


AUTHORIZATIONS

Title	Name	Signature
SOP Author	Emily Brazil	
Program Manager	Joshua Wert	
Division Quality Assurance Manager	Patrick Schuett	

QUALITY CONTROL/QUALITY ASSURANCE DOCUMENTATION

Title: Collection of Physical Habitat Data in Wadable Rivers and Streams
 Type: Standard Operation Procedure #7.23
 Version: 1.0
 Date: 01/30/2025
 Author: Emily Brazil

REVISION HISTORY

Revision	Change Description	Date	Authorization
1.0	Document Creation	01/30/2025	

ACKNOWLEDGEMENTS

(Place to acknowledge peer reviewer)

THIS PAGE LEFT INTENTIONALLY BLANK

Table of Contents

1.0 SCOPE AND APPLICABILITY	2
2.0 SUMMARY OF METHOD.....	2
3.0 HEALTH AND SAFETY WARNING	2
4.0 CAUTIONS	2
5.0 INTERFERENCES.....	3
6.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES	3
7.0 EQUIPMENT AND SUPPLIES.....	3
8.0 PROCEDURE.....	4
9.0 DATA AND RECORDS MANAGEMENT	6
10.0 QUALITY ASSURANCE AND QUALITY CONTROL.....	6
11.0 REFERENCES	6

APPENDIX A. Field Reporting Forms

APPENDIX B. SOP Acknowledgement and Training Form

1.0 SCOPE AND APPLICABILITY

This document presents the North Dakota Department of Environmental Quality, Division of Water Quality's (DWQ) Standard Operating Procedure (SOP) for collecting physical habitat measurements in wadable rivers and streams in North Dakota. This SOP applies to all DWQ field staff, non-DWQ cooperators, and citizen volunteers.

2.0 SUMMARY OF METHOD

Physical habitat measurements are important in understanding the functioning of a stream. Physical habitat measures help put biological and chemical data into a context of the stream's morphology and insight into possible human disturbance. Measurements such as incision height can hint at possible head cutting due to dams or drainage ditching. Canopy cover and overhanging bank width measurements can offer insight to available fish cover. Riparian buffer widths can show how close human land use abuts the stream's edge.

The following procedures have been developed primarily from the modification of the protocols found in the EMAP Western Pilot Study: Field Operations Manual for Wadable Streams (Peck et al. Draft).

3.0 HEALTH AND SAFETY WARNING

Field personnel should be aware that hazardous conditions potentially exist at every waterbody. If unfavorable conditions are present at the time of sampling, the sample visit should be rescheduled. If hazardous weather conditions arise during sampling, such as lightning, personnel should cease sampling and move to a safe location.

Field personnel should also be aware of wildlife, insects, and plants that could be harmful as well as heat stroke and hypothermia. A first aid kit should be accessible for any potential cuts, stings, bites, or contact with poisonous plants. Also ensure there is access to water, sunscreen, insect repellent, and extra clothing. An AED should be accessible in case of emergencies.

4.0 CAUTIONS

PHAB is typically conducted at the end of a sampling event. The river has been walked through multiple times; care should be taken when measuring depth that the stadia rod is not placed into a hole made by previous footprints. Be cautious and aware of vegetation, insects, and wildlife that could be present around the site and when taking measurements.

5.0 INTERFERENCES

Note all factors that may affect the water sample such as high winds/wave action, cattle in water, observed flow, water surface, water clarity, water color, water odor, visual algae cover, number of dead fish, present weather, estimated inches of rain fall in past 72 hours, and any other comments that may be of interest.

6.0 PERSONNEL QUALIFICATIONS/RESPONSIBILITIES

All personnel collecting physical habitat measurements must read this SOP annually and acknowledge they have done so via a signature page (see Appendix B). New field personnel must also demonstrate successful performance of the method. The signature page will be signed by both trainee and trainer to confirm that training was successfully completed and that the new personnel is competent in carrying out this SOP. The signature page will be kept on-file at DEQ along with the official hard copy of this SOP.

7.0 EQUIPMENT AND SUPPLIES

- ☐ Clipboard
- ☐ Physical Habitat Forms (Appendix A)
- ☐ Rapid Bioassessment Habitat Visual Assessment Forms (Appendix A)
- ☐ Black Pens
- ☐ Surveyor Rod (metric) (Stadia Rod)
- ☐ 50 m Fiberglass Measuring Tape
- ☐ Orange Surveyor Flags labeled A – K
- ☐ Handheld Global Positioning Unit (GPS)
- ☐ Clinometer
- ☐ Convex Spherical Densiometer
- ☐ Equipment Vest
- ☐ Waders
- ☐ Personal Flotation Devices
- ☐ Wading Stick or Pole (Optional)

8.0 PROCEDURE

Physical Habitat Measurements Collection

1. Lay out the sampling reach. Locate the X-site coordinates with a handheld GPS unit if the site is predetermined or determine the coordinates of the center of the reach to be sampled. Take at least five (5) channel measurements considered to be “typical” upstream and downstream of the X-site. The reach length is 40 times the average width (minimum reach length is 150 m and maximum is 500 m). The site may be slid about the X-site to avoid sampling obstacles, but the X-site must still fall within the sample reach. The only time an X-site may be outside the sample reach is when targeted reference and impaired sites are being sampled. These sites may be slid outside the X-site coordinates as long as the reach is still in the target population. Be sure to record the new coordinates at the middle of the reach when sliding reaches outside the X-site.
2. The sample reach is divided into 11 transects each spaced 4 stream widths apart (15 m minimum and 50 m maximum). Starting at farthest downstream transect, transects are labeled from “A” to “K”. Orange surveying flags labeled “A” to “K” are used to label each transect when laying out the reach. The X-site, when the site is not adjusted for obstacles, will fall at “F”. At each of the 11 transects a series of measurements will occur
3. Bank measurements are taken at each transect. Bank measurements include wetted width, bar width, bankfull width, bankfull height and incision height. Wetted width is measured across and over mid-channel bars and large rocks. When there are mid-channel bar(s) measure the width(s) and recorded the total width under bar width. Bankfull is defined as the channel that is filled by moderate-sized flood events that occur every one to two years. Evidence for finding bank full include obvious slope breaks, transition from stream sediment to vegetation, moss growth on rocks, drift debris on banks or vegetation and transition zones from flood tolerant vegetation to flood intolerant vegetation. Bankfull height is the height of the determined bankfull from the water’s surface. Bankfull width is measured from bankfull boundary on the left bank to the bankfull boundary on the right bank. Incision height can be the same, but bankfull is NEVER higher than incision height.

4. Depth, substrate size and embeddedness are evaluated at each transect. This is done at five points located at 0, 25, 50, 75 and 100 percent of the wetted width. These points are recorded as the distances from the left bank. These percentages are called Left, Left - Center, Center, Right - Center and Right starting from the left bank wetted edge on the Physical Habitat Field Sheet (Figure1). REMINDER: left bank is on the left-hand side when the flow is at your back or facing downstream. Substrate selection is accomplished by placing the measuring rod at each point and determining the substrate directly beneath it. Size classes are listed on the Physical Habitat Field Sheet (Appendix A). For particles larger than sand, estimate the amount of embeddedness by examining the substrate. Look for breaks in the surface staining, markings or algae growth. By definition, sand and fines are 100 percent embedded and bedrock and hardpan are 0 percent embedded.
5. Bank morphology measurements are taken at each transect on the right and left banks. These measurements include bank angle, undercut bank width and riparian vegetation width. Bank angle is measured by laying the surveyor's rod or measuring stick down on the bank with one end on the wetted edge. Put the clinometer on the rod and read the angle. Vertical banks will be 90 degrees; gradual banks will be < 90 degrees and undercut banks will > 90 degrees. Undercut banks will be measured by turning the clinometer over (it only reads 0-90 degrees) and reading the angle and subtracting it from 180 degree. Undercut width will also be measured on undercut banks. Undercut width is the distance from the water's edge to the point where a vertical plumb line from the bank's edge would touch the water's surface. Also, submerged undercut banks will be measured by reading the amount of measuring rod hidden when it is thrust under the bank. Riparian vegetation width is measured from the vegetative edge nearest the water until the first visible sign of significant vegetative disturbance. This can be row crops, extensive grazing, mowed pasture, a road, etc. If the distance recorded is greater than the 50 m tape estimate the buffer and mention in comments on the form.
6. Vegetative canopy measures are taken at each transect on the left and right bank wetted edge and in the center of the stream facing toward the left and right bank and upstream. A convex, spherical densiometer is taped to limit the grid to 17 intersects. Readings can only be 0 – 17/ The densiometer is held level (using the bubble level) at 0.3 m (1 ft) above the water's surface and positioned so your

face is reflected below the apex of the “V.” Count the grid intersections if any vegetation (tree, grass, shrub, etc.) covers the intersection.

7. A large woody debris tally is taken throughout the entire reach. This tally only includes woody material at least 10 cm (approx. 4 in.) in diameter and at least 1.5 m (approx. 5 ft) in length. This includes only woody debris within (even partially) or spanning above the active channel (a.k.a. the bankfull width).
8. Complete a visual habitat assessment of the sample reach. The habitat assessment methodology follows the Rapid Bioassessment Habitat Assessment described by Barbour et al. (1999).
9. Complete a site field sheet. This includes field chemistry, photographs and a site drawing. The site drawing should include a map of the reach recording in-stream attributes (riffle, pools, bends, trees, etc.), manmade structures, bank attributes, surrounding land use and vegetation. Be sure to indicate north, the direction of flow and approximate locations of each transect. Photographs should be at minimum one upstream and one downstream picture at the X-site.

9.0 DATA AND RECORDS MANAGEMENT

Data collected will be recorded on the field forms (Appendix A). Data recorded on the field forms should be entered into the NDDEQ Ecological Data Application System (EDAS) database throughout the sampling season, when time allows. Field notes should be used to record any quality control activity performed such as measurements taken by more than one sampler, or to record any sampling conditions that may have interfered with the measurements such as cattle in water, observed flow, water surface, water clarity, water color, water odor, visual algae cover, number of dead fish, present weather, estimated inches of rain fall in past 72 hours, and any comments. Field forms and notes should be stored in the appropriate project folder at DEQ.

10.0 QUALITY ASSURANCE AND QUALITY CONTROL

Two re-visit sites will be assessed for QAQC purposes.

11.0 REFERENCES

Barbour, M. T., J. Gerritsen, B. D. Snyder, and J. B. Stribling. 1999. Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Macroinvertebrates and Fish, Second Edition. EPA/841/B-99/002. U. S. Environmental Protection Agency, Office of Water, Washington, D. C.

Peck, D. V., J. M. Lazorchak, and D. J. Klemm. Unpublished draft. Environmental Monitoring and Assessment Program-Surface Waters: Western Pilot Study Field Operations Manual for Wadeable Streams. EPA/XXX/X-XX/XXX U. S. Environmental Protection Agency, Washington D. C.

APPENDIX A
Field Reporting Forms

Physical Habitat (PHAB) Measurement Form

Site ID _____

Date _____

Initials _____

	Left	LCtr	Ctr	RCtr	Right	Left	LCtr	Ctr	RCtr	Right	Left	LCtr	Ctr	RCtr	Right
	Transect A					Transect B					Transect C				
Dist. Left bank m															
Depth cm															
Substrate size															
Embed. 0-100%															
Bank Angle															
Undercut m															
Riparian Veg															
Canopy															
Flag															
	Transect D					Transect E					Woody Debris Tally (4 inX 5 ft)				
Dist. Left bank m															
Depth cm															
Substrate size											Total Count				
Embed. 0-100%											CHANNEL CODES PP = Plunge Pool GL = Glide PT = Pool, Trench RA = Rapid PL = Pool, Lateral Scour RI = Riffle PB = Pool Backwater DR = Dry Channel PD = Pool Impoundment				
Bank Angle															
Undercut m															
Riparian Veg															
Canopy															
Flag															
	Bank Measurements					SUBSTRATE SIZE CLASS CODES									
	A	B	C	D	E	RS = Bedrock (smooth)- (larger than car) RR = Bedrock (rough) -(larger than car) RC = Concrete/Asphalt XB = Large Boulder- (meter stick to car) SB = Small Boulder- (basketball to meter stick) CB = Cobble- (tennis ball to basketball) GC = Coarse Gravel- (marble to tennis ball)					GF = Fine Gravel- (ladybug to marble) SA = Sand- (gritty feel to ladybug size) FN = Silt/Clay/Muck- (not gritty) HP = Hardpan- (Firm consolidated fines) WD = Wood- (any size) OT = Other (explain in comments)				
Wetted Width m															
Bar Width m															
Bankfull Width m															
Bankfull Height m															
Incised Height m															
Channel Code															

Physical Habitat (PHAB) Measurement Form

	Left	LCtr	Ctr	RCtr	Right	Left	LCtr	Ctr	RCtr	Right	Left	LCtr	Ctr	RCtr	Right
	Transect F					Transect G					Transect H				
Dist. Left bank m															
Depth cm															
Substrate size															
Embed. 0-100%															
Bank Angle															
Undercut m															
Riparian Veg															
Canopy															
Flag															
	Transect I					Transect J					Transect K				
Dist. Left bank m															
Depth cm															
Substrate size															
Embed. 0-100%															
Bank Angle															
Undercut m															
Riparian Veg															
Canopy															
Flag															
	Bank Measurements						Flag	Comments							
	F	G	H	I	J	K									
Wetted Width m															
Bar Width m															
Bankfull Width m															
Bankfull Height m															
Incised Height m															
Cannel Code															

APPENDIX B
SOP Acknowledgement and Training Form

SOP Acknowledgement and Training Form

This SOP must be read, and this form signed annually. This form must be kept with the latest version of the SOP.

Document Title:	
Document Revision Number:	
Document Revision Date:	

Please sign below in accordance with the following statement:

"I have read and understand the above referenced document. I agree to perform the procedures described in this SOP in accordance with the document until such time that it is superseded by a more recent approved revision."

[illegible]

SOP Acknowledgement and Training Form (cont.)

Trainee: Sign below to acknowledge that training on this SOP was received, understood, and all questions/concerns were addressed by the trainer.

Trainer: Sign below to acknowledge that training on this SOP was completed for the individual listed and that training is competent to perform the procedures described within.

[illegible]