved Metals / Hardness	1-quart polyethylene cubitainer	Filter (0.45 µm) within 15 min; 5.0 ml concentrated nitric acid	28
Semivolatile Organic Compounds, Herbicides, Pesticides	Two 1-liter glass amber bottles (lab)	On ice, approximately 6°C	7 days

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Sample Type	Sample Container	Processing, Preservation and Storage	Maximum Holding Time
Volatile Organic Compounds	Two 40-ml glass vials (lab) in a Whirl-Pack	5 drops 10% HCl per vial (HCl provided by lab and prepared within 30 days of use), on ice, approximately 6°C	14 days
Radionuclides	Two 1-gallon polyethylene cubitainers	7-10 ml concentrated nitric acid per gallon	6 months

## 7.0 RELATED FORMS

Stream Field Data Form  
 Chemical Sampling Equipment Checklist  
 Total Residual Chlorine Data Upload Form  
 SLD submittal forms

## 8.0 REVISION HISTORY

Revision 5 – 3/18/16 – Removed blank for SVOCs to follow QAPP; changed formatting to be consistent with SOP 1.1; added SLD submittal forms for organics and radionuclides; Removed discussion on compliance sampling because it is covered in SOP 8.3.

Revision 4 - 4/6/2015 – Changes to blank definitions and types. Added TSS/TDS/Cl/SO<sub>4</sub> blanks

Revision 3 – 4/2/2013 – Minor edits to language and some clarification regarding preservation  
 Revision 2 – 12/20/12 – Updated Table 3 and additional language regarding total recoverable aluminum

Revision 1 – 1/23/2012 – Minor edits throughout SOP

Original – 3/21/2011

## REFERENCES

New Mexico Environment Department/Surface Water Quality Bureau (NMED/SWQB). 2016. Quality Assurance Project Plan for Water Quality Management Programs. Santa Fe, NM.

United States Geological Survey (USGS). 1968. Techniques of water-the United States Geological Survey, General Procedure Chapter A6. US Government Printing Office, Washington, DC.

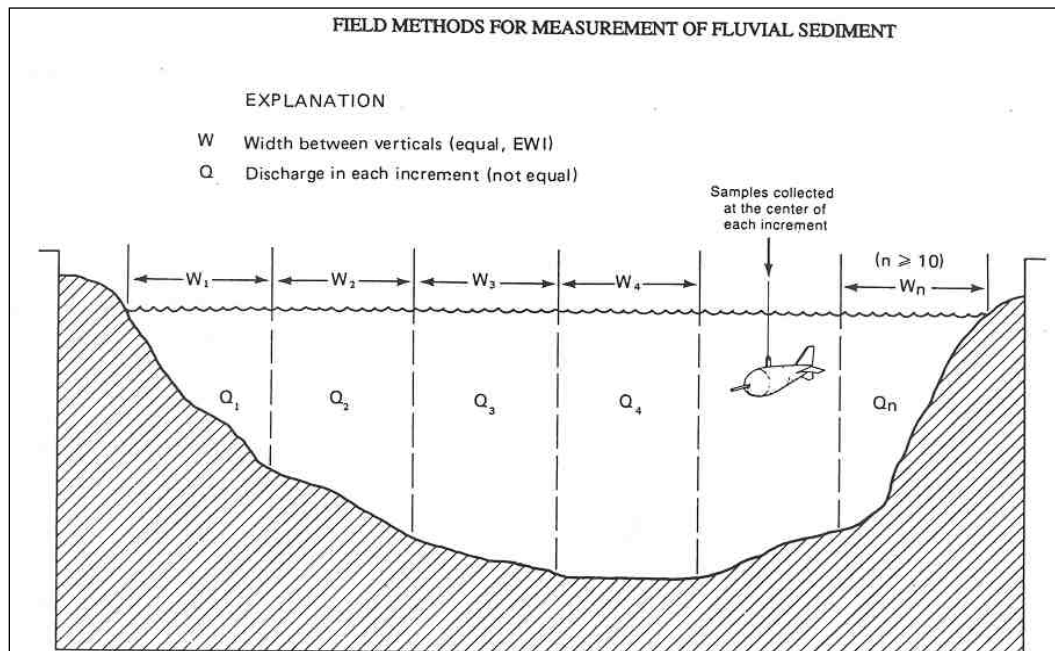
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## APPENDIX A - EQUAL-WIDTH-INCREMENT (EWI) AND DEPTH INTEGRATED (DI) SAMPLE COLLECTION METHODS

Use EWI and DI sampling methods if a stream is large and not well mixed due to inflows from large tributaries, ephemeral channels, waste water treatment plants (WWTPs), and/or agricultural return flows. The preferred sampling technique is the EWI method (USGS 1999). Whether to sample only suspended sediments using EWI methods or to sample additional parameters using EWI methods is at the discretion of the study lead based on the level of mixing in the channel and the objectives of the study.

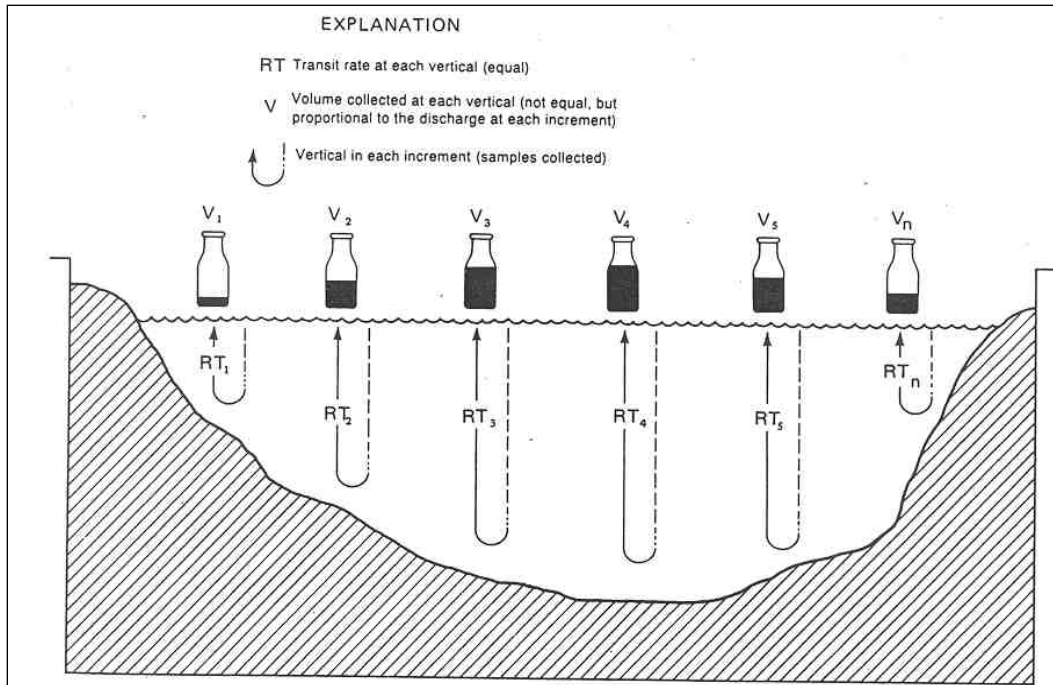
### A.1 Determination of Verticals

String a measuring tape or tagline from bank to bank. Establish between 10 and 20 verticals, depending on the extent to which the stream is not well mixed, by dividing the stream width by the desired number of verticals. Locate the sample station within each width increment at the center of the increment ( $W/2$ ). If the width increment results in a fraction, the number is rounded to the nearest integer to determine the initial station (Figure 1).



**Figure 1.** Equal-width-increment verticals (from USGS 1999).

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**Figure 2.** Sample collection at wadeable sites using DH-48 sampler.

## A.2 Determination of Transit Rate

The transit rate is the speed of lowering and raising the sampler in the sampling vertical. EWI methods require that all verticals be traversed using the transit rate established at the deepest and fastest vertical in the cross section. The descending and ascending transit rate are equal during the sampling traverse of each vertical, and are the same at all verticals, in order to collect a volume of water proportional to the flow in each vertical (Figure 2) (from USGS 1999). The transit rate must not exceed 0.4 times the mean ambient velocity in the vertical while being sufficiently fast to keep from overflowing the sample bottle. Mean stream velocity (measured or estimated), deepest sampling depth, and transit rate diagrams are used to approximate the necessary transit rate based on the equipment and nozzle used (FISP 1999). See below sections for details regarding determination of transit rate depending on equipment utilized.

Sampling procedures for the DH-48 are detailed in FISP 2000c. A cross section displaying relatively stable hydrologic characteristics and uniform depths over a water range of discharge is selected. The sampling device utilized by SWQB is a hand-held US DH-48. It is designed to sample isokinetically, meaning that water and sediment enters the nozzle at the same velocity as the stream being sampled in order to collect a representative sample. A pint milk bottle is held in place and sealed against a rubber gasket by a hand operated, spring tensioned clamp at the rear of the sampler. A brass 1/4-inch internal diameter intake nozzle extends horizontally from the nose of the sampler body. A standard 1/2-in diameter wading rod is threaded into the top of the sampler body for suspending the sampler. The DH-48 can sample to within 3.5 inches

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of the stream bed and can be used in velocities ranging from 1 to 9 ft/sec (FISP 2000c). Specifications and sampling instructions for the alternative DH-81 handheld sampler can be found in FISP 1999.

Prior to sampling, the transit rate is determined using the procedure described in Table 1 utilizing transit rate diagram for the US DH-48 presented in Figure 3 (from FISP 2000c). The wading rod should be held vertically with the sampler and nozzle pointing upstream and as far away from the sampler as possible to avoid interference with the flow from the person taking the sampler. In order to sample with a consistent transit rate, the person collecting the sample determines a reference point above the water surface at the deepest vertical to be sampled at which the sampler is started and stopped. This reference point is used to start and stop all verticals, allowing the same amount of time to elapse during the round trip traverse of the sampler regardless of the stream depth encountered in the vertical. The USGS recommends a reference point on the body of the person collecting the sample, such as his/her hip. Using the determined transit rate, the sampler lowers the DH-48 until it touches the stream bottom, then immediately reverses the direction to raise the sampler until it clears the water surface. To avoid overflowing, the person collecting the sample periodically checks the volume that has been collected and switches out the sample bottle when the volume is approximately 420 mL.

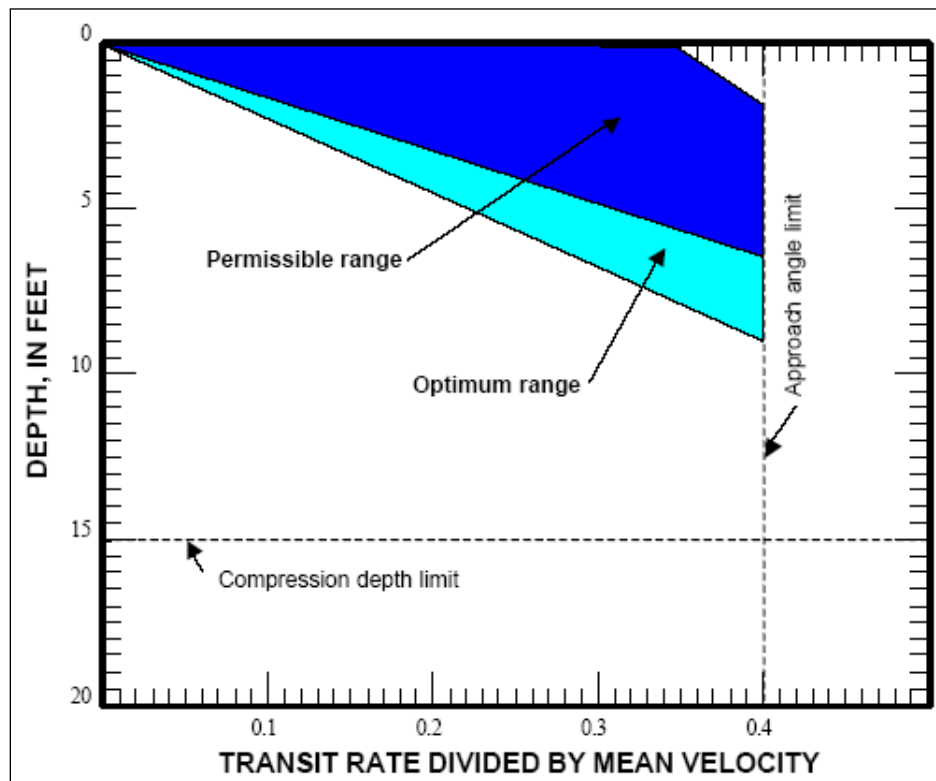
Compositing and/or multiple traverses of the cross section may be necessary. The person collecting the sample returns to the bank and empties the contents of the sampling device into a decontaminated churn or other clean sampling container depending on equipment availability, parameters to be analyzed, and necessary sample volume while agitating the sample to ensure particles are in suspension during the transfer. Before returning to the bank, the person collecting the sample makes notes of or marks his/her last collection vertical on the tagline with a clothespin or similar device. After emptying the sample bottle, the person collecting the sample returns to the marked location and resumes sampling. The procedure is repeated until the necessary volume has been collected and composited. The composited sample is then dispersed and filtered as necessary depending on the parameters to be analyzed. The agitator on the churn is slowly moved up and down while dispensing sample water from the spigot into the appropriate lab sample containers.

**Table 1.** Determining transit rate using transit diagram.

Using the appropriate transit diagram, draw a horizontal line from the maximum sampling depth on the Y-axis to the middle of the optimum range. Move vertically to intersect with the X-axis. Multiple this number on the X-axis times the mean stream velocity to determine the transit rate.

**EXAMPLE FOR DH-48:**

- Mean stream velocity = 4 ft/sec
- Maximum sampling depth = 2.5 feet
- Using transit diagram Figure 7.3 (from FISP 1999), 0.15 = corresponding x-axis value = “transit rate divided by mean velocity”
- $0.15 \times 4 \text{ ft/sec} = 0.6 \text{ ft/sec}$  transit rate



**Figure 3.** Transit rate diagram for US DH-48 sampler

Note: The following volumes were used to produce this diagram: The total volume of the sampler container was 470 mL. The maximum recommended volume was 420 mL. The minimum optimum volume was 300 mL.

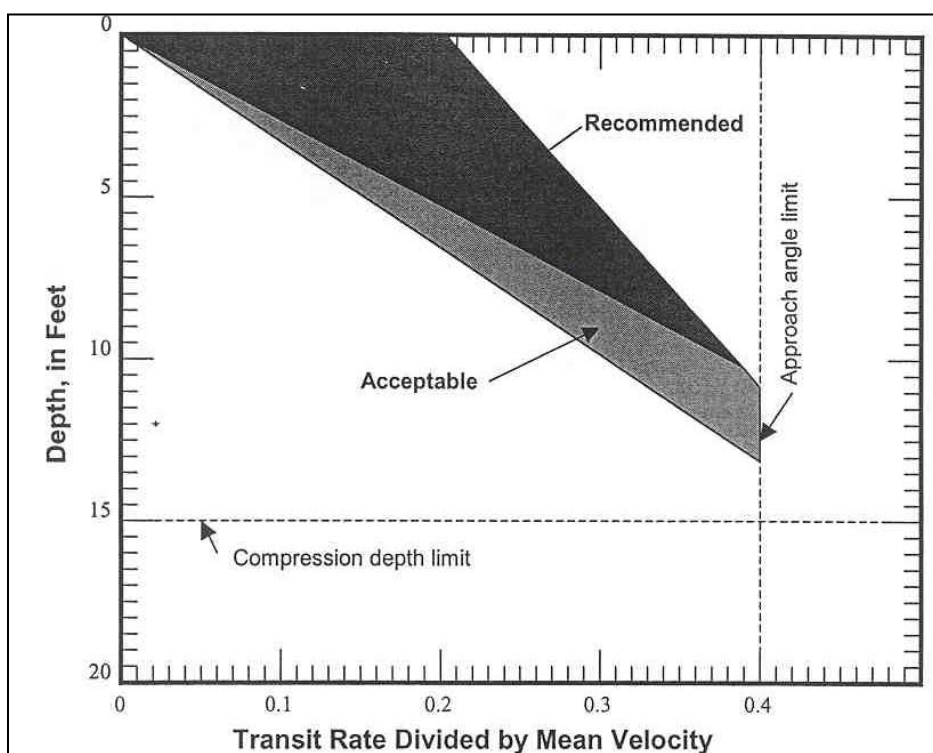
### Sample Collection at Non-Wadeable Sites using DH-95 Sampler

When sampling from a bridge or cableway, SWQB utilized a US DH-95 with a 5/16-inch nozzle (FISP 2000a). The maximum sampling depth for this configuration is 13.3 ft and sampler velocity range is from 2.2 ft/sec to 7.0 ft/sec (FISP 2000b). The sampling device is connected to a hanger bar. The hanger bar is connected to a suspension cable on an "A" reel supported by a bridgeboard. The nozzle is screwed hand tight into the cap. The O-ring is lifted in order to place a triple rinsed Teflon or polypropylene 1L bottle into the sampler cavity. The O-ring fits over the neck of the bottle to hold it in place. The bottle-cap configuration is rotated until the air vent hole in the cap is vertical. The nozzle intake and air vent hole are checked for any obstructions. The person collecting the sample has a lid and extra sample bottle available. The transit rate is determined using the procedure described in Table 1 and the appropriate transit rate diagram (Figure 4) (from FISP 2000b). The sampler is lowered to immediately above the water surface without submerging the nozzle. Using the transit rate determined by the above procedures, the sampler is smoothly lowered into the flow. When the sampler almost touches the streambed, the reel direction is quickly reversed and the sampler is raised to the surface using the same constant transit rate (FISP 2000b). The person collecting the sample avoids hitting the streambed to prevent stirring up loose sediment that could bias the sample. To avoid overfilling, the person collecting the sample periodically checks the volume that has been collected and switches out the sample bottle when the volume is approximately 800 mL.



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Compositing and/or multiple traverses of the cross section may be necessary. The person collecting the sample retrieves the sampler and empties the contents of the sampling device into a churn or other clean sampling container depending on equipment availability, parameters to be analyzed, and necessary sample volume while agitating the sample to ensure particles are in suspension during the transfer. Before retrieving the sampler, the person collecting the sample makes notes of or marks his/her last collection vertical on the tagline with a clothespin or similar device. After emptying the sample bottle, the person collecting the sample returns to the marked location and resumes sampling. The procedure is repeated until the necessary volume has been collected and composited. The composited sample is then dispersed and filtered as necessary depending on the parameters to be analyzed. The agitator on the churn is slowly moved up and down while dispensing sample water from the spigot into the appropriate lab sample containers.



**Figure 4.** Transit rate diagram for US DH-95 with 5/16 inch Teflon nozzle

Note: The following configuration and volumes were used to produce this diagram. The total volume of the sampler container is 1265 mL., which includes a Teflon bottle, bottle adapter and US D-77 cap. The maximum recommended sample volume is 800 mL. The maximum acceptable sample volume is 1,000 mL.

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