DEPARTMENT OF ECOLOGY
State of Washington

Collecting Grab Samples from Stormwater Discharges

Standard Operating Procedure
Version 1.2

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Washington State Department of Ecology

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Please note that the Washington State Department of Ecology's Standard Operating Procedures (SOPs) are adapted from published methods, or developed by in-house technical and administrative experts. Published SOPs can be found on Ecology's website http://ecology.wa.gov, search "quality assurance. Their primary purpose is for internal Ecology use, although sampling and administrative SOPs may have a wider utility. Our SOPs do not supplant official published methods. Distribution of these SOPs does not constitute an endorsement of a particular procedure or method.

Any reference to specific equipment, manufacturer, or supplies is for descriptive purposes only and does not constitute an endorsement of a particular product or service by the author or by the Department of Ecology.

Although Ecology follows the SOP in most instances, there may be instances in which Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
6/29/2018	1.1	General updates to dates, references and website throughout. Safety section update.	All	Brandi Lubliner
1/11/2024	1.2	Recertification. Only version number and date changes	All	Brandi Lubliner

1.0 Purpose and Scope

1.1 This document delineates the Department of Ecology's Standard Operating Procedure (SOP) for manually obtaining representative grab samples from a variety of stormwater conveyance systems. External users that reference this SOP are expected to describe or reference their own agency or jurisdiction safety protocols in their Quality Assurance Project Plan (QAPP), as this document describes Ecology protocols. This SOP covers the use of intermediate collection devices, but does not describe the operation of unattended automated sampling devices used to collect stormwater samples.

1.2 This SOP provides some example procedures using common methods. This SOP has two main objectives:

1.2.1 Employ standard methods to ensure comparability between data collected by different organizations and groups while using equipment from different manufacturers.

1.2.2 Collect stormwater quality samples at a single point in a stormwater conveyance that will be representative of a site's discharge.

2.0 Applicability

2.1 This SOP describes equipment selection, sampling techniques and site selection that applies to a variety of systems.

2.2 This SOP provides standardized methods for use by a variety of stormwater conveyance systems including pipes, outfalls and open ditch systems. However, in some cases, sampling procedures vary based on the type of equipment used to collect samples.

3.0 Definitions

3.1 **Automated Sampler**: A portable unit that can be programmed to collect discrete sequential samples, time-composite samples or flow-composite samples (WCD, 2007).

3.2 **Grab sample**: A sample collected during a very short time period at a single location (Ecology, 2016).

3.3 **Quality Assurance Project Plan (QAPP)**: A QAPP describes the activities of an environmental data operations project involved with the acquisition of environmental information whether generated from direct measurements activities, collected from other sources, or compiled from computerized databases and information systems (EPA, 2002).

3.4 **Intermediate Sampling Equipment**: Equipment other than the parameter-specific analytical sample bottle used to collect sample water. This equipment is typically used to collect sample water prior to pouring into the appropriate laboratory container and submitting the sample to the laboratory for analysis. Intermediate equipment can include Teflon or plastic water dippers, glass or plastic containers, Van Dorn samplers or Kemmerer Samplers. Note that equipment material must be compatible with the parameters sampled. Certain plastics should not be used when collecting some organic parameters, in

particular, oil and grease. Consult your laboratory or refer to bottle type material listed for each parameter in 40 Code of Federal Regulations (CFR) part 136.

4.0 Personnel Qualifications/Responsibilities

4.1 All field staff must be familiar with other standard operating procedures for water quality sampling and/or trained to collect representative environmental samples. This practice will ensure the sampling event is completed efficiently and cross-training on all aspects of sampling will have been completed. Staff must demonstrate a competency for sample collection using appropriate sampling equipment and techniques.

4.2 The field lead directing sample collection must be knowledgeable of all aspects of the project's QAPP and/or project goals and objectives to ensure that credible and useable data are collected. All field staff will be briefed by the Field Lead or Project Manager on the sampling goals and objectives prior to arriving to the site (Ecology, 2016).

5.0 Equipment, Reagents, and Supplies

5.1 A set of sample bottles based on the specific parameters being collected and analyzed (Refer to laboratory and/or most current version of 40 CFR part 136). A good rule of thumb is to bring a few extra sampling bottles during every sampling event.

5.2 Field filtering equipment (if applicable). Consult with your laboratory or check 40 CFR part 136 requirements (e.g., dissolved metals and orthophosphate).

5.3 Field safety equipment including safety vests and/or highly visible clothing, traffic control signs and cones or appropriate field safety forms, and a first aid kit. Refer to Safety Section 9.

5.4 Clean, non-metallic ice chest with ice and plastic barrier. (An ice barrier is a layer of plastic between the sample containers and the ice within an ice chest to prevent potential contamination from ice melt.)

5.5 Personal protective equipment including hardhats, goggles, earplugs, waders, water boots, and powder free gloves.

5.6 Decontamination equipment including distilled water, de-ionized water, wash and rinse spray bottles, appropriate detergents or pesticide grade acetone and/or nitric acid (10% solution) if applicable.

5.7 Writing instruments, driving directions, clip board, and *Rite-in Rain*™ field sheets or notebook.

5.8 Plastic tub/disposal container to collect excess rinsate from your decontamination procedure.

5.9 Water quality meters (pH, conductivity, temperature).

5.10 Miscellaneous hardware: flashlights and head lamps, shovel and brush removal tools, Allen wrench, manhole hook and sledge hammer, measuring tape, extra batteries for field instruments, dry chemical hand warmer heat packs, hand sanitizer, rope, duct tape, ty-raps (and diagonal cutter), survey tape, fluorescent spray paint.

5.11 Intermediate sampling equipment. If using Van Dorn or Kemmerer samplers, refer to Ecology's Standard Operating Procedure for Manually Obtaining Surface Water Samples, V1.3, (July 2016).

6.0 Summary of Procedure

6.1 Select a Representative Sampling Location

6.1.2 Determine the most representative site to safely collect samples and achieve project goals and objectives. The sampling location will be placed at the most downstream location that incorporates all of the targeted drainage area. Drainage areas can include urban, rural, roadways, industrial facilities and/or commercial facilities, mixed uses, or areas conveyed to or from best management practices (BMPs).

6.1.3 Prior to sample collection, review all maps, engineering drawings and reports, hydraulic and hydrology reports, and/or site logs, schedules, to determine an appropriate sampling location to understand when and where onsite activities are taking place for safe site accessibility.

6.1.4 Sampling sites should be free-flowing and not affected by backwater and/or tidal conditions. Proper selection of the sampling location assures the collection of representative samples.

6.1.5 The grab sample location must be located in an area where there is adequate mixing to assure that the samples represent water from the targeted drainage area. Sampling mid-stream in the pipe/channel is a good way to ensure collection of a representative sample If low flow conditions exist, it may not be possible to collect mid-stream in the pipe/channel. For low flow conditions, collect the entire sample stream.

6.1.6 Stormwater grab samples must be collected before the stormwater enters a receiving water body.

6.1.7 Selected sites must have ease of access for vehicles and personnel for safe sample collection activities under the full range of weather conditions that may be encountered.

6.1.8 Additional guidance for collecting grab samples from industrial and construction can be found in references 10.6 and 10.7 in the References Section of this document.

6.1.9 Once sampling locations are identified, the area will be labeled using flagging or labeling on a map with proper direction to the site.

6.2 Pre-sampling Site Visit

6.2.1 The sampling site will be inspected for identification of illegal discharges or illicit connections. The sampling location will be visited during wet and dry weather. The inspection will include an evaluation of the following:

6.2.1.1 Presence of debris

6.2.1.2 Signs of staining

6.2.1.3 Odors

6.2.1.4 Water/discharge discoloration

6.2.1.5 Unusual flows

6.2.1.6 Excessive sediment/solids deposits

6.2.1.7 Unexpected inflow pipes of unknown origin

6.2.2 A wet weather visit can provide information such as discharge flow conditions. The dry weather visit can provide information about dry weather flows, i.e., non stormwater flows. A list of criteria specific to the program objectives should be developed prior to visiting the site. A site visit log form can be developed from this list and filled out during each visit.

6.2.3 Inspect the runoff stream for adequate depth for sampling.

6.2.4 Note the following information in field note books or field data sheets:

6.2.4.1 Contributing land use drainage area

6.2.4.2 Presence/absence of illicit discharges and/or connections

6.2.4.3 All possible site hazards

6.2.4.4 Equipment needed in order to access sites (for examples tools for mechanical opening, waders or reflector vests) and equipment needed to collect the sample.

6.3 Procedure Preparation

6.3.1 Obtain proper sample bottles from the laboratory and arrange for sample analysis.

6.3.2 Gather appropriate equipment (see Equipment List).

6.4 Site Set-up Safety Procedures

6.4.1 Set up safety markers around site such as cones and lights.

6.4.2 Establish access to sampling location, such as open manhole, vault, or ditch.

6.4.3 If sampling location is in a ditch or open conveyance and wading is required, determine a safe point of entry. If deemed safe, enter just downstream of sample site.

6.4.4 Wade in a manner to avoid disturbing the sediment/solids and causing water turbidity.

6.4.5 Sampling personnel will wear chemical-resistant gloves whenever coming into contact with potentially hazardous water or chemical preservatives (NPDES SOP, 2008).

6.5 Collecting Grab Samples from BMPs

6.5.1 In cases where water directly discharges from a drainage area through a stormwater treatment BMP (detention pond, swale), sampling will be collected from discrete location(s) (inlet, outlet or both) depending on the QAPP or project goals and objectives.

6.5.2 Determine total number of inlets/outlets. If more than one inlet/outlet exists, several grab samples may be collected for better representation in order to characterize multiple inlets/outlets.

6.5.3 Ensure BMP sampling location reflects the intended sample accurately. For example, note if pre-treatment exists, and if the sampling location for inflow occurs above or below the pre-treatment. In most cases there should be no pre-treatment stormwater prior to the BMP.

6.5.4 Refer to procedures below when sampling from BMPs using sample bottles or when using intermediate equipment.

6.6 Grab Sample Collection Procedures for Direct Sampling of Stormwater without the Use of Intermediate Equipment

6.6.1. For parameter sequencing prior to filling containers, refer to 6.9 below

6.6.2 Access sampling location

6.6.3 Remove stopper/lid from sample bottle just before sampling. Be careful not to contaminate the cap, neck, or the inside of the bottle with your fingers, wind-blown particles, or dripping water from your clothes, body, or overhanging structures (Ecology, 2016).

6.6.4 If preservative is ***not*** present in the container, face container upstream and proceed as follows:

6.6.4.1 Hold the container near its base, reach out in front as far as possible, and plunge the sample bottle (mouth down) below the surface to about elbow depth if the sediment/solids will not be disturbed (Ecology, 2016).

6.6.4.2 Fill the bottle to the appropriate level depending on the analyte to be tested (Ecology, 2016).

6.6.4.3 Pour out a small volume if needed to create a headspace for mixing in the lab. Do not create a headspace for some analytes like volatile organics (Ecology, 2016).

6.6.4.4 Securely replace the lid of the container. Invert it several times to evenly mix preservative with the sample.

6.6.4.5 Rinse any large amount of dirt or debris from the outside of the container.

6.6.4.6 Refer to section 6.8 for bottle labeling and place directly on ice in appropriate storage

6.6.4.7 Put a note in the field notebook if you suspect that sand or other heterogeneous materials were not adequately represented in the sample.

6.6.5 If preservative ***is*** present in the container and you can reach the water with your hand, use the following procedure:

6.6.5.1 This procedure does not work well in forceful jets of water from drains and outfalls (Ecology, 2016).

6.6.5.2 Hold the container upright and place the lid over the mouth so that only a small area forms an opening (Ecology, 2016).

6.6.5.3 Immerse the bottle 15 cm (6 in) while holding the cap in position with your fingers as far away from the opening as possible (Ecology, 2016).

6.6.5.4 Carefully observe the rate the container is filling and remove it from the water before the headspace area is reached or overfilling occurs (Ecology, 2016).

6.6.5.5 Follow steps 6.6.4.4 – 6.6.4.7 above.

6.7 Grab Sample Collection Procedures Using Intermediate Equipment

6.7.1 For parameter sequencing prior to filling containers, refer to 6.9 below.

6.7.2 Access the sampling site.

6.7.3 Use clean, decontaminated intermediate equipment and rinse equipment with site water prior to sampling (Ecology, 2016).

6.7.4 If an *extension pole* is used with bottles securely attached, remove the lid from the sample bottle being careful not to contaminate the container and follow the procedures in Section 6.6 above (Ecology, 2016).

6.7.5 If any other type of intermediate equipment is used, reach the equipment to the mid-stream column of the discharge stream and collect a water sample.

6.7.6 Bring the sample to a clean, decontaminated area, remove the lid from each container, being careful not to contaminate the cap, neck, or the inside of the bottle with your fingers, wind-blown particles, or dripping water from your clothes, body, or overhanging structures (Ecology, 2016).

6.7.7 Gently mix the water in the intermediate container by inverting (swirling only if there is no cap) before pouring it into the sample containers and/or field filter (if applicable). Field filter any samples prior to pouring water into sample bottles (Ecology, 2016).

6.7.8 For low flow conditions, submerge the equipment into the entire sampling stream and fill bottles. You may have to repeat filling if the intermediate equipment is not able to contain all the volume needed to fill all the sample bottles. Repeat volume collection until bottles are filled.

6.7.9 Fill the sample bottles to the appropriate level depending on the analyte to be tested (Ecology, 2016).

6.7.10 Pour out a small volume if needed to create a headspace for mixing in the lab. Do not create a headspace for some analytes like volatile organics (Ecology, 2016).

6.7.11 Follow steps 6.6.4.4 – 6.6.4.7.

6.8 Labeling Sample Bottles

6.8.1 Bottles should be labeled prior to filling using permanent, waterproof marker on preprinted, waterproof labels. Label all sample bottles clearly with the following information:

6.8.2 Station number

6.8.3 Date and Time

6.8.4 Sample designation (established by the laboratory according to the parameters to be analyzed)

6.8.5 Preservatives added, if appropriate

6.8.6 Sampler's initials

6.9 Sample Processing

6.9.1 If the sample water is highly turbid, the laboratory may need to modify its analytical method for fecal coliform. Consult with the laboratory as soon as possible so they can prepare for adjustments (Ecology, 2016).

6.9.2 For details on parameter-specific bottle types, preservatives and field filtering requirements use the most recent edition of Code Federal Regulations Title 40, part 136 (40 CFR part 136) and/or obtain accurate information from your laboratory.

6.9.2.1 For ***organic*** compounds process raw samples first, followed by filtered samples. Do not field rinse bottles and chill immediately. For ***inorganic*** compounds process raw samples first, followed by filtered samples. Field rinse each bottle with same water that will fill the sample bottle (USGS, Chapter A5, 2002).

6.9.2.2 Organic constituents should be processed using the following priority order: microbiology, organic compounds (whole water or unfiltered) samples first, followed by filtered samples (**do not field rinse bottles),** volatile organic compounds, pesticides, herbicides, polychlorinated biphenyls (PCBs) and other agricultural and industrial organic compounds, total organic carbon (TOC), dissolved organic carbon (DOC), and suspended organic carbon (SOC) (USGS, Chapter A5, 2002).

6.9.2.3 Inorganic constituents should be processed using the following priority order: metals (whole water or unfiltered) samples first, followed by filtered samples, separate-treatment constituents (such as mercury, arsenic, selenium) and major cations, trace metals, mercury, major anions, alkalinity then nutrients (USGS, Chapter A5, 2002).

6.10 Sample Transport and Reporting/ Login Procedures

6.10.1 Complete Chain of Custody procedures.

6.10.2 For immediate delivery to the laboratory after sampling:

6.10.2.1 Pack samples in regular cubed or crushed ice and deliver to the laboratory (with chain of custody).

6.10.3 For next day or after weekend delivery to the laboratory:

6.10.3.1 Keep the samples at a temperature ranging between 4º C and 6º C (Ecology, 2016).

6.10.3 For samples shipped via air or ground freight service:

6.10.3.1 Pack samples using blue ice packs, loose ice in freezer bags or dry ice (check with airline prior to using dry ice for any restrictions).

6.10.3.2 Cool between 4º C and 6º C and store in a dark cooler.

6.10.3.3 Place the Chain of Custody (once completed) into a plastic bag and place inside the cooler.

6.10.3.4 Tape cooler shut and ship to appropriate laboratory address (Ecology, 2016).

6.11 Decontamination

6.11.1 Intermediate equipment (or any other re-usable equipment used for sampling) will be cleaned prior to use and after use using non-phosphorus detergents and rinsed with laboratory grade de-ionized water.

6.11.2 Do not decontaminate sample bottles prior to sample collection. If the sampled parameters require specialized cleaning of bottles, consult with your laboratory.

7.0 Records Management

7.1 *Field sheet data for each sample should include*:

7.1.1 Monitoring station location

7.1.2 Personnel - Initials of Sampling Personnel

7.1.3 Time of sample collection

7.1.4 Sample Method (i.e. intermediate equipment used or individual sample containers)

7.1.5 Field observations that could affect the quality of the samples

8.0 Quality Control and Quality Assurance Section

8.1 Quality Assurance/Quality Control (QA/QC) should be addressed on a project-by-project basis and defined in the QAPP or in project goals and objectives.

8.2 Check the bottle type and materials in the equipment used for sampling to ensure compatibility with every monitored parameter. Also, decontamination detergents and procedures must also be compatible with equipment used and parameters tested.

8.3 Keep sample containers capped during storage at the laboratory and throughout the entire sampling run, except at the exact sampling period.

9.0 Safety

9.1 There are many hazards associated with sampling stormwater. Some of these hazards include fast moving water, deep water, and steep slopes to sampling sites and hostile dogs or people. Use extreme caution when exiting vehicles, walking along busy roads and approaching your sampling site.

9.2 Safety is top priority for field staff and supervisors. Sample sites may be located on or near roads and bridges. Roadside hazards, weather conditions, accidents, and construction should be evaluated before departure (especially in winter). If the hazard is a permanent condition,

relocation of the station may be necessary. Review periodically to assist with these safety determinations.

9.3 Develop a site specific safety plan based on the Environmental Assessment Program Safety Manual (Ecology, 2016) and the Chemical Hygiene Plan (Ecology, 2018b).

10.0 References

10.1 U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 9 Handbooks for Water-Resources Investigations, National Field Manuals for the Collection of Water Quality Data, Chapter A3, *Cleaning of Equipment for Water Sampling*, 2004, Chapter A4, *Collection of Water Samples*, 2006, and Chapter A5, *Processing of Water Samples*, 2002.

10.2 Washington Conservation District, Water Monitoring Program, *Standard Operating Procedure (SOP) No. 1: Automated Water Sampling*, Version 2, July 17, 2007.

10.3 Washington State Department of Ecology, Environmental Assessment Program, *Standard Operating Procedure for Manually Obtaining Surface Water Samples*, October 2006. Version 1.3 Recertified July, 2016

10.4 Washington State Department of Ecology, *How to do Stormwater Monitoring: A guide for construction sites, Publication # 06-10-020,* November 2007.

10.5 Environmental Protection Agency Code of Federal Regulations, Title 40, Protection of Environment, July 1, 2008.

10.6 Florida Department of Protection, *FS 2100 Surface Water Sampling,* DEP-SOP-001/01, March 31, 2008.

10.7 Washington State Department of Ecology Publication #02-10-071, *How To Do Stormwater Monitoring, A Guide for Industrial Facilities*, December 2002, revised 2009.

10.8 City of Tacoma, Pierce County, Clark County and Snohomish County, NPDES Collaborative Stormwater Monitoring Program, SOP NPDES DS 2000 – *Standard Operating Procedures for the Grab Sampling of Surface Storm Water*, May 27, 2008.

10.9 U.S. Department of Transportation, Federal Highway Administration, *Guidance Manual for Monitoring Highway Runoff Water Quality*, Publication No. FHWA-EP-01-022, June 2001.

10.10 Ecology, 2016. Environmental Assessment Program Safety Manual. Olympia, WA. 168 pp.

10.11 Ecology, 2018. Chemical hygiene plan and hazardous material handling plan. Olympia, WA.