DEPARTMENT OF ECOLOGY
State of Washington

Standard Operating Procedure EAP119, Version 1.3

Watershed Health Monitoring: Thalweg Profiling

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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.

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Washington State Department of Ecology

Environmental Assessment Program

Watershed Health Monitoring Program: Standard Operating Procedures for Thalweg Profiling

Version 1.3

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EAP119

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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. 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.

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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	Rev number	Summary of changes	Sections	Reviser(s)
2/24/17	1.1	Removed draft dates, changed title, added footers, updated glossary terms and references, genereal formatting	All	Meghan Rosewood-Thurman
2/28/17	1.2	Reworded following removal of layout SOP citations. Added sentence about sizes being specific to this SOP Reworded last sentence Reworded 2nd sentence Noted that 10 depths are required Noted that 10 depths are required Added link	2.1 3.6 6.1 Note 6.2 6.2.1.2 6.3.1.1 10.17	Glenn Merritt
2/28/17	1.3	Fixed formatting on 3.15.1.1.1	3.0	Meghan Rosewood-Thurman
2/28/17	1.3	Certified	All	Tom Gries

Environmental Assessment Program

Watershed Health Monitoring Program: Standard Operating Procedures for Thalweg Profiling

1.0　　　　**Purpose and Scope**

1.1　　　　This document is the Environmental Assessment Program's (EAP) Standard Operating Procedure (SOP) for Measuring Thalweg Depth for the Watershed Health Monitoring (WHM) Program. This method explains how to collect 100 incremental depth measurements within the thalweg across the length of a WHM sample site. It also describes how to assess the presence of bars, edge pools, and side channels. Observations in this method will be associated with 100 equally spaced thalweg stations in the main channel.

2.0　　　　**Applicability**

2.1　　　　This SOP should be followed when performing data collection events (DCEs). It applies to DCEs performed for either of the WHM Protocols: the Narrow Protocol or the Wide Protocol. We discuss this SOP's use in the Wide Protocol as if floating downstream on a raft, although shallow rivers may be waded upstream to perform the Wide Protocol.

3.0　　　　**Definitions**

3.1　　　　Bankfull stage: This stage is delineated by the elevation point of incipient flooding, indicated by deposits of sand or silt at the active scour mark, break in stream bank slope, perennial vegetation limit, rock discoloration, and root hair exposure (Endreny, 2003).

3.2　　　　Bar: Dry or exposed portions of the streambed. For this method, we are only counting bars that have water on both sides. Figure 1 below provides an example. Bars are lower in elevation than the bankfull stage (islands are higher).
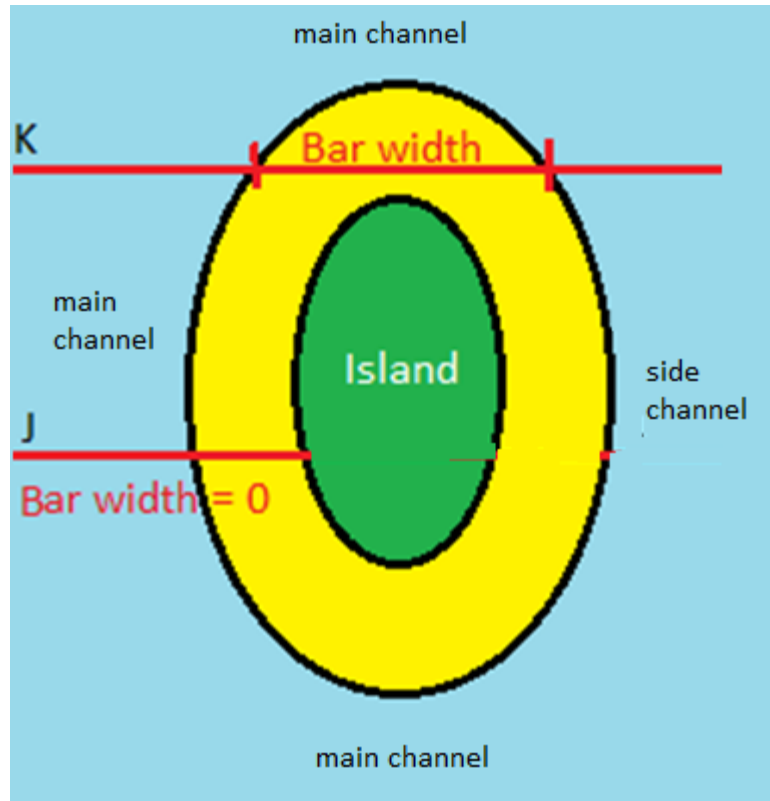
Figure 1. Example transects for recording bars. J has no bar. K does.

Note: *Boulders that rise above the water surface are recorded as bars (with a qualifying note on the field form that indicates the bar is boulder(s) of noted size(s).*

3.3　　DCE: The *Data Collection Event* is the sampling event for the given protocol. Data for a DCE are indexed using a code which includes the site ID followed by the year, month, day, and the time (military) for the start time of the sampling event. For example: WAM06600-000222-DCE-YYYY-MMDD-HH:MM. One DCE should be completed within one working day, lasting 4-6 hours, on average.

3.4　　EAP: Environmental Assessment Program

3.5　　Ecology: The Washington State Department of Ecology

3.6　　Edge pool: Slow water located at the edge of the wetted channel (but connected) where velocity is slow and often in a separate direction from the main flow (Figure 2). We have specific size criteria in this SOP. To be considered an edge pool, the channel must extend 0.5m back from the main channel and be at least 30cm in depth. Examples of edge pools include backwater pools, secondary channel pools, or alcoves (see Armantrout, 1998 or Landers et al, 2002) that meet the size criteria described above.

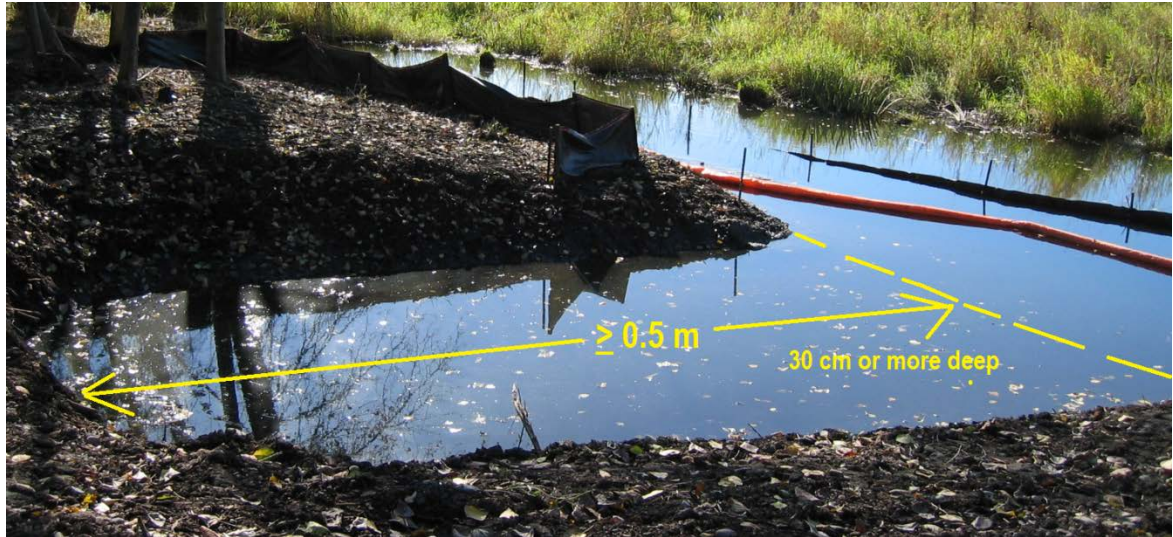**Note:**　*Edge pools must have a wetted connection to the main channel.*

Figure 2. Edge pools must extend back ≥ 0.5 m from the main channel and must extend below the surface ≥ 30 cm. (Image modified from NOAA , 2013).

3.7   Main channel: Channels in a stream are divided by islands (dry ground that rises above bankfull stage). Main channels contain the greatest proportion of flow.

3.8   Major Transect: One of 11 equidistant transects across the length of a site. These transects run perpendicular to the thalweg and are labeled as follows: A (furthest downstream), B, C, D, E, F, G, H, I, J, and K (furthest upstream).

3.9   Minor transect: One of 10 equidistant transects across the length of a site that is sampled using the Narrow Protocol. Each minor transect is located midway between major transects. Minor transects are A5, B5,C5, D5, E5, F5, G5, H5, I5, and J5.

3.10   Narrow protocol: The set of Watershed Health Monitoring SOPs that describe data collection at wadeable sites with an average bankfull width of less than 25m at the index station.

3.11   Protocol: A collection of SOPs used to accomplish a DCE. Watershed Health Monitoring uses two protocols: The *Narrow Protocol* is used for sampling wadeable streams that are less than 25m average bankfull width. The *Wide Protocol* is used for rivers or streams that are wider than 25m average bankfull width or too deep to wade.

3.12   QAMP: Quality Assurance Monitoring Plan. The QAMP for WHM is Cusimano *et al* (2006). An updated version is in early stages of development.

3.13   Side channels: Channels in a stream are divided by islands (dry ground that rises above bankfull stage). Side channels are those that contain less flow than the main channel.

3.14 Site: A site is defined by the coordinates provided to a sampling crew and the boundaries established by the protocol's site layout method: SOP EAP105 (Hartman, 2017) for the Wide Protocol and SOP EAP106 (Merritt, 2017) for the Narrow Protocol. Typically, a site is centered on the index station and equal in length to 20 times the average of 5 bankfull width measurements. Sites cannot be longer than 2 km nor shorter than 150m. Narrow protocol sites range from 150m to 500m long. Wide Protocol sites are up to 2km long and most-frequently longer than 500m . The most downstream end of a site coincides with major transect A; the most upstream end coincides with major transect K.

3.15 Station: Any location within the site where an observation is made or part of a sample is collected.

3.16 Thalweg: Path of a stream that follows the deepest part of the channel (Armantrout, 1998). For WHM, we emphasize Armantrout's use of the word "path" because the thalweg longitudinal profile excludes (sometimes deeper) side pools that are not part of the dominant flow path.

3.17 Thalweg depth: Water depth in the thalweg. This is measured at 100 equally spaced stations in a site.

3.18 Thalweg station: One of one hundred (100) equidistant measurement locations in the thalweg, across the length of a site. For example the thalweg stations at/above each major transect are named as follows:

- A0, A1, A2, A3, A4, A5, A6, A7, A8, A9,
- B0. B1, B2, B3, B4, B5, B6, B7, B8, B9,
- C0, C1, C2, C3, C4, C5, C6, C7, C8, C9,
- …
- J0, J1, J2, J3, J4, J5, J6, J7, J8, J9, and
- K0.

3.19 WHM: Watershed Health Monitoring. A status- and trends-monitoring program within the Environmental Assessment Program at the Washington State Department of Ecology.

3.20 Wide protocol: The set of WHM SOPs that describes the sample and data collection at non-wadeable sites or sites wider than 25m bankfull width. It is an abbreviated version of the Narrow Protocol and is typically accomplished by use of rafts.

4.0 **Personnel Qualifications/Responsibilities**

4.1 This SOP pertains to all Environmental Assessment Program field staff collecting and entering data for WHM.

4.2 All field staff must comply with the requirements of the EAP Safety Manual (Ecology, 2017).

4.3 All field staff must have completed the annual WHM field training and be familiar with both WHM protocols: *Narrow Protocol* and *Wide Protocol.* Training includes sampling goals and objectives as defined in the QAMP.

4.4 Field staff must be annually trained to minimize the spread of invasive species. See SOP EAP070 (Parsons et al., 2016).

4.5 Field staff should know how to identify bankfull stage. Below are some useful resources:

- Hydrologic Processes: Bankfull Discharge (EPA, 2012)
- Identifying Bankfull Channel Edge Part 1 (Grizzell, 2008a)
- Identifying Bankfull Channel Edge Part 2 (Grizzell, 2008b)
- A Guide for Field Identification of Bankfull Stage in the Western United States (Leopold et al. , 1995)
- Flfuvial Geomorphology Module, UCAR COMET Program and NOAA River Forecast Center (Endreny, 2003)

5.0 General Equipment and Supplies

5.1 Tablet (charged) with WHM e-forms.

5.2 Measuring devices (measuring rod, 50m tape, laser rangefinder)

5.3 Wading/rafting gear (pre-cleaned of organisms; see Parsons et al., 2016)

5.4 Paper (waterproof) version of field data forms with number 2 pencil and clip board

6.0 Summary of Procedure

6.1 While traversing the length of the site to perform a DCE, including identification of habitat units SOP EAP120 (Merritt, 2017b), measure water depth at equally spaced stations along the thalweg profile. Identify the presence or absence of edge pools and bars. Count the number of side channels that run adjacent to each thalweg station.

Note: *This procedure is derived in large part from field methods of the Environmental Monitoring and Assessment Program (EMAP) Western Pilot (see field manuals in Stoddard et al., 2005). Some of the SOP is also derived from Moberg (2007).*

6.2 For the **Narrow Protocol**, wade up the main channel. At each major transect, start a new *Thalweg Page* (Figure 3) for the given transect. The data to be recorded include thalweg depth (wetted whole cm), and the presence of bars, edge pools, and side channels (by quantity). The form is also used to document habitat units, but that is discussed in SOP EAP120: *Quantifying Habitat Units for Watershed Health Monitoring* (Merritt, 2017b). Upon reaching the 5th thalweg station, complete the *Minor Transect Page* (Figure 4).

6.2.1   <u>Measure **thalweg depth**</u> at 10 thalweg stations at/above each major transect (A-J).

6.2.1.1   Divide the site length by 100 to determine spacing (to tenth of a meter) between thalweg stations. For example, if the site length is 150 meters, thalweg stations should be 1.5 meters apart. Begin depth measurement at the major transect (e.g., A0) then proceed upstream (e.g., A1…A9).

6.2.1.2   At each thalweg station measure wetted depth (cm) in the thalweg. Record that value on the *Thalweg Page* (Figure 3), next to the appropriate station name.

               Note: *Thalweg depths are **required for all 10 thalweg stations**. Depths are sometimes difficult to measure, but make your best estimate and write good notes about your estimation method.*

Main	WAM06600-007350-DCE-2014-0630-20:34	

Thalweg A	Thalweg	Large Woody Debris

	Depth (cm)				Habitat Unit		Side Channel Count				Notes
A.0	140	Bar	Edge Pool	None	1 ⌄	... ⊕	0	1	2	**3+**	
A.1	85	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.2	58	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.3	112	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.4	110	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.5	108	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.6	108	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.7	100	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.8	112	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	
A.9	66	Bar	Edge Pool	None	1 ⌄	... ⊕	**0**	1	2	3+	

General Thalweg Note:

Figure 3. An example *Thalweg Page* for data recorded between thalweg stations A0 and A9.

6.2.2   At each thalweg station, note if mid-channel **bars** are adjacent by pressing *Bar*.

6.2.3   At each thalweg station, note if **edge pools** are adjacent by pressing *Edge Pool*.

6.2.4   At each thalweg station, note the absence/presence (and count) of **side channels**

6.2.4.1   If side channels are absent, press the 0 button

6.2.4.2   If 1 side channel runs next to the main channel, press the 1 button.

6.2.4.3   If 2 side channels run next to the main channel, press the 2 button .

6.2.4.4   If 3 or more side channels run next to the main channel, press the 3+ button.

6.2.5   Complete the *Minor Transect Page* (Figure 4) when you reach each **minor transect**.

6.2.5.1   Measure widths: **bankfull width, wetted width, and bar width**, each to the nearest tenth of a meter. Measure using the same technique that was used for *major* transects SOP EAP113 (Lemmon, 2017a).

6.2.5.2   Measure compass **bearing** as described in SOP EAP123 (Hartman, 2017b).

6.2.5.3   Assess the **substrate size** at each of 11 points across the bankfull channel, from SOP EAP114 (Lemmon, 2017b).

   Note: *Substrate depths are not required at the minor transects.*

Figure 4. An example of the *Minor Transect Page*, completed upon reaching thalweg station 5.

6.3   For the ***Wide Protocol***, float down the main channel starting at thalweg station J9. At thalweg stations at/above each major transect, start a new *Thalweg Page* (Figure 5), for the given transect. The data to be recorded include thalweg depth (wetted whole cm), and the presence/absence of bars, edge pools, and side channels (by quantity). The form is also used to document habitat units, but that is discussed in SOP EAP120, *Quantifying Habitat Units for Watershed Health Monitoring* (Merritt, 2017b).

Figure 5. An example *Thalweg Page* for data recorded between Thalweg stations J9 and J0 when floating downstream.

6.3.1   <u>Measure **thalweg depth**</u> at 10 thalweg stations at/above each major transect (J-A).

6.3.1.1   Divide the site length by 100 to determine spacing (meters) between thalweg stations. Begin depth measurement at thalweg station 9 then proceed downstream to 0 (e.g., J9…J0).

At each thalweg station, measure wetted depth (cm) in the thalweg. Record that value on the *Thalweg Page* (Figure 5), next to the appropriate station name.

Note: *Thalweg depths are **required for all 10 thalweg stations**. Depths are sometimes difficult to measure, but make your best estimate and write good notes about your estimation method.*

6.3.2	At each thalweg station, note if mid-channel **bars** are adjacent by pressing *Bar*.
6.3.3	At each thalweg station, note if **edge pools** are adjacent by pressing *Edge Pool*.
6.3.4	At each thalweg station, note the absence/presence (and count) of **side channels**
6.3.4.1	If side channels are absent, press the 0 button
6.3.4.2	If 1 side channel runs next to the main channel, press the 1 button.
6.3.4.3	If 2 side channels run next to the main channel, press the 2 button .
6.3.4.4	If 3 or more side channels run next to the main channel, press the 3+ button.

Note: *Do not collect measurements at minor transects when performing the Wide Protocol.*

7.0 Records Management

7.1	Refer to the SOP EAP125 called *Managing Electronic Data Forms with a Mobile Data-Collection Device* (Janisch, 2017). Complete data collection for a DCE while on site.
7.2	Be sure to keep handy a set of paper (waterproof) forms with pencil and clip-board that can be used as contingency.

8.0 Quality Control and Quality Assurance

8.1	PROJECT QA/QC is discussed in the Quality Assurance Monitoring Plan (Cusimano et al., 2006), which is in the process of being updated.
8.2	SAMPLING PRECISION: Repeat the sampling for 10% of all sites per year per Status and Trends Region. Timing of replicates should be several weeks or more later than initial samples (as far apart in time as possible but within the same index period).
8.3	SAMPLING ACCURACY: Persons using this SOP must either attend the annual training event (June), or be trained by someone who did.
8.4	REPRESENTATIVENESS:
8.4.1	Site verification should be finalized on the same day that all other data are collected for the DCE.
8.4.2	Random sample sites must always correspond with streams on the sample frame represented by the statistically-derived coordinates for X. The site must always contain (between Transect A and Transect K) the elevation for the X coordinates.
8.4.3	The stream represented on the frame must also correspond in geometry with a single NHD reach.

9.0 Safety

9.1   All field staff must comply with the requirements of the EAP Safety Manual (Ecology, 2017).

10.0   References

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