DEPARTMENT OF
ECOLOGY
State of Washington

Standard Operating Procedure EAP057, Version 1.2

Conducting Stream Hydrology Site Visits

February 2019
Publication 19-03-209

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

This SOP is available on the Department of Ecology's website at https://fortress.wa.gov/ecy/publications/SummaryPages/1903209.html.

Ecology's Activity Tracker Code for this SOP is 15-060.

Recommended citation:
Myers, J. 2019. Standard Operating Procedure EAP057, Version 1.2: Conducting Stream Hydrology Site Visits. Washington State Department of Ecology, Olympia. https://fortress.wa.gov/ecy/publications/SummaryPages/1903209.html.

Contact Information

For more information contact:

Publications Coordinator
Environmental Assessment Program
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

Standard Operating Procedure for Conducting Stream Hydrology Site Visits

Author - Jason Myers
Date - 3/26/2009

Revision Author – Tyler Burks
Date- 12/04/2018

Reviewer- James R Shedd
Date - 12/04/2018

QA Approval – Arati Kaza, Ecology Quality Assurance Officer
Date - 12/04/2018

Signatures on File

APPROVED: June 4, 2009
RECERTIFIED: 12/04/2018

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 Ecology uses an alternative methodology, procedure, or process.

SOP Revision History

Revision Date	Rev number	Summary of changes	Sections	Reviser(s)
08/10/2015	1.1	Updated Safety Section	8.0	Jim Shedd
08/10/2015	1.1	Updated References	9.0	Jim Shedd
08/10/2015	1.1	Recertified	All	Bill Kammin
12/04/2018	1.2	Overall edits	All	Tyler Burks
12/04/2018	1.2	Recertified	All	Arati Kaza
2/22/2019	1.2	Accessibility and formatting updates	All	Ruth Froese

1.0 Purpose and Scope

1.1 This document is the Environmental Assessment Program (EAP) Standard Operating Procedure (SOP) for conducting stream hydrology flow monitoring site visits.

2.0 Applicability

2.1 This document describes the procedures used when visiting a Department of Ecology stream hydrology monitoring site.

3.0 Definitions

3.1 FMU - Freshwater Monitoring Unit

3.2 ADCP - Acoustic Doppler Current Profiler

3.3 PST – Pacific Standard Time.

3.4 GMT - Greenwich Mean Time. This is Pacific Standard Time (PST) plus 8 hours.

3.5 ADV- Acoustic Doppler Velocimeter

3.6 Logger/Recording Gage - Typically, an automated bubbler or pressure transducer measures and records the stage to an electronic data logger, maintaining a continuous record of stage through a specified period of time. The bubbler or transducer is calibrated to match the primary gage index.

3.7 Terminal end - The end of the pipe that emits an air bubble to detect water pressure.

3.8 Point of Zero Flow - Stage at which water ceases to flow over the control. The point of zero flow is the lowest point on the control.

3.9 Control - The physical features of a stream that control the relationship between stage and discharge at a gage site.

3.10 Gage Height - Often this term is used interchangeably with stage. However gage height is more appropriately used to indicate the water surface observed on a particular indices. (Rantz et al., 1975).

3.11 Stage - The height of the water surface above a datum (Rantz et al., 1975).

3.12 Laser Beam Elevation - The elevation of the plane of the laser emitted by the laser instrument.

3.13 Primary Gage Index - The primary gage index (PGI) is the base gage for the station and is directly referenced to the recording gage. The primary gage index is the most stable and reliable gage at a site. All other gages at a station are considered secondary gage indices.

3.14 Secondary Gage Index - Secondary gage indices are used to confirm the primary gage index. The secondary gage is used to estimate the value of the primary gage if the primary gage is damaged or missing.

4.0 Personnel Qualifications/Responsibilities

4.1 Personnel using this SOP should have training and field experience in making stream-gage site visits, recording and documenting pertinent data on the Stream Gage Logger Notes form and Gaging Station Log form. Personnel should have familiarity with other relevant Environmental Assessment Program SOPs.

5.0 Equipment, Reagents, and Supplies

5.1 Copies of EAP-FMU Stream Gauge Logger Notes form (ECY 070-183) and the Gaging Station Log form (ECY 070-330)

5.2 Necessary equipment for types of actions performed while at a flow site (ADCP, ADV, repair equipment, batteries, etc.).

6.0 Summary of Procedure

Figure 1 An example of a Fresh Water Monitoring Unit Flow Monitoring Station (Photo by Washington Dept. of Ecology)

6.1 Trip preparation

6.1.1 Department of Ecology staff should refer to the Pre/Post Field Excursion Checklist (attachment A) as well as the Vehicle and Equipment Checklist (attachment B) when preparing for a stream hydrology site visit.

6.2 Site Visit

6.2.1 Park near the station in a safe location. Set up appropriate traffic control and safety devices as outlined in EAP's Safety Manual (EAP, 2017).

6.2.2 Check station exterior, sensor deployment infrastructure, and gage indices for damage.

6.2.3 Make a PGI observation prior to checking the logger. Upon each site visit, at the very minimum, a primary gage and other stage observations are noted. See the SOP (EAP042) Measuring Gage Height of Streams (Shedd, 2018) for more detailed instructions on gage measurements.

6.2.4 When visiting a flow monitoring site, use the EAP-FMU Stream Gauge Logger Notes form (ECY 070-183) to record important information as seen on attachment C. Notes are filled out completely with ALL relevant information.

6.3 Stream Gage Logger Notes Form (Front - See Attachment C)

6.3.1 Sta. Name: Fill in the name associated with the station location.
Example: Sta. Name Dungeness River near Mouth

6.3.2 Sta. No. : Fill in the unique six-digit alphanumeric assigned site I.D.
Example: Sta. No. 18A050

6.3.3 Party: Fill in last name(s) of personnel visiting site.
Example: Party Burks/Clishe

6.3.4 When filling out the form, begin in the left-hand vertical column. Fill out additional readings in the subsequent columns.

6.3.4.1 Make additional/multiple readings during the following circumstances; before and after a flow measurement is taken, if the site visit is for an extended period of time, before and after any infrastructure repairs or adjustments, or when there is a rapid change in stage.

6.3.5 Date: Note the month, day, and year observations are being made.
Example:

DATE	11/07/2018	11/07/2018			

6.3.6 Time: Note Pacific Standard Time (PST) for each reading using a 24hr clock. Associate or conduct all observations to the nearest 15-minute interval.
Example:

TIME (PST)	13:45	14:30			

6.3.6.1 When first turning on the data logger, the previously logged value is available upon startup. If it is close to the next 15-minute observation, wait for the automated value to log.

6.3.7 Logger: Note the current stage reading on the data logger if at a telemetry or stand-alone site. For instructions on finding stage readings on the various loggers see specific model manuals or SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).
Example:

LOGGER	5.98	5.96			

6.3.8 Staff: Take a staff reading, if present, at the start of the visit, as well as at the conclusion of the visit, at minimum. If a discharge measurement is conducted, gage indices are measured as close to the start and end of the measurement. Note the average water level and any wave action or "bounce" affecting an accurate reading. Note a positive and negative range of the variation above and below the average.

Example:

STAFF	$5.99^{+-0.03}$	5.97			

6.3.9 Wire Weight: Use wire weight gage, if present, to note water surface elevation. See SOP (EAP042) Measuring Gage Height of Streams (Shedd, 2018 Sect. 6.4) for instructions on WWG use.

Example:

WIRE WEIGHT	23.86	23.88			

6.3.10 Check Bar: Note the check bar distance after using the wire weight gage. The check-bar value is read on the counter and disc, and will be the same if the datum and cable length have remained constant.

Example:

CHECK BAR	49.22	49.22			

6.3.11 Tape Down: Note the Tape Down measurement of the water surface height if one is present at the site. Enter this value under TAPE DOWN in the space provided in the Stream Gauge Logger notes. Use a numerical reference to specify the estimated amount of error due to wind or wave action.

6.3.11.1 Corr. Factor: Note the number usually written on the tape housing that accounts for the offset from the end of the tape and the length of the weight. Enter this value under CORR. FACTOR in the Stream Gauge Logger Notes.

6.3.11.2 Corrected TD: Add the correction factor to the tape down, and enter the sum to CORRECTED TD in both spaces provided in the Stream Gauge Logger Notes.

6.3.11.3 TD RP Elevation: Enter the reference point elevation, typically written on the door of the station house, in the space labeled TD RP ELEVATION on the note form.

6.3.11.4 = WS ELEV@TD: Subtract the corrected tape down from the reference point elevation to give the datum-relative water surface elevation. Enter this value under = WS ELEV@TD on the note form.

TAPE DOWN	18.97	$18.99^{+-0.05}$			

CORR. FACTOR	0.37	0.37			
CORRECTED TD	19.34	19.36			
TD RP ELEVATION:	25.33	25.33			
CORRECTED td	19.34	19.36			
=WS ELEV@TD	5.99	5.97			

6.3.12 The FMU uses a self-leveling laser level as another method of determining stage height. For more detailed instructions on determining stage heights using a laser level, refer to SOP (EAP042) Measuring Gage Height of Streams (Shedd, 2018).

6.3.12.1 Before determining stage height using a laser level, you must confirm the laser beam elevation. Record the established rod reading and the observed rod reading for each laser level reference mark in the LL RM spaces in the lower right corner of the Stream Gauge Logger Notes form.
Example:

	ELEVATION	READING
LL RM1	**2.37**	**2.37**
LL RM2	**0.88**	**0.88**
LL RM3	**3.62**	**3.62**

6.3.12.2 LASER: STADIA ROD READING: Note the height of the laser beam on the stadia rod, and any uncertainty in reading the laser illumination on the stadia rod (i.e. rod reading +/- *n* ft.).

6.3.12.3 - WATER SURFACE, ROD READING: Observe and record the water-surface level on the stadia rod. Note fluctuations or bounce of the water surface against the stadia rod.

6.3.12.4 =DIFFERENTIAL, LASER TO WATER SFC: Subtract the WATER SFC. ROD READING from the LASER: STADIA ROD READING to give the DIFFERENTIAL

6.3.12.5 LASER BEAM ELEVATION: Fill in the laser beam elevation. The laser beam elevation is the elevation of the pad plus the difference between the laser beam plane and the bottom of the laser level instrument mounted on the pad. It is important to distinguish between the elevation of the pad and the laser beam plane. If using a standard FMU laser level the laser beam elevation, including the difference in laser beam height and laser pad, is usually noted on the station door.

6.3.12.6 - DIFFERENTIAL: Fill in the differential calculated between laser and water surface.

6.3.12.7 = STAGE: Subtract the DIFFERENTIAL from the LASER BEAM ELEVATION to get the STAGE.

LASER:STADIA ROD READING	$6.25^{+/-0.01}$	$8.62^{+/-0.02}$			
- WATER SURFACE, ROD READING	$0.34^{+/-0.02}$	$2.69^{+/-0.02}$			
=DIFFERENTIAL, LASER TO WATER SFC	5.91	5.93			
LASER BEAM ELEVATION	11.90	11.90			
- DIFFERENTIAL	5.91	5.93			
= STAGE	$5.99^{+/-0.03}$	$5.97^{+/-0.04}$			

6.3.12.7.1 Uncertainty in observation of the LASER STADIA ROD READING and WATER SURFACE ROD READING should be compounded and included in the final recorded laser level STAGE observation.

6.3.13 At sites where additional parameters are recorded, such as air and water temperature, appropriate quality checks are made using a thermistor and noted in degrees Celsius.

6.3.13.1 The thermistor used for quality checks of continuous field deployed thermistors needs to be quality assured according to standards established in SOP (EAP011)- Instantaneous Measurements of Temperature in Water (Dugger and Ward, 2017), prior to leaving for the field.

6.3.13.2 Make a note of which quality assured thermistor was used on the field trip next to the observations made.

6.3.14 Water Temp: This space is used to note the water temperature on stations equipped with water temperature sensors and a logger. For instructions on finding temperature readings on various loggers see specific model manuals or SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).
Example:

WATER TEMP	12.6

6.3.15 Thermistor: The FMU uses a thermistor to record the temperature, as close as is safely possible to where the temperature sensor is deployed in the stream or river and nearest to the logged 15-minute interval.
Example:

THERMISTOR	12.5

6.3.16 Air Temp: This space is used to note the air temperature on sites equipped with air thermistor and a logger. For instructions on finding temperature reading on various loggers, see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).
Example:

AIR TEMP	24.4

6.3.17 Thermistor: Measure the air temperature near the station's air probe if one is present and note it nearest to the logged 15-minute interval.
Example:

THERMISTOR	24.2

6.4 Stream Gauge Logger Notes Form (Back - See attachment C)

6.4.1 Batt V: Note the current battery voltage. For instructions on finding battery readings on various loggers, see specific model manuals or SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).
Example: Batt V 12.3

6.4.1.1 Min: Note the minimum battery voltage listed on the logger.
Example: Min 11.6

6.4.1.2 Max: Note the maximum battery voltage listed on the logger.
Example: Max 12.9

6.4.1.3 Batteries are replaced when the minimum voltage drops below 11.2v. Damage to batteries and loss of transmissions begins when the voltage is at or below 10.9v.

6.4.1.4 Reset Stats: Circle Y (yes) or N (no) to indicate if the stats were reset during the station visit. Stats track the maximum and minimum battery voltages and number of logger resets between visits. It is important to reset the stats at each visit. For instructions on finding stat readings on various loggers, see specific model manuals or SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.4.1.5 Batt replaced: Circle Y or N to indicate if the battery(s) was replaced during the site visit. When replacing batteries, fill out the battery voltage history form attached to the battery. This is used to track a battery's ability to hold a charge and life expectancy.

6.4.2 GOES Time OK: When visiting a real-time station, check the GOES time. GOES time is used for synchronizing satellite data transmissions. GOES time is set to GMT (Greenwich Mean Time) and is synchronized to within two seconds to

avoid overlapping data transmissions. For directions on locating or correcting GOES time, see SOP (EAP072) - Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.4.3 Data downloaded: Circle Y or N to indicate if data was downloaded from stations with a data logger. During most site visits, data is downloaded directly to a PCMCIA card or USB thumb drive. If a stream discharge measurement is planned during the visit, data is downloaded at the conclusion of the measurement.

6.4.4 .New file erased Y/N: On stations using WaterLOG ® data loggers the .New data file is downloaded. Indicate whether the file was erased after downloading. For more details, see the SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.4.5 Desiccant condition: Note the condition of the desiccant used to keep the electronic components dry. The desiccant consists of color-changing silicone that turns from blue to purple to pink as it becomes saturated with moisture.

6.4.5.1 Circle Y or N to indicate if the desiccant was changed.

6.4.6 CSG checked Y/N: Some stations are equipped with Crest Stage Gages. A crest-stage gage is a vertical section of pipe that has water intake holes located in close proximity to the station. When visiting a site after a high flow event, circle Y/N to indicate if the CSG is checked. Take off the top cap from the crest-gage pipe and lift out the wooden staff. Use an engineer's measuring tape to measure from the bottom of the stick to the cork dust line. Note this in the space HWM _____ FT ON STICK on the back of the Stream Gauge Logger Notes form and any uncertainty in this observation. Take note of the elevation of the reference point in the space REF ELEV_____ FT. Note the sum of the high water mark and the reference mark elevation, and note in the =HWM ELEV_____FT space. This is the crest-stage height. For more detailed information, see SOP (EAP042) Measuring Gage Height of Streams (Shedd, 2018).

6.4.6.1 Circle Y or N next to Added cork if cork was added to the CSG.

6.4.7 Remarks: This section is used to note any relevant information pertaining to the station or site conditions that was not contained in the rest of the form.

6.5 Gaging Station Log (Attachment D)

6.5.1 At sites with continuous loggers there are Gaging Station Log forms inside the station house (See attachment D). Staff and/or basin support should populate each field of this form during each site visit to the best of their ability. This form is a summary of information noted on Discharge Measurement Notes (Shedd, 2017) and the Stream Gage Logger Notes previously discussed. It is useful to fill this form out at the end of a site visit to ensure that nothing was overlooked.

6.5.2 Station name: Fill out the name associated with the site.

6.5.3 Station Number: Fill in the unique six-digit alphanumeric assigned site I.D.

6.5.4 Water Year: Fill out the current water year. These forms are replaced at the beginning of the water year or whenever full.

6.5.5 Fill out the form down the vertical column once per site visit. Typically the arrival observations are entered along with a summary of the discharge measurement.

6.5.6 Party: Fill in the initials of the staff or basin support visiting the site.

6.5.7 Date: Note the month, day, and year notes are being made

6.5.8 Time: Note Pacific Standard Time (PST) arrival observations using a 24hr clock.

6.5.9 PGI: Primary Gage Index- note the primary stage reference used to monitor stage. The primary gage index can vary at different stations between a staff gage, laser level, or wire weight.

6.5.10 SGI: Secondary Gage Index- note the secondary stage reference used to monitor stage.

6.5.11 Aux: Auxiliary gage— typically a crest-stage gage used to verify stage maximums and high water marks; measured shortly after high-water events. In some cases, the aux is a "tertiary" gage index, for example, a scenario where a staff and laser level exist, but a tape down is also measured.

6.5.12 Logger: Note the stage reading from the data logger at your arrival time. For instructions on finding logged stage reading on various loggers see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.13 H_2O Temp.: Note the water temperature on stations equipped with temperature capabilities.

6.5.14 Air Temp.: Note the air temperature when at stations equipped with air temperature logging capabilities.

6.5.15 Thermistor: Note the temperature using a calibrated thermistor; measure as close as safely possible to the sensors that are recording to the data logger.

6.5.16 Batt. V: Note the current battery voltage. For instructions on finding battery readings on various loggers, see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.17 Replaced? (Y/N), V.: Write Y or N to indicate if the battery(s) was replaced during the site visit. If the battery was replaced, note the new battery voltage. Remember to fill out the battery tracking form attached to both the new and replaced batteries.

6.5.18 Download (Y/N): Note Y or N to indicate if data was downloaded from stations with a data logger.

6.5.19 Purge (Y/N): Indicate whether a manual purge was performed. Manual purges are performed when a plug in the orifice line is suspected. This is often associated with very high logger readings that do not match gage readings. For instructions on performing a manual purge, see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.20 Synced (Y/N): For stations that employ older version GPS radios, it is necessary for the logger to sync their GPS clocks. This is necessary to avoid overlapping the data transmission time blocks between individual stations. Loggers will typically display the date of the last sync. For stations with newer GOES radios and Trimble GPS antennas or with syncing disabled, the display will read as xx/xx or 00/00. If there are known GPS syncing problems, verify that GOES time is accurate to within two seconds. Manually set the GOES time (GMT - 8hours), if needed, but do not attempt to sync the system. For specific instructions on setting GOES time see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

Trimble GPS Antenna (Photo courtesy of Trimble)

6.5.21 System Resets: Note the number of system resets if there are any. For instructions on finding the system resets see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.22 Batt. V (Min/Max): Note the current battery voltage. For instructions on finding battery readings on various loggers see SOP (EAP072)- Basic Use and

Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.23 The following section of notes is normally filled out solely by Department of Ecology personnel unless otherwise requested by the basin lead.

6.5.24 Reset Stat Screens (Y/N): Circle Y or N to indicate if the stats were reset during the station visit. Stats track the maximum and minimum battery voltages and number of logger resets between visits. It is important to reset the stats at each visit. For instructions on finding stat readings on various loggers see SOP (EAP072)- Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment (Bookter, 2016).

6.5.25 Measurement (Y/N): Note Y or N to indicate if a flow measurement was taken during the station visit. If a measurement was taken, continue to fill out the blanks below. If a measurement was not taken, fill out an explanation on the backside of the form under Remarks section.

6.5.26 MGH: Note the Mean Gage Height or the gage height that is used for the rating.

6.5.27 Measured Q: Note the measured or average measured discharge in cfs (cubic feet per second)

6.5.28 Professional Rating: Note the field rating given to the flow measurement. This rating is subject to change once reviewed, but best professional judgment should best used when determining the rating at the time. This is usually classified as either excellent (2%), good (5%), fair (8%), poor (over 8%). For more detailed information on rating flow measurements, see SOP (EAP056) - Measuring and Calculating Stream Discharge (Shedd, 2017). Notes explaining the rating are made in the Remarks area on the backside of the form.

6.5.29 Method: Note what instrument was used to conduct the flow measurement. (ADCP, ADV 0.2/0.6/0.8, mechanical meter) These notes are useful to aid in determining what equipment to use at different stages during future site visits.

6.5.30 Location: Describe where the measurement cross section was located. If more room is needed, continue in the Remarks section on the back.

6.5.31 Max Depth: Note maximum depth encountered during measurement.

6.5.32 Max Velocity: Note the maximum velocity encountered during the measurement. The Max Depth and Max Velocity notes are useful in determining if a cross section is wadeable and what type of measurements are made in future.

6.5.33 PZF: Note if a point-of-zero-flow measurement was taken. For instruction on measuring a PZF, see SOP (EAP056) - Measuring and Calculating Stream Discharge (Shedd, 2017).

6.5.34 Control: Note a detailed description of the control type (section, channel, flood plain) and composition (gravel bar, log, rocky outcrop, etc.). Also note information such as distance below gage, condition of the control (partially or fully submerged, debris pile up, effects of vegetation, etc.). Staff should refer to SOP (EAP056) - Measuring and Calculating Stream Discharge (Shedd, 2017). for instructions to accurately describe controls.

6.5.35 Remarks: This section is used to fill in extra information worth noting. This can include information that would not fit on the front portion of the form or a further explanation of a preceding notation. This section is also used to pass on relevant information to the next person visiting the site. This can include unusual flow conditions (ice, weed growth, debris jams), upgrades, maintenance or repairs done to station components, reports of vandalism, reports of station problems, and notes of when surveys were completed.

7.0 Records Management

7.1 Personnel should use the Stream Gage Logger Notes form ECY 070-183 (Rev. 4/17) (Attachment C) to note all applicable information. These forms are returned to the basin lead, with accompanying flow measurement notes if taken, after each site visit.

7.2 The Gaging Station Log form ECY 070-330 (5/10) (Attachment D) is filled out until each column is used and returned to basin leads for input to databases.

8.0 Quality Control and Quality Assurance

8.1 Senior staff, through the senior-level review process evaluates all submitted records and data analyses materials for accuracy and compliance with the methods presented in this document.

9.0 Safety

9.1 All EAP safety policies are followed when obtaining conducting site visits. Refer to the *EAP Safety Manual* (2017, page 43-44) for further information about working in and around streams.

9.2 Personal Flotation Devices are required for persons working in or near streams.

9.3 ANSI/ISEA 107-2004 Class II certified reflective vests or apparel are required while working on bridges and near roads.

9.4 Always consider the safety and traffic situations when obtaining gage heights from a bridge, and take appropriate actions, including suspension of the activity if unsafe conditions exist. Consult the *EAP Safety Manual* (2017, page 37-41) for further guidance regarding bridge safety.

9.5 When operating laser levels, do not stare into the beam or direct the beam at other persons. Check the path of the beam and ensure there is no danger of inadvertently pointing the beam at people in the vicinity.

10.0 References

10.1 Bookter, Andy. 2016. Standard Operating Procedure of Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment. Version 2.0, Washington State Department of Ecology, Olympia, WA SOP Number EAP072 www.ecology.wa.gov/quality

10.2 Dugger, Dan, and Ward, William. 2017. Standard Operating Procedure for Instantaneous Measurements of Temperature in Water. Version 1.2, Washington State Department of Ecology, Olympia, WA SOP Number EAP011, Publication No. 17-03-201 https://fortress.wa.gov/ecy/publications/SummaryPages/1703201.html

10.3 Environmental Assessment Program, 2017. Environmental Assessment Program Safety Manual, March, 2017. Washington State Department of Ecology, Olympia, WA.

10.4 Rantz, S.E., and others. 1975. Measurement and Computation of Streamflow: Volume 1. Measurement of Stage and Discharge. United States Geological Survey Water-Supply Paper 2175

10.5 Shedd, James R. 2017. Standard Operating Procedure for Measuring and Calculating Stream Discharge. Version 1.3, Washington State Department of Ecology, Olympia, WA SOP Number EAP056 www.ecology.wa.gov/quality

10.6 Shedd, James R. 2018 Standard Operating Procedure for Measuring Gage Height of Streams. Version 1.2, Washington State Department of Ecology, Olympia, WA SOP Number EAP042 www.ecology.wa.gov/quality

Attachment A:

PRE/POST FIELD EXCURSION CHECKLIST

Before embarking in the field all FMU staff must:

1. Arrange for lodging (if necessary).
2. Update outlook calendar indicating basin location and duration of trip.
3. Prepare current rating curve sheets for basin.
4. Notify basin contacts (if necessary).
5. Prepare field/float plan form with emergency contact information for specific trip location and duration.
6. Check the van packing lists and pre-trip vehicle inspection before embarking from the Operations Center.

Pre-Trip Vehicle Inspection:

1. Inspect tires for wear/damage on both sides of sidewall. Check tire pressure as well.
2. Check fluid levels (oil, transmission, windshield washer, and radiator) before embarking in order to minimize possible breakdowns.
3. Make sure that the vehicle safety equipment is packed and that a spare tire, jack, and lug wrench are in the van and in working order.
4. If any of these listed items are not in satisfactory working order, please notify Oliver Brock as soon as possible. Do not embark with a vehicle that is in need of service or that is damaged

Upon return from the field:

End of Day-

If staying at a hotel, notify your contact person each evening that you are finished with field sampling, so they do not initiate the rescue protocol. If your trip is only a day trip, refer to end-of-trip protocol.

End of trip-

- Fill vehicle with fuel before returning to the Operations Center.
- Upon return to the Operations Center, please unload your gear and measuring equipment .
- Don't forget to download Flow-Tracker files to your laptop.
- Unload spent batteries and carefully refill them with DI water, if needed.
- Place spent batteries on appropriate chargers after servicing them.
- Load spent desiccant (packs or loose crystals) into appropriate drying ovens and confirm that the oven temperatures are set at the predetermined levels correctly.
- Hang any wet ropes in their designated locations to dry.
- Store ADCP's in their designated locations, tethered to the wall to prevent falling over.
- Clean the interior of the van (if needed). Wash vehicle, if possible.
- Close field/float plan, and notify contact person that your trip is over.

Attachment B:

Vehicle and Equipment Checklist

Standard Vehicle Equipment:

These equipment are present anytime the vehicle is used.

- Cell Phone and Charger

Vehicle Folder containing

- Mileage Logs
- Emergency Information
- Fuel Card
- Maps

Safety Equipment

- First Aid Kit
- MUTCD compliant Safety Vests (2)
- CG Approved PFD (1 per person)
- PFD CO_2 Refill
- Road Cones
- Signs
- Hard Hats (2)
- Orange Strobe

Tools / Other

- Mechanic's Toolbox
- Shovel
- Loppers/Clippers/Machete
- Tire Chains
- 2- 150 ft. Ropes
- Spare Key
- Jack, jack handle, adequate spare
- Flashlight
- Lighter
- Electrical Tool Box
- Pens
- Pencils
- Note Paper
- Flagging Tape
- Orange Spray Paint
- Spare Bucket

Standard Flow Gear

Flow Box:

- Weighted Tape for Tape Down
- Tag Line
- 300 ft. Transect Tape
- Line Clamps
- Swoffer Kit w/ Cables and Fans
- Swoffer Meter
- Bridge Depth Sounding Correction Sheets (2/10, 6/10, 8/10's)
- Survey Pins and Hammer
- Flow Tracker
- Wading rod
- Laser Level
- Stadia Rod
- Thermistor (QC vs. NIST following Dugger and Ward, 2017)
- Spare Batteries for All Devices
- Battery Chargers
- Discharge Measurement Sheets

Station Visit

- Forms ECY 070-330 and ECY 070-183
- PCMCIA card and/or USB Drive
- Multi-meter
- Logger Menu Flow Chart
- Desiccant
- Station and required gate keys
- Appropriate DCP Batteries

ADCP Gear

- ADCP Unit
- MobileDemand Tablet (CHECK BATTERY STATUS)
- Tow Ropes and Carabiners
- ADCP Data Sheet

Bridge Gear (If Needed)

- Lead Flow Weights, all sizes
- Bridge Board
- T-bar
- Reel w/ Swoffer Cable

3-Wheel Crane

- Reel
- Crane Assembly

4-Wheel Crane

- HS Meter Box
- Props
- Meter Body w/Fiber-Fin
- Cleaning Solution
- Lubricant
- Reel
- Crane Assembly/Boom
- Counterweights
- Wheel Chocks

Personal Equipment

- Water
- Food
- Dry Clothes
- Rain Gear
- Sunscreen
- Gloves
- Waders/Hip Boots
- Up to Date Ratings Sheets
- Maps/Station Directions
- Notebook w/ Extra Data Sheets

Decontamination Equipment

- To Be Determined

Attachment C (front):

Washington State Department of Ecology

EAP-FMU Stream Gauge Logger Notes

Sta. Name_____

Sta. No. _____ **Party** _____

DATE					
TIME (PST)					
LOGGER					
STAFF					
WIRE WEIGHT					
CHECK BAR					
TAPE DOWN					
CORR. FACTOR					
CORRECTED TD					
TD RP ELEVATION:					
CORRECTED td					
=WS ELEV@TD					
LASER: STADIA ROD READING					
- WATER SURFACE, ROD READING					
= DIFFERENTIAL, LASER TO WATER SFC					
LASER BEAM ELEVATION					
- DIFFERENTIAL					
= STAGE					
WATER TEMP				ELEVATION	READING
THERMISTOR			LL RM1		
AIR TEMP			LL RM2		
THERMISTOR			LL RM3		

ECY 070-183 (Rev. 4/17)

Attachment C (back):

Batt V _____ Min _____ Max _____

Reset Stats Y/N Batt replaced Y/N

GOES Time OK Y/N

Data downloaded Y/N .NEW file erased Y/N

Desiccant condition _____ Changed Y/N

CSG checked Y/N

HWM _____ ft on stick + Ref Elev _____ ft

= HWM Elev _____ ft. Cleaned Y/N

Added cork Y/N

Remarks: _____

Attachment D (front):

DEPARTMENT OF ECOLOGY
State of Washington

Washington State Department of Ecology
Gaging Station Log

Station Name:_____ Station Number:_____ Water Year:_____

Party												
Date												
Time												
Logger												
SGI												
Aux												
PGI												
H_2O Temp.												
Thermistor												
Air Temp.												
Thermistor												
Batt. V												
Batt. V. (Min/Max)												
Replaced? (Y/N), V.												
Download (Y/N)												
Purge (Y/N)												
Synced (Y/N)												
System Resets												
Reset Stat Screens (Y/N)												
Measurement (Y/N)												
MGH												
Measured Q												
Professional Rating												
Method												
Location												
Max Depth												
Max Velocity												
PZF												
Control (location, condition, etc.)												

ECY 070-330 (5/10)

Attachment D (back):

Party												
Date												
Remarks (Flow conditions, additional tasks performed, etc.)												