

**MISSOURI DEPARTMENT OF NATURAL RESOURCES
 DIVISION OF ENVIRONMENTAL QUALITY
 ENVIRONMENTAL SERVICES PROGRAM
 Standard Operating Procedure**

SOP#: MDNR-ESP-208 EFFECTIVE DATE: December 31, 2016

SOP TITLE: Macroinvertebrate Sampling Using a Hess Stream Bottom Sampler

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SUMMARY OF REVISIONS: Minor grammatical and format changes.

APPLICABILITY: Applies to Water Quality Monitoring Section personnel who perform quantitative sampling of aquatic macroinvertebrates in streams of Missouri.

DISTRIBUTION: MDNR Intranet
SOP Coordinator

RECERTIFICATION RECORD:

Date Reviewed:				
Initials:				

1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) provides guidance for collecting quantitative macroinvertebrate samples using a Canton modified Hess Stream Bottom Sampler (Hess Sampler) in streams (Figure 1; Canton modification, Canton and Chadwick 1984). The information contained within this SOP may be used by all Water Quality Monitoring Section (WQMS) personnel.

The design of the sampler allows for the collection of quantitative replicate macroinvertebrate samples suitable for statistical analyses. Aquatic macroinvertebrates are collected from a standardized area and depth of substrate within flowing waters. The Hess Sampler (see Figure 1) consists of an open stainless steel cylinder 16 inches (40 cm) high, 13 inches (33 cm) diameter, and enclosing an area of 133 square inches (0.086 square meter). A 9.5 X 10 inch inlet is covered with 500 x 500 micron stainless steel mesh on one side of the sampler to allow water to flow into the cylinder. A collection net of 500 x 500 microns is attached to an opening on the opposite side. The downstream net is constructed of Nitex[®] nylon in a choice of mesh sizes. It is designed to prevent escape of organisms and contamination from upstream drift. A threaded plankton bucket with a 500 x 500 micron screen is attached via an adapter to the end of the collection net and serves as a collection bottle.

2.0 SUMMARY OF METHOD

The Hess Sampler was designed for effective sampling of streams with gravel and small cobble bottoms and is generally used within shallow riffle or run sections of streams. The Hess sampler is pushed into the stream bottom to a pre-determined depth to capture organisms within the cylinder. The substrate within the sampler is then disturbed and organisms are released into the water column. Water flows through the upstream opening of the sampler, out through the downstream windows and into the collection net and bucket. Organisms that are dislodged are washed by stream current into the collection net and into the plankton bucket. Samples are rinsed from the plankton bucket with preservative into sample jars.

3.0 DEFINITIONS AND ABBREVIATIONS

- cm – centimeter
- DEQ – Division of Environmental Quality
- ESP – Environmental Services Program
- MDNR – Missouri Department of Natural Resources
- N/A – Not applicable
- SOP – Standard Operating Procedure
- WQMS – Water Quality Monitoring Section

4.0 HEALTH AND SAFETY REQUIREMENTS

- 4.1 Do not attempt to collect Hess samples when stream flow is too swift to safely stand.
- 4.2 The sample collector shall use an appropriate level of personal protection based on the specific work being done. When working in polluted streams, waterproof gloves and waders are required. If chest waders are worn, they must be properly cinched at the waist using a safety belt. All field personnel who are routinely exposed to domestic and animal waste should be vaccinated for Hepatitis A and Hepatitis B. Vaccinations are made available for personnel by the Department.
- 4.3 When working in cold conditions (cold water or cold air), a complete change of dry clothing is strongly recommended in case of accidental immersion.

Figure 1: Hess Sampler



5.0 PERSONNEL QUALIFICATIONS

Field personnel shall have a working knowledge of macroinvertebrate sampling design and collection procedures, including ESP's most current version of *Semi-Quantitative Macroinvertebrate Stream Bioassessment Project Procedure*.

6.0 SUPPLIES AND EQUIPMENT

- Hess Stream Bottom Sampler, Canton modification, with 500 micron inlet screen and net
- Plankton bucket with 500 micron screen
- Net adapter
- Sample jars (500 ml or 1 liter wide-mouth)
- Scrub brush
- Three-pronged hand cultivator
- Squeeze bottle filled with preservative for rinsing samples from plankton bucket into appropriate sample container
- Preservative (10% formalin or 80% ethanol)
- Macroinvertebrate sample labels
- Field data sheets
- Chain-of-Custody
- Hip or chest waders
- Safety belt for chest waders
- Long nitrile, rubber, or trappers gloves

7.0 PROCEDURE

- 7.1 Select sampling locations, sampling sites, and habitats to be sampled according to the objectives of the study. Sampling sites suitable for a Hess Sampler must be deep enough for water to cover the screens but not deeper than the top of the sampler (i.e., maximum water depth of approximately 10 to 13 inches, depending on depth of sampler penetration). There also must be adequate flow to flush collected organisms into the net. For these reasons the Hess Sampler is generally used only within shallow riffle or run sections of streams.
- 7.2 Prepare sampler for sample collection. Attach handles at either end of sampler for desired penetration depth of either three or six inches. A three-inch sampler penetration depth is normally used, as most macroinvertebrates within the sampler will be captured at this depth. A six-inch sampling depth may be employed to ensure that deeper dwelling organisms are captured. Attach net adapter and screw plankton bucket to adapter.
- 7.3 Position sampler for sample collection. While standing just downstream from the sampling site, face upstream and grasp the sampler by the handles and hold it just above the water surface with the collection net downstream. Sight through the sampler opening and plunge the sampler into the substrate. Using a series of clockwise-counterclockwise rotations push the sampler into the stream bottom to the desired depth of approximately three or six inches.
- 7.4 If large cobble or other objects prevent closure of the gap, attempt to remove these obstacles by hand. If the gap cannot be closed sufficiently to prevent loss of organisms, select a new site.

- 7.5 With the sampler in place, first remove any cobble and large gravel from the bottom and gently scrub off any attached animals and periphyton into the net. After cleaning, set these rocks outside the sampler. Next, using the hand cultivator, thoroughly stir the remaining contents for 30 seconds to dislodge and wash contained organisms into the net.
 - 7.6 Remove the sampler and wash any organisms adhering to the collection net into the attached plankton bucket. This is best done by taking the sampler to a nearby area of quiet water and alternately dipping and splashing water onto the side of the net until all organisms have been washed into the plankton bucket.
 - 7.7 Unscrew the plankton bucket and, using a plastic squeeze bottle containing the preservative, rinse contents into an appropriate sample container.
 - 7.8 Using a pencil, fill out an internal label that includes stream name, station, legal description, date, sample number, and replicate number or letter. Use only all-weather paper, such as "Rite in the Rain," for internal labels. Do not use ink for internal labels as ink may dissolve, especially in ethanol.
 - 7.9 Provide a matching adhesive-backed external label and attach it to the sample container. Enter the sample information on an MDNR-ESP-002, *Field Sheet and Chain-of-Custody Record* form, in accordance with the most current version and record pertinent sample information in a field notebook in accordance with the most current version of MDNR-ESP-004, *Field Documentation*.
 - 7.10 Return the sample to the laboratory for processing. Since samples are considered quantitative, 100% of the organisms may be separated from debris using microscopes at 10x magnification. The organisms will then be identified to taxonomic levels consistent with MDNR-ESP-209, *Taxonomic Levels for Macroinvertebrate Identifications*.
- 8.0 SPECIAL CONSIDERATIONS – N/A
- 9.0 QUALITY ASSURANCE/QUALITY CONTROL
- 9.1 Thoroughly rinse the sample net and collecting container between samples or replicates in order to prevent cross contamination.
 - 9.2 Collect samples from a downstream to upstream direction to minimize disturbance of organisms.
 - 9.3 Hess Samplers are typically used to collect replicate samples. A stratified random study design is usually applied. Care should be taken to ensure that water depth, substrate, and velocity conditions are relatively similar within the sampling site before randomizing samples in the riffle or run habitats.

10.0 REFERENCES

Canton S. P. and J. W. Chadwick. 1984. This is a new modified Hess Sampler. Progressive Fish Culturist 46: 57-59.

Missouri Department of Natural Resources. 2010. Field Documentation. MDNR-ESP-004. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 3 pp.

Missouri Department of Natural Resources. 2014. Field Sheet and Chain-of-Custody Record Standard Operating Procedure. MDNR-ESP-002. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 21 pp.

Missouri Department of Natural Resources. 2012. Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 29 pp.

Missouri Department of Natural Resources. 2016. Taxonomic Levels for Macroinvertebrate Identification. MDNR-ESP-209. Missouri Department of Natural Resources, Environmental Services Program, P.O. Box 176, Jefferson City, Missouri 65102. 40 pp.