STANDARD OPERATING PROCEDURE FOR SEDIMENT SAMPLING ON STREAM BANKS AND LAKE SHORES

WATER QUALITY

State of Utah
Department of Environmental Quality
Division of Water Quality

Version 1.0
Effective April 2021

Foreword

Utah Division of Water Quality (DWQ) Standard Operating Procedures (SOPs) are adapted from published methods or developed by in-house technical experts. This document is intended primarily for internal DWQ use. This SOP should not replace any official published methods.

Any reference within this document to specific equipment, manufacturers, or supplies is only for descriptive purposes and does not constitute an endorsement of a product or service by DWQ. Additionally, any distribution of this SOP does not constitute an endorsement of a procedure or method.

Although DWQ will follow this SOP in most instances, there may be instances in which DWQ will use an alternative methodology, procedure, or process.

The methodology detailed below is the protocol followed by DWQ's monitoring staff and verified by DWQ's Quality Assurance officer.

Signature: Benjamin R. Brown
Benjamin R. Brown (Apr 8, 2021 16:24 MDT)

Email: brbrown@utah.gov

_____ _____

Benjamin R. Brown **Date**
Monitoring Section Manager

Signature: Toby Hooker
Toby Hooker (Apr 8, 2021 16:30 MDT)

Email: tobyhooker@utah.gov

_____ _____

Toby Hooker **Date**
Quality Assurance Officer

REVISION PAGE

Date	Revision #	Summary of Changes	Sections	Other Comments

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1.0 SCOPE AND APPLICABILITY

This document presents the Utah Division of Water Quality's (DWQ) Standard Operating Procedure (SOP) for performing soil or sediment sampling along stream banks and lake shores for ambient monitoring purposes. While soils and sediments can be collected for a variety of projects and purposes, this SOP is focused on situations where quantitative sampling using a soil core is not required. Instead, these procedures describe how to obtain reasonably representative and comparable samples of shallow, fine-textured surface soils/sediments that are not presently flooded or inundated and are to be used to determine the concentration of project-specific analytes. This SOP applies to all DWQ field staff, DWQ cooperators, and volunteer monitors trained on this SOP.

The reader should notice that while sediment sampling is often required in response to an unintended pollutant release (or spill), specific SOPs for spill-response purposes should be acquired through DWQ's Spill Response Coordinator (Kevin Okleberry, kokleberry@utah.gov) or from instructions in DWQ's Spill Response Kits.

2.0 SUMMARY OF METHOD

Samples are collected from streambanks and lake shores on the wetted margin above the current waterline. Target areas of fine-grained sediments where the ground has been undisturbed. A stainless-steel scoop is used to collect a sample from a depth of 0-5cm or as specified in the project-specific sampling and analysis plan (SAP). Details on the sampling design layout and specific requirements of the soil sample (i.e. sampling reach, sub-samples and composite requirements) will also be found in a project-specific SAP. To composite a sample, subsamples are added to a stainless-steel bucket/bowl and mixed thoroughly with the scoop.

Samples are placed in a container and kept on wet ice for delivery to the lab as specified in the project-specific SAP.

If sampling for a spill-related project is requested, please coordinate with DWQ's Spills Coordinator or project manager for site specific information.

3.0 DEFINITIONS

Coarse sediment: A general size-class of sediments that are typically larger than sand; i.e. greater than 2 mm diameter. (See fig at back of document for diagram).

DI: De-ionized water

Fine sediment: A general size-class of sediments that are smaller than sand-sized particles, including silts and clays, which are less than 0.05 and 0.002 mm, respectively.

g:	Grams
PPE:	Personal Protective Equipment
SAP:	Sampling and Analysis Plan

4.0 HEALTH AND SAFETY WARNINGS

Hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, it is recommended that the sampling be rescheduled. If hazardous conditions arise during sampling, such as lightning, high winds, rising water, or flash flood warning, personnel should cease sampling and move to a safe location.

When working in Utah and other warm climates, take steps to avoid heat induced illnesses such as heat stroke or heat exhaustion. Use caution when working in waders as drowning hazards exist. Take appropriate precautions when operating equipment and working on, in, or around water, as well as possibly steep and unconsolidated banks, bridges, or edges of ponds/lagoons.

Use caution when sampling from a bridge or boat and take appropriate actions to make the situation as safe as possible; suspend the sampling if conditions are unsafe.

Be aware that additional hazards may be present due to the nature of a spill condition. Wear PPE such as gloves, safety glasses waders and boots to protect yourself from known and unknown contaminants.

All field crews should follow DWQ health and safety procedures and be equipped with safety equipment such as proper wading gear, personal flotation devices (PFDs), gloves, first aid kits, cellular phone, etc.

Wear gloves or wash hands after sampling, especially when sampling wastewater discharges or ponds, lagoons, or other potentially contaminated sampling points.

5.0 CAUTIONS

Some of the sampling containers are glass. Use bubble wrap to protect the samples from breakage.

When collecting samples in the glass bottles and vials for VOC and SVOC samples be sure there is no headspace in the sample, as specified in a project-specific SAP or as required by the analytical method for that parameter class.

6.0 INTERFERENCES

Avoid opening bottles or collecting samples near a running vehicle motor/exhaust or a generator for risk of contamination by gasoline fumes.

Samples must be stored and handled appropriately (i.e., temperature, light sensitivity, and holding times) according to parameter-group, method-, or project-specific requirements; samples not meeting requirements may be invalidated by the laboratory or a data user. Check with the lab or project-specific SAP for specific handling requirements.

During packing and handling of bottles, be sure that caps are tightly sealed.

7.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

DWQ personnel performing water sampling must be familiar with sampling techniques, safety procedures, proper handling, and record keeping. Samplers are responsible for attending refresher meetings held each spring/summer to review procedures and techniques. New staff will be trained in the field by DWQ trained personnel.

Cooperators are required to read this SOP annually and acknowledge they have done so via a signature page that will be kept on-file at DWQ along with the official hard copy of this SOP (see **Appendix 1**).

8.0 EQUIPMENT AND SUPPLIES

See SAP for detailed list of supplies.

- ❑ Copy of this SOP
- ❑ Stainless steel or polyethylene spoons
- ❑ Stainless steel or polyethylene buckets/bowls
- ❑ Collection jars with labels, or ziplock polyethylene sample bags
- ❑ Waterproof marker/pen/pencil
- ❑ COCs/Lab sheets
- ❑ Cooler with wet ice
- ❑ Electric tape for lids
- ❑ Nitrile gloves (if sampling contaminated soils)
- ❑ PPE
- ❑ Waders/boots

9.0 PROCEDURE

The general soil/sediment sampling procedure described below was derived primarily from the April, 2009 version of the National Rivers and Streams Assessment (NRSA) Field Operations Manual (USEPA, 2009), but has been simplified to allow for project-specific differences in sampling approach.

There are many different types and approaches to soil/sediment sampling, and these are commonly based on the depth of material to be collected, the grain-size and other physical characteristics of the substrate, the chemical parameters of interest, as well as the overall project purpose (i.e. ambient monitoring vs. regulatory compliance assessment). Some sampling procedures may require composited samples while others may require a single sample in a jar. In addition, it is good practice, regardless of project purpose, to specify the depth and interval of soil/sediment samples to be collected (e.g. 0 to 5 cm below substrate surface) (USEPA, 2002). Application of the details that control the sampling design for soils and sediments, noted above, is beyond the scope of this document.

9.1 General Sediment Sampling Procedures

Prior to sampling, field crews should refer to the project-specific SAP for details on sampling locations and sampling design layout. If sampling occurs along transects or within quadrats, be sure the areas where sampling will occur are clearly marked before starting.

1. Identify the initial sampling location for sediments at the waterbody.
2. Locate sediments of fine-grained substrate (silty sand, silt, clay, muck) on the wetted edge, but above the waterline of the water body. If most of the surface substrate is composed of particles cobble-size and larger (> 76mm or approx. 3 inches), large cobbles can be carefully removed to allow access to the fine sediments underneath. (See **Appendix 2** for particle size classification).
3. Be sure that the area of sampling has been not been recently disturbed from walking, burrowing, or any previous sample collection.
4. Use a stainless-steel scoop to collect fine sediment to a depth of approximately 5 cm and place the scoop in a clean stainless-steel bucket/bowl for compositing.

Note: The depth-interval of soil/sediment sampling may be project specific; the 0-5 cm depth is commonly used in ambient surface water monitoring projects. Refer to the project-specific SAP for volume and depth specifics.

5. Move to the next location to collect additional subsamples for the composite sample. This could be within a sampling quadrant or at different transects along a reach, or something else.

Note: The number of subsamples to be homogenized into a composite sample may vary with the project. The NRSA survey composited 11 subsamples along a stream reach, but other projects may require more or less subsampling.

6. Once all subsamples have been placed in bucket/bowl, mix thoroughly with the spoon. If sampling for VOC/SVOC, use care mixing and refer to the project-specific SAP or the parameter-specific analytical method for detailed requirements.
7. Label the appropriate sample jar or bag with site name, DWQ site ID, date, time and initials.
8. Transfer sample from the bucket/bowl to the labeled jar or bag. Be sure to follow any method- or analyte-group specific requirements for sample transfer, such as whether to allow air pockets or voids within the sample, etc.
9. Tape the lids of the jars and place jars in the cooler with wet ice.
10. If collecting additional samples move to the new location, use a clean spoon and bucket bowl or triple rinse equipment in site water. Repeat steps 1-10.
11. Ensure that a laboratory request sheet (or COC form) is filled out with appropriate information matching the bottle labels.
12. Clean and/or store all sampling tools, review all field notes, and prepare to leave the site
13. After returning from the field, decontaminate all equipment utilized in the procedure with a Liquinox® wash and a DI rinse.

9.2 Shipping and Handling

Table of shipping and handling requirements from AWAL labs. Other labs may be used in addition to AWAL, so be sure to check with the contracted lab for specific shipping and handling requirements.

Analyte	Method	Sample Quantity [1,2]	Container Type	Hold Time	Preservation
Metals (Except Mercury and Uranium)	SW846 6010D or 6020B	10 g	plastic or glass	6 months	cool 4ºC
Mercury (Cold Vapor Atomic Absorption)	SW846 7471B	10 g	plastic or glass	28 days	cool 4ºC
Uranium	SW846 6020B	10 g	plastic or glass	6 months	cool 4ºC
Bromide	SW 9056 or 9056A	50 g	plastic or glass	28 days	cool 4ºC
Chloride	SW846 9251 or 9056A	50 g	plastic or glass	28 days	cool 4ºC
Corrosivity (pH only)	SW846 9045D	50 g	plastic or glass	immediately	cool 4ºC
Cyanide-Amenable	SW846 90132B	20 g	plastic or glass	14 days	cool 4ºC
Cyanide-Total	SW846 9012B	20 g	plastic or glass	14 days	cool 4ºC
Flash Point	SW846 1010A	30 g	Glass	NA	cool 4ºC
Fluoride	SW846 9056A	20 g	plastic or glass	28 days	cool 4ºC
Free Liquids	SW846 9095B	200 g	plastic or glass	24 hours	none
Grain Size (Sieve)	ASTM 2488-84	500 g	plastic or glass	NA	none
Ignitability	SW846 1010A	30 g	Glass	NA	cool 4ºC
Oil & Grease (Hexane)	EPA 1664B	60 g	plastic or glass	28 days	cool 4ºC
Oil & Grease (Hexane/SGT) (TRPH)	EPA 1664B-SGT	60 g	plastic or glass	28 days	cool 4ºC

Analyte	Method	Sample Quantity [1,2]	Container Type	Hold Time	Preservation
pH	SW846 9045D	50 g	plastic or glass	immediately	cool 4ºC
Phenolics	SW846 9066	30 g	Glass	28 days	cool 4ºC
Phosphate-Total	EPA 365.1	30 g	plastic or glass	28 days	cool 4ºC
Reactive Cyanide	SW846 Vol 1C Chap. 7, 8.3/7.3.3	30 g	plastic or glass	7 days	cool 4ºC
Reactive Sulfide	SW846 Vol 1C Chap. 7, 8.3/7.3.4	30 g	plastic or glass	7 days	cool 4ºC
Solids-Fixed	SM2540G	20 g	plastic or glass	7 days	cool 4ºC
Solids-Total	SM2540B&G	20 g	plastic or glass	7 days	cool 4ºC
Solids-Volatile	EPA 160.4 & SM2510G	20 g	plastic or glass	7 days	cool 4ºC
Sulfate	SW846 9038 or 9056A	50 g	plastic or glass	28 days	cool 4ºC
Total Organic Carbon (TOC)	SW846 9060 (not performed at AWAL)	20 g	plastic or glass	28 days	cool 4ºC
Total Organic Halides (TOX)	SW846 9020B	20 g	plastic or glass	28 days	cool 4ºC
Total Recoverable Petroleum Hydrocarbons	EPA 1664A Mod.	60 g	Glass	28 days	cool 4ºC
Volatiles by GC/MS	SW846 8260C	*	*	14 days	*
Semivolatiles by GC/MS	SW846 8270D	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC
Organochlorine Pesticides by GC/ECD	SW846 8081B	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC
Herbicides by GC/ECD	SW846 8151A	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC
Diesel Range Organics by GC/FID	SW846 8015D Mod.	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC
PCBs by GC/ECD	SW846 8082A	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC
TPPH by GC/MS	SW846 8260C	*	glass/Teflon	14 days	cool 4ºC
TPH (GRO) (C5-C10) Utah by GC/MS	SW846 8260C	*	glass/Teflon	14 days	cool 4ºC
TPH (DRO) (C11-C15) by GC/MS	SW846 8260C	*	glass/Teflon	14 days	cool 4ºC
TPH (DRO) Utah by GC/PID&FID	SW846 8015D Mod.	30 g	glass/Teflon	14 days	cool 4ºC
VOA TPH Fractionation by GC/MS (Utah)	SW846 8260C	*	glass/Teflon	14 days	cool 4ºC
SVOA TPH Fractionation by GC/MS (Utah)	SW846 8270D	30 g	glass/Teflon	14 days ext./ 40 days analysis	cool 4ºC

* Check with the lab for details based on specific sampling methods

[1] – This does not include the volume necessary to perform MS/MSD analyses. Include additional sample (normally 3 times the quoted volume or mass) for each sample requiring an MS/MSD. This extra sample volume should always be included for at least one sample in sample sets of 5 or greater. Contact the laboratory for more information.

[2] – For reporting results in dry weight a total solid analysis must be included. Be sure to collect a sample for total solids.

10.0 DATA AND RECORDS MANAGEMENT

Project-specific data and records management requirements can be found in the project-specific SAP. Before leaving the field site, be sure that all required samples have been collected, labeled, and that all appropriate field sheets, field notes, and sample tracking forms have been filled out completely and accurately.

To maintain the integrity of sample site IDs, sample jars or bags must match the information on the Lab Sheet, or other sample tracking or Chain-of-Custody form. Information on sample labels must be written in permanent ink.

If samples are for enforcement or may involve potential litigation, follow legal Chain-of-Custody procedures for sample handling and sample tracking (refer to DWQ's SOP for Water Chemistry Samples in Streams).

If sampling for a spill, send a scan or photograph copy of the COC, field notes and field data to Kevin Okleberry (kokleberry@utah.gov) who will share the data with the necessary parties.

11.0 QUALITY ASSURANCE AND QUALITY CONTROL

Blanks and replicates are not typically collected for soil sampling for ambient monitoring. See project-specific SAP for QA/QC requirements.

Sometimes in Spills Sampling, samples are collected above the spill site to determine any background contamination.

All sampling equipment must be decontaminated before and after use.

12.0 REFERENCES

USEPA. 2002. RCRA Waste Sampling Draft Technical Guidance: Planning, Implementation, and Assessment. EPA-530-D-02-002. U.S. Environmental Protection Agency, Washington, DC. Online, accessed 4 March, 2021 at: https://www.epa.gov/sites/production/files/2015-10/documents/rwsdtg_0.pdf

USEPA. 2009. National Rivers and Streams Assessment: Field Operations Manual. EPA-841-B-07-009. U.S. Environmental Protection Agency, Washington, DC. Online, accessed 4 March, 2021 at: https://www.epa.gov/sites/production/files/2013-11/documents/nrsa_field_manual_4_21_09.pdf

USEPA. The SW-846 Compendium. https://www.epa.gov/hw-sw846/sw-846-compendium

Related DWQ SOPs:

Standard Operating Procedure for Wetlands Sediment Collection

13.0 APPENDIX

APPENDIX 1 - SOP ACKNOWLEDGMENT AND TRAINING FORM

SOP Acknowledgement Form

This SOP must be read and acknowledged annually, and this form must be kept on file at DWQ.

Document Title:	
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement:

"I have read and understood the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved revision."

Date	Printed Name	Signature

SOP Training Form

Training is required for all new samplers and Refreshers are required annually.

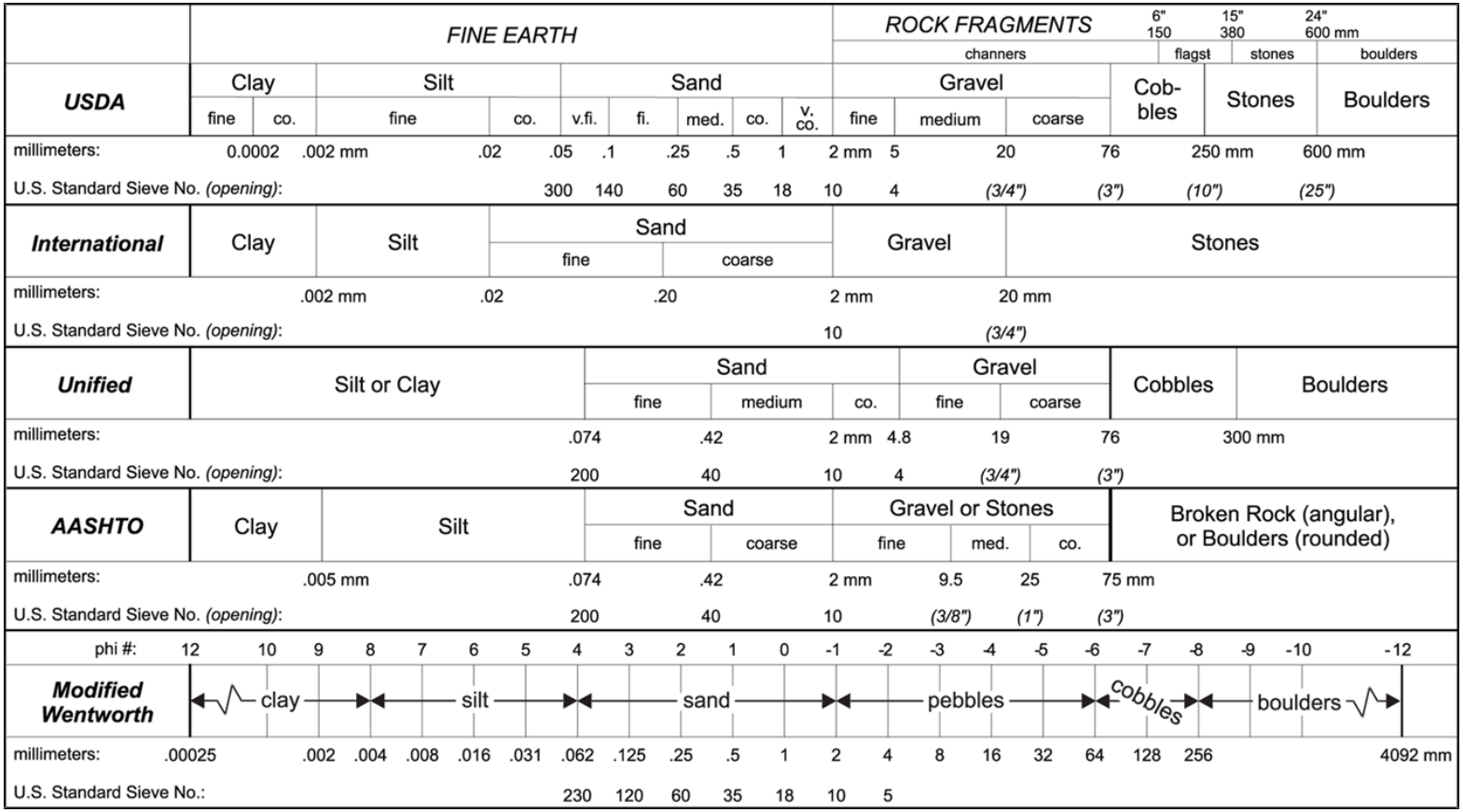
Trainee: Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer: Sign below to acknowledge that training on this SOP was completed for the individual listed and that trainee is competent to perform the procedures described within.

Date	Trainee Printed Name	Trainee Signature	Trainer Printed Name	Trainer Signature

Management Approval
Printed Name:
Signature:
Date:

APPENDIX 2 – Comparison table of soil or sediment particle sizes



Comparison table of comment systems used to classify soil or sediment particle sizes. Obtained online from: "https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054253", as part of a digital version of USDA NRCS's Soil Survey Manual, Chapter 3. Examination and Description of Soil Profiles. As used here, the most important distinction is between those particles smaller than (fine particles) or greater than (coarse particles) sand-size of 2.0 mm diameter.