DEPARTMENT OF ECOLOGY
State of Washington

Standard Operating Procedure EAP019, Version 1.2

Estimating Stream Flows Using a Flume

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Purpose of this Document

The Washington State Department of Ecology develops Standard Operating Procedures (SOPs) to document agency practices related to sampling, field and laboratory analysis, and other aspects of the agency's technical operations.

Publication Information

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Contact Information

For more information contact:

Publications Coordinator
Environmental Assessment Program
Washington State Department of Ecology
P.O. Box 47600, Olympia, WA 98504-7600
Phone: (360) 407-6764

Washington State Department of Ecology – https://ecology.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Bellevue 425-649-7000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Union Gap 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

Original Author – Stephanie Estrella
Date – March 2008

Original Reviewer – William Ehinger
Date – March 2008

Current Author – Stephen Nelson
Date – 2/28/2019

Current Reviewer – Stephanie Estrella
Date – 3/4/2019

QA Approval – Arati Kaza, Ecology Quality Assurance Officer

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SIGNATURES AVAILABLE UPON REQUEST

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. 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 the Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Revision History	Summary of changes	Sections	Reviser(s)
03/13/2008	1.1	Updated equipment list, summary of procedures, and records management	5.0, 6.0, 7.0	S. Estrella
2/24/2016	1.1	Recertified	All	B. Kammin
2/25/2019	1.2	Accessibility changes	All	S. Nelson
7/29/19	1.2	Formatted for publication; added cover page & minor edits	All	J. Ponzetti

Environmental Assessment Program

Standard Operating Procedure for Estimating Stream Flows Using a Flume

1.0 Purpose and Scope

This document is the Environmental Assessment Program's Standard Operating Procedure (SOP) for estimating stream flows with a flume. These data may be used to quantify changes in stream flow over time or in response to ecosystem disturbances.

2.0 Applicability

This document was developed as a stream flow estimation procedure for the Type N Experimental Buffer Treatment (Type N) Study. The procedure may be applicable for other studies assessing stream flow in freshwater streams using a flume.

3.0 Definitions

3.1 EAP: Environmental Assessment Program

3.2 Quality Assurance Project Plan: A written plan that describes how a study will be conducted and its results assessed.

3.3 Type N: perennial and seasonal non-fish-bearing streams under Washington State's current stream typing system (WAC 222-16-030).

4.0 Personnel Qualifications/Responsibilities

4.1 Knowledge of the contents of this SOP.

4.2 This document supplements but does not replace the need for on-the-job training. Field staff responsible for maintaining equipment and downloading data from the datalogger must first receive training from the project or field lead. The field lead is responsible for ensuring that all field staff follow appropriate procedures while downloading data.

4.3 For installation, field staff should be familiar with the pressure transducer and flume manufacturer's installation manual. Field staff should also be comfortable using basic power tools if recommended by the manufacturer's instructions.

4.4 Staff charged with reviewing data for quality control and assurance must have training before accessing and using the Forest Technology Systems (FTS) StreamTrac/Auto Caller software.

4.5 EAP staff who conduct stream flow data downloads and equipment maintenance are responsible for complying with this SOP and the requirements of the EAP safety manual, particularly Chapter 1 "General Field Work" and the following sections of Chapter 2: "Measuring Flows in Rivers and Streams," "Using Hand or Power Tools," and "Driving on Logging Roads" (Ecology 2019).

5.0 Equipment, Reagents, and Supplies

- Accura-Flo Parshall Flume, Montana style, or equivalent—see Appendix A for manufacturer specifications
- Pressure transducer—Ott Messtechnik pressure sensor OTT PS 1 or equivalent
- Electrical conduit pipe, 1.5 inch diameter
- Datalogger—FTS Axion H2 datalogger or equivalent
- Batteries—Two 12-volt valve-regulated lead acid batteries (one battery for installation, plus an extra to swap out and charge between visits)
- Enclosure—FTS enclosure for Turbidity Threshold Sampling station or equivalent. Example enclosure from FTS.[1]
- 8 GB USB flash drive
- Data management software—FTS StreamTrac/Auto Caller software or equivalent
- 6′ × 6′ camouflage netting (if necessary)
- CB radio (if visiting stations requires driving on one-lane logging roads)
- Jaw scoop for pet waste (used for clearing sediment and debris from stilling well in flume)

6.0 Summary of Procedure

6.1 Install a flume at the downstream end of the study basin per manufacturer's instructions (for an example see Appendix A) as shown in Figure 1. Installation will require at least two people, but additional workers may be necessary depending on the size of the flume and width of the stream. In most cases, four people are required to safely lift and carry the flume to the stream. Installed flumes will remain in place until the associated project has ended or destroyed by natural causes (in which case, the flumes must be removed or replaced).

[1] https://ftsinc.com/hydrology/products/weather-monitoring-enclosures/water-quality-enclosure/

Figure 1. Flume installed in a Type N study stream. A pressure transducer housed within the conduit and stilling well measures stage height.

6.2 Install a pressure transducer following the manufacturer's instructions (Ott Messtechnik no date). The vertical position of the sensor should be the same as that of the flume crest or the streambed. If not, record the offset and adjust the data post-process. Use a conduit or other device to protect the sensor (**Error! Reference source not found.**). Secure the apparatus to a stilling well or another stable structure.

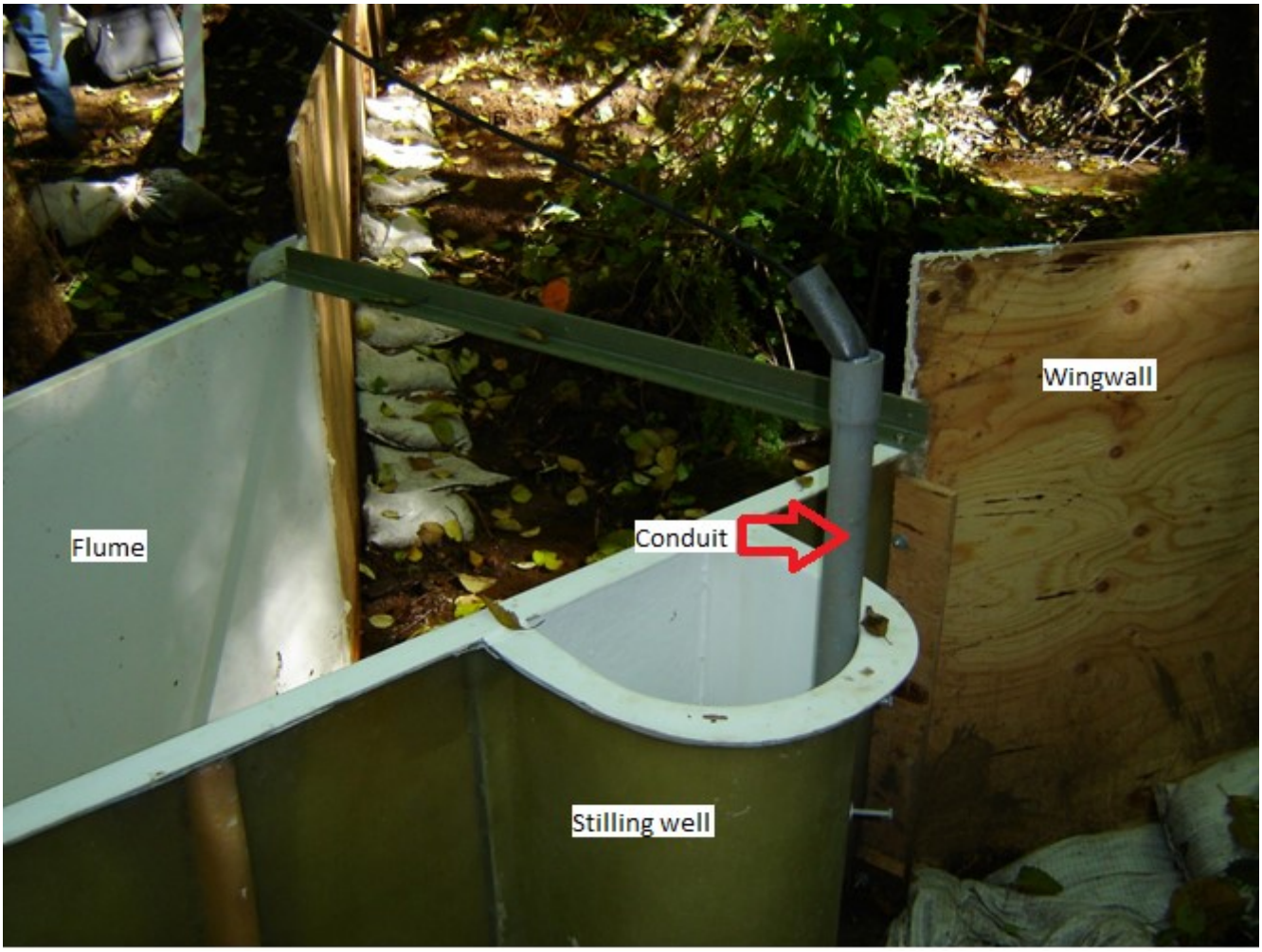

Figure 2. Pressure transducer and conduit in a Type N study stream. Cable ties secure the pressure transducer within the conduit. Holes drilled into the base of the conduit allow water exchange. Bolts secure the conduit to a stilling well and flume.

6.3 Plug the pressure transducer into a datalogger (**Error! Reference source not found.**). Plug the datalogger into a battery. House the electronic components in an enclosure.

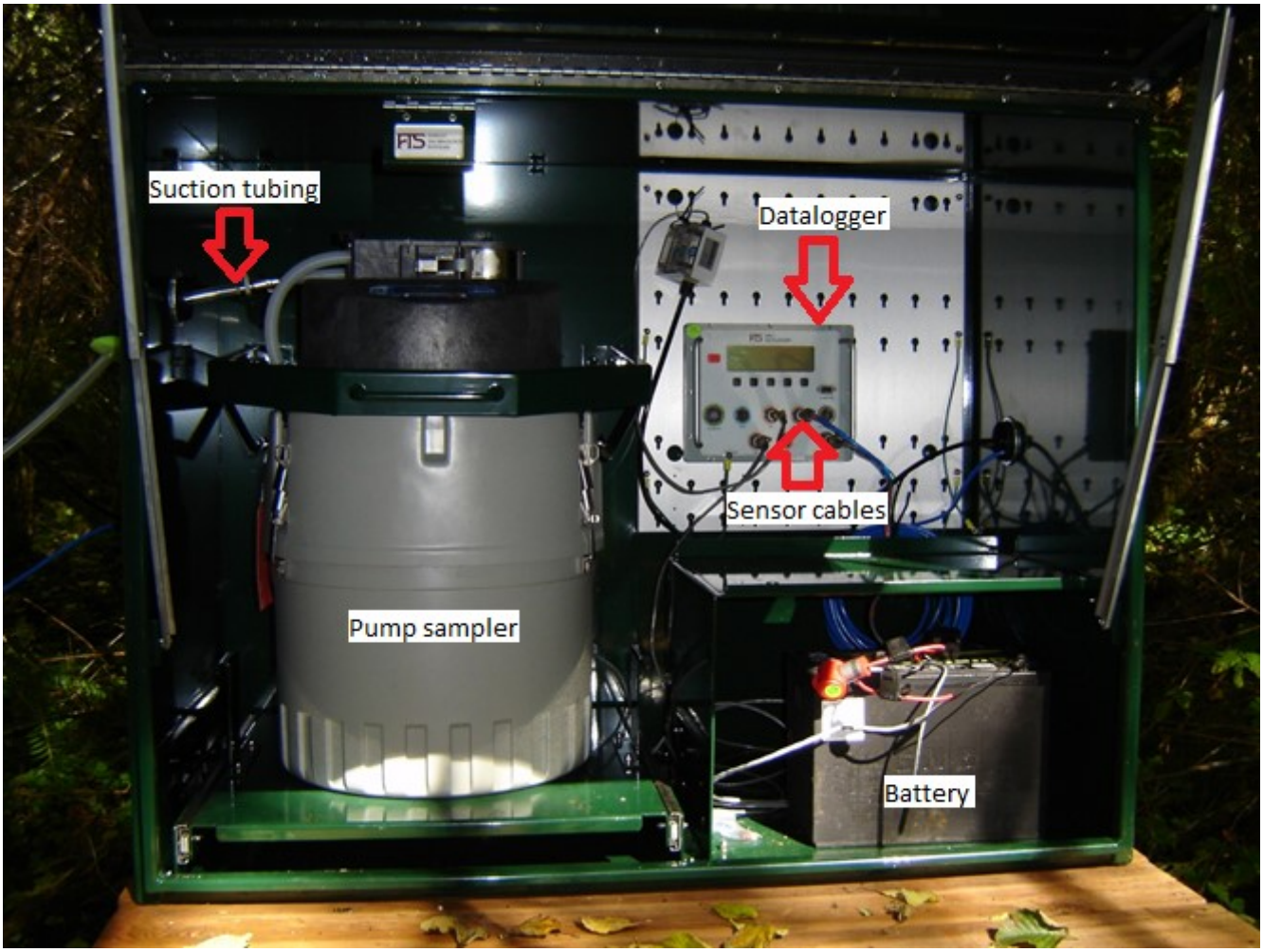

Figure 3. Datalogger with attached components. The pressure transducer cable is connected to the datalogger via a SDI-12 port. The datalogger obtains stage height readings from the pressure transducer at specified intervals.

6.4 Program the datalogger using the Axiom H2 touch screen to record stage height at specified intervals.

6.5 If the enclosure is visible from any roads or trails, cover the enclosure with camouflage netting.

6.6 Visit the study site every 6 weeks to maintain the sensor, flume and stilling well, download data using a USB flash drive, and replace batteries. Sensor maintenance includes removing accumulated sediments from the flume and from inside the stilling well (using a jaw scoop to reach the bottom of the stilling well), resecuring the sensor if needed, remeasuring the sensor offset, and replacing the desiccant in the cable interface. Return the sensor to the manufacturer every three to five years for recalibration.

6.7 Use the stage height versus flow relationship for the flume to calculate stream discharge and estimate mean daily flows.

7.0 Records Management

7.1 Once back from the field, transfer the raw data on the USB flash drive to the appropriate folder on the Y drive (internal Ecology drive). Store the raw data at least until the end of the project.

7.2 Maintain data in the FTS StreamTrac/Auto Caller database or equivalent (database is housed on the SQL server ecybeap under database name FTSData).

8.0 Quality Control and Quality Assurance

8.1 Ensure that site visit data forms are completely filled out in the field (water quality site visit datasheets, available on the Y drive, shared files, Type N Soft Rock folder).

8.2 Staff trained in the use of the FTS StreamTrac/Auto Caller software must upload raw data into the database, then check all data for accuracy and completeness.

9.0 Safety

9.1 File a field work plan on the Ecology SharePoint site and send a copy to the unit supervisor or substitute before commencing field activities.

9.2 Be aware of potential hazards in the field. Hazards include heavy lifting; animals; hunting activity; weather; steep, slippery or uneven terrain; and falling branches or trees.

9.3 Use a CB radio to communicate with other traffic on one-way logging roads. See "Driving on Logging Roads" in Chapter 2 of the EAP Safety Manual (Ecology 2019).

9.4 All field staff are required to complete and maintain First AID/CPR certification.

10.0 References

10.1 Ott Messtechnik. No date. Operating Manual Pressure Sensor OTT PS 1. Ott Messtechnik, Kempten, Germany. 27 pp.

10.2 Ecology [Washington State Department of Ecology]. 2019. Environmental Assessment Program Safety Manual.

11.0 Appendix A. Accura-Flo Parshall Flume Specifications and Installation Requirements

Plastic Laminate: Isophthalic resin reinforced with fiberglass

Tensile strength at break: 17,000 PSI min, ASTM D638

Flexural strength: 30,000 PSI min, ASTM D790

Flexural modulus of elasticity: 12,000,000 PSI min, ASTM D790

Glass Content: 30% minimum

All Surfaces: Sealed with 15 mils of smooth white gel coat

Concrete Anchor Clips (optional): Fiberglass

Stilling Wells (optional): Same as flume

Bubbler Tube (optional): Type 304 Stainless Steel

Staff Gages (optional): White with black markings; graduated in feet and tenths of feet. Integrally molded in flume wall.

Wall thickness: Standard 1/4" nominal, 3/8" for large flume wall surface.

Flumes shall be supplied with integral Foam Reinforcing Ribs and Top Stiffener Angles as required by flume size.

The Parshall flume is intended for use in open channels such as irrigation ditches. Use extreme care when adapting Parshall flumes for use with round pipes. The flume's crest is usually set at an elevation higher that the floor of the upstream channel. A variety of factors influence the selection of the crest elevation. When designing a metering station, it is best to follow the recommendations of a knowledgeable professional in the field.

Parshall flumes may be set in earth or concrete or bolted to companion structures using the 2-inch flange provided on each end. When pouring concrete, it is advisable to brace the flume internally with 2" × 4" blocks cut to size. This temporary bracing will prevent bulging of the sidewalls. Remove the braces after the concrete has set.